TODAY’S GOALS

• Engage in a dialog and reflective thinking. Looking for personal aspirations and motivations.
• Start thinking and planning of possible projects and cooperation.
TODAY’S PROGRAM

• What are we doing? In other words, what is Art, and what is Science?
• A dialog and reflection, aspirations and motivations, navigating possibilities.
• Moving towards concrete ideas and goals.
  • I will be available for you for discussion and consultation until the end of this year, if you are interested in developing research-related projects related to music. See contact info at the end of this presentation.
• If we have time, we can talk about qualitative/quantitative research and also about statistics (some info at the end of this presentation)
• If you are considering scientific career, I recommend you to read the lecture notes by Emily Oates entitled as “Truth, experiment and government science” (email me and I’ll send them)
WHAT IS MUSICAL ART?

• First, think of humanity’s past achievements in the musical arts that you think are of great value to everybody, but also to you personally.

• Then, think of what the people who achieved those things did in order to achieve them:
  • What principles and values guided their work?
  • We are not interested in personal motivation or talent, but in the more abstract problem of what was it that they were trying to accomplish in their work that resulted in something of great value?
WHAT IS SCIENCE?

• First, think of examples of humanity’s past achievements in the sciences (mathematics, physics, psychology, etc.) that you think are of great value, to everybody, but especially to you personally.

• Then, think what the people who achieved those things did in order to achieve them:
  • What principles and values guided their work?
  • We are not interested in personal motivation or talent, but in the more abstract problem of what was it that they were trying to accomplish in their work. What makes their work so valuable to you, and to others?
WHAT IS (MUSICAL) ART?
WHAT IS SCIENCE?

• The supreme value in science is (universal, general, relatively persistent) truth, in both observation and theory. Secondary values are its relevance (what difference does it make) and proof (how do we know it). There is really not much else.

• We know currently two basic forms of scientific method that aim for empirical truth: the non-experimental science of Aristotle and others (400BC~), and the experimental natural-scientific method of Galileo, Newton, Kepler, Descartes and others (1600~).
  • Former method: Assume a theory based on common sense and/or authority (famous author, books, Pope, Queen Margrethe II), and then deduce, classify or organize observations based on that theory. Latter: Assume a hypothesis/theory out of the blue, but test it by means of an experiment. (Third option is Richard F. Feynman’s “Cargo Cult Science,” but I won’t discuss this here.) There are also many forms between these extremes.

• A more detailed explanation of some of these points can be found at the end of this presentation. I’ll skip it today.
In the following, there are few questions; answer them according to your interests and personal preferences/motivations.

Some of these answers will be used to establish groups for the afternoon work.

They will also try to guide your own, personal way forward.
QUESTION 1

• Global warming and climate change is an important scientific topic that has societal, ethical and political ramifications. Which of the following best describes your attitudes and behavior with respect to this topic?
  • I haven’t paid any attention to the issue.
  • I have read popular science articles and books about the phenomenon. It is important for societies to take steps to lessen the impact of climate change, for example, by taxation and regulation.
  • I am familiar with at least some scientific literature on this topic.
  • I have read (regularly or sometimes) skeptical and conspiracy-based articles, books and/or web pages which try to question the hypothesis that humans are causing dangerous global warming.
  • I have downloaded original data used in climate science research and tried to examine the data myself.
QUESTION 2

- You enter an airplane for a long intercontinental flight. At the gate, you are informed that all regular seats are booked by mistake. You are given the two options below. Which one would you prefer?
  - Option 1: You spend the whole trip in the cockpit "jumpseat" to follow the captain and her co-pilot to fly the plane; or,
  - Option 2: You pay 10€ extra and travel in a luxury seat, 1st class, with newspapers, movies, music, Internet, and other services available.
QUESTION 3

• Which of the following describes you best:
  • I like to work alone. I read books and articles, and think about the materials alone to better understand the big picture for myself. I prefer to master things before interacting with others. I am fascinated by very complex topics.
  • I enjoy collaborating with my colleagues. I prefer to develop new ideas in social interaction and in an environment where constant feedback is possible. I consider myself a social person. Readings long books in isolation is not for me, and it does not bring the best out of my abilities.
QUESTION 4

• What above all else interests you?

  • *Pedagogy* (I want to be a better teacher; to develop my teaching methods and skill; to better understand my student’s problems and concerns; to test and experiment with different methods; to get structured feedback on my teaching; I am overall very concerned with my teaching, and always want to help my students to the best of my abilities).

  • *Personal Competence* (I want to develop my personal, professional skills; to cope with a challenge in my work; to change an orientation or emphasis in my work; to expand my career into something new; to expand my skill set; to bring something new and novel into my work).

  • *Understanding and Explaining* (My main interest is in understanding something in music, or musicians, in general; to understand what happens in the human brain, related to music (listening, performing, composing); to understand a phenomenon that interest me; to gain a deeper grasp of some of the aspects that are involved in my personal work; I want to write a book and use some scientific knowledge in it).

  • *Basic and Pure Research* (I am interested in learning and doing scientific research; to work for a Ph.D in a scientific discipline; to work with complex problems and data; to master complicated topics; to be skeptical of other’s ideas; to chart new areas and ideas; to publish scientific results).
QUESTION 5

• How narrow you think your focus could be?
  • I have a holistic approach. I am interested in the big picture, where everything is connected with everything else. I am not afraid of broader, philosophical approach and/or questions. I like to analyze connections between things. I am not afraid of abstract ideas and concepts, and it does not matter to me if some concept is only loosely defined. I don’t aspire for mathematical precision.
  • I like to work with very narrow, tiny, specific and marginal problems, until they are solved to my full satisfaction. I don’t like vague, undefined concepts. I prefer concrete and precise mathematical problems to loose philosophical mumbo-jumbo. Philosophers are never able to sole any problem anyway.
QUESTION 6

• Which of the following you think you could do?
  • Collect some observations systematically, for a longer period of time and/or from several participants/situations.
  • Read a substantial amount of previous literature (~20 books) on some topic.
  • Analyse data by using statistical methods and statistical software, by yourself.
  • Use mathematical scripting, for example, MATLAB, or programming languages.
  • Spend 6-12 months to write a scientific report.
  • Go to a scientific conference on a topic that interests you.
  • Submit your own work for anonymous peer review process, where it is criticized anonymously by your peers (other researchers, typically more experienced than you).
  • Do research by following detailed instructions and orders from a supervisor.
TOWARDS MORE CONCRETE GOALS AND PROJECTS

• The purpose of the afternoon session is to start the process of developing more concrete ideas and projects.

• Today we work in four groups based on your answers to Question 4.

• We will close the day by going through the ideas that have been discussed in the groups. However, you are not required to craft formal presentations.
TOWARDS MORE CONCRETE GOALS

• Things to discuss in the group
  • In the group, first introduce yourself to others. Who you are, what do you do? Maybe exchange contact information.
  • In Question 4, you selected one option (pedagogy, competence, personal growth, research). Elaborate why you selected what you did. What more specific issues interests you? All members in your group should first do this, as a form of introduction.
  • Transform your specific issue into the form of just one question. Then think of possible realistic ways of answering that question, or solving that particular problem.
SOME REFLECTIONS ON SCIENCE
Several thousand years ago, some Greek philosophers, Aristotle among them, left a record of their thought process. These written documents contained the first systematic method for observing and explaining nature, a method that is still used today by many:

- Collect as much observations as possible,
- Select a theory based on common sense and/or on authority (Aristotle, famous professor or author, your supervisor, Margharet II),
- Use the theory to explain, describe, classify and organize your observations.

A synthesis was made of Aristotle and Roman Catholic Church that ruled the Western intellectual world for one thousand years.
NATURAL PHILOSOPHERS

• During the 17th century, some men and women began to question Aristotle’s ideas. This led to the Scientific Revolution, which in turn led to the "scientific era" that we are still living today.
It first occurred to Galileo, who lived in Renaissance Italy, that we should perhaps submit Aristotle’s claims to observation by means of a controlled, rigorous experiment. This was a revolutionary new idea that was not accepted, at the time, by almost nobody else.

It also occurred to Galileo that, in submitting claims for empirical testing, we should use measurements and mathematics.

Descartes, when he was a young man, noticed that nothing that was taught to him in the Jesuit school, apart from some geometrical truths, had been shown to be true. It was all speculation or hearsay. He proceeded to the conclusion that he must doubt everything, from which he then derived one solid truth: “I think, therefore, I exist.”

Kepler, who came into the possession of Brahe’s astronomical observations, formulated, by a method of hypothesis testing, what we can today call the first natural laws about planetary orbits.
ISAAC NEWTON (1642-1726)

• Isaac Newton stands at the borderline between the past and the future. His physical work was the humanity’s future, while his alchemy and biblical-historical work represented the past that is now forgotten.

• Newton was indoctrinated inside the Aristotle’s system, however, he found Galileo’s, Descartes’ and Kepler’s writing on his own when he was a young man.

• He at once developed Descartes’ geometry further and invented calculus, the basis of almost all modern rigorous science (he was 20 or so);

• Then he took Galileo’s and Kepler’s previuos work and formulated the theory of universal gravitation, which is where modern physics, or deeper understanding of the physical reality, really begins.
Today we have bifurcation:

- If you study history, for example, you can’t use experimentation and mathematics, and there are presumably no historical-natural laws, therefore, you will use Aristotle’s method: collect facts and organize them around narratives. The same applies to a lot of qualitative research, and research in the “soft sciences” in generally. In fact, in my experience the so-called ”soft sciences” are simply a continuation of Aristotle’s method.

- Then we have research that adopts the thinking of 17th century natural philosophers, and the method has been applied as it was invented back them. Thus, what Galileo wrote about experimentation and mathematics is simply assumed "as is" today. This has also the name ”hard sciences”.

- This is important if you work in an artistic field, because you cannot take either of these methods as self-evidently useful for your own purposes. These approaches differ from each other in many ways, and where one can be applied to other often can’t, and vice versa.

- The researchers inside these traditions do not typically understand each other and cannot often communicate in a constructive way.
WHICH METHOD TO USE?

• If you want to collect new observations and classify them in some meaningful way, then use Aristotle’s method. Use this if your topic of interest involves:
  • History and historical facts, analysis of human production (e.g. artwork), opinions of people, social-normative ideas and processes, law, ethics and morals, polling.

• If you want to understand causation (cause and effect relations), you must use natural-scientific experimental method.
  • For example, what in the brain causes people do to different things, what musical themes or properties cause aesthetic experiences or pleasure?
ON STATISTICAL INFERENCE

• It is said that the point of statistical inference is to "separate signal from the noise". But what is signal and what is noise, and why to separate them? What’s the problem in separating them?

• If on Monday a certain man walks behind you in Aarhus, you will ignore him. If you see the same man on Tuesday, walking behind you, you’d think: "What a coincidence!". But if you see him the third day, other possibilities have to be evaluated. You’d think: "Could this be a coincidence, or is something going on here?"

• Science is like that. Coincidence is called "null hypothesis", which says basically that what you observed is random coinckidence, even if it looks as if there were something there. We are often required to test how likely this scenario is. A lot of statistics concerns such testing. And it is nontrivial. How many times do you have to see the same man in order to say that now there is only 1% chance that this is pure coincidence? At any rate, each day you see the same man the probability of a coincidence is smaller -- therefore, in research, as in real life, we like to take several measurements before we are convinced. So there’s a relation between quality of your observations, the amount of observations, and the probability of the "mere coincide" hypothesis.

• So the "signal" = "something is going on here". And "noise" = everything else. I think science is literally about exposing conspiracies (by Nature).
So more concretely, we first look at your observations.

- How were they taken? Are all measurement independent? What types of scales? How much random variation is there? What variables were used? And so on.

And then based on these, we try to estimate the likelihood of the null hypothesis ("there's nothing there"). So there are various tests and parameters which are set to match the conditions above, which is the important part – the rest is just computing (e.g. in SPSS). If you haven’t done this before, you should consult somebody at first.
ABOUT THE AUTHOR

- Specialized in language and brain.
- Currently employed in the Centre for Music and Brain, Aarhus University.
- After being 20 years in science, I have again rediscovered the joy of music (you can listen my ”production” at [www.vedacelik.net](http://www.vedacelik.net)) or search this name (Veda Celik) in facebook and befriend me.
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