INF 385T: Concepts and Practices in 3d Printing (27620 / 27529)

Fall 2019
UTA 1.506A
Thursday 3pm – 6pm

Instructor: Walker Riley
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Office Hours: Noon-3pm Thursday in the Makerspace

I. Course Description

3d printing is one of the fastest growing technologies commercially available today. This course will highlight the ways in which 3d printing applies to the field of information science in both theory and practice. In this class we will:

- Explore the many applications of this budding technology, as well as discuss the implications of what the technology is likely to become in the near future.
- Investigate the potential dangers associated with 3d printing, as well as the policy that will mitigate that danger.
- Look at how the open-source movement has helped make 3d printing what it is today, and how that has affected the manner in which 3d printing community treats intellectual property.

This course will be relevant for not only Information Science students, but also for those in the fields of Computer Science, Architecture, Engineering, Digital Arts, Health-care, Infrastructure, Public Policy, and many more.

II. Course Aims and Objectives

After taking this course, students will be able to:

- Identify and appreciate the ever-growing applications for 3d printing
- Make a compelling case for why 3d printing and maker spaces in general are important tools for cultivating creativity and learning in communities
- Understand the complexities of ownership and intellectual property law in America
- Utilize 3d modeling software to design and create digital 3d models capable of being printed
- Operate, optimize, and troubleshoot a 3d printer and any software used to 3d print

III. Tentative Course Schedule

Week	Discussion Topic	In Class Exercise	Assignment Due
Jan 23	Introduction	Download Blender, Get to know navigation	
Jan 30		Blender 1: extrude, rotate, scale	
Feb 6	Libraries	Blender 2: merge, subdivide, import stl	Turn-in 1
Feb 13	Education	Blender 3: Boolean modifiers	Turn-in 2
Feb 20	Maker Spaces	Blender 4: Sculpting and Mirroring	Turn-in 3
Feb 27	Museums and Archives	Blender 5: Optimizing for	Turn-in 4

		Printing	
Mar 5	Dealer’s Choice	Cura 1: Quick Prints and View Modes	Turn-in 5
Mar 12	Dangers and Policing	Cura 2: Supports, Brims, Rafts	Paper Proposal, Turn-in 6
Mar 19	Spring Break		
Mar 26	Opensource & Transparency	Cura 3: Layer Height, Print Speed	Proposal for final projects, Turn-in 7
Apr 2	Copyright and Ownership	Cura 4: Infill, Warping, Supplements	Turn-in 8
Apr 9	Dealer’s Choice 2	Cura 5: Editing G-code	Paper Draft, Turn-in 9
Apr 16		Workshop	Final Project Model, Turn-in 10
Apr 23		Workshop	
Apr 30		Workshop	Paper Final Draft
May 7	Final Projects Due	Presentations	Final Project Documentation

IV. Lab rules (Memorize)

- No food or drink is allowed in the labs. You may leave beverages in covered containers in the cubbies in the ante room.
- Report any accidents or incidents to me immediately, even if you think it is minor.
- Closed toe shoes are required; no high heels. You may keep a pair of lab shoes in the designated space in the ante room.
- Protective clothing must be worn as appropriate. On days when we work with reagents pants and long sleeves are required.
- Do not put your hands in your mouth while in the lab, ever. We will be working with/around carcinogens.
- Avoid touching your face.
- Backpacks, purses, sweaters, etc. are to be stored in cubbies during class. Tables and counters should remain as clear as possible.
- Chairs are not tables.
- Only use materials, tools and equipment for which the instructor has given you permission.
- No pens; pencils only.
- Follow the instructor's directions. If you have a question about procedure, ask the instructor rather than another student.
- Always leave the lab cleaner than you found it. I don’t care that it was not your mess.
- New rules may be added.

V. Course Requirements

- **Research Paper:**

  Throughout the semester, you will develop a research paper related to the topic of 3d printing or maker spaces (can take many forms; lit review, case study, experiment etc...) We will have plenty of time in class to get feedback and brainstorm for topics or ideas for your paper. The paper does not have to be publishing quality, but you are welcome to put as much effort into the paper as you would like. Sources can be taken from class readings if they are relevant.

  I offer an alternative to a traditional paper, which will be to build a printer and turn in documentation in place of a your paper. Details will be discussed in class.

  - **Paper Proposal:**

    Turn in a topic, along with a rough outline of the paper. You can change your topic later if necessary. This proposal is primarily to make sure that you are thinking of a paper. It is advisable to have a few sources in mind at this stage.

  - **Rough Draft:**

    Rough drafts should be at least 1000 words, and have at least 10 sources (half of which must be scholarly). Citation styling is up to you. It is up to you how you reach your 1000 words. You can have the first half of your paper thoroughly written, with the second half untouched. You can lightly develop the entire paper. You can have a few paragraphs developed throughout an otherwise skeletal framework of a paper.

  - **Final Draft.**

    Final drafts should be 2500+ words with at least 20 sources (again, at least half of which should be scholarly). I want to see that you thoroughly explored your topic and through about it on a level deeper than just what your sources present to you.

- **Final Project:**

  The final projects will be individual, but I am willing to consider allowing group work for a sufficiently complicated final project. The project will consist of:.

  - **The Model:**

    I want to see that you have a firm grasp of the basics of blender. Having that been said, do not, by any means feel like you have to stop there. If you wish to follow online tutorials in addition to class and you use more complicated tools than we did in class, then please do.

    Final models should show a reasonable amount of complexity to justify why it took several weeks to make. We will discuss model requirements in more detail in class.

  - **The Print:**

    This is a 3d printing class, so I expect all final projects to be printed and ready for presentation by the last class day. If the print does not look good, or does not work as intended, then as long as your documentation explains why, that is fine. The work put into the print is more important than the final project.

  - **The Documentation:**

    Documentation will make up the greatest portion of the final grade. I want a step by step walk through your thought process and I want to see what you did that failed. If you design a mechanical piece that doesn't quite fit I want to know about it, and I want to hear about how you fixed the problem. If you and a group mate have differences in design, I want to hear about it, and I want to know how or if a compromise was reached.

    When writing about your model, tell me which methods you used: did you use a boolean merge or did you merge by hand, etc… When writing about printing tell me every setting you chose and why, and if you had to print multiple times I want to know that as well.

    Documentation can come in whichever form you or your group are most comfortable with. I will accept papers, hand written journals, blog posts, video… whatever is easiest for you to accurately record your process.

- **Turn-ins:**

  The weekly turn-in system is something I am trying as a way to accommodate everyone's individual schedules, while still ensuring that everybody learns the course material. There will be 10 turn-in classes. Each class, students are expected to turn in an assignment of their choosing. Assignment options will be detailed below.

Each assignment is worth a specific maximum grade. Turn-in grades are cumulative, meaning the grade you receive on an assignment on week 3 will be added to the grades received on week 1 and 2. At the end of the semester, students are expected to have earned a 100. Late work will not be accepted on weekly turn-ins, but there are opportunities to make up for lost points in subsequent turn-ins.

All assignment options require documentation. Regardless of what you are turning in, I need to be able to follow your thought process, understand any problems or failures you encountered, and have an idea of all the steps that were taken to get to the final product.

The assignment options, as well as their grade point (GP) maximums, are as follows:

- **Standard Print (10 GP maximum) :** This is a basic model print-job. Find a model you would like to print (this can include your own designs), print it, and document the process. Experiment with settings. You would have to be consciously trying in order to break a printer, so don't be afraid to just guess when selecting print settings. If your print turns out to be a nasty pile of melted plastic, that is fine, as long as you learn from the experience. Documentation for printing must include information about settings(printing temperature, bed temperature, layer height, wall thickness, support settings, infill settings, etc...)
- **Print + Post Processing (12 GP maximum) :** This is a lot like the standard print, but should be followed by any number of post-processing techniques. Examples of post-processing include priming and painting, sanding, gluing and smoothing, acetone smoothing, incorporating other media such as crafts or electronics, etc…
- **Printer Setting Comparison Write-up (15 GP maximum) :** Setting comparisons will consist of printing the same model 2 or more times, while changing one setting (print temperature, print speed, layer hight, material, density, etc…). The resulting prints should then be compared in your documentation. Did the setting change make a noticeable difference? What is the cost/benefit of using which setting?
- **Follow a Blender Tutorial (8 GP maximum) :** Following tutorials online is useful early on to help develop familiarity with the Blender interface. Documentation for following a tutorial must include a link to the tutorial used. You are not expected to write down every step you take, as I will assume you just follow what the tutorial says. Do however write down any confusion you have along the way.
- **Model Design (15 GP maximum) :** Using Blender, produce a 3d-printable model. Subject matter is up to you, but I will be grading on complexity and use of tools learned. Blender is a frustrating software early on, so please remember to write down all frustrations you encounter in your modeling process in the documentation. Ugly models will get a good grade as long as your documentation is thorough.
  Using an online tutorial as a reference is fine, as long as the end product is original. If you do use reference material, make sure to link/cite said tutorial in your documentation.
- **Make a Blender Video Tutorial (25 GP maximum) :** Record and narrate a tutorial of how to create an original model of your own design. Video Tutorials will, with the tutorial creator's permission, be posted to Panopto to serve as a learning tool for fellow students. Documentation should cover not only the video editing process, but the original modeling process as well.

More detail on weekly turn-ins will be given in class.

- ## Participation
  - ### Weekly Reading

    Weekly readings will be posted in canvas. All students are expect to have read all weekly readings before class as the first portion of class will be spend discussing them.
  - ### Discussion Leading

    Students will be expected to lead discussion in class twice over the course of the semester. Topics for discussion follow the calendar above and students will be given a chance to sign up for their topics in the first two weeks of class. Generally there will be 2 discussion leaders per topic, but some weeks will likely end up with 1, and some may end up with 3 upon request.

    Detail about what is expected of a discussion leader will be given on canvas.
  - ### Attendance

    All students are expected to attend every class. Attendance will be taken. What you get out of

this course will be significantly impacted by your participation, and as such, I expect everyone to not just show up, but to be engaged and contribute.

Having that been said, I understand that life gets in the way some times. If you know you will be missing class, try to let me know as soon as possible. If you miss class and I never hear from you about why, your participation grade will be lowered accordingly.

This policy has been abused in previous semesters, so I have put a cap on number of absences I will excuse. As long as you do not try to abuse my leniency with attendance this will not affect you.

Note: Due to other policy abuses, I must make it clear that the participation grade is penalty based. You start the semester with full credit, and lose points as you skip class or don't engage in class. Even though participation is 15% of the final grade, if you skip enough classes, your participation grade can go negative and thereby reduce your final grade by more than 15 points.

VI. Lab Hours (Thursdays Noon-3, Makerspace)

Every Thursday before class, I will be in the Makerspace. You can find me there if you need to talk about anything, or if you would like to print. This is the block of time in which most of your printing should be done since I will be there to supervise/take the blame if anything catches on fire (nothing should catch fire, but it isn't exactly impossible given how printers operate).

If this block of time does not work for you, I will happily work with you on a case-by-case basis to schedule alternative times for lab hours.

If you elect to build a printer, then this is also the block of time you should take advantage of for that.

VII. Grading Procedures

Grades will be determined as follows:

Attendance and Participation: (15%)
Weekly Turn-ins: (45%)
Final Paper: (20%)
Final Project and Print: (20%)