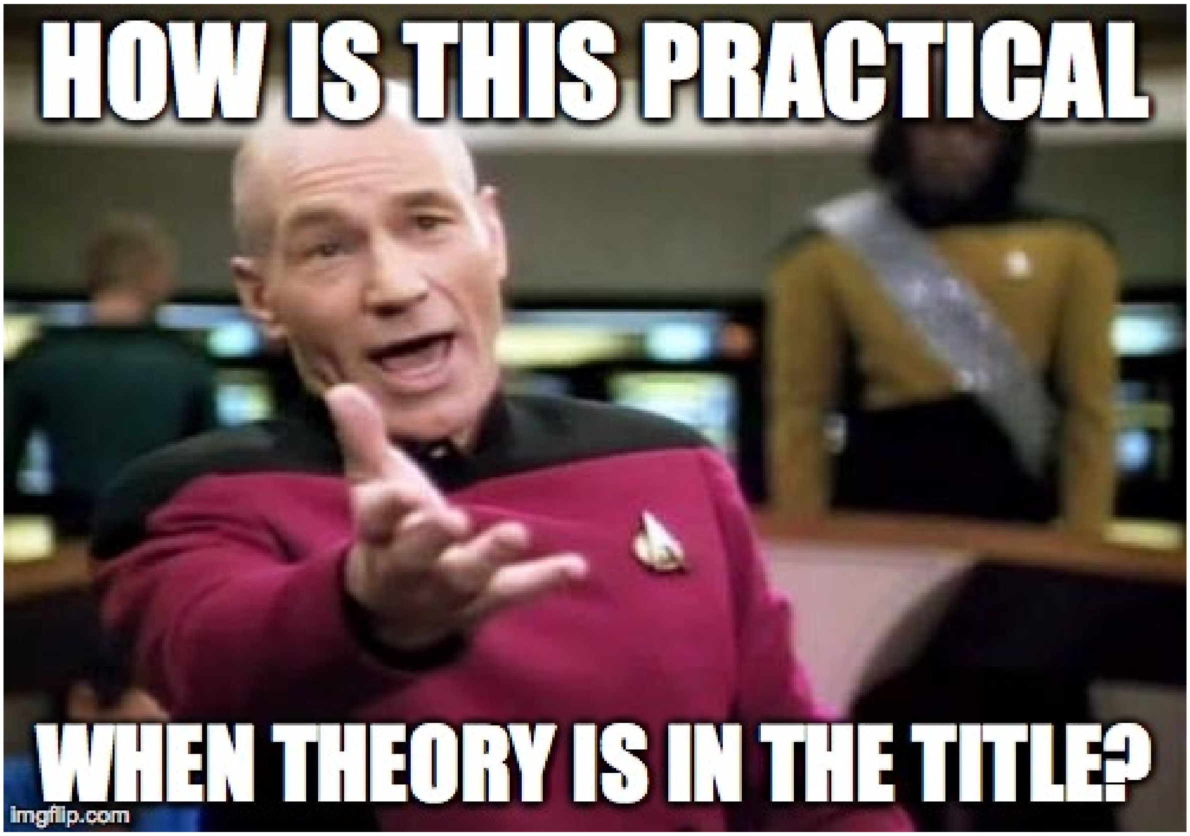
Week 3 Live Session

w203 Instructional Team

January 23, 2017

1. **Why are we studying probability theory?**



2. **Sharing Math**

   Over the next few weeks of the course, we'll solve a lot of math problems together. To hand in math for homework and labs, you can either

   (a) Handwrite your solutions and scan them.

   (b) Write your solutions in Latex.

   We have not found a single method that's great for sharing math equations in live session. Typically, we'll use some combination of:

   (a) The Adobe Connect whiteboard. A tablet with stylus is recommended.

   (b) The notes pod.

   Even though it takes a little effort, it will help if you learn a little Latex. We will be able to use the syntax for communicating equations in the notes and chat pods.

3. **Probability Practice**

   (a) Suppose you're taking a statistics class and that in each week you are either caught up or behind on the readings. If you are caught up in a given week, the probability that you will be caught up in the next week is 0.7. If you are behind in a given week, the probability that you will be up to date in the next week is 0.4. Assume that you are caught up before the class starts, which means that the probability you are caught up in week 1 is 0.7. What is the probability that you are caught up in week 3?

(b) A test for certain disease is assumed to be correct 95% of the time: if a person has a disease the test will give a positive result with probability 0.95. If a person does not have disease the test will give a negative result with probability 0.95. A random person drawn from a certain population has a probability 0.001 of having the disease. Given that a person drawn at random just tested positive, what is the probability that they have the disease?

4. **Patents and Operationalization**

Before class, we asked you to read exerpts from a recent paper on patents.

Schoenmakers, W., Duysters, G., (2010), The Technological Origins of Radical Inventions, Research Policy 39, pp. 1051-1059.

> Inventions come in many different forms ranging from incremental or run-of-the-mill inventions, to radical or breakthrough inventions. Most inventions can be characterized as incremental inventions. Incremental inventions consist of minor improvements or plain adjustments to existing products or technology. Their individual impact on the technological system is usually limited. Radical inventions on the other hand are generally considered as being a risky departure away from existing practice (Hage, 1980). Radical inventions exhibit key characteristics that are inherently different from existing products or technologies. They often lie at the hart of changes in technological paradigms (Nelson and Winter, 1982), thereby creating new technological systems and sometimes even new industries. Although incremental inventions might be a principal source of measured productivity growth, without the original radical invention they would not have been possible. Radical inventions are thus considered to be a crucial basis for a sequence of subsequent developments around this original invention (Mokyr, 1990)...
>
> We are particularly interested in how an invention can be a catalyst for the development of subsequent inventions. We especially want to focus on those inventions that can be considered radical or breakthrough. Therefore we focus our attention to those inventions that serve as a basis for many successive inventions...
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> Patent data is the single most dominant indicator in invention studies. For a patent to be granted it must be novel, non-trivial, and useful. If a patent meets these requirements, a legal title will be created containing information on for instance the name of the inventing firm and also on the technological antecedents of the knowledge, the patent citations. In the European Patent Office (EPO) system, the patent applicant can include citations to prior patents (and prior technological and scientific literature), but ultimately it is the patent examiner from the patent office who determines what citations will be included in a patent (Michel and Bettels, 2001). Patent citations reveal the so-called "prior art" of the newly developed patent. Citations to other patents, the so-called backward citations, indicate on what preceding knowledge the new patent is based. They provide a kind of patent family tree. The citations from other patents to a patent, the so-called forward citations, on the other hand are an indication for the importance of the patent...
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> Since we expect, in line with Ahuja and Lampert (2001) and Dahlin and Behrens (2005), that radical inventions are a rather rare phenomenon, we selected only the most highly cited patents as our group of radical patents. The highest cited radical patent received 54 citations and the least cited 20 citations.We put our cut-off value at 20 citations based on the beforementioned expectation that truly radical inventions will rather be an uncommon occurrence, and we observed that many patents have 19 or less citations, whereas only very few have more than 20 citations... We ended up with a group of 96 radical patents. For the construction of the non-radical inventions we randomly selected 96 patents from the group of patents with less than 20 forward citations. For both groups we collected the necessary

> variables using, besides EPO, Worldscope. We ended up with 74 patents in the radical group and 83 patents in our non-radical group for whom we had sufficient information to perform the analysis...
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> As a first independent variable we use the number of times a patent is citing other patents (COP). Some scholars assert that radical patents are based on completely new knowledge; knowledge that was not available in the market before, while others especially point at the recombination of beforehand-unconnected knowledge as a source of radical inventions. For scholars in favour of the first viewpoint the assumption is, that, if a relatively large amount of citations for a new technology is to scientific literature, than this is an indication of novelty (Carpenter et al., 1981), since the new technology in that case is than not based on already existing technologies, but instead on science itself (Dahlin and Behrens, 2005)...
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> Looking at the first variable (COP) we see that the group of radical patents cites more patents than the group of non-radical patents, 2.5541 compared to 1.2651. This variable is also significant (see Table 2). Our first hypothesis is thus rejected. Radical patents are apparently even more reliant on the recombination of already existing knowledge than non-radical patents...
>
> In contrast to the conventional wisdom that radical inventions are based less on existing knowledge, we find that they are to a higher degree based on existing knowledge than non-radical inventions. For radical inventions already existing knowledge seems of paramount importance. Radical inventions are also to a higher degree based on emergent technologies, and especially on a combination of mature and emergent technologies than non-radical inventions.

Discussion Questions:

1. Schoenmakers and Duysters are particularly interested in radical inventions. Explain what their conceptual definition is and how it is related to their operational definition.

2. In your opinion, does the author's operational definition of radical invention have validity? (does it have face validity? construct validity?)

3. If you believe there is a discrepancy between the author's operational definition of radical invention and the intended concept, how could this affect their conclusions? What factors, other than whether an invention is radical, could be driving their results?

4. In what other ways could you operationalize the concept of radical invention?