



IUPUI

**SCHOOL OF INFORMATICS  
AND COMPUTING**

DEPARTMENT OF HUMAN-CENTERED COMPUTING  
Indiana University-Purdue University  
Indianapolis

**NEWM N549  
3D Prototyping and Articulation**

**Department of Human-Centered Computing  
Indiana University School of Informatics and Computing, Indianapolis  
Fall 2015**

*Section No.:* *Credit Hours:* 3  
*Day/Time:*  
*Location:* IT 255, Informatics & Communications Technology Complex  
535 West Michigan Street, Indianapolis, IN 46202 [\[map\]](#)  
*First Class:*  
*Instructor:* Zebulun M. Wood, MS in Technology, Lecturer  
*Office Hours:*  
*Office:* IT 463, Informatics & Communications Technology Complex  
535 West Michigan Street, Indianapolis, IN 46202 [\[map\]](#)  
*Phone:* 317-278-4140 (Office)  
*Email:* [zwood@iupui.edu](mailto:zwood@iupui.edu)  
*Website:* <http://www.indianauploaded.org> (personal affiliate)

**COURSE DESCRIPTION**

This course covers advanced 3D organic modeling, sculpting, articulation rigging, animation, rendering, and printing of objects, characters, creatures, and plants. Students create and 3D print fully articulated models while researching and experimenting with strategies for collecting, wrangling, and analyzing datasets and visualizing them both on screen and in physical prototypes.

**EXTENDED COURSE DESCRIPTION**

Students develop a set of objects and display them appropriately for their intended application. Of possible objects, students choose from a wide variety of data to anticipate applicable solutions using 3D printing. Students concept their proposals using their own creations or in collaboration with campus or community partners. They research techniques and references gathered from industry and academia and experiment on complex datasets to find appropriate visualizations and physical prototypes. Students evaluate and analyze data to create concrete manipulatives that can inform, inspire, and educate.

**Recommended Texts:**

Fry, Ben. (2007). [Visualizing data](#). O'Reilly Media. ISBN-10: 0-596-51455-7 ISBN-13: 978-0-596-51455-6

Stacey, Mark, Salvatore, Joe, & Jorgensen, Adam. (2013). *Visual intelligence: Microsoft tools and techniques for visualizing data*. Wiley. ISBN-13: 978-1-118-38803-7

### **Resources for Reference**

[DATAWATCH](#)  
[Converting MRI Data](#)

### **Equipment needed:**

- Notebook
- Box Account (<http://www.box.iu.edu/>)

### **Software used:**

- Autodesk Maya 2014 or higher
- Zbrush 4r6 or higher
- Adobe Production Suite
- MarkerWare Bundle 1.0.2

## **STUDENT LEARNING OUTCOMES**

Upon completion of this course, students will	RBT	PGPL	Assessments
1. Research, evaluate, and design plans for a 3D printing production.	5, 6	1, 2	Assignments 1–9
2. Model, prepare, develop, test, and refine production methods in a 3D printing pipeline.	4–6	1–3	Milestone 1–2, Final
3. Evaluate tradeoffs when incorporating 3D printing in applications, including feasibility.	5	1–3	Milestone 1–2, Final
4. Research comprehensively the challenges and costs of any proposed project.	5	2	Milestone 1–2, Final
5. Evaluate, test, and experiment with various datasets to create applicable solutions.	5	1, 2	Assignments 7–9
6. Perform design thinking towards prototype test cases.	5	1–3	Milestone 1–2, Final
7. Critique and create solutions for effective and appealing 3D printing used in prototyping, articulation, and visualization.	5, 6	1–3	Milestone 1–2, Final

RBT: Revised Bloom's Taxonomy

## Principles of Graduate and Professional Learning (PGPL)

Learning outcomes are assessed in the following areas:

- |                                             |                          |
|---------------------------------------------|--------------------------|
| 1. Knowledge and skills mastery (K&S)       | <i>Major emphasis</i>    |
| 2. Critical thinking and good judgment (CT) | <i>Moderate emphasis</i> |
| 3. Effective communication (EC)             | <i>Some emphasis</i>     |
| 4. Ethical behavior (EB)                    |                          |

### Expectations/Guidelines/Policies:

- Attendance. For success in this class I expect students to attend each class session. I will only allow missed classes if you give me notice a full week in advance. This class has a stringent attendance policy of 1 dropped letter grade for each 3 classes missed. I will take attendance at the beginning of each class.
- Exams/quizzes. There are no exams or quizzes
- Homework Assignments. I will require homework exercises following tutorials or in class demo each week. I expect these to be completed by the next class.
- Class Assignments. Class tutorials and demos must be completed with the instructor.
- Class assignments/projects must be finished and handed in on time. If you can't get in an assignment before class, email it to me.
- Final projects will not be accepted late.

### Date for each class meeting:

- Specific pre-class readings
- Specific subject matter/topics covered
- Goals and objectives of each class period

## WEEKLY SCHEDULE

Week 1:

Introduction: Syllabus, Student & Instructor Introductions,  
Student Knowledge Inventory  
Lecture: Equipment/Software Introduction  
Goals of Class, requirements for application and discovery  
Lab: Go over current models in students' inventory  
**Assignment: Bring in models to inventory**  
**Collect resources and network for collaborations, visualization, data that interests you**

Week 2:

Lecture: Introduce equipment in action, \*things to watch out for  
Lab: Review models, data types and options for editing  
**Assignment: Bring in models to inventory**  
**Continue to collect resources and network for collaborations, visualization, data that interests you**  
**Research trends and identify possible area of exploration**

## Week 3

Lecture: History and trends in Visualization and 3D Printing,  
Identify process options

Lab: Review data, make watertight and to scale, print

**Assignment: Bring in models to inventory**  
**Continue to collect resources and network for collaborations, visualization, data that interests you**  
**Research trends and identify possible area of exploration**  
**Create model from data, prepare for print**

Week 4 LAB DAY: Visit with Community or On Campus Partners

**Assignment:** Final .stl ready for print/review  
**Continue to collect resources and network for collaborations**

## Week 5

Guest Lecture: Invited Guest forecasting needs in BIG DATA Applications  
Review Model Application 2 pitches

Lab:

**Assignment:** Check for watertight-ness/ material efficiency

## Week 6

Guest Lecture: Invited Guest forecasting needs in Visualization/ or Abstraction  
Applications

Review Model Application 2 pitches

Lab:

**Milestone 1 Due:** Check for watertight-ness/ material efficiency

## Week 7

Review first models for print check, selection on what to print to be determined

**Assignment:** Pitch 2<sup>nd</sup> Model and Collaboration/ Present Final Models from 1<sup>st</sup> round

## Week 8

Lecture: Continue discussion Applications and Trends  
Review Model Application 2 pitches

Lab:

**Assignment:** Check for watertight-ness/ material efficiency

## Week 9

Lecture: Cleaning/Prepping Data with various applications  
Review models, begin printing ready models

Lab:

**Assignment:** Print approvals check (have watertight, and efficient)

## Week 10

Lecture: Editing Accurately, Engineering in Design

Review models, begin printing ready models,

Lab:

**Assignment:** 2<sup>nd</sup> .stl ready for print/review / pitch final Prototype and Partnership

Research of Trends forecasting for final project- Plan Development

Week 11

Lecture: Review final prints of model 2 and pitches for Final Mold Prototyping for Mass Manufacturing

Lab:

**Milestone 2:** Pitch for Final, Collaborative plan  
Check for all articulated pieces watertight-ness/ material efficiency

Week 12

Lecture: Discuss chosen methods for models, and how to tackle implementation

Lab:

**Assignment:** Check for all prototyped pieces, Check for watertight-ness/ material efficiency

Week 13

Lecture: Visit with Community Partners

Lab: Begin check and print of final prototypes

**Assignment:** Finish and prep for presentation with collaborators

Week 14:

Lecture:

Lab: Begin check and print of final prototypes

**Assignment:** Finish and prep for presentation with collaborators

Week 15

**Present Final Prototype, Future Work, and Industry Forecast in your area**

Week 16

**Present Final Prototype, Future Work, and Industry Forecast in your area**

### **Grading Information:**

- **Weekly Assignments**

All assignments are to be delivered in a folder with your name, class , and week titled, if the assignment is Maya based; with zipped Maya project folders, and will be evaluated through Oncourse within the week.

Each weekly assignment is worth 50 points each.

Weekly assignments will consist of certain body parts and beginning to develop an appreciation of how the body works and moves. Students will learn to see, be patient, and develop a strong sense of foundations in proportion and anatomy.

### **Milestones**

Milestones are key points in the course in which students will be asked to generate their own technical solutions, present research and methods to one another as well as critique and analyze each other's methods from work over weeks.

- **Milestone 1** is a preliminary check on pipeline and material efficiency for creating models for 3D print. *Worth 100 pts*
  - This project is very dependent on your evaluation, planning, and execution of techniques in and outside of class to create an efficient 3D print. Productions often are thrown hurdles and delays; you will be responsible for hitting deadline and planning for these moments, while presenting your methods.
- **Milestone 2** is a primary check on manipulation and use of datasets to create opportunities for visualization.
  - This project is very dependent on your evaluation, planning, and execution of techniques in and outside of class to create an efficient 3D print. Productions often are thrown hurdles and delays; you will be responsible for hitting deadline and planning for these moments, while presenting your methods, research and printing of your manipulations, and plans to refine your experience.

### **Research Topic**

This is your presentation on any given topic related to 3D printing, its uses, and trends. You must relate your research towards the final project you have chosen show your tests, methods, research, and successful implementation of said method into the final presentation. Your research into specific problem area will supplement and support the design and experiments towards your final prototype and partnership with a real or simulated client.

- **Example Topics are but not limited to**
  - Previous solutions towards the display and understanding of specific information
  - Present method and creation of manipulative
  - Anticipate understanding and design challenges of specific information with manipulative and potential opportunities

### **Final Project Milestone and Report on Research**

This is your final, printed out, this can be a high detailed commercial object, still life 3D character or creature, or a fully articulated printed limb by limb action figure of a character or creature.

- 100 points towards model, level detail, quality, and efficiency
- 100 degree of difficulty, sell ability of project
- 100 points for display of final product

### Tentative Assignments

	<i>Due Date</i>	<i>Assignment</i>	<i>Points</i>
Assignment 1		Bring in Models that you have already	50
Assignment 2		Check for watertight-ness/ material efficiency	50
Assignment 3		Check for watertight-ness/ material efficiency	50
<b>Milestone 1</b>		Final .stl ready for print/review	100
Assignment 5		Pitch/model 2 <sup>nd</sup> model of print	50
Assignment 6		Check for watertight-ness/ material efficiency	50
Assignment 7		Preliminary print approvals check	50
<b>Milestone 2</b>		2 <sup>nd</sup> .stl ready for print/review / pitch final articulated model	100
Assignment#8		Check for all articulated pieces watertight-ness/ material efficiency	50
Assignment 9		Check for all articulated pieces Check for watertight-ness/ material efficiency	50
<b>Final and Research Presentation</b>		Delivery of final product/ files	300
<b>TOTAL</b>			<b>900</b>

**Grading Scale:**

A+	97 – 100	Outstanding achievement, given at the instructor’s discretion
A	93 – 100	Excellent achievement
A–	90 – 092.99	Very good performance and quality of work
B+	87 – 089.99	Good performance and quality of work
B	83 – 086.99	Modestly acceptable performance and quality of work
B–	80 – 082.99	Marginal acceptable performance and quality of work
C+	77 – 079.99	Unacceptable work (Core course must be repeated for credit)
C	73 – 076.99	Unacceptable work (Core course must be repeated for credit)
C–	70 – 072.99	Unacceptable work (Course must be repeated for credit)
D+	67 – 069.99	Unacceptable work (Course must be repeated for credit)
D	63 – 066.99	Unacceptable work (Course must be repeated for credit)
D–	60 – 062.99	Unacceptable work (Course must be repeated for credit)
F	Below 60	Unacceptable work (Course must be repeated for credit)

No credits toward major, minor, or certificate requirements are granted for a grade below B–.

**CODE OF CONDUCT**

All students should aspire to the highest standards of academic integrity. Using another student’s work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code > Responsibilities > Academic Misconduct* at <http://www.indiana.edu/~code/>. All students must also successfully complete the Indiana University Department of Education “How to Recognize Plagiarism” Tutorial and Test. <https://www.indiana.edu/~istd> You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else’s words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com. <http://www.ulib.iupui.edu/libinfo/turnitin>

**Academic Misconduct:**

1. **Cheating:** Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.
  - a. A student must not use external assistance on any “in-class” or “take-home” examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use



of tutors, books, notes, calculators, computers, and wireless communication devices.

- b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.
  - c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
  - d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.
  - e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.
  - f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
  - g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.
  - h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.
2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.
  3. **Plagiarism:** Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.
    - a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
    - b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
      1. directly quoting another person's actual words, whether oral or written;
      2. using another person's ideas, opinions, or theories;
      3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
      4. borrowing facts, statistics, or illustrative material; or

5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment
4. **Interference:** A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
5. **Violation of Course Rules:** A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.
6. **Facilitating Academic Dishonesty:** A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

#### **OTHER POLICIES**

1. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.
2. **IUPUI course policies:** A number of campus policies governing IUPUI courses may be found at the following link: [http://registrar.iupui.edu/course\\_policies.html](http://registrar.iupui.edu/course_policies.html)
3. **Classroom civility:** To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones engagement in private conversations and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, surfing the Internet, and posting to Facebook or Twitter during class are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued" (IUPUI Strategic Initiative 9). IUPUI prohibits "discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or [veteran] status" (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

4. **Bringing children to class:** To ensure an effective learning environment, children are not permitted to attend class with their parents, guardians, or childcare providers.
5. **Course Evaluations:** Course evaluations provide vital information for improving the quality of courses and programs. Students are urged to complete one course and instructor evaluation for each section in which they are enrolled at the School of Informatics and Computing with the following three exceptions: (a) The student has withdrawn from the course; (b) fewer than five students are enrolled in the section (in which case anonymity is impossible); and (c) the section is a laboratory that must be taken with a course having a different section number. Course evaluations are completed at <https://soic.iupui.edu/app/course-eval/>. Course evaluations are open from the eleventh week. Course evaluations are anonymous, which means that no one can view the name of the student completing the evaluation. In addition, no one can view the evaluation itself until after the instructor has submitted the final grades for the course. In small sections, demographic information should be left blank, if it could be used to identify the student.
6. **Communication:** For classroom-based courses, instructor or teaching assistant should respond to emails by the end of the next class or, for online courses, within two Indiana University working days, which excludes weekends and holidays. The instructor should provide weekly office hours or accept appointments for face-to-face, telephone, or teleconferenced meetings, and announce periods of extended absence in advance.
7. **Email:** Indiana University uses your IU email account as an official means of communication, and students should check it daily for pertinent information. Although you may have your IU email forwarded to an outside email account, please email faculty and staff from your IU email account.
8. **Disabilities Policy:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of accommodations needed for the course. Students requiring accommodations because of a disability must register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: [aes@iupui.edu](mailto:aes@iupui.edu), Tel. 317 274-3241). Visit <http://aes.iupui.edu> for more information.
9. **Administrative Withdrawal:** A basic requirement of this course is that students participate in all class discussions and conscientiously complete all required course activities and/or assignments. If a student is unable to attend, participate in, or complete an assignment on time, it is the student's responsibility to inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and a student who has been

- administratively withdrawn from a course is ineligible for a tuition refund. Contact the instructor with questions concerning administrative withdrawal.
10. **Emergency Preparedness:** Safety on campus is everyone’s responsibility. Know what to do in an emergency so that you can protect yourself and others. For specific information, visit the emergency management website. <http://protect.iu.edu/emergency>
  11. **Student Advocate:** The Student Advocate provides assistance to students with personal, financial, and academic issues. The Student Advocate Office is located in the Campus Center, Suite 350. The Student Advocate may also be contacted by phone at 317 274-4431 or by email at [studvoc@iupui.edu](mailto:studvoc@iupui.edu). For more information visit <http://studentaffairs.iupui.edu/advocate>.
  12. **Counseling and Psychological Services (CAPS):** Students seeking counseling or other psychological services should contact the CAPS office by phone at 274-2548 or email at [capsindy@iupui.edu](mailto:capsindy@iupui.edu). For more information visit <http://life.iupui.edu/caps/>.

## MISSION STATEMENT

The Mission of IUPUI is to provide for its constituents excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI’s mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University’s Strategic Directions Charter.

## STATEMENT OF VALUES

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana’s capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.