

Yale



CREATIVE CONSILIENCE  
of Computing and the Arts

# COMPUTING AND THE ARTS

UNDERGRADUATE  
HANDBOOK

2010-2011  
Edition

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## 1. INTRODUCTION

The Bachelor of Arts in Computing and the Arts is an interdepartmental major designed for students who wish to integrate work in computing with work in one of the arts disciplines: Art, History of Art, Music, and Theater Studies. The major was approved by Yale College in the spring of 2008 and first offered in the fall of 2009.

For students with a computing perspective, issues in these disciplines present interesting and substantive problems: How musicians use computers to compose; the limitations of current software tools used by artists; the types of analyses done by art historians; challenges in designing and using virtual sets in the theatre; ways that virtual worlds might help to envision new forms of artistic expression; lessons that can be learned from trying to create a robotic conductor or performer.

For students with an artistic perspective, computing methods offer a systematic approach to achieving their vision. A foundation in computer science allows artists to understand existing computing tools more comprehensively and to use them more effectively. Furthermore, it gives them insight into what fundamentally can and cannot be done with computers, so they can anticipate the future development of new tools for computing in their field.

The major is part of the larger C2 “Creative Consilience of Computing and the Arts” initiative. Other activities associated with the initiative include a colloquium series and graduate research. Current C2 graduate research includes sketching methods for architectural design, searching in digital visual collections, 3D scanning of cultural heritage sites, programming languages for computer music systems

and building museum exhibits from archival photographs. Undergraduates are welcome to attend the colloquium series, and there are frequently opportunities to participate in C2 research projects.

## 2. COURSE REQUIREMENTS

Students choose a track in art, history of art, music, or theater studies. The prerequisite for all tracks is:

- ◆ CpSc 112a or b *Introduction to Programming*. (Students with little programming experience are advised to complete this course during the freshman year.)

The additional prerequisites for the *art* track are:

- ◆ Art 111a or b *Visual Thinking*.
- ◆ Art 114a or b *Basic Drawing*.

There are no additional prerequisites for the *history of art* track.

The additional prerequisite for the *music* track is:

- ◆ Musi 210a or b *Elementary Studies in Analysis and Composition I*

as determined by the Music Theory Placement Test. (Students who do not place into or out of Musi 210 a or b may have to take a lower-level course first.)

The additional prerequisites for the *theater studies* track are:

- ◆ ThSt 110a and 111b *Survey of Theater and Drama*.

There is no required favorable review of studio work for admission to any track.

Twelve term courses are required beyond the prerequisite(s), not including the two-term senior project. Three Computer Science courses are common to all tracks:

- ◆ CpSc 201a or b *Introduction to Computer Science*.
- ◆ CpSc 202a *Mathematical Tools for Computer Science*.
- ◆ CpSc 223b *Data Structures and Programming Techniques*.

Students are advised to complete these courses by the end of the sophomore year. Students may substitute: Math 244a *Discrete Mathematics* for CpSc 202a.

The remaining nine courses are track-specific, as specified below. All requirements for a *single* track must be satisfied.

The *art* track requires the following courses:

- a) three 100-level courses beyond Art 111a or b and 114a or b, such as
  - ◆ Art 132a or b *Introductory Graphic Design*
  - ◆ Art 138a *Digital Photography*
  - ◆ Art 145a *Introduction to Digital Video*;
- b) two Art courses at the 200- or 300-level;
- c) one Art course at the 400-level;
- d) two Computer Science courses chosen from
  - ◆ CpSc 475b *Computational Vision & Biological Perception*
  - ◆ CpSc 478b *Computer Graphics*
  - ◆ CpSc 479a *Advanced Topics in Computer Graphics*;
- e) one additional intermediate or advanced Computer Science course (excluding CpSc 490a or b *Special Projects*).

The *history of art* track requires the following courses:

- a) one introductory History of Art course chosen from

- ◆ HsAr 112a *Introduction to the History of Art: Prehistory to the Renaissance*
- ◆ HsAr 115b *History of Western Art from the Renaissance to the Present*;
- b) two History of Art courses (representing different areas) at the 200-, 300-, or 400-level;
- c) HsAr 401a or b *Critical Approaches to Art History*;
- d) one 400-level History of Art seminar;
- e) one studio art course (which may have prerequisites);
- f) two Computer Science courses chosen from
  - ◆ CpSc 437a *Introduction to Databases*
  - ◆ CpSc 475b *Computational Vision and Biological Perception*
  - ◆ CpSc 478b *Computer Graphics*
  - ◆ CpSc 479a *Advanced Topics in Computer Graphics*;
- g) one additional intermediate or advanced Computer Science course (excluding CpSc 490a or b *Special Projects*).

The *music* track requires the following courses:

- a) two computer music courses from a Music perspective:
  - ◆ Musi 325a *Fundamentals of Music, Multimedia Art and Technology*;
- b) five Music courses chosen from
  - ◆ Musi 312a and 313b *Composition Seminar I*
  - ◆ Musi 343a *Music Cognition*
  - ◆ Musi 395a *Compositional Applications in Music, Multimedia Art and Technology*
  - ◆ Musi 412a and 413b *Composition Seminar II*
  - ◆ Musi 450b *Special Topics in Music, Multimedia Art and Technology*
  - ◆ Musi 466b *Music and Multimedia Art*
  - ◆ Musi 471a or 472b *Individual Study*;

- c) two computer music courses from a Computer Science perspective:
  - ◆ CpSc 431a *Computer Music - Algorithmic and Heuristic Composition*;
  - ◆ CpSc 432a *Computer Music---Sound Representation and Synthesis*;
- d) one additional intermediate or advanced Computer Science course (excluding CpSc 490a or b *Special Projects*).

The *theater studies* track requires the following courses:

- a) ThSt 210a *Introduction to Performance Concepts*;
- b) three courses in dramatic literature or theater history;
- c) two upper-level Theater Studies production seminars in design, directing, or playwriting;
- d) one computer music course chosen from:
  - ◆ CpSc 431a *Computer Music---Algorithmic and Heuristic Composition*
  - ◆ CpSc 432a *Computer Music---Sound Representation and Synthesis*;
- e) one graphics course chosen from:
  - ◆ CpSc 478b *Computer Graphics*
  - ◆ CpSc 479a *Advanced Topics in Computer Graphics*;
- f) one additional intermediate or advanced Computer Science course (excluding CpSc 490a or b *Special Projects*).

For all tracks the senior requirement is a two-term project supervised by faculty members from both Computer Science and the arts department and approved by the director of undergraduate studies. Students must submit a written report, including an electronic abstract and web page(s). The project is taken as one term of:

- ◆ CpAr 491a or b *Senior Project for Computing and the Arts*

and one term of:

- ◆ Art 495a or b *Senior Project*
- ◆ HsAr 499a or b *The Senior Essay*
- ◆ Musi 490 *Senior Essay for Intensive Majors in the History, Theory, or Composition of Music*
- ◆ ThSt 491a or b *Senior Project in Theater Studies*

depending on the track chosen.

The entire program of each student majoring in Computing and the Arts must be approved by the director of undergraduate studies. Courses taken Credit/D/Fail may not be counted toward the major.

### 3. SENIOR REQUIREMENT

To ensure that there are the resources needed and appropriate advisors in both computer science and the arts discipline, each student must submit a project proposal for the senior requirement **no later than the end of reading period in the second term of their junior year**. The form is available at:

<http://dus.cs.yale.edu/CPAR/senior.pdf>

#### Frequently Asked Questions Regarding the Senior Requirement

##### 1. *How do I choose a project?*

There are two general approaches:

- *student sells project to professors*: for example, you get an idea, write a proposal that describes the scope of the project

and includes a list of deliverables, and find faculty members in computer science and in your arts discipline willing to supervise the work (which may require changes in the proposal)

- *professor sells project to student*: for example, a faculty member in art, computer science, history of art, music, or theater studies has a list of possible projects and potential second advisors, and you select one (which may involve changes in the nature of the project) and a host of possibilities in between.

## 2. *What kind of project is appropriate?*

One that requires significant work in both computing and an arts discipline, which may involve analysis, design, or expression, or some combination of the three:

A project in analysis implements and uses computational techniques to address an historical or theoretical issue in an arts discipline. Examples include creating a database of creative works and computing a set of characteristics that may answer a particular question; harmonic analysis of a piece of music; and a method for analyzing the authenticity of a painting.

A project in design develops new software tools for creative expression. Examples include programming languages for representing art, animations, or music; and extensions of a computer graphics system to allow new modes of representation. The emphasis is on the range and ease of expression facilitated by the software, rather than on creating an individual work.

A project in expression creates an individual work whose production has a computational component, such as an

algorithm for music composition or for image rendering. The emphasis is on the end creative work rather than on the generality or usability of the software.

3. *Who may advise a project?*

You must have advisors from computer science and from your arts discipline. Both must be faculty members in their respective departments.

4. *When should I do my senior project?*

Most students take one of the required courses each term during their senior year. However, if your advisors approve, you may also take both courses during the second term of your senior year.

5. *In which order should I take the senior project courses?*

There is no standard order since the range of projects is so broad. Thus you should take the courses in the order that you and your advisors feel is more appropriate.

6. *What are the “deliverables?”*

Whatever you and your advisors decide you must complete by the end of the project.

7. *May I change my project at a later date?*

Yes, as long as your advisors agree to the change.

#### 4. COMPUTING FACILITIES

The faculty, researchers, and students within the C2 initiative use a variety of computing resources, ranging from conventional PC's and scientific workstations to high-powered compute-servers and workstation clusters used as parallel computers. These systems are interconnected by an Ethernet local area network, which is in turn connected to the Internet via fiber optic technology to the campus backbone.

The educational computing facility for undergraduate majors in Computer Science and Computing and the Arts (affectionately known as the "Zoo" and the site of regular late-night pizza parties; web site: <http://zoo.cs.yale.edu>) is located on the third floor of the Arthur K. Watson building, which houses the department of Computer Science. It consists of Linux workstations and Windows graphics workstations. This facility is used for courses in computer science and unsponsored research by majors and is available via both console and remote login 24 hours a day, 365 days a year. Thus students in computer science and computing and the arts have essentially unlimited access.

Depending on the courses and projects an individual student selects, a student may also apply for access to the Digital Media Center for the Arts (DMCA):

<http://www.yale.edu/dmca/>

The DMCA is specifically available to faculty, staff, and students of Yale's Arts Departments and Institutions.

Students pursuing the music track may apply for access to the YalMusT Lab:

<http://www.yale.edu/yalemus/yalmust/>

## 5. ADVISORS AND FURTHER INFORMATION

The Director of Undergraduate Studies (DUS) for the major is Prof. Stanley Eisenstat (AKW 208, email: [stanley.eisenstat@yale.edu](mailto:stanley.eisenstat@yale.edu)). All students interested in the major are encouraged to consult with the DUS.

The Class Advisor (CA) for juniors and seniors in the major is Prof. Holly Rushmeier (AKW 514, email: [holly.rushmeier@yale.edu](mailto:holly.rushmeier@yale.edu)).

Students in the major will meet with either the DUS or CA at the start of each term to discuss the selection of courses and to have schedules signed. The DUS and CA will also be available throughout the year to answer questions about the major; sign petitions to double-major or change majors; and so forth.

The **comparts** mailing list contains postings of interest to undergraduates majoring in computer and the arts or taking courses in the subject, including announcements of new courses and faculty, colloquia and other departmental events, recruiting visits and employment/internship opportunities, as well as messages from the director of undergraduate studies. To join the mailing list, send an email request to: [holly.rushmeier@yale.edu](mailto:holly.rushmeier@yale.edu).

Further information can be found at:

<http://www.cs.yale.edu/c2>

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