PHIL/HIS 449: EHPP SENIOR CAPSTONE
AUTONOMOUS VEHICLES
Fall 2016
TR, 3-4:20pm
Baker Hall A54

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Course Description & Objectives
The purpose of the EHPP capstone course is to challenge you to use the knowledge and skills that you have developed throughout the EHPP program. Your goal is to work together in a collaborative way to engage with an important social issue. Your analysis of the course topic should be informed by historical, ethical, legal, and policy considerations. Your end product will consist of both a written policy brief and an oral presentation of your recommendations.

The broad topic of this year's course is the growth in autonomous vehicle (AV) development and testing in the Pittsburgh region and beyond. Uber opened its local Advanced Technologies Center and began driverless research in 2015, and Mayor Bill Peduto took the inaugural driverless Uber ride in September of 2016. Other AV projects are also underway in the Pittsburgh metro area, which is host to Argo AI, Delphi, Aurora, and others. The surge in development locally has played a central role in the recent tech boom in Pittsburgh, contributing to both economic revitalization and city plans to improve livability. However, a central feature of the city's approach to attracting AV research and development to Pittsburgh early on was to take a very hands-off approach with respect to the regulation of AV testing and use on city streets, and to try and partner with companies – Uber in particular – to further the city's agenda. More recently, there have been signs that the city and Mayor Peduto may be regretting that approach as the relationship with Uber has soured. As Uber continues to grow its presence in the region, and as more AV companies are attracted by the strong AI and robotics communities in Pittsburgh, there are several questions that must be answered. What are the costs and benefits associated with the growth of AV? How should city, state, and federal regulations be structured so as to best promote the safety of pedestrians, cyclists, and other drivers as AVs become a larger and larger proportion of cars on the road? How should AVs be programmed to take into account ethical considerations about the preservation of human life and the protection of private and public property? How should liability be construed for damage or injury caused by AVs? What responsibilities do AV companies, the city, and society as a whole have to workers who are displaced in cab, delivery, and trucking industries, among others?

These and other questions form the backdrop for your research this term. Your first task, after getting a handle on the background and relevant actors, will be to determine what policy question or problem you want to solve. This is a multi-faceted issue, and you will not be able to address all open questions in one semester. Rather, your goal should be to identify and focus in on a manageable aspect of the AV topic that you feel it is important for local, state, or federal officials to address in policy-making and to articulate the goal that you think any policy should strive to

achieve. From there, you will work to identify what you think is the most feasible and impactful way to implement policy to promote that goal.

In developing your policy recommendations, you should consider as your audience the Pittsburgh City Council. Your specific client is City Councilman Dan Gilman, a Carnegie Mellon EHPP alum (2004). You can find out more about Councilman Gilman from his website: http://pittsburghpa.gov/district8/councilman-dan-gilman . As you begin your research, I strongly recommend looking at previous years' capstone results. You can find them here: http://www.cmu.edu/hss/ehpp/capstone-projects/index.html

This course will not operate in the same way that the bulk of your courses do. This course is designed to be **student-directed** and as such my role as instructor is to point you in the right direction and offer guidance where it is needed. But as the policy-makers, it is **your responsibility, as a group, to:**
- Identify the specific policy problem or question that you will work to address as a group and articulate clearly that problem as well as the goal(s) that you believe any solution to that problem should serve. The project you identify should be feasible to complete over the course of a semester with approximately 100-150 person hours of work available per student
- Organize yourselves into a coherent team, including a division of labor in a manner that plays to your team members' strengths
- Develop a team organizational infrastructure to ensure efficient communication, sharing of information, and meeting planning
- Research those issues germane to your project, remembering that your policy recommendations should be informed by historical, legal, and ethical considerations
- Organize your output into a coherent analysis and recommendation
- Present your findings in a clear, accessible manner in both a written report and an oral presentation to your client and myself

Grading
Your individual grades for this course will be determined on the basis of both my assessment of your work as well as the assessments of your peers. Each of you will present your individual contributions to the work product during the semester. I will solicit feedback from you about the contributions of your peers both at midterm and at the end of the semester. Your grades will be assessed as follows:
- Individual presentations 20%
- Final written product 30%
- Final group oral presentation 25%
- Individual contributions to group project: 25%
  - Grades for this last item will be based on my observations of your working as a group as well as input from your peers. This will include attendance at scheduled meetings; contributions to research, writing, and organizational tasks; and ability to work well with other team members

Broad Course Outline
Step 1: Background Research
During this part of the course, you should be informing yourselves about the political climate in Pittsburgh related to autonomous vehicles, as well as reading background materials about the relevant ethical, historical, and legal context of your project. You should identify any relevant local, state, or federal laws that may be germane. You should start to think about what some of the relevant ethical issues are to the future of AV development and regulation.

Step 2: Defining the Project
During this part of the course, you will work as a team to articulate a clear mission statement. This mission statement should clarify what you have identified as the most important considerations in the development of regulation for AV, both legal and ethical. You will need to identify the scope of the policies you seek to develop (City? State? Federal?)

During this stage of the project, you will also need to develop a work plan and division of labor. This requires you to establish responsibilities, mechanisms of accountability, and logistical details. Note that although work must be allocated to different individuals or small groups, it is absolutely essential that as the project progresses that you are all talking to each other about where you are and reviewing each other's work. **If you don't coordinate your work, you will end up with a fractured and incoherent final product. If you don't review and provide feedback on each other's work from the outset, you may be shocked at the end of the term to find that many parts of your project require major additional research and/or revision.**

Step 3: Research & Analysis
During this part of the course, you will need to determine what it is that you need to learn more about in order to complete the project you have defined. This will involve:
- Identification of topics you need more information about
- Determining where and how you can get that information, and following through to gain it
- Identifying relevant stakeholders with whom you should consult, developing lines of communication with those stakeholders, and seeking their input
- Identifying the most relevant ethical considerations that will come into play in the development of your policy and developing an ethical framework to inform your policy
- Identifying any relevant local, state, or federal statutes or case law and ensuring that your recommendations adhere to both the letter and the spirit of those laws

This stage also involves identifying where you as a group do not feel adequately equipped to fill in gaps in your knowledge. Part of working in a professional capacity is recognizing when you need to ask for help, being able to identify the best people to solicit that help from, and learning how to solicit help in such a way that others are willing to provide it to you.

Step 4: Construction of Policy Recommendation(s)

Once your analysis of the issue is complete, it will be time to assemble your policy brief. You will need to assemble a written product that motivates the need for policy in this area; clearly and coherently enunciates the relevant ethical, legal, and historical considerations that informed your policy recommendations; provides a brief statement of the policy(ies) you are recommending; and provides a more in-depth report of each aspect of your recommendation, including recommendations for implementation and scale-up.

By the last few weeks of the semester, you should have a solid draft of your policy brief so that you can begin to develop and refine your oral presentation, using this period also to clarify and revise your policy brief.

Academic Integrity & Plagiarism

Plagiarism refers to the use of any ideas or words from another person or source without appropriate citation. All sources used for this course should be appropriately credited, including information found on the internet, in readings, or from discussions with local stakeholders. If you are unsure about how or whether to credit something, ask. I have a zero-tolerance policy for cheating: **Any student found to have plagiarized any portion of this project may be subject to failure of the course at my discretion.** Additionally, all available institutional penalties will be sought.

If you wish to request an accommodation due to a documented disability, please see me and contact Disability Resources at access@andrew.cmu.edu or 412-268-2013 as soon as possible.

Tentative Schedule
(Subject to change. You as a group will be largely tasked with scheduling after the first few weeks of the semester.)

Aug. 29: Introduction to Topic, Course Mechanics, and Expectations
Please read before class the following articles to familiarize yourself with the political context of AV development Pittsburgh:
* https://mobile.nytimes.com/2017/05/21/technology/pittsburgh-ubers-driverless-car-experiment.html
* https://motherboard.vice.com/en_us/article/lets-watch-pittsburghs-mayor-slowly-realize-uber-is-not-his-friend
* http://www.pennlive.com/news/2016/12/is_uber_taking_pittsburgh_for.html
* http://www.post-gazette.com/local/city/2017/02/01/City-Controller-Michael-Lamb-Pittsburgh-should-have-access-to-Uber-data/stories/201702010073
* https://qz.com/904744/pittsburgh-officials-are-criticizing-ubers-one-way-relationship-with-the-city
* http://www.post-gazette.com/news/transportation/2017/05/16/Delphi-automotive-stock-pittsburgh-bmw-ottomatika-self-driving/stories/201705160127
* http://amp.timeinc.net/fortune/2017/04/28/aurora-innovation-startup/

STEP 1: PRELIMINARY RESEARCH

Aug. 31
The History of AV Development
- Matthaei, R., A. Reschka, et al. (2016). Autonomous Vehicles. Handbook of Driver Assistance Systems. H. e. a. Winner. Switzerland, Springer International**:** 1519-1556.

Uber's Urban Invasion
- https://theincline.com/2017/02/03/peduto-on-ubers-relationship-with-pittsburgh-i-can-only-guess-that-they-are-trying-to-make-2017-better-than-2016/
- https://theincline.com/2017/02/06/mayor-peduto-told-us-uber-let-pittsburgh-down-heres-how-uber-responded/
- https://www.theguardian.com/technology/2017/apr/12/why-everyone-hates-uber-seven-step-playbook
- https://www.nytimes.com/interactive/2017/04/02/technology/uber-drivers-psychological-tricks.html
- http://money.cnn.com/2017/04/04/technology/pittsburgh-uber-mayor/index.html

Regulatory Context and Policy Needs
- https://www.entitymag.com/ethics-self-driving-cars-facts/
- https://theincline.com/2017/02/27/a-human-might-not-have-to-be-behind-the-wheel-of-a-self-driving-car-anymore-per-this-proposed-pa-bill/
- http://www.post-gazette.com/opinion/Op-Ed/2017/04/02/Self-driving-but-not-self-regulating/stories/201703300064
- http://www.post-gazette.com/news/transportation/2017/06/14/Pittsburgh-mayor-Bill-Peduto-guidelines-model-self-driving-vehicles-National-Press-Club/stories/201706140120
- https://www.technologyreview.com/the-download/608727/germany-takes-an-ethics-stance-on-driverless-cars-dont-kill-humans/

Summary report from 2017 National Summit on Design & Urban Mobility:
- https://urbanmobilitysummit.org/s/NSDUM-Summary-Report.pdf
- More resources here: https://urbanmobilitysummit.org/final-report/

Wiki tracking legislative and regulatory developments at international, federal, and state levels:
- http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action

Sept. 5
Regulation of Development, Testing, and Use
- Fagnant, D. J. and K. Kockelman (2015). "Preparing a nation for autonomous vehicles: opportunities, barriers, and policy recommendations." Transportation Research Part A **77**(1): 167-181.

- Milakis, D., B. van Arem, et al. (2017). "Policy and society related implications of automated driving: A review of literature and directions for future research." Journal of Intelligent Transportation Systems **21**(4): 324-348.
- Kalra, N. and S. M. Paddock (2016). Driving to Safety: How Many Miles of Driving Would it Take to Demonstrate Autonomous Vehicle Reliability? Santa Monica, CA, RAND Corporation.
- Danks, D. and A. J. London (2017). "Regulating Autonomous Systems: Beyond Standards." IEEE Intelligent Systems **32**(1): 88-91.
- Thierer, A. D. and R. Hagemann (2015). "Removing Roadblocks to Intelligent Vehicles and Driverless Cars." Wake Forest Journal of Law & Policy.
- Pearl, T. H. (2016). "Fast & Furious: The Misregulation of Driverless Cars." NYU Annual Survey of American Law **forthcoming**.
- Brodsky, J. S. (2016). "Autonomous Vehicle Regulation: How an Uncertain Legal Landscape May Hit the Brakes on Self-Driving Cars." Berkeley Tech L.J. **31**: 851-878.

Programming Ethical Cars
- https://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360/
- Goodall, N. (2016). "Can You Program Ethics Into a Self-Driving Car?" IEEE Spectrum **53**(6): 28-58. (6 pages long, despite citation page numbers)

Sept. 7: City Councilman Dan Gilman
Your client, Dan Gilman, will be coming to class to discuss what he thinks are the most pressing questions. Use this time to garner as much information and input from him as you can. Ultimately, you will decide what kind of policy you will develop, but Councilman Gilman's expertise should inform that decision.

Sept. 12
Energy & Public Health Impacts of AV
- Wadud, Z., D. MacKenzie, et al. (2016). "Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles." Transportation Research Part A **86**(1): 1-18.
- Pettigrew, S. (2017). "Why public health should embrace the autonomous car." Australian and New Zealand Journal of Public Health **41**(1): 5-7.
- Fleetwood, J. (2017). "Public Health, Ethics, and Autonomous Vehicles." American Journal of Public Health **107**: 532-537.
- Crayton, T. J. and B. M. Meier (2017). "Autonomous vehicles: Developing a public health research agenda to frame the future of transportation policy." Journal of Transport & Health **in press**.

Impacts on Workforce
- https://www.weforum.org/agenda/2016/12/goodbye-car-ownership-hello-clean-air-this-is-the-future-of-transport/

- <https://www.theguardian.com/technology/2017/may/17/uber-lyft-driver-ratings-customer-impact>
- <http://www.businessinsider.com/autonomous-trucks-tesla-uber-google-2017-6/#peloton-a-trucking-startup-backed-by-volvo-and-ups-plans-to-use-truck-platooning-to-save-on-fuel-4>
- Furman, J. (2016). Is This Time Different? The Opportunities and Challenges of Artificial Intelligence. AI Now: The Social and Economic Implications of Aritifical Intelligence Technologies in the Near Term. New York University.
- Arntz, M., T. Gregory, et al. (2016). "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis." OECD Social, Employment and Migration Working Papers **No. 189**.

Sept. 14
Existing and Lacking Legal Frameworks
- Smith, B. W. (2014). "Automated Vehicles are Probably Legal in the United States." Texas A&M Law Review 1: 411.
- Sheiberg, K. (2015). "Embracing the Imminent: Proposed Legislation for Automated Cars in Pennsylvania." Pitt J Tech L & Pol'y 15: 265.
- Wing, C. (2017). "Better Keep Your Hands on the Wheel in That Autonomous Car: Examining Society's Need to Navigate the Cybersecurity Roadblocks for Intelligent Vehicles." Hofstra Law Review 45: 707.
- Gillespie, M. (2016). "Shifting Automotive Landscapes: Privacy and the Right to Travel in the Era of Autonomous Motor Vehicles." Washington University Journal of Law and Policy 50: 147-170.
- Smith, B. W. (2017). "Automated Driving and Product Liability." Michigan State Law Review forthcoming.
- Hevelke, A. and J. Nida-Rümelin (2015). "Responsibility for Crashes of Autonomous Vehicle: An Ethical Analysis." Science and Engineering Ethics 21: 619-630.

Algorithmic Risks and the Black Box of AI
- <https://www2.deloitte.com/us/en/pages/risk/articles/algorithmic-machine-learning-risk-management.html?nc=1>
- <https://www.wired.com/2016/10/understanding-artificial-intelligence-decisions/>
- <https://www.scientificamerican.com/article/can-we-open-the-black-box-of-ai/>
- <https://www.scientificamerican.com/article/demystifying-the-black-box-that-is-ai/>
- <http://www.sciencemag.org/news/2017/07/ai-revolution-science>
- <http://www.sciencemag.org/news/2017/07/how-ai-detectives-are-cracking-open-black-box-deep-learning>
- <https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/>

Recommended Additional Reading:
Maurer, M., J. C. Gerdes, et al., Eds. (2016). Autononous Driving. Berlin, Springer.

STEP 2: DEFINING THE PROJECT

Sept. 19: Organizational meeting.
On this day you will, as a group, determine the distribution of labor, establish your organizational infrastructure, set a tentative schedule for the rest of the semester (including hard deadlines on which you will have to produce deliverables for me), and assign first individual research assignments. Necessary hard deadlines:
- Project definition and scope, formal write-up
- Individual presentations on allocated research and analysis – set aside two class days for presentations. This should coincide roughly with the end of Step 3/beginning of Step 4 and must occur before mid-semester grades are due (Oct. 23)
- Target date for research completion
- Target date for initial written draft
- Target date for revised written policy

Sept. 21: *From this date forward, I will not attend class meetings regularly. You are nevertheless required to meet during this time in the reserved space to coordinate and continue your research. I am available to attend any meeting during regular class time if you would like me to, but must be given a minimum of 48 hours' notice, and can attend meetings during other times if those times are coordinated with me in advance. I will also attend arbitrary meetings throughout the semester unannounced to check in on your progress (not unlike a boss would). Any hard deadlines established on the 20th you can expect me to be in class.*

Sept. 26:

Sept. 28:

Oct. 3:

Oct. 5:

Oct. 10:

Oct. 12:

Oct. 17:

Oct. 19: *I am traveling on this date and unavailable to attend any meetings*

Oct. 24:

Oct. 26:

Oct. 31:

Nov. 2:

Nov. 7:

Nov. 9:

Nov. 14:

*Nov. 16: *I am traveling on this date and unavailable to attend any meetings**

Nov. 21:

*** Nov. 23: No Class Meeting, Thanksgiving Break***

Nov. 28:

Nov. 30:

*Dec. 5: **These dates set aside for practice of oral presentation***

*Dec. 7: **These dates set aside for practice of oral presentation***