Spring 2020

ID 364-002: Industrial Design Studio IV - Performative Materials and Products (Revised for Remote Learning)

Martina Decker

Follow this and additional works at: https://digitalcommons.njit.edu/sad-syllabi

Recommended Citation
https://digitalcommons.njit.edu/sad-syllabi/57

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in School of Art and Design Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact digitalcommons@njit.edu.
EMERGENT MATERIALS AND TECHNOLOGIES IN SPORTS PERFORMANCE

Emergent Materials and technologies have advanced many sectors and industries. In the sports industry, this phenomenon has been commonly referred to as “Technological Doping” in recent years but has in fact been influencing world records for many decades. Of course, the sports performance is dependent on multiple factors, such as the athletes’ psychological and physiological condition. But the influence of sports equipment should not be underestimated. When looking at the Olympic records of men’s pole vault since 1896 (Figure 1) for example, one can clearly see the influences of materials science on the performance of the athletes. Switching from wood to aluminum in the 50s and then to glass fiber composites in the 60s for the poles can be clearly observed in the corresponding athlete’s performance. Similarly, polyurethane based swimsuits captured the world’s attention when they enabled athletes to break over 160 world records. The “supersuits” that are reducing drag in water were subsequently banned from sports competitions by FINA (Figure 2).
The construction industry is another example that has been greatly influenced by material science and nanotechnology. This industry particularly looks towards emergent materials to assist in solving many issues of societal concern such as the conservation and generation of energy in the constructed environment. Especially the photovoltaic cell research has been constantly improved since the 70s. By now the BIPV (Building Integrated Photovoltaic) market for instance is expected to surge to $26 billion by 2022\(^1\) and the design of the products that are being integrated at the building envelope level has to be carefully considered to enable the material inventions.

THE STUDIO:
This Industrial Design Studio will be primarily concerned with emergent technologies and how they are enabling new products. We will contemplate how the developments in the STEM (Science, Technology, Engineering, and Math) fields are shifting the design culture from “reinvention” back to “invention”.

Throughout the semester, we will be focusing on a number of emergent materials and technologies that have been enabled by nanotechnology. We will pay special attention to for example Smart Materials that can “sense” their environment. This genus of materials is known to react to various stimuli in their surroundings (changes in temperature, changes in light, electric fields, or chemicals present) with a significant materials response that can include a shape change, a change in color, luminescing qualities or the generation of an electric current.

In the first two assignments, we will examine various ways in which reactive, performative designs can respond to a variety of situations that arise in our surroundings. In doing so, we will consider how smart materials might enable us to go beyond the tried and tested territory of conventional materials, and spur on design innovation through recent developments in materials science ourselves. Prototyping and testing will be an integral part of these assignments.

---

In the final assignment we will use the skillset that we acquired early in the semester and dive deeper into a customer discovery. In this context you will start contemplating product lines or product families for the project you have developed in the second assignment. All design works for the final assignment are to be submitted digitally. Physical prototypes in lieu of renderings are permitted in this assignment but not required. Prototypes or sketch models need to be photographed and/or documented in video format if they are to be considered for the final grade.

COURSE OBJECTIVES

Throughout the term, we will have opportunities to rigorously examine a number of issues. Students will be expected to execute and present research on materials and technologies and develop convincing design propositions that make use of recent advancements in emergent technologies and smart materials. You will be provided information, through presentations, discussions, readings, and reviews, to allow you to focus on these objectives:

- to develop an awareness and knowledge of emergent materials, in particular the various types and classes of smart materials: what they are, how they perform, what they can do, and what their limitations are
- to develop an appreciation of the broad design implications of emerging technologies
- to develop the ability to examine and comprehend the fundamental principles present in relevant precedents, including works by designers that make use of smart materials and emergent technologies
- to make choices regarding the incorporation of such principles into your own projects
- to contemplate new design applications for smart materials, applications that might exploit their unique properties and, at the same time, might help us address problems that merit our concern
- to develop and implement an effective search strategy appropriate for your information needs
- to gain an appreciation for performative prototyping efforts in design and to learn about the difference between works-like and looks-like prototypes
- to develop design propositions that are reasonable and convincing arguments based on research and evidence
- to develop innovative design works that elegantly, and appropriately, make use of emergent materials and are active and reactive
- to develop an independent sense of experimentation and scrutiny, yet participate in critical discourse
- to get familiar with the designer-client relationship
- to demonstrate effective representation and communication skills that are highly-accomplished throughout the semester
- to develop time management skills that are highly accomplished

COURSE READINGS AND RESOURCES

A portion of this course is devoted to the study of relevant literature on material technologies. Core readings will be taken from the following:


Students should also take advantage of the Pluralsight for software tutorial.

**COURSE STRUCTURE AND SCHEDULE**

All students are expected to attend all classes, work on their projects in studio, and participate in group-discussions. Student presentations are a mandatory part of the course and should be seen as invaluable opportunities for learning. Project assignments will be issued on the dates listed in the schedule below. Each project assignment is due at the beginning of class, on its due date, for review. You will also submit the documentation of your entire assignment in digital form, at the beginning of each review. The semester is arranged as follows, but may be subject to change:

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topics Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thu</td>
<td>23-Jan-20</td>
<td>SMA Workshop / Assignment 1 Issued</td>
</tr>
<tr>
<td>2</td>
<td>Mo</td>
<td>27-Jan-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>30-Jan-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td>3</td>
<td>Mo</td>
<td>3-Feb-20</td>
<td>Assignment 1 Due Assignment 2 Issued</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>6-Feb-20</td>
<td>Presentations on Materials Background Research</td>
</tr>
<tr>
<td>4</td>
<td>Mo</td>
<td>10-Feb-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>13-Feb-20</td>
<td>Field Trip Material ConneXion TBD</td>
</tr>
<tr>
<td>5</td>
<td>Mo</td>
<td>17-Feb-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>20-Feb-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td>6</td>
<td>Mo</td>
<td>24-Feb-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>27-Feb-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td>7</td>
<td>Mo</td>
<td>2-Mar-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>5-Mar-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td>8</td>
<td>Mo</td>
<td>9-Mar-20</td>
<td>Project Development / In-Class Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>12-Mar-20</td>
<td>Class Cancelled</td>
</tr>
<tr>
<td>9</td>
<td>Mo</td>
<td>16-Mar-20</td>
<td>Spring Recess</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>19-Mar-20</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Mo</td>
<td>23-Mar-20</td>
<td>Assignment 2 Due</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>26-Mar-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td>11</td>
<td>Mo</td>
<td>30-Mar-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>2-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td>12</td>
<td>Mo</td>
<td>6-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>9-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td>13</td>
<td>Mo</td>
<td>13-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>16-Apr-20</td>
<td>Online Interim Review</td>
</tr>
<tr>
<td>14</td>
<td>Mo</td>
<td>20-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>23-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>FR</td>
<td>24-Apr-20</td>
<td>Last Day to Withdraw</td>
</tr>
<tr>
<td>15</td>
<td>Mo</td>
<td>27-Apr-20</td>
<td>Project Development / Online Working Sessions</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>30-Apr-20</td>
<td>Assignment 3 Due</td>
</tr>
<tr>
<td>16</td>
<td>Mo</td>
<td>4-May-20</td>
<td>Digital Documentation Due / Last Class</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>7-May-20</td>
<td>Reading Day 2</td>
</tr>
<tr>
<td>17</td>
<td>Mo</td>
<td>11-May-20</td>
<td>Final Exams</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>14-May-20</td>
<td></td>
</tr>
</tbody>
</table>
EVALUATION

Grades for each project are initially assessed on the day that the project is submitted for review. A presentation at the review is mandatory in order to receive a grade for the assignments. Final grades will be determined at the end of the semester, with the complete submission of your work from the entire semester; it will also include an assessment of your individual participation in the course and group sessions. Grades are determined according the instructor’s judgment of how well students achieve the objectives of the course, and the specific objectives and requirements of each project assignment. All group reviews of student work are a mandatory part of the course and should be seen as invaluable opportunities for learning. Although these sessions may inform the grading by the instructor, grades are not determined by the reviews. The value of each project assignment, as a percentage of your total evaluation for this course, is as follows:

Assignment Structure: Grade System:
- Assignment One 15%  
  - Assignment Two 25%  
  - Assignment Three 40%  
  - Individual Participation 10%  
  - Digital Documentation / Kepler3 Documentation 10%  
  100%

- A (4.0) Superior  
- B+ (3.5) Excellent  
- B (3.0) Very Good  
- C+ (2.5) Good  
- C (2.0) Acceptable  
- D (1.0) Minimum  
- F (0.0) Inadequate

DIGITAL DOCUMENTATION

Digital documentation of the entire work of the semester will be required of each student. The documentation for each assigned project is to be submitted on the day of each review, before the presentations. This documentation will provide the Department with a review of your study, and information contained in the digital files might be used in future electronic or printed media publications, either in whole or in part. This record will also enable interested students, faculty, and others to have access to your work in the future. Please be advised that it is highly recommended that you make a copy of the digital package for your own records.

The Digital Documentation has the following requirements:

- The title of the submission (CD, DVD, Google Drive Folder) should be your name only (LAST_FIRST).
- By the end of the semester it will contain three folders titled ASSIGNMENT 1, ASSIGNMENT 2 and ASSIGNMENT 3. Each of these folders shall contain six folders titled: IMAGES, VIDEOS, PRESENTATION, RESEARCH, TEXT, and SOURCE_FILES.
- In the first folder, IMAGES, you are to place high-resolution images of your own creation that were submitted. Each image is to be a 72 ppi/dpi JPEG, at maximum quality (i.e. compression value 10 or 12). The longest dimension of each image, horizontal or vertical, must not be less than 3000 pixels. When you title each image file, simply number the file (i.e. 01.jpg, 02.jpg, 03.jpg, 04.jpg, 05.jpg...).
- The second folder, VIDEOS should contain all animations and videos you have produced to demonstrate your work. Any animated movies that are submitted must be saved as Quicktime MOV, MPEG-4, or AVI files. The larger the size and quality, the better, but movies shall not be smaller than 1024 x 768 pixels.
- In the third folder, PRESENTATION, you are to include a copy of any PowerPoint, Keynote or similar presentations that were made. This folder must also contain a PDF copy of your PowerPoint presentation in its entirety.
- In the fourth folder, RESEARCH, you are to place complete documentation of the technologies that you researched and presented as PDFs. A bibliography and hyperlinks to Internet content should also be included in a PDF or MSWord (.doc) file that summarizes...
the resources you referenced. You will use the Chicago Style for your referencing:
http://www.chicagomanualofstyle.org/tools_citationguide.html

- In the last folder, TEXT, you are to place a written description of your projects. The referencing is to be Chicago Style:
  http://www.chicagomanualofstyle.org/tools_citationguide.html
- In the last folder, SOURCE_FILES, you will place any raw files that were used to create materials for your final presentation, such as AutoCad, Revit, Photoshop, or similar files.

This digital documentation submission will be evaluated in relation to the stated objectives of the course and a demonstrative consideration of:

- The quality and legibility of the chosen images.
- The appropriateness of the images in relation to the objectives of the study.
- Selective documentation of the whole work, and significant parts of the project.
- Evidence of ambitious and thorough research.
- Craft and quality of writing.
- Adherence to the requirements listed above.

Kepler Documentation:
You will receive more information regarding how many files to post on Kepler. All files must be resized and renamed. Do NOT upload folders! Please fill out all of the metadata information. The maximum size is 2000 x 2000 pixels. Images must retain their original proportions without being enlarged. In cases where the width to height ratio exceeds 3:1 you may resize the short dimension to 2000 pixels. To distinguish PROCESS documents from FINAL documents, be sure to enter labeling information in the pull-down metadata section built into each Kepler file. The filename should be saved according to the following naming convention: <Lastname, Firstname ##.jpg>. You must login into the NJSOA network to fulfill this portion of the assignment. The guidelines described here, are in place to promote economical representations of student work and to ensure the sustainability of the Kepler system. Grossly oversized images will be deleted without notice and will not be considered for grading purposes. You must submit your PowerPoint slides as jpegs. It is good practice to keep the images at 72 dpi. You will not receive your final grade until you submit.

ADDITIONAL INFORMATION

Academic Integrity:
Academic integrity is crucial to the reputation of any post-secondary institution including NJIT. Academic dishonesty diminishes our reputation as a high-performance university. In this studio the NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

Attendance:
Attendance will be taken during each class and is an explicitly required component of all on-campus/location-based classes for all students in the School of Art + Design. After three absences, students may be docked one-half grade for each subsequent unexcused absence. In other words, if the final grade would have been an “A”, it results in a “B+”. Similarly, a “B+” is reduced to a “B”, and so on. There is a one-half grade penalty for each absence after the third. In the case of illness or other special circumstance, notification should be given to the instructor as soon as possible and before the date in question. The instructor has to be notified at the beginning of the semester if a student will miss a session (or more) due to religious observance.

Tardiness:
Students are expected to arrive to class on time. The time limit that constitutes an absence versus tardiness is 15 minutes.
Late work:
Project assignments and digital documentation of your work are due at the beginning of class on the specified dates. Students should make every effort to avoid incomplete work and late submissions. Late submissions are not acceptable, except in the case of documented illness or special circumstances. Presentations on review days are mandatory in order to receive a grade.

Last day to withdraw:
Please note that the 6th of April 2020 is the last day to withdraw from this course.

Students with Disabilities:
Students seeking accommodations due to disabilities are required to notify the instructor at the beginning of the semester.

Cell Phone Policy
The use of cell phones during class time is only permitted for emergencies.

Lab Policy
At the material Dynamics Lab, you are expected to maintain a clean and professional studio environment.
ABOUT MARTINA DECKER

Martina Decker is an Associate Professor in the College of Architecture and Design at the New Jersey Institute of Technology. She is originally from Munich, Germany where she received her professional architecture degree from the University of Applied Sciences. Ms. Decker has worked on a wide range of award-winning projects that show her penchant for interdisciplinary work. They include art installations, consumer products and buildings. She pursues design innovation through the exploration of emergent materials, working directly with various types of smart materials and nanomaterials. At NJIT, Martina continues her interdisciplinary endeavors in her Material Dynamics Lab.

ABOUT THE MATERIAL DYNAMICS LAB

In the Material Dynamics Lab, we focus on how emergent materials and technologies can help us address contemporary issues and challenges. In particular, the lab pursues applications for smart materials and nanotechnology in our designed products and the built environment. This includes materials that can enable interactive and reactive objects as well as architectural environments.

The Material Dynamics Lab serves as a vital junction for interdisciplinary innovation, connecting a variety of NJIT’s departments, research centers and specialized labs to generate design solutions to an assortment of problems, including: water conservation and quality, energy conservation and production, health and safety, and security.