VIP Team Shape Machine

Section VIP-2601 – 3601 – 3602 - 4601- 4602 – 4603 – 6601 - 6603 - VY5, Variable Credits

Class: Tue 3:30-4:40pm | **Van Leer | Room E465**

Instructor Information

Instructor	**Email**	**Drop-in Hours & Location**
Athanassios Economou	thanos@gatech.edu	Tue 1:00pm-2:00pm Hinman 202A

GTA / Mentors	**Email**	**Drop-in Hours & Location**
Yichao Shi	yshi431@gatech.edu	Tue 1:00pm-2:00pm Hinman 214
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General Course Information

Description

The Shape Machine VIP explores novel applications using Shape Machine, a new vector-based shape-rewrite modeling technology developed at the Shape Computation Lab at the College of Design at Georgia Tech. The Shape Machine VIP course aims to cater students with varied interests, such as core software development spanning from front-end to back-end frameworks, and software design, to user interaction design and testing, and entrepreneurship/ market discovery for Shape Machine applications.

The course is project-based and provides each student the opportunity for deeper engagement on a broad range of topics that they find exciting and interesting. For instance, a student with a background in computer science could choose to their research project on adding a feature to Shape Machine or make a new plugin integration to a CAD tool. Similarly, a student with a background in Design or Entrepreneurship could choose Designing plugins and websites or work on market discovery.

The current version of Shape Machine is implemented in Rhino, a NURBS 2D/3D CAD software and features shape-based search and replace (⌘F/⌘-R) operations and a logical processing framework to allow programming code by drawing shapes. Notably, Shape Machine can interpret DrawScript, a Turing-complete, imperative programming language that uses shapes instead of lines of code. Unlike the node-based or object-oriented applications typically used by AEC professionals, DrawScript is visually intuitive for anyone, regardless of their previous programming experience and offers a unique way to learn programming and to gain visual intuition for common programming problems extending beyond design.

Background

The Shape Machine VIP is part of the Georgia Tech Vertically-Integrated Projects (VIP) Program and operates in a research and development context. Undergraduate students that join VIP teams earn academic credit for their participation in design/discovery efforts that assist faculty and graduate students with research and development issues in their areas of expertise.

The teams are:

- Multidisciplinary - drawing students from all disciplines on campus;
- Vertically-integrated - maintaining a mix of sophomores through PhD students each semester;
- Long-term - each undergraduate student may participate in a project for up to three years and each graduate student may participate for the duration of their graduate career.

The continuity, technical depth, and disciplinary breadth of these teams are intended to:

- Provide the time and context necessary for students to learn and practice many different professional skills, make substantial contributions to the project, and experience many different roles on a large, multidisciplinary VIP team
- Support long-term interaction between the graduate and undergraduate students on the team. The graduate students mentor the undergraduates as they work on VIP projects embedded in the graduate students' research
- Enable the completion of large-scale projects that are of significant benefit to faculty members' research programs.
- Each team will determine working times, designated as “sub-team meetings.” Students are responsible for participating in their team and sub-team meetings. If you miss any meeting, you are responsible for knowing what occurred in that meeting, typically by discussing it with other team members. An excused absence does not relieve you of that responsibility.

Pre- &/or Co-Requisites

There are no pre-requisites or co-requisites for this course.

Course Goals and Learning Outcomes

The goals and learning outcome vary as the subject matter of the VIP requires a multidisciplinary approach and expertise and backgrounds from various fields. By the end of this course sequence, students will be able to:

1. **Design and implement** core software development spanning from front-end to back-end frameworks and software design **(for CS majors)**
2. **Integrate diverse technologies** for user interaction design and testing (**for CS majors, Comp Media and Designers)**
3. **Apply data-driven approaches** such as machine learning and analytics to improve operational efficiency **(for CS majors)**
4. **Understand and engage in the commercialization process**, including market discovery, business planning, marketing, and stakeholder communication. Entrepreneurship for Shape Machine applications. (for Business majors, Design, Engineers)
5. **Experience different roles on a large, multidisciplinary team**

Course Requirements & Grading

VIP teams function like real-world project teams. Members work on different aspects of a shared project, ranging from sophomores to graduate students, and from first-time participants to those with multiple semesters of experience. Students may enroll for variable credit hours, which are considered in grading. **Note:** Zero-credit enrollment is reserved for paid participants and follows the same grading criteria.

Grading Overview

Each student is evaluated across three core areas, with three mandatory requirements. Regardless of role or experience, students must demonstrate achievement in all three areas:

1. **Documentation and Records (33%)**
   - Maintain individual documentation (required).
   - Contribute to team documentation: VIP Wiki, blog

2. **Personal Contributions (33%)**
   - Complete assigned reports.
   - Contribute code (via GT GitHub) if team is developing software.
   - Engage actively in the project.

- Pursue knowledge relevant to the project.
- Contribute to technical progress.
- Experienced members may also contribute to project management.

3. **Teamwork and Interaction (33%)**
   - Participate in peer evaluations. Failure to submit results in a full letter grade deduction.
   - Attend meetings on time.
   - Collaborate toward team goals.
   - Coordinate and assist teammates.
   - Contribute to team presentations.

As part of the assessment of the above, each student is required to:

- Maintain a VIP notebook. Scans of well-maintained VIP notebooks are available on the VIP website. **Each student must understand that if work is not documented in their VIP notebook, "Then you didn't do it,"** (i.e. work that is not documented in the notebook will not count toward your grade).
- Complete the mid-term peer evaluation. This is a web-based form, and links are available on the VIP website. **Failure to complete the peer evaluation will result in a full letter grade deduction. Late submissions are not accepted.**
- Complete the final peer evaluation, which will be available for one week during the week preceding finals. **Failure to complete the peer evaluation will result in a full letter grade deduction. Late submissions are not accepted**

Rubric

Student meets or does not meet specified expectations.

A = meets expectations on 13 standards and meets all * expectations

B = meets expectations on 11 standards

C = meets expectations on 9 standards, etc.

Each section below is 1/3 of the assessment.

Standard Met	Area	Expectations Demonstrable weekly process even if the weekly results might be inconclusive and will require further work. A "does not meet standard" assessment) means that there is evidence of new work that can measured in terms of the expect time allotted for the number of credits thee students take the course (for example, on a weekly basis, 2 hrs for 1CR, 5 hrs of work for 2CRs, and 8 hrs for 3CRs.
	Documentation (1/3 of grade)	
___	Consistent to-do lists	Leaves each meeting with work to do; checks items off list as tasks/work are completed; progress/work can be tracked over time.
___*	Explanation of what was done (in individual notebook/documentation)	Sufficient explanation of work, progress, and next steps. Someone knowledgeable/skilled in the field would be able to understand decisions made, repeat what was done, and obtain the same result.
___*	Reflects on what did/did not go well	Discusses what did and did not go well. **Instructors can add detail on how frequently or infrequently this should occur – is it in weekly reflections, an organic part of documentation, etc.? If you have too**

		many items in the documentation group, this could be collapsed into "explanation of what was done" above.
___	Team-level documentation	Expectations for team-level documentation
___	Team-level documentation	Expectations for team-level documentation
	Contributions (1/3 of grade)	
___	Proactive	Identifies or asks for tasks to do; does not stop working and searches for solutions when obstacles arise – checks team documentation, searches online, reaches out to teammates, etc.
___	Learning	Acquires knowledge or skills needed for the project.
___	Quality of effort	Work is timely, thorough, and accurate; Student comes to meetings prepared.
___x2*	Appropriate level of contribution	**Considering the course level and number of credit hours**, contributions to the project were appropriate. Early-stage contributions may include obtaining skills needed to do the work.
	Teamwork (1/3 of grade)	
___*	Attitude and participation	Demonstrates interest in the project; treats teammates with respect; pays attention to the people speaking during meetings; avoids distractions during meetings; participates in discussions around others' work; acknowledges the value of others' contributions.
___*	Engages with others' work	Knows what others on the team/subteam are doing; checks in/stays abreast of their progress; gives teammates constructive feedback and suggestions; helps or provides guidance to teammates; helps keep the team/subteam moving forward.
___	Communicates well	Facilitates communication within the team; exchanges relevant information with teammates; clear and timely communication.
___	Adaptable	Able to pivot when plans change or problems arise; willing to accept help; solicits and listens to suggestions and feedback; uses suggestions and feedback to improve.
___**	Peer evaluations	Completed peer evaluations by the deadline. Provided thoughtful feedback.

* Required in order to earn an A. Instructors can choose which items this applies to.
** Required in order to earn an A. Not completing peer evaluations is associated with a letter grade reduction.

*** You could also flag items as required for earning an A or B.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Course Materials

A handful of references on the Shape Machine technology is provided below.

Websites

https://shapemachine.design.gatech.edu/

https://shape.gatech.edu/

Readings

Economou, A (2025) Shape Machine: Shape-Based Search and Replace in CAD. In Shape Computation. Mathematics and the Built Environment, vol 9. Birkhäuser, Cham. https://doi.org/10.1007/978-3-031-81623-9_16

Hong TCK (2025) The two-window problem and a solution: An alternative programming language for visual design, Architectural informatics: Proceedings of the 30th International Conference of the Association for Computer-Aided Architectural Design Research in Asia (CAADRIA) 2025, Vol. 1, Hong Kong, 407-416.

Economou, A., Hong, TCK., Newton, R. (2024). Shape meets Euclid: Integrating shape computation with ruler and compass procedures, Automation in Construction, Volume 165, 105562, ISSN 0926-5805, https://doi.org/10.1016/j.autcon.2024.105562

Newton, R., Economou, A. (2024). Redefining Line Maximization. In: Gero, J.S. (eds) Design Computing and Cognition'24. DCC 2024. Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-031-71918-9_16

Shi, Y., Economou, A. (2024). Dougong Revisited: A Parametric Specification of Chinese Bracket Design in Shape Machine. In: Gero, J.S. (eds) Design Computing and Cognition'24. DCC 2024. Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-031-71918-9_15

Economou, A., Hong, TC.K. (2023). Back to the Drawing Board: Shape Calculations in Shape Machine. In: Gero, J.S. (eds) Design Computing and Cognition'22. DCC 2022. Springer, Cham. pp. 549-567 https://doi.org/10.1007/978-3-031-20418-0_33

Hong, TC.K., Economou, A. (2023) Implementation of shape embedding in 2D CAD systems, Automation in Construction, Volume 146, pp. 1-15, 104640, ISSN 0926-5805, https://doi.org/10.1016/j.autcon.2022.104640

Hong, TC.K., Economou, A. (2022). Five Criteria for Shape Grammar Interpreters. In: Gero, J.S. (eds) Design Computing and Cognition'20. Springer, Cham. pp.191-207 https://doi.org/10.1007/978-3-030-90625-2_11

Hong, TC.K., Economou, A. (2022). What shape grammars do that CAD should: The 14 cases of shape embedding. Artificial Intelligence for Engineering Design, Analysis and Manufacturing, 36, E4. pp. 1-20 https://doi.org/10.1017/S0890060421000263

Economou, A., Hong, TC.K, Ligler H, and Park J. (2021). Shape Machine: A primer for visual computation. In Lee J.-H. (eds), A New Perspective of Cultural DNA, KAIST Research Series, Springer Nature Singapore Pte Ltd, pp. 65-92. https://doi.org/10.1007/978-981-15-7707-9_6

Yu, Y., Hong, TC.K., Economou, A., Paulino, G (2021). Rethinking Origami: A Generative Specification of Origami Patterns with Shape Grammars, Computer-Aided Design, Volume 137, 103029, ISSN 0010-4485, pp. 1-14 https://doi.org/10.1016/j.cad.2021.103029

Recommended readings

Stiny, G. 2022. Shapes of Imagination. Cambridge: MIT Press https://direct.mit.edu/books/oa-monograph/5489/Shapes-of-ImaginationCalculating-in-Coleridge-s

Kotsopoulos S (ed). 2025. Shape Computation: Fifty Years, 1972–2022. Mathematics and the Built Environment, vol 9. Birkhäuser, Cham. https://link.springer.com/book/10.1007/978-3-031-81623-9

Course Website and Other Classroom Management Tools

The course uses Canvas and/Teams as tis main Management Tools. Other Classroom Tools (e.g., Slack, GitHub, etc.) are used on a case-by-case basis within individual subteams.

Peer evaluations are administered by the VIP Program Click Here to access peer-evaluations from off campus. Click here to access from on campus. You will be prompted to sign in. Users can only log in from on campus or via VPN. Students can only access the peer evaluation portion of the system during active evaluation periods.

Course Policies, Expectations, & Guidelines

VIP is a collaborative, multidisciplinary, project-based learning and research experience. Your success in this course depends not only on your technical contributions but also on your active engagement with your team and the broader learning process.

Your Role in the Learning Process

As a VIP student, you are expected to:

- Take initiative in exploring and applying knowledge relevant to your project.
- Collaborate effectively with team members across disciplines and experience levels.
- Document your work thoroughly.
- Reflect on your learning and contributions throughout the semester.

This course is a real-world team environment, where learning is dynamic, self-directed, and collaborative. Your growth depends on your willingness to engage, contribute, and learn from others.

Team Meetings and Participation

Attendance and active participation in **team meetings** and **sub-team meetings** are required. These meetings are essential for:

- Coordinating project tasks and timelines.
- Sharing progress and receiving feedback.
- Learning from peers and mentors.
- Contributing to team decisions and direction.

Failure to attend meetings without valid reason may negatively impact your grade and your team's progress. If you anticipate missing a meeting, communicate with your team and advisor in advance.

Use of External Resources

You are encouraged to consult external sources to support your learning and project work. However:

- Do **not present someone else's work as your own**.
- Always **cite and reference** external materials used in your notebook, code, presentations, or other deliverables.
- Proper attribution is essential to maintain transparency and integrity in a collaborative research environment.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Active Participation at all class meetings is mandatory and crucial to the successful completion of the class. Absences will be excused only for medical or family emergencies, Institute-approved events, and religious holidays documented in writing. (According to a new policy, you must notify your instructor in writing during the first two weeks of the semester about any anticipated absences for religious holidays.) Late arrivals will be counted as absences.

NOTE: Absences due to special and/or unforeseen circumstances must be discussed with the instructor as early as practically possible.

Active Participation in all VIP meetings and reviews is mandatory and essential to successful completion of the class. Absences will be excused only for medical or family emergencies or for Institute-approved events and religious holidays documented in writing. In the event of a medical emergency or an illness that is severe enough to require medical attention, students are responsible for contacting the Office of the Dean of Students as soon as possible to report the medical issue or emergency, providing dated documentation from a medical professional and requesting assistance in notifying their instructors. The medical documentation will be handled confidentially within the Office of the Dean of Students and will inform a decision as to whether communication with instructional faculty is appropriate. According to the institution's policy, you must notify your instructor in writing during the first two weeks of the semester about any anticipated absences for religious holidays).

Attendance will be taken at the beginning of each session by either the instructor or graduate teaching assistant/mentor. To ensure equitable instruction to all students and effective use of VIP meeting time, there cannot be reiteration of this material to students arriving late.

Three (3) unexcused late arrivals will count as one (1) unexcused absence. Missing three classes without an approved excuse will result in a letter grade reduction. Missing more than three classes, excused or unexcused, might result in a meeting with your instructor and the Architecture Program Office to determine a course of action, and can result in an incomplete grade (I) or a failing grade (F) in this course. Note that some exceptions are made at Georgia Tech for "approved Institute activities" (e.g., field trips and athletic events) and religious observances. See this catalog page for more information. Students are highly encouraged to submit any class absence verification that is required due to documented illness, hospitalizations, accidents, death in the family, family emergencies, and lengthy illnesses to the dean of students. (https://studentlife.gatech.edu/request-assistance)

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Students are expected to submit digital documentation of their work through Canvas and Teams in the required format(s) and by the time(s) specified by assignment briefs. Extensions may be given only on prior notice and compliance with the institute guidelines. See "approved Institute activities" (e.g., field trips and athletic events) and religious observances and/or All-Majors Career Fair and off-campus

interviews.. See this catalog page for more information. One-day late assignment will lose 10% of the grade; three days late assignment 25%; and one-week late assignment will lose 50% of the grade. Work not submitted after a week won't be accepted.

Inclement Weather and Digital Learning Days

The class will switch to digital learning days mode due to inclement weather

https://gatech.service-now.com/home?id=kb_article_view&sysparm_article=KB0023604

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Student Use of Mobile Devices in the Classroom

Student Use of Mobile Devices in the Classroom is not allowed

Additional Course Policies

VIP Room and Equipment Use Policy

VIP rooms and equipment are shared resources used by multiple teams. To ensure a productive and respectful working environment, the following rules apply:

1. Room Usage Priorities

Room use is prioritized as follows:

1. Scheduled team meetings, lectures, and learning modules
2. Weekly sub-team meetings (multiple groups may share the space)
3. Video conferences or special meetings with VIP stakeholders
4. Other project-related work (multiple groups may share the space)

Room schedules are available on the VIP website.
Note: A "good neighbor" policy applies—students may use rooms during other activities as long as they do not cause disruption. Quiet individual work or studying is allowed when it does not interfere with scheduled uses. Similarly, multiple groups may use a VIP room at the same time.

2. Cleanliness and Conduct

- Everyone is responsible for keeping rooms clean.
- Food is allowed, but spills must be cleaned immediately.
- **Gum must be disposed of properly—do not stick it under desks or on carpets.**
- Rooms are monitored by cameras; violations may be reviewed via video.

3. **Equipment Use**

- Equipment may be designated for general use or assigned to specific teams.
    - General use examples: Projector in Klaus 1440, monitors in VL 465 and VL 463B.
    - Equipment assignments may change each semester.
- If unsure about equipment access, contact: vip-request@ece.gatech.edu
- Use equipment only for its intended purpose. Misuse may pose safety risks.

Important Equipment Rules:

- Equipment may not be removed from VIP rooms without a signed loan agreement approved by a VIP Director.
- You are financially responsible for any equipment not returned in good condition.

- You must know how to operate equipment safely. Approval to use equipment does not imply safety training has been provided.

4. Computer Accounts

- Accounts are for individual use only—do not share with others.
- All usage must comply with Georgia Tech, USG Board of Regents, and State of Georgia policies.
- Respect privacy and data integrity. Having access to a file does not mean you are authorized to read or modify it.

5. BuzzCard Access

- Access is a privilege and is logged.
- Rooms are under video surveillance. In cases of theft, vandalism, or messes, logs and footage will be reviewed.
- Do not allow unauthorized individuals into VIP spaces.
- Always secure the room (close the door) when leaving.

Campus Resources for Students

Undergraduate Student Academic Success Resources:
A list of resources for undergraduate students' academic success and information about advising can be found at Success at Tech.

- 1:1 Tutoring: Students looking for additional assistance outside of the classroom are advised to consider working with a peer tutor through Knack. Georgia Institute of Technology has partnered with Knack to provide students with access to verified peer tutors who have previously aced this course. To view available tutors, visit gatech.joinknack.com and sign in with your student account.

Graduate Student Academic and Professional Success Resources:
A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- Professional Development such as the programming from the Career Center and other professional development resources and events"]

Student Well-Being:
At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu)

Course Schedule

Week	Date	Activity/Event
Week 1	Week of Jan 11	Introductions Overview of team's work Discussion of semester goals

Week 2	Week of Jan 18	Sub-team selections finalized Sub-team meeting times finalized Verification of Student Participation in Class Due by Friday at 4pm
Week 3	Week of Jan 25	Deskcrits
Week 4	Week of Feb 1	Deskcrits; Assignment: Self-grade with rubric
Week 5	Week of Feb 8	Deskcrits
Week 6	Week of Feb 15	Web-based peer-evaluations released for students to complete. Online form due by end of the day Friday. Late submissions will not be accepted.
Week 7	Week of Feb 22	Submit individual VIP documentation for mid-term grading. Midterm presentations (Part I)
Week 8	Week of March 1	Midterm presentations (Part II) Midterm grades for 2000-level courses due in OSCAR (S for satisfactory, U for unsatisfactory).
Week 9	Week of March 8	Spring break Submit individual VIP documentation for mid-term grading. Midterm presentations
Week 10	Week of March 15	Deskcrits; Withdrawal Deadline (TBA)
Week 11	Week of March 12	Deskcrits
Week 12	Week of March 29	Team Presentations
Week 13-14	Week of Apr 5 &12	Deskcrits
Week preceding finals	Apr 19	Web-based peer-evaluations released for students to complete. Online form closes at 11:59PM on Tuesday. Late submissions will not be accepted.
Last week of class	Week of Apr 26	Final presentations Turn in individual VIP documentation for final grading.
Finals Week	Apr 30 – May 7	No final. No assignments.