



# Ethics in Engineering Design

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- Lecture for CIV 441 (Civil Engineering, Senior Design Class)  
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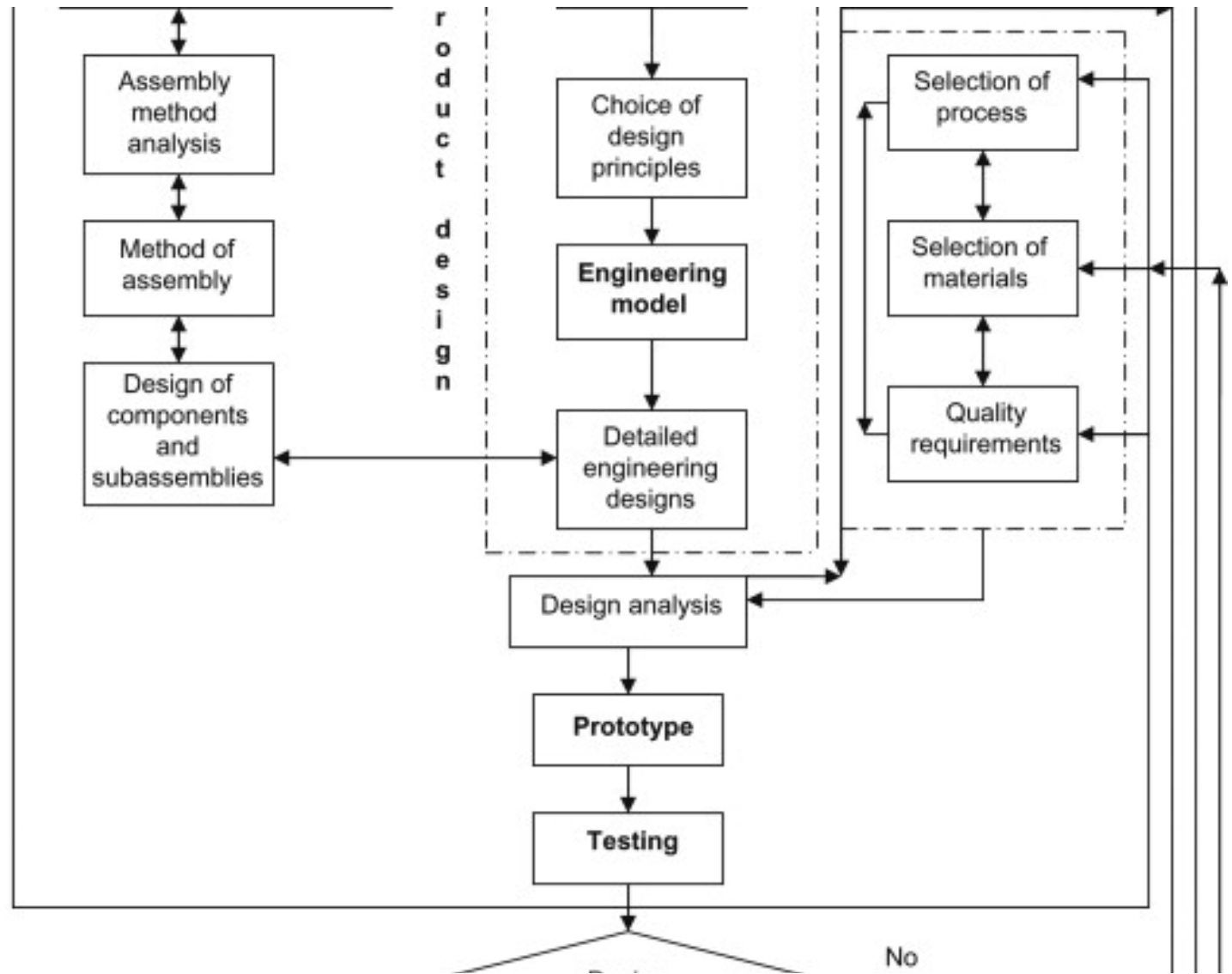


# How Shall We Begin? With Definitions?

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- **Ethics:** The moral principles that govern the conducting of an activity.
- **Engineering design:** An iterative process used to identify problems and develop and improve solutions.
- **Ethics in Engineering Design:** The moral principles that govern the iterative process that is used to identify problems and develop and improve solutions.

Or with a  
Smart  
Graph?





No. That's too old-fashioned. Let's ask a large language model (LLM).

Hello, GPT-4: *Tell me about ethics in engineering design.*

# GPT-4's Answer:

Ethics in engineering design refers to the principles and standards that guide the decision-making process in engineering design. These principles and standards aim to ensure that engineers act in the best interests of society, protect the safety and well-being of people, and preserve the environment.

Some of the key ethical considerations in engineering design include:

- 1. Safety:** Engineers have a responsibility to ensure that the products they design are safe for use. This includes considering the potential risks and hazards associated with the product and designing it in a way that minimizes the risk of injury or harm.
- 2. Sustainability:** Engineers should design products with sustainability in mind, considering the long-term impact on the environment and future generations. This includes using materials and processes that minimize waste and reduce carbon emissions.

- 3. Social Responsibility:** Engineers have a responsibility to consider the impact of their designs on society. This includes considering issues such as accessibility, social equity, and cultural sensitivity.

- 4. Professionalism:** Engineers are expected to maintain high standards of professionalism, including honesty, integrity, and accountability. They should adhere to relevant codes of ethics and conduct themselves in a manner that upholds the reputation of the engineering profession.

- 5. Intellectual Property:** Engineers should respect the intellectual property rights of others and avoid infringing on patents, copyrights, or other forms of intellectual property.

Overall, ethical considerations play a crucial role in engineering design, and engineers have a responsibility to ensure that their designs meet high ethical standards. By doing so, they can help promote the well-being of society and contribute to a sustainable and equitable future.

Using the thumbs down button on the GPT-4 website I said I don't know what "high ethical standards" are and requested a more precise answer.

GPT-4's new answer is below:

### Original Answer



Ethics in engineering design refers to the principles and standards that guide the decision-making process in engineering design. These principles and standards aim to ensure that

### New Answer



Something went wrong. If this issue persists please contact us through our help center at [help.openai.com](https://help.openai.com).

# After GPT's "something went wrong" reply I used its *regenerate response* button and got this slightly improved feedback:

Engineering design involves creating solutions to problems using scientific and mathematical principles. However, the ethical considerations involved in engineering design are equally important as the technical ones. Ethics in engineering design involves considering the moral implications of design choices and the potential impact they may have on society, the environment, and individuals.

Some key ethical considerations in engineering design include:

- 1. Safety:** Engineers have a responsibility to ensure that their designs do not pose a threat to human health and safety. This includes considering the risks of failure and implementing appropriate safety features.
- 2. Sustainability:** Engineers must consider the environmental impact of their designs, including resource consumption, waste generation, and carbon emissions. They should strive to create sustainable solutions that minimize negative environmental impacts.

- 3. Equity:** Engineers should consider the potential impacts of their designs on different groups of people, including those with disabilities, those from marginalized communities, and those with limited resources. They should strive to create designs that are accessible and equitable for all.

- 4. Privacy and Security:** Engineers have a responsibility to protect user privacy and data security. They must ensure that their designs do not compromise user privacy or expose sensitive information to unauthorized access.

- 5. Intellectual Property:** Engineers must respect intellectual property rights and avoid infringing on patents or copyrights.

To ensure ethical engineering design, engineers should follow codes of ethics and conduct, such as those established by professional organizations like the National Society of Professional Engineers (NSPE) and the Institution of Engineering and Technology (IET). Additionally, engineers should engage in ongoing education and training on ethical considerations in engineering design.



Again, I used the thumbs down button and wrote: “I agree, ‘the ethical considerations involved in engineering design are equally important as the technical ones.’ However, there are different philosophical ethics, **Kantian ethics** and **utilitarian ethics** for instance, and I would like to know which ones to use for engineering ethics – can you help?”

Once more, **“something went wrong.”** And now the GPT (Generative Pre-Trained Transformer) gave up and did not even allow me to regenerate another response.

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Or, maybe, GPT-4 didn’t simply give up but had just lost its ethics team with its philosophers who would have known about the various ethics theories?





# Consider this news from March 13, 2023:

*The Verge*, a technology website, informed us that Microsoft had dismissed its ethics & society experts

PLATFORMER / MICROSOFT / TECH

## Microsoft lays off team that taught employees how to make AI tools responsibly



/ As the company accelerates its push into AI products, the ethics and society team is gone

By [ZOE SCHIFFER](#) and [CASEY NEWTON](#)  
Mar 13, 2023, 8:15 PM EDT | [24 Comments](#) / [24 New](#)



- **The Verge wrote:**
- The move leaves Microsoft without a dedicated team to ensure its AI principles are closely tied to product design at a time when the company is leading the charge to make AI tools available to the mainstream, current and former employees said.
- More recently, the team has been working to identify risks posed by Microsoft's adoption of OpenAI's technology throughout its suite of products.
- **The ethics and society team was at its largest in 2020, when it had roughly 30 employees including engineers, designers, and philosophers.**

# How Shall We Proceed Now? Go back to our initial definitions?

We could. But without the educated input of philosophers, we'll most likely stumble about the “moral principles” that should govern engineering design.

Shall we follow the GPT-4 advice and turn to the codes of ethics of professional engineering organizations?

Well, like the Ten Commandments they are useful to a degree. The National Society of Professional Engineers (NSPE) for instance has issued the following [nspe.org/resources/ethics/code-ethics](https://www.nspe.org/resources/ethics/code-ethics) :

- 1. Hold paramount the safety, health, and welfare of the public.
- 2. Perform services only in areas of their competence.
- 3. Issue public statements only in an objective and truthful manner.
- 4. Act for each employer or client as faithful agents or trustees.
- 5. Avoid deceptive acts.
- 6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

**I suggest exploring the new approach that I am taking in my own research, which is on automotive ethics.**

In April 2019, when I began this research, I googled “automotive ethics” and received over 62 million answers in less than 1 second. The top answer was: “to perform high-quality repair service at a fair and just price.” This result was linked to the venerable Code of Ethics of the National Automotive Service Association.

This morning, I googled “automotive ethics” again and received over 77 million results in 0.35 seconds. On the right are the first two results:



Stony Brook University

<https://www.stonybrook.edu> › est › \_pdf › Aut... ⋮

## Automotive Ethics 2.0

Dec 11, 2019 — ADS programming must prepare for accidents, sy attacks, and dilemma situations, yet engineering lacks a universal.

You visited this page on 4/17/23.



Gili's Automotive

<https://www.gilisautomotive.com> › technician-code-of... ⋮

## Code of Ethics For Auto Mechanics

We stand on our sound business principles and uphold high ethic Technician Code of **Ethics**. ASE Certified Code of **Ethics**. All of or

Below is what you get when you follow the first link



# Automotive Ethics 2.0

Professor Wolf Schäfer  
Department of Technology &  
Society

DTS Lecture Series

December 11, 2019

Automated Driving Systems (ADS) will operate on land, in the oceans as well as in air and space. Their first major appearance will be self-driving cars and trucks on highways and in cities. Building supersafe robotic vehicles is a great engineering promise, however, its most underdeveloped element is the design of automotive ethics. Enabling these vehicles for critical decision-making in edge cases is crucial, but also the most obscure part of their moral machinery. ADS programming must prepare for accidents, systemic failures, hacking attacks, and dilemma situations, yet engineering lacks a universal machine ethics and an overarching moral code for AI-driven systems. Various ethical theories – libertarianism, utilitarianism, Kantianism, for example – are available, yet an ADS implementation of any of them would appear arbitrary. The design of morally valid, universal ADS control systems is further complicated by different moral preferences in large Western, Eastern, and Southern cultural clusters. Hence, responsible engineering must begin to address automotive ethics now, before the massive advent of ADS.

My talk is now the first Google result for the automotive ethics query – not too bad .

I introduced Automotive Ethics 2.0 in 2019 with the slide below:

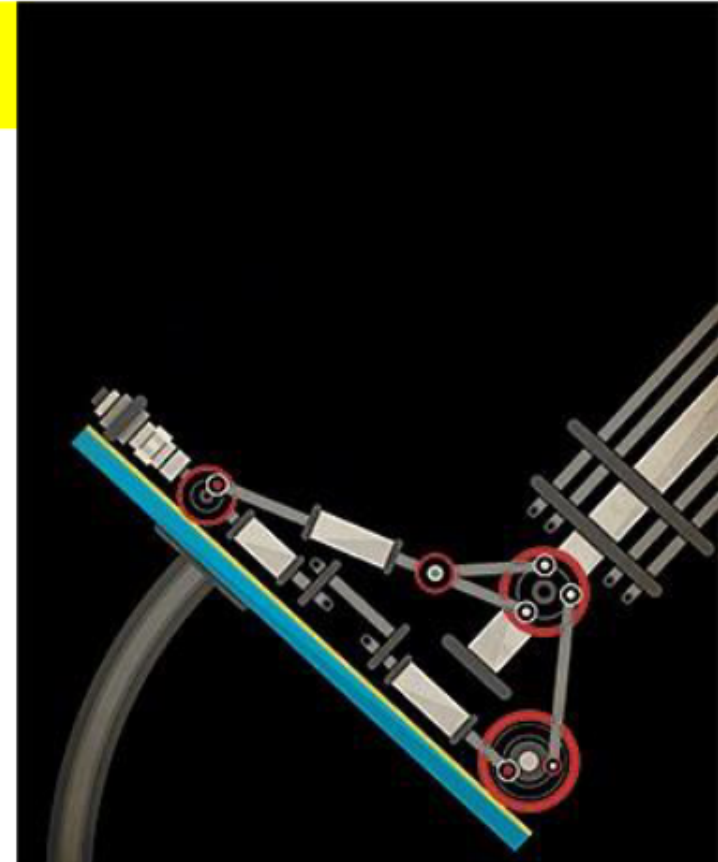
## Automotive Ethics 2.0 = AI + E

DTS at Stony Brook adds the E of ethics to the artificial intelligence of AVs and AEVs: AI + E.

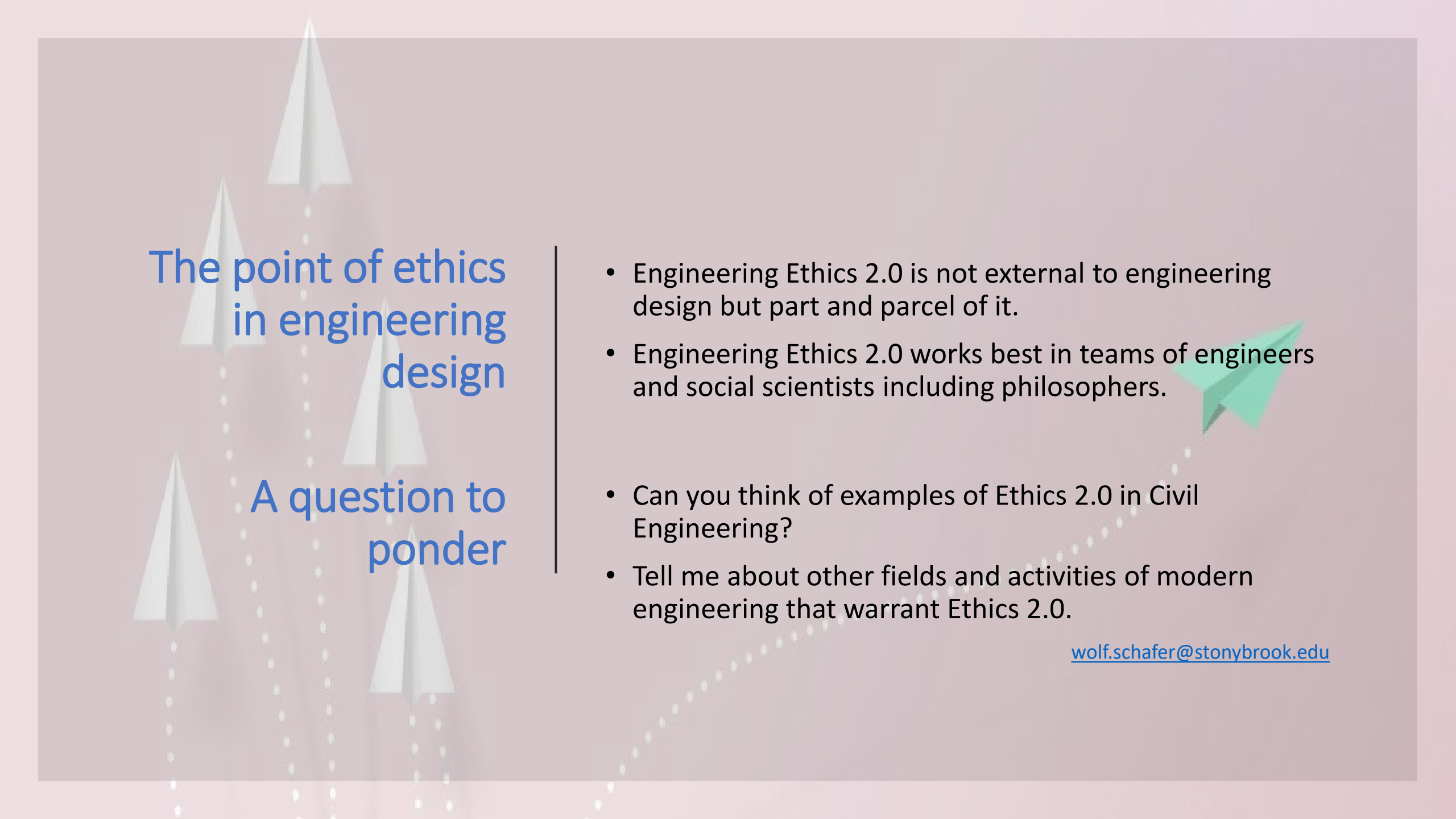
Electric vehicles (EVs) are already on our streets. Automated\* Vehicles (AVs) and Automated Electric Vehicles (AEVs) are coming. The latter are no longer human-driven but steered by Artificial Intelligence (AI).

The difference between Automotive Ethics 1.0 and 2.0 is between an **aspirational Code of Ethics** like the Ten Commandments, which human actors *should* follow, and a **preprogrammed algorithmic ethics** that Automated Driving Systems (ADS) *will* follow.

\* A footnote on our terminology: We distinguish between “automated” and “autonomous.” A Nissan engineer nailed the reason why when he said: “A truly autonomous car would be one where you request it to take you to work and it decides to go to the beach instead.”







## The point of ethics in engineering design

A question to  
ponder

- Engineering Ethics 2.0 is not external to engineering design but part and parcel of it.
- Engineering Ethics 2.0 works best in teams of engineers and social scientists including philosophers.
- Can you think of examples of Ethics 2.0 in Civil Engineering?
- Tell me about other fields and activities of modern engineering that warrant Ethics 2.0.

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