What are, for you, the three most interesting/challenging things/issues you've learned this semester? Why? (480-500 words)

The three most interesting (and challenging) things that I have learned this semester have come from the space where theory meets practice.

First, the difficulty of whistleblowing – specifically Dr. Jean Arrigo's assertion that you should not be a whistleblower without a substantial savings account and second career. I think there is a lot of academic emphasis on the difficulty of helping engineers think about ethics. We have let ourselves believe that engineers are not critical ethical thinkers and that this is the biggest challenge to a nation of ethical engineers. As a result, we spend a lot of time and energy thinking about ways to integrate ethical training into engineering curricula and considering how to help engineers make "the right choice." These are good and important things to do. These actions, I think, come from a place of theory – educators, academics, and some engineers looked at the way engineers work now and concluded that engineering, as a profession, would be more ethical if engineers had better training. Dr. Arrigo's statement came from a place of practice. Her experiential knowledge of the personal costs of whistleblowing informed her statement and I think should give everyone pause when considering why engineers are "choosing" unethical choices.

The second most interesting thing I learned this semester came from Dr. Kistiakowsky via Dr. Mian. The idea that there is no inside way to be an activist is a powerful idea, and one that is counter to many of the narratives that we see in popular media. The idea of the person

sabotaging from the inside, the double agent who pretends to be a company person by day but is an activist at night – these are powerful tropes that contribute to the idea that you can, if not destroy then at least undermine, a robust scientific-capitalist-industrial enterprise from the inside. In activist communities, we speak often about a diversity of approaches and there being not one right mean to achieve a social justice end. However, Dr Kistiakowsky's statement makes me wonder if there are at least a few "wrong" ways.

The third thing that stands out this semester is hearing Dr. Bednarek discuss her work as an "Honest Broker of Policy Alternatives." The honest broker section forced me to think through, for perhaps the first time, some of the fundamental differences between the development of scientific knowledge and the construction of technological artifacts. Dr. Bednarek's experience was a useful illustration of how honest brokering can work under two very specific conditions: when done about scientific topics and when between clearly situated scientific stakeholders. I wonder about the translatability of this activity to a technological context. I am not a scientist, but it seems like technological problems are less-clearly bounded and technological stakeholders less-clearly situated. This unit also raised questions for me about the viability of destroying technological knowledge should all parties agree that no good could come of it.

How have the class sessions, topics, and discussions with your colleagues made you think differently about engineering, science, and politics? Are there any things from your Story of Self that you feel differently about? Is there anything you learned that adds color to your Story of Self? Why or why not? (480-500 words)

While reflecting on this semester, class has changed my thinking in a several ways and has left other areas remarkably unchanged.

The changed

Class discussions with other students have been helpful in two ways. First, because of the intimate class size, I have been able to really get a sense of the ways that maturity of thought manifests in contributed ideas (in myself as well). When classmates preface a topic with "I hadn't thought about this before today" vs. "I've been thinking about this for years," the following sentences are obviously very different. As a result, these conversations were instructive to me in both honoring all contributions, and thinking critically about the depth and nuanced contained in a contribution. This, in turn, has helped me think more critically about the general discourse I encounter about engineering, science, and technology (ES&T hereafter) and has, I believe, made me a better engineer and more critical student of the social study of ES&T.

Second, I have found it helpful to read others' reflection papers. I have found it fascinating to see the myriad of ways we all react to the same topic. Seeing diversity of reaction has helped me think more pluralistically about ES&T issues. It is easy to reinforce existing beliefs through

curated exposure to people and topics that agree; it is much harder to critically engage with violently divergent thoughts and make space for their existence and (sometimes) validity. As an individual, an activist, an engineer, and a student dedicated to intersectional, anti-racist praxis, this seeing has contributed to my ability to do intersectional work.

The "Unchanged"

Second, my Story of Self was not a story of Things I Know, but rather a narrative of my experience; this class has not changed that story at all. Because it was a narrative of my experience, I do not look back on it with added color because of class. However, the things that I have learned in class have reinforced my existing individual ethical framework. The ideas that I had entering class – that ethics are important, that individuals can make ethical choices and that those choices have impact – are now more developed and, in a sense, more real. Reading about the specific activism of Linus Pauling, for example, helps to make concrete the idealistic notion of one person being able to make a difference. It also illustrates the limitations of individual activism. The class readings and discussions have helped me to develop a more nuanced sense of what individual activists can achieve. The work of Science for the People has also helped me to think more critically about the role of collective action in my work.

While my Story of Self may not have been changed by class, if I were to write a speculative piece about my future work, it would now include learnings from our readings and discussions. The past remains unchanged, but this class has altered the range of futures I envision.

How might you speak to other engineers about the role of engineers in society and the complexities of doing engineering work? What are the barriers you might have to overcome to engage with engineers about the things we've discussed in class, and how might you overcome them? (360-375 words)

In general, when I speak to other engineers about engineering work, I am struck by the almost-schizophrenic dichotomy between the small amount of control an engineer thinks they have as an individual and the "we control everything" amount of power that they think engineering has. As a result, I struggle to rightsize engineering as a profession and engineers as individual workers, because I believe that workers/individual engineers may have more control than they think and that the profession of engineering, while vital, is not the only one that matters nor is it in sole control of the world.

One of the ways that this dichotomy manifests is as a sense of powerlessness in the face of problems. For example, discussing the volumes of untested rape kits in Detroit, I've found engineers to shrug and say "what can we do? It's a failure of the criminal justice system." They neglect the real possibility that faster and more affordable testing (a discrete science & engineering challenge) could make a sizeable impact; or that perhaps offering their own labs for a small portion of the kits could make a dent.

On the other hand, discussing poverty or other systemic inequities with engineers, I have found their default is to develop engineering "solutions" – like soylent – to address food scarcity.

While engineered food could certainly make a small difference in the availability of food to those living with scarcity, it is unlikely to be the best, or most-effective solution.

One way that I like to think about this is with the old “if you only have a hammer, everything looks like a nail.” In the case of the rape kits, it is as though there are a field of nails, but viewed from the wrong angle and so one cannot see that there are in fact many opportunities to make change.

Like we saw with Edwards and the Flint water crisis, when only engineering solutions are invoked for human problems, there will be vast moral remainders. The ability of engineers to use discernment to find the right position of engineering and expertise to solve problems is going to be crucial as we discuss how engineering impacts and overlaps with society.

How might you speak to non-engineers about the role of engineers in society and the complexities of doing engineering work? What are the barriers you might have to overcome to engage with non-engineers about the things we've discussed in class, and how might you overcome them? (360-375 words)

One of my favorite things when talking to non-engineers about engineering is their sense of fluidity about the things that engineers can control. Non-engineers have an expansive sense of the possible influence of engineers, both individually and as a collective. As part of this expansiveness, I have found that non-engineers *overestimate* the complexity of engineering tasks and *underestimate* the complexity of everything else involved in the practice of engineering.

As an example, I have heard non-engineers marvel at a fancy new website and wonder aloud how the development team got a dataset to display on screen in a certain way. They imagine this specific task to be very technologically complex, nearing on unfathomable for non-engineers to understand. The reality is that the collection, analysis and interactive display of a dataset was a simply a series of hundreds or thousands of smaller tasks that are not particularly complicated and the knowledge of which is independently available through technical manuals. (Which is not to underestimate the *volume* of work involved.)

The challenge is in explaining the difficulty of the volume of human decisions involved in everything else besides the dataset – wrangling stakeholders, negotiating technical deliverables vs budget, determining the legality of dataset ownership, figuring out how often to send emails to users, etc. While I do not expect non-engineers to be able to think like engineers, I do

consistently find non-engineers unable to consider scope and scale-based challenges in a way that is conducive to further discussion.

One of the ways that I overcome this is to have non-engineers explain, in detail, an aspect of their work or avocation. When thinking through the minutia and deconstructing the decision processes they use, I have found that they are able to get a sense of the scale and scope of their work and thus have a framework to use for thinking about those same ideas in an engineering context.

Ultimately, what I want non-engineers to understand about engineering is not its task-based complexity but its humanity. Engineering work is performed by humans and for humans, and like any other human-centered occupation, comes with all of the attendant difficulty. Unfortunately, helping non-engineers understand this is not something that I have mastered yet.