INTERACTIVE TELECOMMUNICATIONS PROGRAM
FALL 2015
COURSE DESCRIPTIONS

TIER 1 - FOUNDATION COURSES

Comm Lab: Animation
(2 Points) ITPG-GT.2002.1 Call#5857 Tues 09:00am to 11:30am Marianne Petit
(2 Points) ITPG-GT.2002.2 Call#5858 Thur 3:20pm to 5:50pm Gabe Barcia-Colombo
(2 Points) ITPG-GT.2002.3 Call#5859 Mon 12:10pm to 2:40pm Marianne Petit
This course explores the fundamentals of storytelling through animation. Students will create two short animation pieces over the course of seven weeks. The first part of the course is devoted to the stop motion sing Dragon Stop Motion. The second part of the course is devoted to digital collage animation using After Effects. Drawing skills are not necessary for this class, however, you will keep a sketchbook. Basic video and sound skills are required. This two-credit course will meet the last seven weeks of the semester.

Comm Lab: Video and Sound
(2 Points) ITPG-GT.2001.1 Call#5848 Tues 12:10pm to 2:40pm Gabe Barcia-Colombo
(2 Points) ITPG-GT.2001.2 Call#5849 Thur 3:20pm to 5:50pm Gabe Barcia-Colombo
(2 Points) ITPG-GT.2001.3 Call#5850 Wed 6:30pm to 9:00pm Sarah Rothberg
(2 Points) ITPG-GT.2001.4 Call#5851 Mon 12:10pm to 2:40pm Marianne Petit
This course explores the fundamentals of sound and video. Students will learn the basics of both audio and video recording using audio field recorders and a variety of cameras (from the Panasonic Xacti through the Canon 5D D-SLR) as well as editing and exporting in Final Cut Pro. Students will work in teams to produce both an audio soundscape and a three-minute video short. This two-credit course meets for the first seven weeks of the semester.

Comm Lab: Visual Language
(2 Points) ITPG-GT.2005.1 Call#5854 Mon 3:20pm to 5:50pm Katherine Dillon
(2 Points) ITPG-GT.2005.2 Call#5855 Wed 3:20pm to 5:50pm Nancy Nowacek
(2 Points) ITPG-GT.2005.3 Call#5856 Tues 12:10pm to 2:40pm Katherine Dillon
(2 Points) ITPG-GT.2005.4 Call#5989 Thur 3:20pm to 5:50pm Nancy Nowacek
The goal of this course is to provide students who are new to the principles of visual design with the practical knowledge, critical skills and confidence to effectively express their ideas in a visually pleasing and effective way. Over the course of 7-weeks an overview of the many tools and techniques available to convey an idea, communicate a message and influence an experience will be presented, discussed and applied. Topics covered in the course include: typography, color, composition, branding, logo and information design. This class is intended for students who do not have formal graphic design or visual arts training but recognize the powerful impact of visual decisions in their work.

COURSE OUTLINE
Class 1 – Principles of Visual Communication
Class 2 – Signage and Information Systems
Class 3 – Typography/Composition
Class 4 – Logo and Brand Design
Class 5 – Color Theory
Class 6 – Information Design

Each meeting a new topic will be presented. The format will be a class discussion with a focus on examples of the theme for the week. Each topic will have a related assignment that will done by each student individually and presented and critiqued in the following class. For students new to or with limited skills in Photoshop or Adobe Illustrator there will be a series of informal weekly workshops led by residents to teach the basics and answer questions on use of the software. Completion of the assignments and participation in the class discussion is required. Students must maintain a blog where they post their assignments. This two-credit course will meet for the first seven weeks of the semester.
Applications
(4 Points) ITPG-GT.2000.1   Call#Gordie will enroll you   Tues 3:45pm to 6:30pm   Nancy Hechinger
This introductory class is designed to allow students to engage in a critical dialogue with leaders drawn from the artistic, non-profit and commercial sectors of the new media field, and to learn the value of collaborative applications in response to issues raised by the guest speakers. Interactive media projects and approaches to the design of new media applications are presented weekly; students are thus exposed to both commercial as well as mission-driven applications by the actual designers and creators of these innovative and experimental projects. By way of this process, all first year students, for the first and only time in their ITP experience, are together in one room at one time, and as a community, encounter, and respond to, the challenges posed by the invited guests. The course at once provides an overview of current developments in this emerging field, and asks students to consider many questions about the state of the art. For example, with the new technologies and applications making their way into almost every phase of the economy and rooting themselves in our day to day lives, what can we learn from both the failures and successes? What are the impacts on our society? What is ubiquitous computing, embedded computing, physical computing? How is cyberspace merging with physical space? Class participation, group presentations, and a final paper are required.

This course meets in room 200 of the Cantor Film Center (36 E. 8th Street).

Introduction to Physical Computing
(4 Points) ITPG-GT.2233.1   Call#5711   Tues 12:10pm to 2:40pm   Daniel Shiffman
(4 Points) ITPG-GT.2233.2   Call#5712   Thur 12:10pm to 2:40pm   Lauren McCarthy
(4 Points) ITPG-GT.2233.3   Call#5713   Wed 12:10pm to 2:40pm   Shawn Van Every
(4 Points) ITPG-GT.2233.4   Call#5714   Thur 3:20pm to 5:50pm   Lauren McCarthy
(4 Points) ITPG-GT.2233.5   Call#5715   Wed 12:10pm to 2:40pm   Daniel O'Sullivan
(4 Points) ITPG-GT.2233.6   Call#5716   Wed 12:10pm to 2:40pm   Daniel Shiffman
(4 Points) ITPG-GT.2233.7   Call#5822   Tues 09:00am to 11:30am   Roopa Vasudevan
What can computation add to human communication? Creating computer applications, instead of just using them, will give you a deeper understanding of the essential possibilities of computation. The course focuses on the fundamentals of programming the computer (variables, conditionals, iteration, functions, and objects) and then touches on some more advanced techniques such as data parsing, interfacing with hardware, mobile development, and HTML5/DOM. The JavaScript-based 'p5.js' programming framework is the primary vehicle for the class. All sections assume no programming experience at all. The end of the semester is spent developing an idea for a final project and implementing it using computer programming. (Programming (Pure), Foundation) https://github.com/ITPNYU/ICM

Introduction to Computational Media
(4 Points) ITPG-GT.2301.1   Call#5717   Wed 09:00am to 11:30am   Thomas Igoe
(4 Points) ITPG-GT.2301.2   Call#5718   Wed 3:20pm to 5:50pm   Thomas Igoe
(4 Points) ITPG-GT.2301.3   Call#5719   Wed 09:00am to 11:30am   Daniel Rozin
(4 Points) ITPG-GT.2301.4   Call#5720   Thur 12:10pm to 2:40pm   Jeffrey Feddersen
(4 Points) ITPG-GT.2301.5   Call#5721   Wed 12:10pm to 2:40pm   Benedetta Piantella
(4 Points) ITPG-GT.2301.6   Call#5722   Thur 12:10pm to 2:40pm   Benedetta Piantella
(4 Points) ITPG-GT.2301.7   Call#5921   Wed 3:20pm to 5:50pm   Daniel Rozin
This course expands the students' palette for physical interaction design with computational media. We look away from the limitations of the mouse, keyboard and monitor interface of today's computers, and start instead with the expressive capabilities of the human body. We consider uses of the computer for more than just information retrieval and processing, and at locations other than the home or the office. The platform for the class is a microcontroller, a single-chip computer that can fit in your hand. The core technical concepts include digital, analog and serial input and output. Core interaction design concepts include user observation, affordances, and converting physical action into digital information. Students have weekly lab exercises to build skills with the microcontroller and related tools, and longer assignments in which they apply the principles from weekly labs in creative applications. Both individual work and group work is required.

Tier 2
Creativity in the 21st Century Economy: Pitching Your Projects as Branded Content
(1 Points) ITPG-GT.2781.1   Call#20951   Sat 1:00pm to 6:00pm   Sat 1:00pm to 4:45pm   Michael Rosenthal
Traditional advertising is dead. Brands have realized that in order to succeed in the 21st century they need to be associating themselves with cool content rather than hoping people stick around for the ads (they don't). As such
there is a growing opportunity to have brands pay to be associated with your tech savvy, creative media project. In this class we'll do an overview of this emerging field, discuss some of the different approaches and what typical deals tend to look like, and then dive into your specific projects and discuss ways you can be presenting your work to brands and agencies. This class will take place on two subsequent Saturdays. You should come prepared with an existing project you want to work with. During the week between classes you'll be expected to prepare both a written and verbal pitch, both of which you will present on the second Saturday to the class and special guests from the industry for feedback.

This one-credit course will meet on Saturday, November 14 from 1 p.m. to 6 p.m. and Saturday, November 21 from 1 p.m. to 4:45 p.m.

Holograms Hacks
(1 Points) ITPG-GT.2787.1 Call#25370 Mon 3:20pm to 6:20pm Jason Sapan
Holography is one of the most powerful but least used of the visual 3D technologies with a resolution of approximately 10 billion pixels by 3,000 deep. In this class we will actually make 3D holograms with lasers and learn how to use dimension to its fullest extent. You will be free to design a hologram that can be used in any creative way as an active or passive element in a project.

This one-credit course will meet on Monday, November 2 and Monday, November 16 from 3:20 pm to 6:20 pm, and on Monday, December 7 from 3:20 pm to 6:05 pm.

Mapping Systemic Relationships
(1 Points) ITPG-GT.2739.1 Call#20952 Sat 12:00pm to 6:00pm Sun 12:00pm to 2:45pm Howard Silverman
Systems thinking is relational thinking, and the best way to understand systemic relationships is to map them out. In this class we will develop, discuss, and compare a range of mapping (i.e., diagramming) techniques, such as: social ecosystem mapping, analog mapping, concept mapping, causal mapping, influence mapping, and scenario mapping. We will use these mapping techniques to examine social and environmental issues, and the resulting maps will inform our conversations as we consider and critique strategies for effective engagement. No explicit familiarity with systems thinking is required; this class will serve as both introduction for newcomers and augmentation for old hands. Students will work individually and collectively to apply mapping techniques to case studies (provided as text, audio, video) of social and environmental issues. These mappings will challenge students to articulate and clarify both their understandings of complex situations and their hypotheses about affecting change in areas of concern or opportunity. Throughout the course, hands-on exercises will be woven together with introductions to relevant systems theory and discussions of mapping insights.

This one-credit course meets on Saturday, November 7 from 12 noon to 6 p.m. and Sunday, November 8 from 12 noon to 2:45 p.m.

Speculation as Process
(1 Points) ITPG-GT.2741.1 Call#21091 Sat 1:00pm to 6:00pm Sun 1:00pm to 4:45pm Chris Woebken/Richard The
The Speculation as Process course is built around ongoing research on futuring methods at The Extrapolation Factory. Over the course of the class, we will develop imagination devices and futuring process followed by an iterative series of rapid investigations, incorporating design-fiction prototyping and re-contextualization of the ideas generated. The class will research new tools and methods for generating speculative concepts with the intention to suggest develop new interactions and tools around emerging scientific research in the area of to be re-contextualized back into New York City (ie. Finance world, Psychic Reading Salon or Office of Emergency Management). The multiplicity of speculative prototypes aims to develop a new language for engaging with these emerging scientific and technological developments in the efforts for providing a system for situating near-term efforts with future guideposts, shape design discussions and ultimately evaluate those developments and influence our collective futures.

This one-credit course will meet on Saturday, September 12 from 1 pm. to 6 p.m. and Sunday September 13 from 1 p.m. to 4:45 p.m.

Computational Portraiture
(2 Points) ITPG-GT.2625.1 Call#5961 Sat 12:00pm to 5:00pm Sun 12:00pm to 2:30pm James George
Ten percent of all photographs ever taken were created in just the last year. How has the ubiquity of cameras changed our culture's relationship to images and altered photography as an artistic medium? By combining digital imaging, new sensing technology, algorithms, and metadata like geolocation, scientists and artists are discovering ways to synthesize new forms of vision out of vast data sets. Have these processes revealed new ways of seeing? What possibilities await in the near future?
During this 2-point course we will survey recent artworks made with techniques such as photogrammetry, 3D scanning, and computer vision, and research the tools used to create them. Students will have one week to conduct a portrait study using one of the techniques explored.

**This two-credit course will meet on Saturday, October 3, Sunday, October 4, and Saturday, October 17 from 12 noon to 5 p.m., and Sunday, October 18 from 12 noon to 2:30 p.m.**

**Crafting Mindful Experience**

(2 Points) ITPG-GT.2627.1  Call#5962  Mon 6:30pm to 9:00pm  Frederick Muench

Over the last 10 years our sustained attention and gratitude have decreased while perceived stress, social and material comparison and entitlement have increased. There have been numerous attempts to build technologies that enhance our mindful awareness and wellbeing but few have gained the traction expected based on the scope of the problem.

The goals of this course are to understand underpinnings of stress and wellbeing, methods used to improve wellbeing, and ingredients of affective computing systems and behavior change paradigms. Based on this foundation, we will perform in-depth reviews of existing services, products and applications, practice various forms of meditation, and you will design systems that foster positive experiences, mindful awareness, meditative and embodied states, physiological balance, etc. The projects you develop will be based on your personal goals and needs and you can use any medium of delivery (e.g., device, application, video, performance). The emphasis in this class is on theory and creatively tackling new methods to foster a higher state of internal harmony and wellbeing.

The class will meet for the first 7 weeks of the semester.

Week 1 - What is the problem? Practice: Universality

Week 2 - What is meditation and mindfulness? What are the physiological & neurological mechanisms of the different forms of practice? Practice: Mindfulness Meditation.


Week 5 –What are the ingredients of happiness and successful behavior change? Practice: Compassion and Gratitude.

Week 6 –How can we engineer our external world to foster internal wellbeing? Practice: Reshaping our Environment.

Week 7 –Present Final Projects. Practice: Class Guided

**This two credit course will meet the first seven weeks of the semester.**

**Designing for Seniors in the Information Age**

(2 Points) ITPG-GT.2743.1  Call#20995  Thur 09:00am to 11:55am  Russell Blanchard

Design is a field which occupies itself with the hypothetical questions of 'what if?' and 'what could be?'. In any design process we are presented with dozens or hundreds of questions along the way. Like in a geometric proof, each decision we make will have an effect on subsequent questions and answers. How and why we make these decisions will determine whether a design will succeed or fail.

This course will teach research, analytical, and design techniques which will help designers identify critical opportunities and make informed and defensible design decisions which will stand up to the scrutiny of clients and resonate with end users.

We will focus on identifying opportunities to create physical and technological design solutions which will help seniors and Baby Boomers remain relevant and integrated in mainstream society and extend the quality of their lives.

Consider that there are over 80 million Boomers in the US controlling over one trillion dollars in assets (80%+ of the US total). The oldest Boomers are now only 73 years old but, as a group, they have already come to dominate the medical device market. Still, most products and brands are geared for Traditionals (the previous generation) whose cultural priorities and values differ significantly from the 'consumer culture' oriented and tech aware Boomers.

" Through direct research and analysis, we will identify latent opportunities for disruptive design solutions, both physical and technological which will help preserve and extend societal engagement and the quality of life for the target demographic. Students will conduct various forms of field research working with individuals and organizations in our target demographic to test their assumptions and hone their solutions. They will then build prototypes which can be tested by the targeted end user. Possible organizations will include; AARP, Senior Planet, Aging 2.0, OATS (Older Adults Technology Services) "The course will require a significant amount of field research and iterative studio work. It will include:

• Research: Qualitative and quantitative methodologies for collecting target information, problem identification and analysis. 'Design Research Methods and Perspectives' edited by Brenda Laurel will be used as a guide.
• Iterative Exploration: Ideation, sketching, sketch modeling (on computer and real life), 3D analysis, testing for feedback
• Design Development: Choosing direction, honing supporting material (research) into compelling case, prioritizing problems to address in designs, human factors, usability, refining drawings, models, detailing, materials, colors, finishes, etc.
• Presentation: deliverables may include; digital graphic presentation, renderings, research, drawings, scale model/prototype, video, process book. Final presentations will be presented, by the students, to our participating organization(s) for evaluation. This two-credit course will meet in the first six weeks of the semester.

Educate the Future
(2 Points) ITPG-GT.2745.1 Call#20999 Fri 3:20pm to 5:50pm Gregory Dorsainville
The New York Times reported in the spring of 2014 that fewer High School grads have opted to attend College, halting a trend of increasing matriculation for four plus decades. What is going on? As education in the US experiences a shift from being perceived as the most obvious method of higher social mobility, the viability of Higher Education is in doubt. The product of Higher Education is ripe for upheaval with new thinking in the presence of the digital, mobile, and social media revolutions that have changed many industries this decade.

This course will ask you to observe, imagine and create the vision of Higher Education, 1 year, 5 years, 10 years into the future. How will people learn? How will teachers teach? How will you measure your academic success? How will students connect to peers and experts? Who will be able to attend this future? Will higher ed be on your wrist or in a building? Will education be gamified?

Our weekly conversation will have voices from people helping to shape and improve education today, with futurists, with designers, and with content creators. We will explore the current education landscape globally. We will restructure education in terms of experience design, with the goal of improving the experience for the learner. We will discuss how our experiences have motivated our learning. At the end we will design experiences that capture the essences of these visions. This two-credit course will meet in the first seven weeks of the semester.

From Prototype to Fabrication: Planning for Mass Production
(2 Points) ITPG-GT.2749.1 Call#21001 Thur 6:30pm to 9:00pm Sarah Krasley
Navigating the world of mass production can be challenging. Prototyping and making one of something for class is pretty straightforward, but what happens when other people want one? How much will it cost to make five of what I made once? How about 50? How about 5000? Where will it be manufactured and with what machines? Questions like these can feel daunting.

This class is for students who have identified a well-defined product idea and/or digital or physical prototype. Coursework will focus on increasing the student's understanding of how they would attempt to mass produce the product and how much it would cost.* Classes will be a combination of lecture, hands-on work, and student presentations. Between the first and second session, students will be assigned to work through a network manufacturer to complete their BOM and RFQ. This two session class teaches an approach to planning for mass production. In the first session, we will learn what goes into a Bill of Materials (BOM) and how to structure a request for quote (RFQ). In the second session, we will review student presentations of their results working with sourcing providers and evaluate different options for production against a set of criteria (hypothetical and real). This two-credit course will meet in the first seven weeks of the semester.

Future Interfaces
(2 Points) ITPG-GT.2751.1 Call#21002 Thur 12:10pm to 2:40pm David Lobser / Kenneth Perlin
Traditional user interface elements, such as buttons, sliders and drop down menus, require computer users to conform to a regime of screen-based and device-driven affordances. In this class we will envision a future where the human mind and body are unshackled by such anachronisms, and language itself extends to include intuitive gestures that can interact directly with the world around us.

Using a custom library for gesture and virtual/augmented reality developed at Ken Perlin's lab, we will examine the roots of sign languages such as ASL, of Chinese logograms, and the ways in which children naturally develop their own languages. We will imagine a future where we will share an immersive, computer augmented reality which we can manipulate and use to communicate visual ideas with each other just as naturally as we use speech and gesture today. This two-credit course will meet in the first seven weeks of the semester.
Intro to 3D for Printing
(2 Points) ITPG-GT.2757.1    Call#21005    Mon 3:20pm to 5:50pm    Xuedi Chen
3D environments and objects are powerful prototyping tools. This class will introduce the basics of 3D modeling techniques in Rhino and students will learn to create assets for prototyping and 3D printing. The class will take an industrial design approach to design and build with specifications and materials in mind. Students will learn to think, plan, design, and produce well thought out objects to fit their specific needs. (examples: motor mounts, enclosures, wearables etc.)

This two-credit course will meet the first seven weeks of the semester.

Intro to Fabrication
(2 Points) ITPG-GT.2637.1    Call#5965    Mon 6:30pm to 9:00pm    Benjamin Light
(2 Points) ITPG-GT.2637.2    Call#5993    Mon 6:30pm to 9:00pm    Benjamin Light
(2 Points) ITPG-GT.2637.3    Call#20757    Wed 6:30pm to 9:00pm    Benjamin Light
(2 Points) ITPG-GT.2637.4    Call#20758    Wed 6:30pm to 9:00pm    Benjamin Light

Time to get your hands dirty. Prototypes need to be created, motors have to be mounted, enclosures must be built. Understanding how things are fabricated makes you a better maker.

But hardware is hard. You can’t simply copy and paste an object or working device (not yet anyway), fabrication skills and techniques need to be developed and practiced in order to create quality work. You learn to make by doing.

In this class you will become familiar and comfortable with all the ITP shop has to offer. We will cover everything from basic hand tools to the beginnings of digital fabrication. You will learn to use the right tool for the job.

There will be weekly assignments created to develop your fabrication techniques. There will be in class lectures, demos, and building assignments. Emphasis will be put on good design practices, material choice, and craftsmanship.

Sections 1 and 3 of this two-credit course will meet in the first seven weeks of the semester; sections 2 and 4 will meet in the last seven weeks of the semester.

Performing Participation
(2 Points) ITPG-GT.2759.1    Call#21008    Mon 3:20pm to 6:15pm    Taeyoon Choi

Is there a script behind our participation in everyday events? What are the factors that are engineered into human experience? This class will explore the codes of participation embedded in technological spectacle of daily life by staging experimental happenings. Happening, a term coined by a performance artist Allan Kapprow in the 50s, transforms space as an interface for unconventional situations to occur and a site of confrontation and stimulation. Contemporary performance artists create work outside the division of staged and timed events, toward art work that seeks to establish sense of affect and presence. This class will explore participation as an artistic medium to create an unconventional performance art piece. The classes will be split between 40% lecture and 60% student participation through physical activities.

Learning outcome:

Become confident improvising in unexpected situation. Create series of happenings with instruction and documentation.

Objective:

Interpret the meaning of participation we perform in daily life, consumption and communication.

Perform participation in the public sphere, using technology to build commons between individuals.

This two-credit course will meet the first six weeks of the semester.

Product Autopsy
(2 Points) ITPG-GT.2775.1    Call#21010    Tues 6:30pm to 9:00pm    Leonardo Bonanni

Where do things come from? What are they made of? How do they impact society and the environment? That is what this class is about. Product Autopsy is the process of revealing the hidden life of things: the people, the places, and the ideas that made them possible. Over the course of this half-semester class, students will select personally relevant products or services and disassemble them to reveal their impact. Along the way we will
become familiar with the state of the art in impact assessment, including environmental footprinting / Life-Cycle Assessment, social impact assessment, cultural sustainability and operational risk and resilience. Over the course of seven sessions students will prepare a detailed autopsy of their selected products using the most relevant impact metrics and present the results in a mid-term exhibit/review. Projects will be evaluated with an eye toward finding opportunities for radically sustainable alternatives to the way things are made today. *This two-credit course will meet the first seven weeks of the semester.*

**Art Strategies**  
(4 Points) ITPG GT.2785.1  
[Call#24813](#) Wed 3:20pm to 6:15pm  
Marina Zurkow

Art is not a monolithic category!

This class is an introduction to the diverse practices gathered under the category “Visual Art.”

This world of visual art includes sound installation and performance, and happens not only in galleries and museums, but also on streets, parks, rivers, in nail salons and rowboats. Artists now are hybrid beings, bringing into their work personal orientations of race, class, gender – even interspecies interests, focuses ranging from law, neuroscience, beekeeping, and the legacies of 125 years of “modern” experimentation.

Whether you want an introduction to art-making and the concerns that inform it, or have an established practice, this class is an opportunity to workshop new approaches for your own work, and begin to encounter the strategies and contexts of established artists working in the fields filed under Art.

“Art Strategies” connects your studio practice with a survey class. In the spirit of “borrowing” or trying on, you may find newly resonant connections between your desire for expression, and an introduction to the practices and theoretical contexts of established artists.

This 12-week class will cover 6 art strategies, combining research with bi-weekly assignments. You will work individually on assignments, and in teams to present research. The assignments are structured as responses to the strategy topic – for instance, how can you create a quick prototype for a project using appropriation as your framework? How can you use a lens of feminist critique?

The class will be rich in individualized resources and critique, and will provide a topical survey of artists working in diverse ways. We will be conscious of the ways in which these practices integrate and challenge the uses of technology, and will also briefly address funding models, presentation, and contexts.

Example strategies include agit-prop, appropriation, corporate drag, counterfactual fiction, ethnography, expanded cinema, fictional documentary, identity politics, institutional critique, intervention, irony, kitsch, post-internet, procedural actions, social practice, the archive, theater of the absurd.

Movements we will look at include animal studies, bio-art, bio-politics, collectivism, Dada, environmental art, feminism (first-third wave), Fluxus, the post-natural, post-structuralism, post-black, occupy, queer theory, Situationists.

**Basic Analog Circuits**  
(4 Points) ITPG GT.2728.1  
[Call#5724](#) Tues 3:20pm to 6:15pm  
Eric Rosenthal

Todays mostly digital world also requires a basic knowledge of circuits that do not require computer processing. Analog circuits are simpler, lower cost, smaller and require less power and still perform many of the functions of digital circuits. In this course students will learn about the basic principles of electricity, components such as resistors, capacitors, diodes, transistors, audio amplifiers, power supplies and timers and circuits that interface to digital devices. The course includes circuits design and fabrication through lectures and hands on labs. Students will also learn the operation of electronic test equipment such as the digital multimeter, oscilloscope and function generator.

**Big Games**  
(4 Points) ITPG GT.2454.1  
[Call#20760](#) Fri 3:20pm to 5:50pm  
Gregory Trefry

What happens to games when they escape the boundaries of our tabletops, desktops and living rooms? From massively multiplayer online games to mobile games that turn the city into a gigantic game grid, super-sized gaming opens up new spaces in which to play and seeps into the interstices of our days. Whether these games are measured in terms of number of players, geographical dimensions or temporal scope, they represent a new trend in
which the “little world” created by a game threatens to swallow up the “real world” in which it is situated. This class is a hands-on workshop focused on the particular design problems of large-scale games. In this class students: develop a foundation of basic game design understanding from which to approach the specific issues particular to big games; analyze existing digital and non-digital large-scale games, taking them apart to understand how they work as interactive systems; and work on a series of design exercises that explore the social, technological, and creative possibilities of large-scale games.

**Big Screens**
(4 Points) ITPG-GT.2680.1   Call#5723  Fri 3:20pm to 5:50pm    Mimi Yin
This class is dedicated to experimenting with interactivity on large-scale screens. Students will work in pairs to develop one project over the course of the semester, culminating with a showing at InterActive Corps’ 120 X 12-foot video wall at their corporate headquarters on 18th St. and the West Side Highway. A mock-up of the system is available at ITP for testing. Class time is divided between independent project development, critique, technical demonstrations, and field trips to IAC. Registration for this course will happen through a separate lottery which you will enter in pairs.

**Bodies in Motion**
(4 Points) ITPG-GT.2773.1   Call#21011  Thur 6:30pm to 9:00pm    Todd Bryant /Javier Molina
Course Description: This course provides an introduction to the concepts of motion capture and the motion capture production pipeline to perform and record 3D animations for film and video games as well as stream for live performances. Students will learn all of the tools for tracking props and performers using MAGNET’s cutting edge motion capture studio. Students will also develop concepts around the technology and integrate their data into 3D computer graphics along with keyframe and procedural animation and custom 3D assets to build final projects using the Unreal game engine.

Program Learning Objectives: To design a workflow of MoCap and ‘how to’ guides for diverse type of projects using motion capture and the basics of world and character building in the game engine Unreal. Reading assignments introduce students to constructed historical perspective of MoCap and investigates principles particular to animation and performance.

The objective of the course is to allow students to understand the importance of pre-production and planning which includes notions of storytelling, 3D modelling and texturing, best practices to capture the sessions, world building methods in video art and game development, and live show running.

Course Objectives

- To create storyboards and define recording shots before capturing data.
- To understand and use the correct motion capture pipeline
- To learn the skills to direct an effective motion capture session (best calibration)
- To learn the best practices for capturing and cleaning data
- To be able to apply the data to models in Maya, Unreal Engine, and Max/Jitter
- To be able to perform real-time retargeting for Live Performances

Course Structure
The class consists of a weekly lecture and a weekly 2 hour lab session. Students will work in groups and will be required to attend a self-selected lab session on weekends.

Examples of motion capture projects will be presented in lectures and discussed in the classroom. Students must demonstrate satisfactory achievement of course objectives through fulfillment of one final project at the end of the semester and a mandatory submission for the programs showcase. Final projects will require students to use a wide variety of software and studio time at MAGNET’s black box mocap studio. Students will be able to process their motion capture data for use in an animation or live performance. Collaboration with students and faculty from other programs is encouraged.

This four-credit course will meet at 2 Metrotech, Brooklyn, NY.

**Cabinets of Wonder**
(4 Points) ITPG-GT.2470.1   Call#5954  Thur 3:20pm to 5:50pm    Nancy Hechinger
If you were inventing a museum today, what would it look like? Who would be there? What would its main purpose be? The first museums were called Cabinets of Wonder. Usually, a viewer with a guide, often the collector, would open doors and drawers to see what was inside—amazing things from different parts of the world, different times. They were windows on the world to places the visitors would probably never be able to go; to see things they would
never otherwise be able to see. And now there’s television, movies, the internet and travel. Why do people go to museums now? Will they in the future? Today, most museums seek to educate and to include more and more diverse visitors than they used to. How do people learn in public spaces? How do we know that they do? How can they make use of the new interactive technologies and not lose what’s special about them? The class is an exploration, observation and theory class with some design mixed in. Museum and exhibit visits are your primary assignments for the first half of the course—usually accompanied by a reading. You will also make some record of your visit (including a sketchbook, a dioramas, reviews) There will be guest speakers from Museums and exhibit design firms, and several field trips. In the second half of the course, you begin to imagine how you might reinvent a museum and develop a full-scale presentation of your own Cabinet of Wonder.

Cooking With Sound
(4 Points) ITPG-GT.2940.1 Call#20762 Mon 3:20pm to 6:15pm T3db0t Hayes
What is it about the propagation of compressed air waves that gives rise to such a vast panoply of history, culture, ideas and artworks? What exactly does sound consist of, and how can we use (and abuse) it? Utilizing sound in our projects is a lot like cooking: we find and make ingredients, manipulate them, mix them together, bake at 400º, serve. Cooking With Sound explores the phenomenon of sound from the ground up, investigates its history, practice and potential as a medium for art, communication, and pleasure, and provides students the skills and knowledge for forming and shaping these potentials. Topics include acoustics and the physics of sound (and how a single vibrating string gives rise to music theories around the world), the digitization of sound (and how you can do it yourself with a handful of resistors), sound as art medium and its interpretation and criticism, and the many various tools and techniques for wielding this ephemeral yet eternal wonder.

Creative Computing/Interactions Lab
(4 Points) OART-UT.20.1 NOT FOR ITP Tues 3:20pm to 5:50pm Luisa Pereira Hors
What can computation add to human communication? Creating computer applications, instead of just using them, will give you a deeper understanding of the essential possibilities of computation. Conversely excitement about your computational project ideas whether they be in the domain of art, design, humanities, sciences or engineering will best propel your acquisition of skills necessary to realize those ideas. This course will begin with the expressive capabilities of the human body and how we experience our physical environment. The Physical Computing skills will allow you to go past the limitations of the mouse, keyboard & monitor interface and at locations other than the home or the office. The platform for the class is a microcontroller (Arduino brand), a very small inexpensive single-chip computer that can be embedded anywhere and sense and actuate in the physical world. The core technical concepts include digital, analog and serial input and output. The second portion of the course focuses on fundamentals of computer programming (variables, conditionals, iteration, functions & objects) as well as more advanced techniques such as data parsing, image processing, networking, computer vision. The Java-based ‘Processing’ programming environment is the primary vehicle. Processing is more oriented towards visual displays on desktops, laptops, tablets or smartphones but can also connect back to the physical sensor & actuators from the first part of the class. The course is designed for computer programming novices but the project centered pedagogy will allow more experienced programmers the opportunity to play further with their project ideas and make lots of friends by helping the other students.

Note: This is an undergraduate course for non-ITP students.

Designing for Data Personalization
(4 Points) ITPG-GT.2761.1 Call#21012 Thur 6:30pm to 9:25pm Samuel Slover
The world is awash with new data, but how can designers take the next step to make this data more meaningful in people's day-to-day lives and interactions? Put differently, instead of giving people yet more data and visualizations to interpret, how can we personalize this data to provide simple insights that more intimately connect with what people really care about?

In this class, we’ll examine how personalized design can give people more meaningful and pleasant experiences with their data interactions. We’ll explore how new technologies and designs are implementing these personalization strategies and how they’re being successful (or not). The course will cover 3 main topic areas, each with a lecture and studio component:

1. Making (Dry) Data Personal & Playful - Personality and playfulness can go a long way in creating richer interactions around data. We’ll examine how to make seemingly 'boring' data interesting through design and personalization strategies.
2. Designing for the Self - It often helps to start by designing for our own problems. We'll explore how to track and design around a dataset of our own that we'd like to better understand.

3. Re-Contextualizing Everyday Data - Given the sheer number of daily data interactions, there's so many opportunities to do it better. We'll explore how to take data we encounter everyday (the weather, food labels, subway delays) and re-contextualize it to give people more pleasant and smarter interactions.

Students will learn techniques on how to work with existing Web APIs, how to build and use their own Web APIs (with Node.js and MongoDB), and will implement user-facing designs utilizing p5.js and other Web technologies. Class examples will be presented in Javascript. Javascript tutorials will be assigned as a pre-requisite for those with little to no Javascript experience.

**Designing for Digital Fabrication**
(4 Points) ITPG-GT.2890.1 Call#5957 Tues 09:00am to 11:30am Daniel Rozin
The ability to digitally fabricate parts and whole pieces directly from our computers or design files used to be an exotic and expensive option not really suitable for student or designer projects, but changes in this field in the past 5 years have brought these capabilities much closer to our means, especially as ITP students. ITP and NYU now offer us access to laser cutting, CNC routing, and 3D stereolithography. In this class we will learn how to design for and operate these machines. Emphasis will be put on designing functional parts that can fit into a larger project or support other components as well as being successful on a conceptual and aesthetic level. In this class we will discover methods to design projects on CAD applications for total control of the result, and we will develop algorithmic ways to create designs from software (Processing) to take advantage of the ability to make parts and projects that are unique, customizable, dependent on external data or random. The class will include 3 assignments to create projects using the three machines (laser, router, 3D) and the opportunity to work on a final project.

**Designing for Live Performance**
(4 Points) ITPG-GT.2521.1 Call#5903 Mon 12:10pm to 2:40pm Andrew Lazarow
For centuries, great works of music, theater, and dance, have combined art and science to make integrated performances that move audiences. Today, we are seeing exciting changes as artists experiment with video and real-time interactivity to draw audiences even deeper into the performance, and enhance the shared experience of the moment. This class explores conceptual approaches to design, industry-standard software, prototyping frameworks, and data flow programming to provide student designers with the cutting-edge tools necessary to confidently collaborate with writers, directors, and performers. Structured as a studio course, students will make designs for contemporary performance pieces, and collaborate with working artists to design original projects.

**Developing Assistive Technologies**
(4 Points) ITPG-GT.2446.1 Call#21080 Tues 7:00pm to 9:00pm R. Luke DuBois / Anita Perr / Marianne Petit
This multi-disciplinary course allows students from a variety of backgrounds to work together to learn about and develop assistive technology. Partnering with outside organizations, students will work in teams to identify a clinical need relevant to a certain clinical site or client population, and learn the process of developing an idea and following that through to the development of a prototype product.

**Digital Imaging: Reset**
(4 Points) ITPG-GT.2550.1 Call#5846 Tues 12:10pm to 3:05pm Eric Rosenthal
Digital cameras and printers are making photography more ubiquitous and more useful than ever. This course is a workshop that looks at changing the rules for capturing and printing digital imagery. By gaining a better understanding of the engineering fundamentals and limitations of digital photography, students can produce breathtaking images with all the benefits of digital media but with an image quality that rivals film. Students experiment using low cost, hands-on tips and tricks in software and hardware to capture high dynamic range, expanded color, night color, 3D, time lapse, and stop motion images using a digital camera and printer. While using mostly off-the-shelf tools, these experiments require students to dig down to see the nitty-gritty of today's and tomorrow's technologies for digitally sensing, encoding, compressing, transmitting and displaying images.

**DIY-VR**
(4 Points) ITPG-GT.2765.1 Call#21014 Mon 6:30pm to 9:00pm Christopher Kairalla
The field of Virtual Reality is changing almost daily. New products and techniques now give us incredible control over the immersive VR experience, and the vocabulary for VR communication is now being written. Powerful game engines like Unity3D have lowered the bar for VR hobbyists and artists, and modern-day cell phones have all of the components necessary to render convincing VR in real-time. This class will focus on experimental and narrative VR
projects. We will look at the history of visual storytelling and art, as well as critical analysis of media, as a starting point for conceiving our VR projects. We will continuously compare older mediums to VR in order to best understand what works well in a VR experience. We will also discuss the history of VR, and look at recent VR projects.

The class will cover 3 broad conceptual themes, which will give focus to the projects. The themes are recontextualization, symbolism, and mythology. Some techniques that we will explore are 2D media in a 3D space, 3D world building, VR GUI, and external networked interfaces.

Our primary tool will be Unity3D. Unity allows us to combine a variety of media- images, audio, 3D models, and programming- into a single real-time VR experience. Although VR creation has never been easier, there will be a learning curve for most students. Be prepared to spend time outside of class learning new skills. Because of the diversity of skills required, students are encouraged to collaborate. Success in the class is based on weekly assignments, a midterm project, and a final project. Class participation and discussion are also required. No previous knowledge of Unity3D is necessary, but students should be motivated to explore and learn on their own. Ideally, students will have completed either an animation class, or one post-ICM programming class.

**Fandom**

(4 Points) ITPG-GT.2965.1  **Call#20763**  Wed 6:30pm to 9:00pm  Zoe Fraade-Blanar
Fandom is the study of the communities that form around popular culture, whether based on a shared love of Harley Davidson bikes, PBR Beer, Miley Cyrus, or 3D printing. In design, proper fan management can mean the life or death of a project; well-thought-out interactions can lead to hoards of adoring, evangelical users, and bad interaction can spell shame and embarrassment. From Air Jordans to World of Warcraft, this class explores the influences and motivations that separate fans from mere users. We chart the evolution of fan culture as an important social and economic force, from early 16th century religious manias to its recent rebirth as modern-day geek and nerd culture. Along the way we’ll discuss fangroup commercialization, appropriation, monetization, and other techniques available to us as creators to get the most out of them.

**Homemade Hardware**

(4 Points) ITPG-GT.2767.1  **Call#21015**  Thur 6:30pm to 9:00pm  Andrew Sigler
Hardware is not hard, and rapidly prototyping circuit boards is easier than ever with new tools at ITP. This class is about artists and designers taking control of their hardware, and exploring the potential of embedding their projects into the world around them.

We will begin with a study of popular microcontrollers, how they work, how they’re made, and how we program them. We will then dive into how printed circuit boards (PCBs) are made at ITP, through hands-on experience with each machine and process on the floor. Some tools include micro-milling machines, surface mount parts (SMD), and Eagle CAD. We will then touch upon some new problems and opportunities that arise when making and designing embedded things. These include designing and ordering parts, low-power and energy harvesting, and incorporating sensors and radios in a design.

The first half of the course will include small weekly projects to help teach the process. Classes will be split equally between lecture and workshop, either in the classroom or with the equipment. Students will finish a midterm project around Spring break, and a final project of their choosing at the end of the semester. Introduction to Physical Computing is a prerequisite.

**Live Web**

(4 Points) ITPG-GT.2734.1  **Call#5915**  Tues 12:10pm to 2:40pm  Shawn Van Every
The World Wide Web has grown up to be a great platform for asynchronous communication such as email and message boards which has extended into media posting and sharing. Recently, with the rise of broadband, more powerful computers and the prevalence of networked media devices, synchronous communications have become more viable. Streaming media, audio and video conference rooms and text based chat give us the ability to create new forms of interactive content for live participants.

In this course, we’ll focus on the types of content and interaction that can be supported through web based and live interactive technologies as well as explore new concepts around participation. Specifically, we’ll look at new and emerging platforms on the web such as HTML5, WebSockets and WebRTC using JavaScript and Node.js.
Experience with web technologies are (HTML and JavaScript) are helpful but not required. ICM level programming experience is required. ( Social Software, Internet, Video )

**Making Sense of Social Data**  
(4 Points) ITPG-GT.2771.1  Call#21016  Fri 09:00am to 11:55am  Gilad Lotan / Danah Boyd  
Data are created and collected all around us, trails left from interactions in social media, accessible through streams, feeds, APIs, and data-stores. These data are used to power a growing number of services, modeled not only off our own interactions but also interactions of our friends and larger network of connections. While well intended, and many times well functioning, the growing range of uses of systems that algorithmically score content means there are a growing number of unintended consequences and inherent biases. In order to untangle some of these issues, we'll dive into the literature, while building our own algorithmically-driven data services.

In this class we will explore various computational social science approaches to understanding networked users. We'll collect data by talking to real people, as well as use Python scripts to access data from APIs such as Twitter and Instagram. We'll learn how to make sense of these different data, touching topics such as qualitative interviewing, content analysis, natural language processing, content classification, authority ranking, and clustering. We'll also be using a number of open source tools that help us make sense of networks, including Gephi and Python’s networkx library. And we'll be diving into literature from various fields - including sociology and media studies - to make sense of social data that we gather along the way.

**New Interfaces for Musical Expression**  
(4 Points) ITPG-GT.2227.1  Call#5710  Tues 6:30pm to 9:00pm  Greg Shakar  
The course focus is on the design and creation of digital musical instruments. Music in performance is the primary subject of this class. We approach questions such as "What is performance?" "What makes a musical interface intuitive and emotionally immediate?" and "How do we create meaningful correlations between performance gestures and their musical consequences?" Over the semester, we look at many examples of current work by creators of musical interfaces, and discuss a wide range of issues facing technology-enabled performance - such as novice versus virtuoso performers, discrete versus continuous data control, the importance of haptic responsiveness as well as the relationship between musical performance and visual display. Extensive readings and case studies provide background for class discussions on the theory and practice of designing gestural controllers for musical performance. Students design and prototype a musical instrument - a complete system encompassing musical controller, algorithm for mapping input to sound, and the sound output itself. A technical framework for prototyping performance controllers is made available. Students focus on musical composition and improvisation techniques as they prepare their prototypes for live performance. The class culminates in a musical performance where students (or invited musicians) will demonstrate their instruments. Prerequisites: H79.2233 (Introduction to Computational Media) and H79.2301 (Physical Computing).

**Persuasive Design**  
(4 Points) ITPG-GT.2645.1  Call#5972  Thur 3:20pm to 6:15pm  Katherine Dillon  
In subtle and not-so-subtle ways technology is influencing our behavior – from buying more books on Amazon than we intended to, to helping us change bad personal habits to leveraging the voices of many– technology presents an opportunity to be an agent of change. This 4pt class will explore how technology can be used to influence behavior. We will look at a number of behavioral theories including incentive–based design, gamification and social influence. We will review case studies on how these techniques have been used to effectively motivate behavior change. After researching theories on behavior motivation, working in pairs, students will identify a problem or issue that they hope to influence. Students will document the problem, develop a concept to influence the behavior associated with that problem and prototype (or build) their solution. They will test their solution and draw conclusions from the experiment. Projects can attempt to influence social change at a large, social scale or at a personal level. The unifying theme behind the projects will be that they intend to inspire positive change.

This four-credit course will meet the first twelve weeks of the semester. The goal of the course is to provide students with a solid understanding of the potential technology provides to motivate and affect change in behavior. Students will develop projects that aim to influence behavior.

**Printing Code**  
(4 Points) ITPG-GT.2949.1  Call#20764  Mon 09:00am to 11:30am  Rune Madsen  
In this course students explore the use of computational techniques to produce physical prints, focusing on the intersection between graphic design and creative coding. Class time will be divided between exploring design
topics like colors, grids and typefaces, and applying these towards computational topics like randomization, repetition and generative form.

Weekly readings include relevant writings from the history of graphic design (Josef Muller-Brockmann, Paul Rand), articles from the history of computation (Vannevar Bush, Douglas Englebart, Martin Krampen) and everything in between (Sol Lewitt, Edward Tufte, etc).

Weekly homework can be produced using the digital printers at NYU's Advanced Media Studio, however students are encouraged to utilize whatever physical printing techniques they prefer, that being stencils, letter press, silk screen, weaving or home-made printers.

The class aims not only to teach the students how to create physical prints via code, but also to have something interesting to say about it. The class requires ICM or similar programming background.

**Programming from A to Z**  
(4 Points) ITPG-GT.2536.1 Call#20765 Mon 12:10pm to 2:40pm Daniel Shiffman  
This course focuses on programming strategies and techniques behind procedural analysis and generation of text-based data. We’ll explore topics ranging from evaluating text according to its statistical properties to the automated production of text with probabilistic methods to text visualization. Students will learn server-side and client-side JavaScript programming and develop projects that can be shared and interacted with online. There will be weekly homework assignments as well as a final project.

**Project Development Studio**  
(4 Points) ITPG-GT.2564.1 Call#5904 Wed 6:30pm to 9:00pm Stefani Bardin  
This is an environment for students to work on their existing project ideas that may fall outside the topic areas of existing classes. It is basically like an independent study with more structure and the opportunity for peer learning. This particular studio is appropriate for projects in the area of interactive art, programing, physical computing and digital fabrication. There are required weekly meetings to share project development and obtain critique. Students must devise and then complete their own weekly assignments updating the class wiki regularly. They also must present to the class every few weeks. When topics of general interest emerge, a member of the class or the instructor takes class time to cover them in depth. The rest of the meeting time is spent in breakout sessions with students working individually or in groups of students working on related projects.

**The Stratosphere of Surveillance**  
(4 Points) ITPG-GT.2779.1 Call#21017 Thur 09:00am to 11:30am Adam Harvey  
Mass surveillance is a vast yet largely invisible infrastructure that enmeshes our cities, workplaces, homes, borders, and even our social interactions. From the databases that store our most personal media to the satellites that peer down from space, this class explores the stratosphere of surveillance technologies that are reshaping the world order.

This class begins by inverting Bentham's architecture of the Panopticon and placing the individual at the center. From here we will look outward at the myriad ways of being seen, analyzed, and tracked through real world examples and demonstrations of both lo-fi and advanced surveillance techniques. Technologies covered include biometrics (face, iris, fingerprint, and gait); online tracking (cookies, browser fingerprinting, network analysis, and packet sniffing); advanced imaging (thermal, IR, aerial, computer vision, and capturing "media in the wild"); and hacking (using examples from Kali/PwnPi). Selected texts will accompany each set of technologies and we will discuss their implications in class.

After developing an understanding of the diversity of surveillance technologies, students will work collaboratively to develop a well researched response to subvert, critique, improve or adapt to the type of surveillance they find most relevant.

Through topics covered in this class students will gain a technical understanding of surveillance, security, and privacy enhancing technologies; be able to communicate securely using encryption; and learn how to better navigate the emerging landscape of mass surveillance. A working proficiency with the command line and basic programming techniques is recommended.
The Temporary Expert: Research-based Art and Design Practice  
(4 Points) ITPG-GT.2547.1 Call#5905 Tues 3:20pm to 5:50pm Marina Zurkow  
Cultivating a “Research-based Practice” requires an artist/designer to be a pioneer, a detective and a mystic all in one.

What does it look like to make work in, through and as research? How do you follow a hunch? Engage experts and passersby to explore both legitimate AND preposterous leads? Be expansive? How do you leave your own trail of documentation that can contribute to a body of knowledge beyond the products of your own art? These forms of research may mix a variety of scientific and intuitive methods. The artist/designer is free to employ speculation, open-endedness, and irony; to use design as a way to probe or even provoke the chosen fields of inquiry.

The class is devoted to the question of how to initiate and investigate research and incorporate it intelligently and sensitively into your work. This class is about developing your own idiosyncratic and well-documented means of pulling threads, following leads, and becoming fearless about asking for help and others’ expertise. You become a temporary expert.

Through hands-on practice, case studies, guest speakers from both art and science, and readings on ethnography, research, and the idea of a public, we will explore method, documentation and presentation of your research, and the merits of both success and failure.

Student work is divided into two 3-week research areas and one final 5-week research project. All topics will have historical, technological and social components to explore. Research includes ethnography, interviews, published papers, media, video, drawing, visiting archives, and at least three face-to-face meetings with strangers for each of the assignments. We will look at artist and designers whose work is based on research, and ones whose work IS the research (art in the form of lecture, field notes, tours, experiments, etc).

Understanding Networks  
(4 Points) ITPG-GT.2808.1 Call#5725 Tues 09:00am to 11:30am Thomas Igoe  
Interactive technologies seldom stand alone. They exist in networks, and they facilitate networked connections between people. Designing technologies for communications requires an understanding of networks. This course is a foundation in how networks work. Through weekly readings and class discussions and a series of short hands-on projects, students gain an understanding of network topologies, how the elements of a network are connected and addressed, what protocols hold them together, and what dynamics arise in networked environments. This class is intended to supplement the many network-centric classes at ITP. It is broad survey, both of contemporary thinking about networks, and of current technologies and methods used in creating them. Prerequisites: Students should have an understanding of basic programming (Intro to Computation Media or equivalent). Familiarity with physical computing (Intro to Physical Computing or equivalent) is helpful, but not essential. Some, though not all, production work in the class requires programming and possibly physical and electronic construction. There is a significant reading component to this class as well.

Possible topics include:

* topologies: how to think about them (nodes and links), how few workable ones there are, and how there’s no topology so stupid it isn’t in use some place.
* addressing and routing: what a namespace is, three ways to generate a name (nesting, serial uniqueness, random pseudo- uniqueness), the difference between smart and dumb networks, why the phone network and the internet differ even though they use the same wires
* protocols: envelopes and contents, the stack and the reference lie, end-to-end principles, reliability vs. speed tradeoffs
* scale: more is different, scale breaks otherwise workable systems, makes redundancy and degeneracy critical, tends to push systems
* a discussion of security and its effects

Possible exercises include:

* Basic socket communication, both software and embedded hardware versions
* Client-server programming
* A group protocol/messaging exercise
* An HTTP/RESTian model exercise