Seminar: Philosophy of Science

Winter 2024 topic: Measurement

General Information

Course #	PHIL 641
Term	Winter 2024
Course pre-requisite(s)	None, but undergrads require permission of instructor
Course co-requisite(s)	None
Restrictions	Not open to students who have taken PHIL 541
Course schedule	Thursdays 11:35 AM-02:25 PM
Number of credits	3
Course location	LEA 917

Instructor Information

Name	Eran Tal
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Office hours for students	Wednesdays 1:30-2:30 PM (Jan 10-Apr 3, except during March break)
Office location	LEA 933

Course Overview

Measurement is a central source of knowledge in the physical and social sciences. Over the last two decades, philosophers of science have been paying increasing attention to the problems and concepts underlying measurement. What sorts of things are measurable? Is human well-being, for example, measurable in the same sense that temperature is? How is it possible to tell that an instrument measures the quantity it is intended to? To what extent are measurement outcomes affected by social values? Can computer simulations function as measuring instruments? This seminar will explore these and related questions by studying concrete historical and contemporary scientific episodes. Discussions will be non-technical and no special background knowledge is required.

Course Materials

Weekly required readings are available for download from myCourses. References to additional readings are included below, and some of them are also available for download from myCourses.

Course Schedule

Wk	Date	Description	Assignments and/or Readings Due
1	Jan 4th	Introduction	No required reading. Additional reading: Tal, E. (2020). Measurement in Science. *Stanford Encyclopedia of Philosophy*, Zalta E., (ed.) (freely available online) Chang, H. & Cartwright, N.L. (2008). Measurement. In *The Routledge Companion to Philosophy of Science*, S. Psillos and M. Curd (eds.), New York: Routledge, pp. 367–375.
2	Jan 11th	History of physical measurement	Chang, H. (2004). *Inventing Temperature: Measurement and Scientific Progress*, Oxford: Oxford University Press. Chapter 2: "Spirit, Air and Quicksilver", pp. 57-102. Stevens, S.S. (1946). On the theory of scales of measurement. *Science* 103, pp. 677–680. Additional reading: Kuhn (1977 [1961]). The Function of Measurement in Modern Physical Sciences. In: *The Essential Tension*, University of Chicago Press, pp. 178-224. Hacking, I. (1983). *Representing and Intervening*, Cambridge: Cambridge University Press. Ch. 14: "Measurement", pp. 233-245.
3	Jan 18th	The problem of coordination	Van Fraassen, B.C. (2008) *Scientific Representation: Paradoxes of Perspective*, Oxford: Oxford University Press. Ch. 5: "The Problem of Coordination", pp. 115-140. Additional reading: Poincaré, H. (1898), "The Measure of Time", in: *The Value of Science*, New York: Dover, 1958. Pp. 26-36. Excerpts from Reichenbach, H. (1927). *The Philosophy of Space and Time*, New York: Dover Publications, 1958. Carnap, R. (1966). *Philosophical foundations of physics*, G. Martin (ed.), reprinted as *An Introduction to the Philosophy of Science*, NY: Dover, 1995. Ch. 8: "Time", pp. 78-85.
4	Jan 25th	Operationalism	Bridgman, P.W. (1927), excerpts from: *The Logic of Modern Physics,* New York: MacMillan. Additional reading: Chang, H. (2009). Operationalism. *The Stanford Encyclopedia of Philosophy*, Edward N. Zalta (ed.) (freely available online). Stevens, S.S. (1935). "The operational definition of psychological concepts", *Psychological Review*, 42(6): 517–527. Hempel, C.G. (1966). *Philosophy of Natural Science*, Englewood Cliffs, N.J.: Prentice-Hall. Ch. 7: "Concept Formation", pp. 85-100.

5	Feb 1st	Representational Theory of Measurement	Excerpts from Luce, R.D. & Suppes, P. (2004). Representational Measurement Theory. In *Stevens' Handbook of Experimental Psychology*, vol. 4: Methodology in Experimental Psychology, J. Wixted and H. Pashler (eds.), New York: Wiley, 3rd edition, pp. 1–41. <u>Additional reading:</u> von Helmholtz, H. (1887). *Counting and measuring*, C.L. Bryan (trans.), New Jersey: D. Van Nostrand, 1930. Campbell, N.R. (1920). *Physics: the Elements*, London: Cambridge University Press. Ch. 10: "Fundamental Measurement", pp. 267-294. Nagel, E. (1931). Measurement. *Erkenntnis*, 2(1): 313–333. Krantz, D. H., Suppes, P., Luce, R. D., & Tversky, A. (1971). *Foundations of Measurement Volume 1: Additive and Polynomial Representations*. Academic Press. Ch. 1: "Introduction", pp. 1-37.
6	Feb 8th	Realism about quantities and quantity values	Teller, P. (2018). Measurement Accuracy Realism. In I. F. Peschard & B. C. van Fraassen (Eds.), *The Experimental Side of Modeling* (pp. 273–298). University of Minnesota Press. <u>Additional reading:</u> Tal, E. (2011). How Accurate Is the Standard Second? *Philosophy of Science* 78 (5), pp. 1082-1096. Isaac, A. M. (2019). Epistemic loops and measurement realism. *Philosophy of Science*, *86*(5), 930–941. Grégis, F. (2023). Do quantities have unique true values? The problem of non-uniqueness in measurement. *Measurement*, *221*, 113498. Wolff, J. E. (2020). *The metaphysics of quantities*. Oxford University Press.
7	Feb 15th	Measurement in the social sciences	Cartwright, N.L. and R. Runhardt (2014). Measurement. In N.L. Cartwright and E. Montuschi (eds.), *Philosophy of Social Science: A New Introduction*, Oxford: Oxford University Press, pp. 265–287. <u>Additional reading:</u> Porter, T. (1995). *Trust in Numbers*, Princeton University Press. Ch. 2: "How Social Numbers are Made Valid", pp. 33-48. Gould, S.J. (1996). *The Mismeasure of Man*, 2nd ed., W.W. Norton. Ch. 5: "The Hereditarian Theory of IQ: An American Invention", pp. 176-263.
	Feb 19th		**Essay outline due on myCourses by 11:59PM**
8	Feb 22nd	Psychometrics	Alexandrova, A. (2017). *A Philosophy for the Science of Well-Being*, OUP. Ch. 6. "Psychometrics as Theory Avoidance", pp. 129-152. <u>Additional reading:</u> Borsboom, D. (2005). *Measuring the mind : Conceptual issues in contemporary psychometrics*. Cambridge: Cambridge University Press. Chapters 2 & 3, pp. 11-84.

			Fayers, P., & Machin, D. (2016). *Quality of life : The assessment, analysis, and reporting of patient-reported outcomes* (Third ed.). Chichester, West Sussex, UK: John Wiley & Sons. Chapter 4: "Scores and measurements: validity, reliability, sensitivity". Nunnally, J., & Bernstein, I. (1994). *Psychometric theory* (3rd ed.) New York: McGraw-Hill. Chapter 3: "Validity".
9	Feb 29th	Patient-reported outcome measures	McClimans, L. (forthcoming). *Patient-Centered Measurement*, Oxford University Press. Ch. 3: "Epistemic Dialogue". <u>Additional reading:</u> Hand, D. J. (2004). *Measurement theory and practice: the world through quantification*, Wiley. Ch. 6: "Measurement in medicine", pp. 182-203. McClimans, L. (Ed.). (2017). *Measurement in medicine: Philosophical essays on assessment and evaluation*. London: Rowman and Littlefield International. Introduction, pp. vii-xv. Stegenga, J. (2018). *Medical Nihilism*. Oxford University Press. Ch. 8 "Measuring Effectiveness", pp. 112-133.
	Mar 7th		**Winter reading week – no seminar**
10	Mar 14th	Measurement in economics 1: health economics	Bognar, G., & Hirose, I. (2014). *The Ethics of Health Care Rationing: An Introduction*. Routledge. Chapter 2: "The Value of Health", pp. 29-52. <u>Additional reading:</u> Hausman, D. (2015). *Valuing Health: Well-being, Freedom and Suffering*, Oxford University Press. Broome, J. (2002). Measuring the burden of disease by aggregating well-being. In C.J.L. Murray et al. (eds.) *Summary measures of population health: concepts, ethics, measurement and applications*. World Health Organization, pp. 91-113.
11	Mar 21st	**Essay outline 'workshop'**	Group discussion of essay outlines. Required reading: each other's essay outlines.
12	Mar 28th	Measurement in economics 2: inequality	Basso, A. (2022). The comparison of inequality measurements across countries and time. *The British Journal for the Philosophy of Science*, 719568. <u>Additional reading:</u> Boumans, M. (2005). *How economists model the world into numbers*. Routledge. Reiss, J. (2001). Natural economic quantities and their measurement. *Journal of Economic Methodology*, 8:2, pp. 287-311. Morgan, M. S. (2007). An analytical history of measuring practices: The case of velocities of money. *Measurement in Economics: A Handbook*, 105–132.

13	Apr 4th	Measurement and computer simulation	Parker, W. S. (2017). Computer Simulation, Measurement, and Data Assimilation. *The British Journal for the Philosophy of Science*, *68*(1), 273–304. Additional reading: Morrison, M. (2009). Models, measurement and computer simulation: The changing face of experimentation. *Philosophical Studies*, *143*(1), 33–57. Lusk, G., 2016, "Computer simulation and the features of novel empirical data", *Studies in History and Philosophy of Science* 56: 145-152.
	Apr 12th		**Final essay due on myCourses by 11:59PM**

Evaluation

The final mark will be composed of the following:

Name of Assignment	**Due Date**	**% of final grade**
In-class presentation	Once during term	25%
Outline of final essay	February 19th	15%
Final essay	April 12th	50%
Participation in class discussion	Ongoing	10%

In-class presentation: This is a 15-minute presentation of the required text(s) for the week. The idea is **NOT** to summarize the entire text but to briefly state the author's main theses and then focus on one or two aspects of the text that you found particularly interesting and / or problematic. End the presentation with one or two questions for class discussion. Using handouts is encouraged.

Essay outline: divided into (1) research question, (2) main thesis, (3) brief background, (4) a summary of your argument, and (5) bibliography. Sections (1)-(4) should be no longer than 2 pages. Additional instructions on preparing the outline will be given in class.

Final essay: a research essay of about 5000 words. Instructions for writing the essay will be given in class.

Submitting work: essays and outlines are to be submitted online through myCourses – **not by email**. Submit file in **PDF or DOCX** format only. In other words: if you are using a word-processor other than Microsoft Word, please use the 'save as' or 'export' function to save your work as a PDF before uploading it.

Policy for Late Work: Extensions to deadlines must be requested at least a week in advance of the deadline (except in cases of medical or other emergencies). Essays and essay outlines will be penalized at the rate of 3 percentage points per day overdue.

McGill Policy Statements

Language of Submission:

"In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded." (Approved by Senate on 21 January 2009 - see also the section in this document on Assignments and Evaluation.)

The FRENCH TRANSLATION about this right may also be used on your course outline:

« Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue). »

Academic Integrity:

"McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures" (see www.mcgill.ca/students/srr/honest/ for more information). (Approved by Senate on 29 January 2003)

The FRENCH TRANSLATION of the Academic Integrity statement may also be used on your course outline:

« L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/).»