Spring 2015 Syllabus

ESPM 290/MBA 290: Designing Sustainable Materials and Products: Problem Solving for Society and the Environment

ESPM 290, CCN: 30299
MBA 296.3 (no CCN, non MBAs can enroll through Haas during the 3rd week of classes)

Wednesdays, 3-6 pm, 118 Barrows Hall (note: we will have breaks, an active learning class design, and time for collaborative work on class projects)

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Course overview: Using a “public ethics” framework, we will explore the practical challenges and ethical conundrums of redesigning materials and products to make them safer and more sustainable in our very complex modern industrial system. We will also investigate the problems of moving to a more environmentally and socially sustainable future.

We begin the seminar with classes that explore fundamental concepts and structures that are part of this public ethics framework. Using eleven new cases specially developed for this course about products like electric cars, flame retardants, and nanotechnology materials, we look at green design, ethical reasoning, systems thinking, life cycle analysis, information failure, regulatory failure, and organizational denial.

Next, we look in depth at two cases that map ethical issues and agency through a material’s product life cycle: rare earth elements in electronics and bioplastics in drinking bottles. We then examine the potential contributions of various processes for influencing the design of sustainable materials. These processes include corporate supply chain management strategies and organizational structures, litigation in the courts, regulatory reform, design tools, and social movements. We will conclude the course with a materials problem in which you will come up with a theory of change for achieving a transition. You can vote on what this problem will be.

In general, the course will be a highly interactive "brainstorming" process about how to transform our materials design, production and use system. After the first month, most classes will be student-led with faculty contributions and facilitation. We aim to foster a shared learning process for all of us. Throughout, we will collaborate in imagining a new system and how we can make the transition to that system. Critically, the public ethics framework we will develop can be applied to many other technological systems (e.g., water, energy, transportation).
Graduate students from all departments are encouraged to enroll, especially Chemistry, Chemical Engineering, Haas, ESPM, CNR, Political Science, Sociology, STS, Public Health, ERG, CED, Engineering, GSPP, and Law. Qualified undergraduates are eligible but must consult with the instructors.

Our learning goals are:

- Understand/interrogate the key concepts of systems analysis, public ethics, life cycle, agency, green chemistry, learning, and transitions;
- Develop familiarity with key ethical reasoning principles and processes;
- Understand the institutional, organizational, political, and cognitive contexts within which sustainable materials design can occur;
- Be capable of mapping the ethical conundrums that may exist across a material’s life cycle, as well as who in this life cycle is able to influence the material’s design and who should take responsibility for doing so;
- Understand some processes through which materials can be made more sustainable (e.g., litigation, supply chain reforms, regulatory change, design tools, and social movements); and
- Develop a public ethics framework to guide transitions toward sustainable technological systems of all kinds (not simply materials).

Assessment will comprise:

- **Class project**: 60% (see below for some details)
- **Class participation**: 25% (you will be evaluated by your peers and reviewed by faculty at the end of semester)
- **Class presentation**: 15% (you will lead one class with 1-2 other students, presenting a joint 15 minute talk on the class topic and then running a class exercise to facilitate thorough exploration of the public ethics issues; you will sign up for your preferred top three topics)

You can take the class for a letter grade but can also opt for a pass/fail grade. However, experience has taught us that students usually do very well if they put in serious thought and commitment.

**Class Project**: you will form small interdisciplinary teams of ~ 3 students and choose a manageable research project that examines some aspect of the transition to a sustainable materials system. We would like you to research the scientific, economic, regulatory, legal, political, management and other challenges that are making it difficult to achieve this transition, the strategies for overcoming these challenges, and the ethical questions and conundrums that underpin and complicate the problems and the possible solutions.

It is up to your group to decide how to define the focus of your research. You could, for example, focus on a specific material or product that you think needs to be redesigned; or on a particular ethical concern that specific actors (e.g., NGOs, engineers, business
managers) grapple with when trying to improve a material; or on how environmental and social effects could be better visualized for consumers or legislators. Or you could focus on researching an innovative idea for stimulating change in production systems (such as creating a knowledge commons that opens up materials data for better design). We see this as a “brainstorming studio” and strongly encourage you to push the boundaries of what’s possible. More details will be provided in the first two classes. Time will be set aside in the classes to work on your class project.

**Ethics:** We will not look favorably on plagiarism or a lack of collaborative effort in research and teaching teams. We will draw on exercises to help build team collaboration at the outset.

All readings are available on the course website on Bcourses.

**Class 1 - January 21. Introduction to Systems Theory and Public Ethics (faculty-led)**

In this class, we introduce the course and participants, before turning to an appraisal of systems analysis and the concept of public ethics. By public ethics, we mean something that is different from traditional ethical approaches that focus on individual and organizational responsibility: an ethics that can be expressed through the politics and societal governance of new technologies. Ethics can be embedded into the nature and structures of the industrial economy that we live and work in. To explore systems analysis and public ethics, we use a specially written case to consider the sustainability of electric cars. EVs are usually assumed to be inherently more sustainable than conventional vehicles. But are they? Taking a systems perspective we consider such questions as:

- Can EVs be manufactured sustainably? Or at least more sustainably than conventional cars?
- Even if the GHG emissions can be reduced in manufacturing, is driving EVs better for the environment than driving conventional or non-plug-in hybrid cars? Is an electricity based transportation system viable in our current driving culture?
- What should happen when we are done using EVs? Can they be recycled in a less environmentally damaging way than conventional cars – or not?
- What actors will need to take responsibility for making sure the transition to an EV-based transportation system will not cause unintended, but preventable harm?

**Readings:**


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Class 2 - January 28. Green Materials and the Life Cycle Perspective (faculty-led)

In this class, we delve more deeply into the product life cycle perspective and how it helps illuminate some of the challenges facing green designers. Industrial ecologists developed the concept of the product life cycle to illuminate the multiple stages at which products (and the materials with which they are composed) can have hazardous impacts on nature and humanity. These include the stage at which the raw materials used in producing a material are extracted from the earth, the stages at which raw materials are manufactured into finished materials and goods, the stage at which the good is used, and the end of life stage at which the product is recycled or otherwise disposed of. We consider the ethics embedded in bringing a life cycle viewpoint to bear on green design. Among the questions we will ponder are: Why might it be more ethical to take a life cycle view as contrasted to other, more reductionist types of analysis? How does this view change the ways in which we think ethically about product design? To explore these questions, we use a case of the manufacturing and use of polyvinyl chloride (PVC). What is PVC, and how is it made? How has PVC production changed over time? What problems does PVC cause, and for whom at each stage of its life-cycle? What problems have yet to be resolved? What is the best way to think about mitigating PVC’s many remaining hazards? What challenges will have to be overcome to develop new materials with the same functionality that are truly safer and more environmentally benign?

Readings:

Class 3 - February 4. Connecting Agency and Ethical Reasoning (faculty-led)

In this class, we examine ethical theories that frame the discourse that surrounds decision-making related to green materials and product design. A key theme in the course is the ability of people to make and carry out ethical decisions at multiple levels or scales across the production system. We call this ability “agency”. Systemic change entails the work of all or many of the agents in this system, whether or not they deliberately collaborate. These agents often approach their roles in the system from different ethical perspectives, depending on their own personal beliefs and contextual factors. We explore the moral and political controversies that arise when decision makers, at the same or different points in the materials system, use different ethical theories as the basis from which they weigh in on the question whether or not it is “right” or “good” to take action to produce safer, more environmentally benign products. We will look at utilitarianism and non-consequential, deontological theories of justice; and whether and how designers, companies, policy makers, and consumers are applying these ethical theories to the use of Bisphenol A in baby bottles and food containers. We investigate the ethical arguments that these actors make to justify their positions on what should or should not be done to protect infants and others from exposure to BPA. We also consider how environmental justice might change this calculus.
Readings

Class 4 - February 11. Regulation and Governance of Materials. (faculty-led)

In this class, we turn to the larger “infrastructure” of the government and public politics system within which sustainable materials are developed. To a large extent, it is this infrastructure that calls for public ethics analysis to be conducted. The pervasive lack of knowledge about the environmental, social, and health effects of materials can only be understood as a public ethics conundrum -- as something that is caused by the structure and processes of regulation. For our case study, we introduce students to the key principles and features of the Toxic Substances Control Act (TSCA) as the most important legislative framework governing materials in the US. We will examine how the structure of the law shapes the toxicity of the materials that are now in use; in particular, we will look at the utilitarian ethical norms embedded into the law. We will also look at alternative ways to approach the governance of materials, such as the precautionary principle that REACH has begun promoting in the European Union. We will consider why and how these laws and regulatory regimes shape and constrain the ethical choices available to product designers.

Readings:


Class 5 - February 18. Social Scientific Insights into Ethical Challenges (student-led)

In this class, we consider a variety of factors that affect moral decision making by agents in the materials system by discouraging green design. These factors include moral blindness, paralysis, opposition, and denial at individual, corporate, government, or society levels. They can result from the cognitive biases and limitations that shape our
behavior. They can also result from institutional, economic, and political pressures on us to behave in certain ways rather than others. The inability of organizations to transfer, recall, and be critical of information is frequently a reason why corporations fail to recognize that particular products can be ecologically damaging. Regulatory systems may not detect early warning signs of dangers. We therefore consider what social science (especially social psychology, history, and organizational anthropology) can illuminate about the ethical challenges that exist in the sustainable materials system. To explore these dimensions, we examine the use of flame retardants in furniture, electronics, and clothing. There is long-standing evidence that flame retardants do not achieve what they are meant to and that they are harmful substances. There is also evidence that industry has known about this for decades yet has continued to produce and use flame retardants. What may explain the behavior of corporations in promoting flame retardants instead of seeking non-toxic alternatives? Why have government agencies and legislatures failed to acknowledge and act on the risks of flame retardants?

Readings:


Explore: http://greensciencepolicy.org/topics/flame-retardants/

**Class 6 - February 25. Applying Life Cycle Ethics: Rare Earth Elements in Sustainable Electronics** (Student-led)

In this class, we work through the entire life cycle of rare earth elements (REEs) used in consumer electronics, using Apple’s iPhone as our case study. We pay special attention to the geopolitical issues of sourcing REEs as well as the environmental effects of extracting them from the earth, their use in manufacturing, and their recycling and disposal. Our goal is to map the environmental, health, and social effects of REEs and the variety of ethical choices that arise in the design, manufacturing, and use of these materials. Here, the material is mineral in nature. We ask questions such as: what ethical rules could be used to evaluate the extraction of REEs? Should consumers in the US care about what happens around mines in China? Can designers effectively design out the problems of electronic wastes and worker exposures to REE contaminants?
Should companies factor in the geopolitical accessibility of REEs when deciding whether to use them at all?

Readings:

Class 7 - March 4. Applying Life Cycle Ethics: Biobased plastics. (Student led)

In this class, using Coca-Cola’s new bioplastic bottle as the focus of our case study, we work through the entire life cycle of biobased plastics from raw materials to the end of life. We pay particular attention to the ecological and social effects of agricultural production and to the challenges of recycling and biodegrading materials. Our goal is to map the environmental, health, and social effects of bioplastics and the variety of ethical choices that could come up in the design, manufacturing, and use of these materials. This case will also illustrate that materials can vary greatly in the range of ethical questions that are raised (i.e., a comparison between REEs and bioplastics). Here, the material is biological in nature and involves the use of industrial biotechnology. We consider questions such as: what ethical principles can be used to choose between different biomass feedstock and generations of technologies? Should labor issues be integrated into production as well as toxicity? Does the fact that a material is “renewable” automatically make it more ethical than a oil-based material?

Readings:

Class 8 - March 11. Learning Experiments: Change Through Corporate Supply Chain Initiatives (Student led)

In this class, we begin switching from looking at the effects of materials to the various processes that we can use to influence their design toward more sustainable and just forms. These processes can encourage the many actors involved in a materials life cycle to learn how to exert their agency and to make ethical choices more effectively. Here, we consider the ways in which product manufacturers and retailers can reshape their supply chains to reduce the toxicity and environmental impacts of their products, in the absence of government action mandating this. Corporations can instigate changes through their policies, business strategies, organizational cultures, and R&D work. These initiatives often impose costs on the firm itself as well as its suppliers, consumers, and larger societies. Conversely, environmentalists often characterize these programs as “greenwashing.” Using Walmart’s Sustainable Chemicals Policy as the focus for the case study for this class, we ask: What strategies has Walmart developed to increase the likelihood that its suppliers will begin to redesign their products to make them safer and more environmentally sustainable? Are they likely to be effective? Are they ethical? Should private firms be the ones deciding how to improve the safety and environmental
sustainability of products? From an ethical perspective, does it matter if the initiatives involve collaborations with environmental NGOs? Are these voluntary corporate initiatives “good enough” alternatives to regulation? What might make them “good enough”? Firms and their trade associations routinely lobby against environmental regulation. Do green firms have an ethical responsibility to lobby just as hard for regulation to make green design the societal norm?

Readings:

Class 9 - March 18. Learning Experiments: Change Through Legislative/Regulatory Means (Student-led)

In this class, we will examine the challenges and politics of instigating systemic change through law-making and regulation. Remaking a framework for the governance of sustainable materials is potentially highly influential, yet is particularly difficult to accomplish. We will consider the development of new regulatory regimes for sustainable materials. In particular, we will compare and contrast two regulatory reform efforts that are underway: attempts in Congress to modernize the Toxic Substances Control Act at the federal level; and the pioneering experiment of California’s Green Chemistry Initiative. In the former, we will analyze the repeated efforts in Congress over the past few years to reform TSCA. In 2010, the Kid-Safe Chemicals bill expired due to vehement industry opposition. In 2013, Congress has taken up a reform bill that many environmental NGOs are denouncing as deeply flawed because it would, for example, allow more stringent state-level standards to be overridden at the federal level. In the latter, we will look at the policy experiment of the California green chemistry policy regime in depth. This entails tracing how the rule for safer consumer products has evolved over the past 4 years and the role of industry, NGO, and state government officials in shaping that rule. Many ethical problems have appeared in the politics of making, implementing, and fighting the regime. For both examples, we look at questions such as: What sorts of principles should drive the design of reforms? Who should have a voice in deciding what ethics should count? Should legislators trade off more stringent standards against the increased likelihood of actually achieving change?

Readings:
Laura Moreno. “Regulatory Reform of Chemicals Regulation in the United States.” BCGC Case #8

**Students will vote in this class on the problem to concentrate on in the final two classes**

SPRING BREAK!!

Class 10 - April 1. Learning Experiments: Change Through Litigation (Cranor-led)
This class will focus on the extent to which the courts can be used to help create and diffuse new ethical norms in opposition to the dominant norms encouraging the use of harmful materials. We will focus on the notion of toxic torts, which has developed as a potentially potent means of holding corporations accountable but face numerous problems in being realized, such as causation and proof of harm. We will look at the ethical reasoning that lawyers and judges may engage in when resolving cases, and at the possibilities and constraints of litigation. We will ask whether courts are capable of bringing about systemic change. We will discuss these issues using a case written by a leading legal academic and activist that focuses on recent litigation over MOCA and zinc denture crème in products to explore how “legal activists” like Carl Cranor have struggled to persuade judges to adopt a new approach to weighing scientific evidence of the new toxicology that promises to make manufacturers more accountable for the harm their toxic products inflict on consumers.

Readings:
BCGC Case #9


This class addresses one of the biggest challenges of green design: the lack of information about the health and environmental effects of the tens of thousands of chemicals in use today. We will investigate the development of “design tools” (chemical safety assessment methodologies and decision aids) that can help chemists, engineers, product designers, policy makers, and consumers overcome this challenge by giving them access to this information. We will use a case on the design tools that are emerging in the green building industry to consider how activists are trying to pull back the veil of ignorance to enable better green building design. We will critically assess the development, use, and the strengths and weaknesses of several such tools, including the Green Screen, the Pharos Project, the Health Product Declaration, and the LEED Green Building Standard. These tools are instruments of the emerging “alternatives assessment” movement, by which activists hope to both encourage and enable designers at all levels of our industrial system to evaluate chemicals, materials, and products for harm and find substitutes for the harmful ones. Many ethical issues are embedded in these tools. For example, there are many trade-offs between social, health, and ecological effects made in developing the underlying criteria and weights used in tools. However, these trade-offs are often hidden and invisible to users. We will consider how the tools’ structure may shape and constrain design choices, who is designing them and on what basis, and how far these tools can become more inclusive of societal voices.

Readings:
BCGC Case #10.
Class 12 - April 15. Learning Experiments: Social Movement Campaigns (student led)

In this class, we will examine the ways in which social movements could help shape the design and use of sustainable materials. Social movements can involve a wide variety of civil society actors (e.g., NGOs, community groups, consumers, or civic scientists) who work on the idea that societies have a public ethics role in helping decide on whether or not people should be exposed to harmful materials. This could be through mass campaigns, consumer boycotts, information strategies, or environmental justice struggles at the factory or company level. To what degree can NGOs and communities participate in designing materials? Are scientists, companies, and governments ethically obliged to collaborate with them? What challenges exist for more participatory design approaches? We will use a case of nano-materials in consumer products, where social movements are now trying to intervene in the early introduction of these new materials to the market. We will look critically at whether we can develop a “materials sovereignty” model, akin to the “food sovereignty” framework that is now appearing in agri-food systems. Can we say that citizens should ethically have sovereignty over what materials they are using, or should they just leave the choices of materials up to industry and technical experts?

Readings:
Akos Kokai. 2014. “Participatory Politics: The Place of Social Movements in Green Design?” BCGC Case #11.

Our Final Two Classes: The final two classes will focus on a problem that the students collectively choose. We will take a “transitions” approach to thinking more systematically about the process of changing the sustainable materials system.

Class 13 - April 22. Transitions I: Defining Change

In this class, we focus on thinking about what a sustainable materials system would look like and what sorts of changes in the existing system would be needed to achieve that system. We pay special attention to the idea of fostering diverse, multiple, open-ended pathways (rather than allowing a specific pathway to prevail, as we have seen in industrial chemicals thus far).

Readings:
TBA
Class 14 - April 29. Transitions II: Leading Change

In this class, we turn our attention to the challenges of how to foster the leadership needed to accomplish the transition to a sustainable materials system. Drawing on the whole course, we map the specific steps and leadership acts that are needed.

Readings:

TBA

CLASS PROJECTS DUE BY MAY 13, 2015.