



PAINTING

COURSE: AD 150 – Color and Composition (3 credits)
PROGRAM: Foundation/School of Art + Design
LOCATION: First-year/fall term (undergraduate)
INSTRUCTOR: Glenn Goldman

DESCRIPTION: The foundation-level course serves as a multiple media introduction to two-dimensional design, color theory, and two-dimensional digital graphics (raster and vector) in the context of image creation and image processing. Subjects include basic principles of design, color models and mixing in both traditional and digital mediums, and graphic design. Principles are discussed in the context of architecture, interior design, entertainment, advertising/marketing, package design, industrial design, and fine art.

PROJECT: Traditional painting and two-dimensional digital representation.

REQUIREMENTS: Using paint software (*Corel Painter*) and without scanning, create a digital facsimile of a painting, extract the principle color palette, create a composite (*Corel Draw* or *Adobe Illustrator*) in 11” x 17” size showing the process/steps by which the painting was reproduced, and write a formal analysis of the painting. The facsimile must be produced in three weeks. The composite and analysis are due in the following week for a total time spent of four weeks. Students are permitted to work in either RGB or CMYK color space and must produce a facsimile in excess of three million pixels in order to give sufficient resolution to the final product.

OBJECTIVES: (1) To enhance visual literacy with the introduction to works of fine art. (2) To provide opportunities to improve information literacy in the process of researching art, artistic movement(s), and artists in the preparation of written essays with appropriate citations and references. (3) To provide exposure to a variety of two-dimensional images depicting three-dimensional examples of architecture, interior design, object/artifact design, and/or landscape in an evocative non-photorealistic manner. (4) To begin to explore the role of color in the perception of space and surface. (5) To begin to experiment with interpretative representation of space and surface. (6) To provide an opportunity to learn and become relatively proficient with raster/paint software (*Corel Painter*) that serves as a digital analog to freehand/traditional drawing and is useful in various ways when designing and presenting original work (by “touching up” or modifying algorithmically generated images created with automated processes, as a tool to create original materials for use in the rendering of three-dimensional models for documentation of existing conditions and/or presentation of original designs, and to create original evocative works - especially in combination with wireframe three-dimensional expressions - that may effectively communicate design intent) that may be created by interior designers, architects, industrial designers, and digital designers in a variety of two- and three-dimensional applications. (7) To develop an appreciation that the computer does NOT dictate a particular style or image type but that, ultimately, the designer/creator is responsible for whatever is presented – and has the power to modify any image to produce desired results. (8) To develop a visceral understanding that the effort required to create good work with digital graphics is as labor intensive as the effort required with traditional/analog media. (9) To provide an opportunity to learn and use a limited subset of commands available in drawing software (*Corel Draw* and/or *Adobe Illustrator*) for compositing and layout. (10) To assist us in clarifying our thoughts and observation of art by writing about it and practice critical writing and communication skills.

REFERENCES and RESOURCES: (1) Albers, Josef. *Interaction of Color/Revised Edition* (New Haven: Yale University Press, 2006). (2) Barnet, Sylvan. *A Short Guide to Writing about Art/11th Edition*. (Upper Saddle River, NJ: Pearson Prentice Hall, 2014). (3) Feisner, Edith Anderson. *Color Studies*. (New York: Fairchild Publications, 2001). (4) Goldman, Glenn. *Architectural Graphics: Traditional and Digital Communication*. (Upper Saddle River, NJ: Prentice Hall, 1997) Pages 32-36. (5) Heller, Nancy G. *Why A Painting Is Like A Pizza: A Guide to Understanding and Enjoying Modern Art*. (Princeton, NJ: Princeton University Press, 2002). (6) Itten, Johannes. *The Elements of Color*. (New York: Van Nostrand Reinhold, 1970). (7) Lupton, Ellen and Jennifer Cole Phillips. *Graphic Design: The New Basics*. (New York: Princeton Architectural Press, 2008). (8) Newall, Diana. *Art in Detail: The Impressionists*. (New York: Metro Books, 2008). (9) Quiller, Stephen. *Color Choices: Making Sense Out of Color Theory*. (New York: Watson-Guptill, 1989). (10) Wong, Wucius. *Principles of Color Design: Designing with Electronic Color/2nd Edition*. (New York: John Wiley & Sons, 1997) Pages 59-97 and 101-144.

Recommended field trips to Guggenheim Museum, Museum of Modern Art, and Metropolitan Museum of Art, New York, NY.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

VOICE: MOTION-BASED NARRATIVE

COURSE: DD 284 – Video and Animation (3 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Second-year/spring term (undergraduate)
INSTRUCTORS: Augustus Wendell and Polina Zaitseva

DESCRIPTION: This course explores concepts of linear, motion-based two-dimensional media and includes motion graphics, live action filming, particle systems, digital video editing and digital video compression. Projects include the design and production of multiple projects addressing both technical and creative decision making. Overall, the semester focuses on narrative design and the craft of motion-based media.

PROJECT: The fourth and final project of the semester is a three and one-half week original animation or film. Each student is required to design, pitch, develop, and present a story through film or animation. Students choose the medium of production after a semester of analog, live action and digital animation assignments. Project-specific objectives include (1) providing students an opportunity to apply the semester of narrative studies into an original story; (2) selecting, planning and executing a high-resolution film or animation production; and (3) provide students the opportunity to develop a personal voice, vision and style in the field of time based narrative. Applications used for 3D modeling include *Blender*, *Autodesk 3DS Max*, and *Autodesk Maya*. 2D graphics for animations are created with *Corel Painter*, *Corel PaintShop Pro*, and *Adobe Photoshop*. Compositing and non-linear editing of all work is accomplished with *Adobe Premiere*, *Adobe After Effects*, and *Adobe Audition*. (Images shown are screen captures from animation.)

REQUIREMENTS: Students are required to create an original story and then submit a 60-90 second original film or animation mastered at 1280 x 720px 24 FPS 1.0PAR H264 Codec. The animation is required to have a custom slate countdown. Students are required to have a properly licensed or royalty free soundtrack.

OBJECTIVES: (1) Gain perspective and understanding about important milestones in motion-based art and design; (2) Provide opportunities to explore post production techniques and application pipelines; (3) Provide opportunities to explore basic storytelling design principles using motion media; (4) Provide an introduction to motion based computer graphics and an opportunity to learn, practice, and become familiar and relatively proficient with editing and compositing applications; (5) Provide exposure to a reflective and iterative design process; (6) Provide exposure to criteria used in creating and evaluating two and three-dimensional motion compositions; (7) Develop a sense of quality of craft that is motion media specific; (8) Develop the ability to clearly plan, document and present a motion project.

RESOURCES: Students have access to *Pluralsight* tutorials about software applications from the lab. Students have 24/7 access to the Animation Lab that contains Lenovo P710 dual Xeon workstations with NVIDIA Quadro P5000 cards, 256GB RAM and Windows 10 Professional.



GAME PROPOSAL & ENVIRONMENT/HISTORY OF GAMES

COURSE: DD 275 – History of Games (3 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Second-year/fall term (undergraduate)
INSTRUCTOR: Taro Narahara

DESCRIPTION: The course is a guided exploration through the world of games. Students experiment, play, and analyze various aspects of games – from early traditional games to current generation electronically-mediated games; from individual games to collaborative online games. Formats for electronic games from proprietary consoles to open source mobile platforms are studied. Game types will be analyzed with particular attention paid to the virtual environments in which these games take place. The expressive and persuasive aspects of games will also be explored.

PROJECT: In the final project, students are given a variety of options from which to choose. They may create artistic 2D and/or 3D representations based on an original concept for environment, characters, and/or assets. Alternatively, they may create interactive-based content using game engines based on original design proposals which may include the use of programming skills. The final option is the creation of a physical game utilizing digital fabrication methods and assemblies. Storyboard of gameplay when relevant is also required.

REQUIREMENTS: A series of analytical and creative tasks are undertaken throughout the semester, starting with an analysis of traditional games covering a variety of genres, from sports games to strategy war games. Subsequently game structures, environments, characters, props/tools, etc. are all studied. The course includes two creative projects. The first, students are asked to create original digital environments using game engine software. At the end of the semester, students are given the opportunity to select from a wide range of options for a final project that relates to digital interactive game play. The options include the development of a game and character or environment based on a non-game literary/narrative or other source.

Final submission includes storyboards and preliminary sketches for the proposed game, story/script, analysis and narrative description of game structure, 3D model(s) (created in either *Autodesk 3DS Max* or *Autodesk Maya*) of environment and/or character(s), screen captures showing development of 3D model, and a series of sequential renderings (three to ten still images) illustrating key views/perspectives of the environment(s) and/or positions and costumes/apparel for the character(s). Screen captures of process work must also be submitted.

COURSE OBJECTIVES: (1) To gain perspectives and understanding about the history of both traditional and non-traditional (digital) games. (2) To provide exposure to principles of game structures including concepts, such as abstract strategy games, game tree, and state space through simple game examples. (3) To provide opportunity to explore underlying concepts, technologies, and languages of contemporary video game productions. (4) To improve facility with 3D modeling software and game engine applications. (5) To gain an understanding of available game-related digital environments not only from a standpoint of a game-player but also from that of a game-maker. (7) To provide an opportunity to develop the ability to present (“pitch”) a game idea project to others.

REFERENCES: (1) Bogost, Ian. *Persuasive Games: The Expressive Power of Videogames*. (Cambridge, MA: MIT Press, 2007). (2) Botermans, Jack. *The Book of Games: Strategy, Tactics & History*. (New York: Sterling, 2008). (3) Burnham, Van. *Supercade: A Visual History of the Videogame Age, 1971-1984*. (Cambridge, MA: MIT Press, 2003). (4) Hofer, Margaret K. *The Games We Played: The Golden Age of Board and Table Games*. (New York: Princeton Architectural Press, 2003). (5) Newman, James A. *100 Videogames*. (London: BFI, 2007). (6) Nielsen, Simon Egenfeldt with Jonas Heide Smith and Susana Pajares Tosca. *Understanding Videogames: The Essential Introduction*. (New York: Routledge/Taylor & Francis Group, 2008). (7) Taylor, T.L. *Play Between Worlds: Exploring Online Game Culture*. (Cambridge, MA: MIT Press, 2006). (8) Thompson, Jim. *Game Design Course: Principles, Practice, and Techniques – the Ultimate Guide for the Aspiring Game Designer*. (Hoboken, NJ: Wiley, 2007). (9) Reas, Casey. *Processing: A Programming Handbook for Visual Designers and Artists*. (Cambridge, MA: MIT Press, 2007). (10) Watkins, Adam. *Creating Games with Unity and Maya: How to Develop Fun and Marketable 3D Games*. (New York: Focal Press/Taylor & Francis Group, 2011).

RESOURCES:

Students have access to *Pluralsight* tutorials about software applications from the lab. Students have 24/7 access to the Animation Lab that contains Lenovo P710 dual Xeon workstations with NVIDIA Quadro P5000 cards, 256GB RAM and Windows 10 Professional. Software applications available include Maya, 3DS Max, Mudbox, Unity, and Unreal.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

BIOMECHANICAL CHARACTER DESIGN

COURSE: DD 363 – Digital Design Studio I (5 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Third-year studio course/fall term (undergraduate)
INSTRUCTOR: Polina Zaitseva

DESCRIPTION: The course focuses on three-dimensional design in a digital milieu. The course includes project-based applications focusing on the design and digital representation of a combination of architectural or environmental settings for games, theater, advertisements, books, or similar contexts as well as assets/objects that populate the spaces. The course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design. As a general design program, various aspects of digital design and entertainment are included. Overall, the semester focuses on narrative and graphic design with still images.

PROJECT: One of four projects during the fall semester is the design of an abstract character that combines both biological/bionic and mechanical aspects into one creature. Students also design/create the environment in which their characters exist.

REQUIREMENTS: Students are to create an abstract bionic/steampunk/mechanical creature (insect, mammal, fish/aquatic life) and place it in a “realistic” natural environment using lighting techniques, depth of field, and compositing. Viewers must be able to recognize the creature and the origin or model should be clear. Students will be evaluated on both the design of the creature and the high resolutions compositions created placing the creature in context.

OBJECTIVES: (1) Provide an initial exercise for character design and modeling. (2) Learn and attain facility in the use of 3D modeling software to create high-detail physically realistic models of imaginary characters/creatures. (3) Continue the study of the impact of object location, camera lens choice, and camera location on image composition. (4) Continue to develop an ability to create physically-based lighting rigs and environments. (5) Continue to practice and gain facility with software tools of *Autodesk 3DS Max*, *Autodesk Maya*, *Blender*, and *Adobe After Effects* in a design context. (6) Begin the study of creative art direction and styles through research of precedents for biomechanical models and steampunk.

RESOURCES: A subscription to *Pluralsight* provides students with software tutorials that they may access within the studio on campus. Students use their own workstations (Lenovo P510) in studio.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

HOMAGE TO STORYTELLING

COURSE: DD 363 – Digital Design Studio I (5 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Third-year studio course/fall term (undergraduate)
INSTRUCTORS: Polina Zaitseva

DESCRIPTION: The course focuses on three-dimensional design in a digital milieu. The course includes project-based applications focusing on the design and digital representation of a combination of architectural or environmental settings for games, theater, advertisements, books, or similar contexts as well as assets/objects that populate the spaces. The course includes modeling with different geometries (e.g. NURBS, polygonal) and advanced techniques in rendering with lighting and materials as well as issues of production design. As a general design program, various aspects of digital design and entertainment are included. Overall, the semester focuses on narrative and graphic design with still images.

PROJECT: One of four projects during the fall semester is to compose and create a series of images to illustrate a narrative. The project is meant to combine and leverage previous experiences in creating work that elicits an emotional response as well as their knowledge of environment and character design.

REQUIREMENTS: (Re)create an existing scene in the selected and approved narrative. The illustration may include any character or building or environment. The interpretation must be illustrative of the narrative and may be either 3D or a combination of 2D and 3D. Provide a minimum of three overall images and five details. Project will be presented onscreen and serially.

OBJECTIVES: (1) Provide additional opportunities for character design and modeling. (2) Reaffirm the importance of a thoughtful and iterative design method. (3) Continue the cinematographic and compositional studies of the impact of object location, camera lens choice, and camera location on the image(s). (4) Introduce the use of fur and hair plug-ins and textures in 3D model creation and rendering. (5) Continue to practice and gain facility with software tools of *Autodesk 3DS Max*, *Autodesk Maya*, *Blender*, *Adobe Photoshop*, *Adobe Illustrator*, and *Adobe After Effects* in a design context. (6) Begin to seriously develop a personal “signature” and style.

REFERENCES and RESOURCES: A subscription to *Pluralsight* provides students with software tutorials that they may access within the studio on campus. Students use their own workstations (Lenovo P510) in studio. Software needed is available either by download for student versions (e.g. *Cinema 4D*) or on the local network (e.g. *Autodesk 3DS Max*, *Autodesk Maya*, *Blender*, *Corel Draw*, *Corel PaintShop Pro*, *Corel Painter*). Adobe products are available by subscription at student pricing.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

FANTASY WORLD DESIGN

COURSE: AD 463 – Collaborative Design Studio (5 credits)
PROGRAM: School of Art + Design
LOCATION: Fourth-year studio course/fall term (undergraduate)
INSTRUCTOR: Jessica Ross

DESCRIPTION: The penultimate design studio in the School of Art + Design brings all students from Digital Design, Industrial Design, and Interior Design (and on occasion, Architecture, Information Technology, or Biomedical Engineering) back together for a required collaborative experience during which the students from the various disciplines work on common ventures, simulating a professional environment in which each student brings her or his discipline-specific knowledge to a team working on a complex project. The projects and faculty change each year with three to four studios offered annually from which teams of students may choose. Projects in past collaborative design studios have included an interactive circus, adaptive re-use of the abandoned Newark Prison into a Museum of Industry, Lifestyle Studio in which students developed a product and/or service for marketing to a chosen demographic, Superhero Studio in which students developed/designed a superhero along with her/his lair, costumes, accessories, and storyline, Fantasy Studio in which fictional warring fantasy societies were created requiring the design of characters (including and especially non-human ones), habitats (cities and landscapes and furniture), weapons, attire, and more. Each project has individual components and contributions from each discipline participating, that add up to a complete effort.

PROJECT: The studio will focus on the creation of a fictional civilization. Students will design a human-based civilization that would require all the tools, technologies, systems, transportation, cities and infrastructure, crafts, etc. The era and characters will be fixed early in the project to allow the students to focus on design and production. Following the philosophy of Peter Jackson and WETA Workshop, students will create the world as if it were real. Every weapon, tool, prop, and component are to be designed with functionality in mind and with a consistent look and feel. The story to be used involves the discovery of artifacts that show the existence of a “lost civilization” complete with politics and conflict. The class must determine the ruling species, the nature of any government, military capabilities including armor and weaponry, religion, culture, art and architecture, biology, ecology, and geography. The total design of the civilization will be the subject of an exhibit at the end of the semester.

REQUIREMENTS: Students work collectively as a group to set the direction of the story/civilization. Research on different aspects of a (the) civilization are assigned to each student for sharing in class-wide discussions early in the semester. Mirroring the process in industry, each student is responsible for different aspects of the design which are reviewed regularly throughout the semester by colleagues to assure a common direction. For example, one student was responsible for transportation, another for weaponry, and still another for residential development. In the production of the exhibit, one student was responsible for invitations and publicity, a pair of students (with full participation by the instructor) created/painted the physical mural for the exhibit, another produced animations of characters, etc. The full civilization was later presented in exhibit format, and individual files (including process screen captures and photographs of production) were all submitted.

OBJECTIVES: (1) Provide design students from different disciplines an opportunity to collaborate in a manner that allows each student to contribute his or her own expertise towards a common goal and work in a manner that is reflective of the professional design process. (2) Provide an opportunity to increase proficiency in an information-technology enabled/facilitated design process. (3) Allow students a measure of choice (within an admittedly limit set of constraints) to personalize and focus their design efforts in their final year of undergraduate study. (4) Provide students with an opportunity to indulge (within tight constraints) flights of fancy in a thoughtful and iterative design process. (5) Provide opportunity to design and create a multiple-media physical and digital exhibit that requires consideration of how to tell a story in addition to (merely) creating the assets and components of the story.

RESOURCES: Students have access to wood and metal shop to build prototypes and physical assets for the final exhibit. Digital work will be done on student workstations supplemented as needed with access to Animation Lab and Motion Capture Lab. Students have 24/7 access to their assigned design studio throughout the semester and have use of an additional “wet” room for physical fabrication/construction near their design studio. A room is made available for the final exhibit that provides time for setup as well as the exhibit itself.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

DESIGN FOR PUBLIC GOOD

COURSES: DD 464 – Digital Design Studio III (5 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Fourth-year studio course/spring term (undergraduate)
INSTRUCTOR: Augustus Wendell

DESCRIPTION: The design course is a five-credit studio in the final semester of the four-year undergraduate program and, as such, is intended to provide students an opportunity to concentrate on particular areas of interest prior to graduation. As a general program, students have been exposed to video and animation, gaming, interactive graphics, aspects of motion picture production, web design, and physical computing. Students are expected to propose their own projects in which they will individually create a narrative-based and/or interactive project focused on a topic that provides, in some way, for the public good. Topics suitable for projects include (but are not limited to) public service announcements against bullying, warnings against distracted driving (or walking), promoting responsible parenting, advocacy for LGBTQ community including same-sex marriage, recycling, constructed response to climate change, or mental health awareness and/or support and information for students.

PROJECT: Optional projects include the creation of a motion-based visual narrative (video or animation) or a physical/interactive research-based or speculative solution that focuses on a topic of the public good. Specific requirements vary based on the specific area of digital concentration. Students may work in the areas of 3D/2D animation (with motion capture), 3D illustration and environmental design, live-action production, branding/identity/print/marketing/advertising for public education, or interactive gaming.

REQUIREMENTS: Students working on an animation will be expected to produce a 30 to 40 second HD movie with soundtrack and full post-production processing. Students working on 3D illustration or environment design are expected to create one high quality three-dimensional digital environment. Presentation will include a minimum of 8 high resolution images with at least two different lighting scenarios. All assets must be custom designed. Live action production must result in a 40 to 60 second HD movie with multiple compositing and camera tracking/matching layers. Students who are producing marketing materials must produce a multifaceted marketing campaign ranging from banner ads to be placed on websites, to print advertising, to a video for placement on social media. Students creating a publicity or branding campaign must produce full implementation manual, design of logos and color schemes, publicity materials and guidelines for use and creation of additional related print and/or online publication. Projects in this category are most effectively realized via collaboration with a non-profit organization that has a product or service to distribute (like the Center for Counseling and Psychological Services at NJIT). Gaming students are expected to produce a fully functional working prototype of the game with basic game mechanics/play, and several original assets and textures. As part of the process, students will develop storyboards, game tree, define the target market, and produce a written description with game instruction and play manual. HCI/Physical Computing projects (either research-based or speculative) must include both digital and physical components. These may include projects in mobile/ubiquitous computing, augmented reality, and adaptive environments.

OBJECTIVES: (1) To formulate a conceptual and artistic position on topics of digital designs relevant to the student concentration area (entertainment, interactive graphics, physical computing and medical applications). (2) To understand the pipeline of the digital design production and demonstrate an ability to effectively use it. (3) To develop a sophisticated and complex project that integrates multiple formats of digital media such as modeling, rendering, video editing, interactivity, and graphic design. (4) To link artistic and creative endeavors to topics of broader social, cultural, or intellectual reach in order to use skills learned for the public good. (5) To give students, where appropriate, an opportunity to work with real non-profit clients.

REFERENCES: (1) Online tutorials for various software applications are available with a College subscription to *Pluralsight* as are instructional books and manuals in the reference section of the Littman Architecture and Design Library. (2) Lupton, Ellen and Jennifer Cole Philips. *Graphic Design: The New Basics* (New York: Princeton Architectural Press, 2008). (3) Software used included *Adobe Photoshop, Adobe Illustrator, Adobe After Effects, Adobe Premiere Pro, Corel Draw, Corel Painter, Autodesk Maya, Autodesk 3DS Max, Blender, Cinema 4D*. (4) Motion capture equipment by Vicon.



NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN

3D CHARACTER MODELING AND DESIGN

COURSES: DD 444 – 3-Dimensional Character Development (3 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Fourth-year/fall term (undergraduate)
INSTRUCTOR: Andrzej Zarzycki

DESCRIPTION: The course is an in-depth exploration of 3D character design, modeling, and animation for video games and cinematographic production. Conceptual art and technical/production topics are considered. Precedent studies are required from sources including illustration, gaming, and video/animation disciplines as well as theatrical and cinematographic choreography including fashion designers and make-up artists. 3D modeling, UV unwrapping, texturing and rigging as well as pipeline production processes are also included. Students apply fundamentals learned in Video & Animation (DD 284) along with more advanced concepts and techniques in digitally creating and animating 3D characters. Focus is on both conceptual and technical/production aspects of character design.

PROJECT: Design, model, rig, and animate a fictional character; and create the “backstory” for the character.

REQUIREMENTS: Students must design, model, and animate a fictional bi-ped/humanoid character. Progress screen captures are required to document the process of modeling, lighting, and texturing the model. Provide turntable animation in addition to character and narrative-specific movement as well as still image renderings of all characters designed.

OBJECTIVES: (1) Introduce students to the history, complexity, and opportunities (including varied sources of inspiration) of designing characters. (2) Provide instruction and opportunity to model characters in a design context. (3) Provide opportunity to expand and extend knowledge and skill of character rigging introduced in earlier course(s). (4) To understand kinetic behavior of biped and quadruped characters. To gain an understanding of the pipeline of the digital character design and demonstrate an ability to transfer geometries between various modeling, texturing, and rendering software without data loss.

REFERENCES: (1) Cabrera, Cheryl. *An Essential Introduction to Maya Character Rigging* (New York, NY: Focal Press/Routledge/Taylor & Francis, 2008). (2) Goldfinger, Elliott. *Animal Anatomy for Artists: The Elements of Form* (New York, NY: Oxford University Press, 2014). (3) Gray, Henry. *Anatomy of the Human Body* (Philadelphia, PA: Lea and Febiger, 1918). (4) Palamar, Todd. *Maya Studio Projects: Photo Realistic Characters* (Hoboken, NJ: Sybex/Wiley, 2011) (5) Seegmiller, Don. *Digital Character Design and Painting* (Independence, KY: Charles River Media Graphics/Delmar Cengage Learning, 2003).

Online tutorials for *Maya* and *Mudbox* are available as are instructional books and manuals in the reference section of the Littman Architecture and Design Library. A subscription to *Pluralsight* provides online access to additional resources in the lab and in the design studios on campus.



COMPUTATIONAL DESIGN/INTERACTIVITY

COURSE: DD 364 – Digital Design Studio II (5 credits)
PROGRAM: Digital Design/School of Art + Design
LOCATION: Third-year studio course/spring term (undergraduate)
INSTRUCTOR: Taro Narahara

DESCRIPTION: All Digital Design students take one semester of physical computing within the undergraduate design studio sequence, devoting the term to the study and use of Arduino and Processing and the creation of projects emphasizing interactive techniques. They utilize sensors in student-built projects, along with 3D printing and laser-cutting. There is an explicit requirement to create interactive products and applications.

PROJECT: Individual interactive assignments. Some projects involve the use of Microsoft Kinect or Asus Xtion Pro Live to create interactive installations (e.g. interactive digital projection, augmented reality block construction game) and various ways particles and/or objects may be remotely manipulated through physical activity (e.g. proximity-controlled lighting, hand movement). Other projects require the design and construction of a kinetic interactive prototype using both sensor(s) and actuator(s) based on a conceptual idea in the context of the student(s) area of discipline (e.g. architecture, industrial design). Multi-disciplinary projects that link to other fields (e.g. biomedical engineering) are encouraged.

REQUIREMENTS: Deliverables vary by project. In all cases, built proof-of-concept elements are required that demonstrate degree of response to stimuli. Students build all components of physical projects and work with instructor to write code in Processing. Where interactive or kinetic products are designed and built, all components must be neatly integrated into the prototype using digitally fabricated parts (generally laser-cut or 3D-printed). Deliverables include live demonstration of project, a one-page description of the project that includes all hardware, software, methods and materials used, and references to online tutorials or resources. Also required is a video (up to two minutes in length) that captures the successful interactions inherent in the project, image files and photos of the product, and all files for Arduino, laser cuts, and 3D prints.

OBJECTIVES: (1) Provide design students with an opportunity to learn some computer programming and apply the knowledge to a project that deals either with human/computer interface. (2) Require digital design students to get out of the virtual environment into the physical one by building components and thinking of user interface(s). (3) Provide an opportunity for students to mix physical and digital with augmented and virtual reality applications of interactive computational design. (4) Introduce rapid prototyping, CAD/CAM, and algorithmic design for designers. (5) Explore potential relationships between various human senses (touch, hearing) and inanimate objects. (6) Reinforce the importance of craft when making digital or physical products. (7) Provide exposure to various sensors, actuators, and their applications in design. (8) Reinforce the importance and provide opportunity to practice a reflective and iterative design process with multi-phase/stepped projects that require prototypes and proof-of-concept products throughout the design process.

REFERENCES: (1) Bohnacker, Hartmut. *Generative Design: Visualize, Program and Create with Processing*. (Princeton Architectural Press, 2012). (2) Borenstein, Greg. *Making Things See: 3D Vision with Kinect, Processing, Arduino, and MakerBot*. (O'Reilly Media/Make, 2011). (3) Fry, Ben. *Visualizing Data: Exploring and Explaining Data with the Processing Environment*. (O'Reilly Media/Make, 2011). (4) Goldstone, Will. *Unity game development essentials: build fully functional, professional 3D games with realistic environments, sound, dynamic effects, and more!* (Packt Publishing, 2009) (5) Igoe, Tom. *Making Things Talk: Using Sensors, Networks and Arduino to see, hear, and feel your world/2nd Edition*. (O'Reilly Media/Make, 2011). (6) Margolis, Michael. *Arduino Cookbook*. (O'Reilly Media/Make, 2011). (7) Noble, Joshua. *Programming Interactivity: A Designer's Guide to Processing, Arduino, and Openframeworks*. (O'Reilly Media/Make, 2011). (8) Reas, Casey. *Processing: A Programming Handbook for Visual Designers and Artists*. (MIT Press, 2007) (9) Shiffman, Daniel. *Learning Processing: A Beginner's Guide to Programming Images, Animation, and Interaction*. (Morgan Kaufmann, 2015). (10) Terzidis, Kostas. *Algorithms for Visual Design Using the Processing Language*. (Wiley, 2009). *Pluralsight* tutorials available when logged onto CoAD network.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

RESIDENTIAL INTERIOR DESIGN (VISUALIZATION AND DESIGN)

COURSE: INT 363 – Interior Design Studio III (5 credits)
PROGRAM: Interior Design/School of Art + Design
LOCATION: Third-year studio course/fall term (undergraduate)
INSTRUCTOR: Adam Raiffe

DESCRIPTION: A hands-on studio course that focuses on residential design and scale, with an emphasis on (sometimes idiosyncratic) needs of individual clients. Emphasis is placed on the use of information technology/digital media in the design process and the presentation of design proposals. Preliminary integration of multiple technical variables is included. Students deal with issues that include programmatic complexities, aesthetic choices, building systems integration, material and furniture specifying processes, and code requirements.

PROJECT: Design in detail the interior space of a residential structure in disrepair in New Jersey. The client is an artist/craftsperson and the project must include space for working and displaying the work. An existing garage may (or may not, at the discretion of the designer) be converted into living space.

REQUIREMENTS: A complete set of design documents must be provided that include all floor plans (furnished), kitchen details and interior elevations, cross-section through double-height space(s), renderings (kitchen, public area, master bedroom).

OBJECTIVES: (1) To understand and appropriately apply theories of human behavior related to concepts of home, place identity and place attachment for residential environments. (2) To gather appropriate and necessary information and research findings to resolve programmatic design issues (evidence-based design). (3) To evaluate, select, apply, and synthesize information and research findings to generate multiple concepts and/or multiple design responses to programmatic requirements. (4) To produce competent presentation drawings across a range of appropriate media. (5) To learn about and apply the use and selection of appropriate materials and products on the basis of their properties and performance criteria, including environmental attributes and life cycle cost. (6) To be able to lay out and specify furniture, fixtures, and equipment. (7) To understand the relationship of building and environmental control systems as an integral component of interior design solutions. (8) To demonstrate knowledge and application of interior construction and building systems.

REFERENCES: (1) De Chiara, Joseph with Julius Panero and Martin Zelnik. *Time-Saver Standards for Interior Design and Space Planning/2nd Edition*. (2) De Chiara, Joseph and Michael J. Crosbie. *Time-Saver Standards for Building Types/4th Ed.* (New York: Mc-Graw Hill, 2001). (3) Harmon, Sharon Koomen and Katherine E. Kennon. *The Codes Guidebook for Interiors*. (Hoboken, NJ: John Wiley & Sons, 2008). (4) Mitton, Maureen and Courtney Nystuen. *Residential Interior Design: A Guide to Planning Spaces/2nd Edition*. (Hoboken, NJ: Wiley, 2011). (5) Neufert, Ernst with Peter Neufert, Bousmaha Baiche, and Nicholas Walliman. *Architects' Data/3rd Edition*. (Hoboken, NJ: Wiley-Blackwell/John Wiley & Sons, 2002). (6) Pile, John and Judith Gura. *History of Interior Design/4th Edition*. (Hoboken, NJ: Wiley, 2013).



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

COMMERCIAL DESIGN – ENTERPRISE DEVELOPMENT CENTER

COURSE: INT 364 – Interior Design Studio IV (5 credits)
PROGRAM: Interior Design/School of Art + Design
LOCATION: Third-year studio course/spring term (undergraduate)
INSTRUCTOR: Julio Figueroa

DESCRIPTION: A studio course that offers advanced introduction to commercial design, with a particular focus on office interior environments for current generation workers. Students are exposed to client requirements as well as sociological, physiological, and psychological aspects of design while using the site and building context to develop the spatial and physical character of the interior space. This course includes and makes links to issues of sustainability and buildability.

PROJECT: The semester-long project includes the programming and design of more than 55,000 square feet over three floors in the NJIT Enterprise Development Center, a public/private initiative supporting technology-focused start-ups in northern New Jersey/New York City metropolitan area. To attract younger (i.e. “millennial”) workers, student designers are asked to re-imagine the work environment/work typologies and amenities that should be offered to tenants. Students are expected to apply the knowledge acquired in previous technical courses like Building and Interior Systems to resolve conceptual, technical, aesthetic, and functional aspects of the design.

REQUIREMENTS: Prepare a full set of documents explaining the design proposal as well as the research and evidence behind decisions made to incorporate millennial tenant spaces and “typologies of working.” Prepare plans, interior elevations, furniture and finish schedules, and a series of renderings of both working and collaborative spaces (e.g. cafeteria, lounge(s)/lobby, group work spaces).

OBJECTIVES: (1) To engage in the practice of a design process that facilitates the resolution of an interior design problem. (2) To gather appropriate and necessary information and research findings to resolve design issues (evidence-based design). (3) To evaluate, select, apply and synthesize information and research findings to generate multiple concepts and/or multiple design responses to programmatic requirements. (4) To demonstrate creative thinking and originality through presentation of a variety of ideas, approaches, and concepts for a commercial environment. (5) To include learning experiences that engage students in collaboration, consensus building, leadership, and team work. (6) To produce competent presentation drawings across a range of appropriate media. (7) To provide opportunity and continued practice during which students select and apply appropriate materials and products on the basis of their properties and performance criteria, including environmental attributes and life cycle cost. (8) To be able to layout and specify furniture, fixtures and equipment. (9) To understand the relationship of building and environmental control systems as an integral component of interior design solutions for commercial office environments. (10) To demonstrate knowledge and application of interior construction and building systems. (11) To encourage thinking and creative interpretation of the project’s overriding goals, the formal language and character of the design, the organization, group interaction, and privacy. (12) To demonstrate craft and integrity in the model and drawings. (13) To increase communication skills, visual, and verbal presentation. (14) To understand the ADA (American with Disabilities Act) regulations and standards, specifically as it applies to building entrances, interior circulation, and bathroom facilities.

RESOURCES: Students will take field trips to commercial furniture showrooms in New York City. Students create work in dedicated studio space with access to software on the College of Architecture and Design network. Primary modeling application will be Autodesk Revit.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

CULTURAL ARTS CENTER FOR NEWARK – DESIGN AND VISUALIZATION

COURSE: INT 464 – Interior Design Studio V/Comprehensive Studio (5 credits)
PROGRAM: Interior Design/School of Art + Design
LOCATION: Fourth-year studio course/spring term (undergraduate)
INSTRUCTOR: David Brothers

DESCRIPTION: A comprehensive interior design studio with a project of advanced design and programming complexity concentrating on a larger multi-level institutional and/or mixed-use building type. The semester consists of a single design project, broken up into various components in a structured process. Students work to initiate research and development through all design phases to synthesize the functional, sociological, aesthetic, regulatory, and project-specific technical requirements of their projects as they relate to interior design. Students produce an interiors project that demonstrates the understanding and integration of furniture and finishes, environmental and life-safety systems, temporary and permanent interior construction systems, and principles of sustainability. As part of the final project, multiple media investigations that include video and VR are used to comprehensively explore design opportunities.

PROJECT: The studio is a semester-long engagement with the making of public interior space, structured around the design of a Cultural Arts Center for Newark, New Jersey. Students will first perform typological studies about community and cultural centers after which they are required to engage various local stakeholders in the arts including, but not limited to: Theater/Music (NJIT Theater Department, Newark School of the Arts), Visual Arts (Newark Arts, Empty Space Gallery), Community Organizations (Ironbound Community Center, Greater Newark Conservancy), and Social Justice Organizations (Newark LBGTQ Community Center, Family Success Center – Newark East, Family Success Center – Newark West). Thorough code and building analyses of the existing structure and neighborhood will precede the programming of the space and proposals for the spatial organization of any new facility.

REQUIREMENTS: Preliminary research shall be assembled into a two- to three-minute video (without voiceover) that describes what each designer believes to be the most important aspects of the project and how these define the goals of the proposed facility. These videos must include interviews, site studies, existing building analysis, and programmatic adjacency diagrams. After approval of the overall program and project, students are to completely design the interior facility including all spaces, furnishings and finishes, and interior building systems. VR explorations of the building shall be used throughout the design process to better understand the nature of the spaces design, and the clarity of the interior organization. The final project shall be presented with a combination of still images that include plans, sections/interior elevations, and renderings of important spaces as well as real-time interactive VR tours of the building for “visitors” and guest critics.

OBJECTIVES: The comprehensive studio for Interior Design is, in part, a “test” for students in their final semester of design studio to assure that the level of expertise meets CIDA standards for a designer who is ready for an entry-level position in the profession. This means, among other things, that the project must comply with health, safety, and welfare requirements of users – including ADA requirements. CIDA-based objectives are: (1) To continue developing an understanding of the social/cultural dimensions of interior environments. (*CIDA Standard 4*); (2) To demonstrate an understanding of the concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. (*CIDA Standard 13*); (3) To understand and appropriately apply theories of human behavior for learning environments. (*CIDA Standard 7*); (4) To engage in the practice of a design process that facilitates the resolution of an interior design problem. (*CIDA Standard 8*); (5) To gather appropriate and necessary information and research findings to resolve programmatic design issues (evidence-based design). (*CIDA Standard 8*); (6) To analyze historical precedent as a means of exploring issues pertaining to the project typology. (*CIDA Standard 10*); (7) To evaluate, select, apply and synthesize information and research findings to generate multiple concepts and/or multiple design responses to programmatic requirements. (*CIDA Standard 8*); (8) To demonstrate creative thinking and originality through presentation of a variety of ideas, approaches, and concepts for a residential environment. (*CIDA Standard 8*); (9) To engage in collaboration, consensus building, leadership, and team work. (*CIDA Standard 5*); (10) To produce competent presentation drawings across a range of appropriate media. (*CIDA Standard 9*); (11) To select and apply appropriate materials and products on the basis of their properties and performance criteria, including environmental attributes and life cycle cost. (*CIDA Standard 13*); (12) To be able to layout and specify furniture, fixtures, and equipment. (*CIDA Standard 13*); (13) To understand the relationship of building and environmental control systems as an integral component of interior design solutions. (*CIDA Standard 14*); (14) To demonstrate knowledge and application of interior construction and building systems. (*CIDA Standard 15*)

REFERENCES and RESOURCES:

A variety of online articles about typologies and community requirements are available. Students will use assigned studio space for work. Primary modeling application is Autodesk Revit and VR is accomplished with Enscape 3D and Oculus Rift.



**NEW JERSEY INSTITUTE OF TECHNOLOGY
COLLEGE OF ARCHITECTURE AND DESIGN**

PRODUCT DESIGN

COURSES: AD 463 – Collaborative Design Studio (5 credits), ID 364 – Industrial Design Studio (5 credits), ID 464 (5 credits)
PROGRAM: Industrial Design/School of Art + Design
LOCATION: Third- and fourth-year studio courses (undergraduate)
INSTRUCTOR: José Alcalá and Martina Decker

DESCRIPTION: Design studios for product design program and a collaborative design studio that combines students from different programs (the penultimate design studio in the School of Art + Design) to work on common projects. Products designed vary in focus from term to term and include office supplies, building/architectural products, furniture, “smart” sensor-based and adaptive products, musical instruments, and more. Products use material properties and/or integrated electronics and sensors to solve problems that are identified by students and/or faculty as those for which there is (or may be) a commercial market and/or those that are specifically targeted to improve quality of life for individuals.

PROJECTS: Third-year students are asked to identify a need and develop a specific product used in the home or by individuals that requires material investigations to fit the appropriate production techniques, smart materials, and interactive requirements for solving problems. Fourth-year collaborative projects require the use of nanotechnology and material science combined with electronics to generate products used in a subfield of robotics called “soft robotics” to create active and reactive products that interact with the user. Fourth-year individual products utilize electronics and sensors to create interactive projects (like new types of musical instruments). An iterative and interactive design process is used that combines traditional media sketching, three-dimensional solid modeling (using SolidWorks as the primary tool), and then creating physical prototypes with a combination of digital fabrication (3D printing, CNC cutting, laser cutting) and traditional construction/production techniques.

REQUIREMENTS: Students must produce a physical prototype of whatever product is being designed and proposed. The process is defined and must be documented as part of the project. This process includes (1) study of precedents and investigation of current products; (2) ideation sketching for alternative proposals; (3) exploration of form and alternatives with digital modeling (SolidWorks); (4) digital visualization (renderings) of proposed products; (5) physical prototypes (generally a combination of 3D printed objects with hand-finishing); (6) package design and product booklet justifying production; (7) video and/or live demonstration of working proof-of-concept product.

OBJECTIVES:

(1) To develop an awareness of teamwork structures and dynamics. (2) To gain an appreciation of the nature and value of collaborative practices. (3) To learn from relevant precedence. (4) To develop an awareness and knowledge of emerging technologies that are influential to the development of products in general, and soft robotics in particular (for Collaborative Design Studio). (5) To develop aesthetically pleasing and successful design projects. (6) To develop an independent sense of experimentation and scrutiny, yet participate in critical discourse. (7) to develop design propositions that are reasonable and convincing based on research and evidence. (8) Be able to use a comprehensive design process that integrates multiple media from freehand sketching to virtual models to 3D printed prototypes. (9) Increase facility with use of digital media for visualization and study of alternatives (including color options) for product design.

RESOURCES:

Students have access to wood shop, metal shop, 3D printers, and other fabrication facilities. The “Idea Factory” under the direction of Prof. Martina Decker has additional tools and facilities available to the Collaborative Design Studio and to the third-year studio. A variety of references, especially for soft robotics are available and include: (1) Cecilia Laschi, et al. Soft Robotics: Trends, Applications and Challenges, Proceedings of The Soft Robotics Week, April 25-30, 2016, Livorno, Italy [e-book]. Cham: Springer International Publishing, ©2016. (2) Laschi, Cecilia, and Barbara Mazzolai. Lessons from animals and plants: the symbiosis of morphological computation and soft robotics. IEEE Robotics & Automation Magazine 23.3 (2016): 107-114. (3) Rolf Pfeifer, et al. The Challenges Ahead for Bio-Inspired 'Soft' Robotics. Communications of the ACM, vol. 55, no. 11, Nov. 2012, pp. 76-87. (4) Blaine Brownell. Transmaterial: a catalogue of materials that redefine our physical environment. New York: Princeton Architectural Press. ©2006. (5) Philip Ball. Made to Measure: new materials for the 21st century. Princeton, NJ: Princeton University Press. ©1997.