Special Topics in Computer Science: Usability of Programming Languages (CMSC 388W)

Term: Spring 2021
Credits: 1
Course Dates: Jan 29, 2020 - May 7, 2020
Course Times: F 11:00 AM - 11:50 AM
Instructor: Michael Coblenz
Pronouns: he/him
Email: mcoblenz@umd.edu
Office Hours: By appointment
Classroom: https://umd.zoom.us/j/93063843695?pwd=c1QyQ2RnYlg0TUJBNElJUzVrZ1dEdz09

Course Description
Which is better: Python or Java? Is using a strongly typed language worth the hassle? Is it true that dynamically-typed languages are better for prototyping work, whereas statically-typed languages are better for deployed software? These questions all relate to the relationships between languages and people.

In this special course, we will study how to design and evaluate the usability of programming languages. How can we design programming languages that empower programmers and software engineers to be more effective at achieving their goals?

We will start by studying techniques for gathering insights about users, and then we will read and discuss papers investigating major questions in the area: how do types help programmers? How can we analyze a programming language or other notation for usability?

This course is just the beginning. After taking the course, you might want to do your own language design and research projects, potentially leading to publication! I am looking for students to work with over the summer, and taking this course is great preparation.

This course is targeted at students who are interested in learning how to design and evaluate how programming language design affects programmers and software engineers. Students ranging from mid-stage undergraduates to PhD students are welcome; a diversity of experience will make class discussion more interesting.

Course Objectives

After successfully completing this course you will be able to:

- Summarize key aspects of existing evidence regarding usability of programming language constructs.
- Design and execute usability studies and use Cognitive Dimensions of Notations to analyze the usability of programming languages.
- Leverage key technical approaches, such as gradual types, that might improve language usability.
- Analyze and evaluate scientific research in the area of programming language usability.

Required Resources

- Course Website: elms.umd.edu

Course Structure

We will meet 14 times. Discussion in these meetings is a key part of participation in the class. In addition, the course includes a mix of *reading* and *practice* assignments. Most weeks, one of the two kinds of assignments will be due, but on occasion, both kinds of assignments will be due.

In lieu of a final exam, the course includes a final project. During the course, you will propose a usability study of a programming language or IDE feature. The project will involve conducting this usability study, presenting your results, and writing a report. The presentation will take place on the last day of class; the report will be due on the final exam day.

Campus Policies

It is our shared responsibility to know and abide by the University of Maryland's policies that relate to all courses, which include topics like:

- Academic integrity
- Student and instructor conduct
- Accessibility and accommodations
- Attendance and excused absences
- Grades and appeals
- Copyright and intellectual property

Please visit www.ugst.umd.edu/courserelatedpolicies.html for the Office of Undergraduate Studies' full list of campus-wide policies and follow up with me if you have questions.

Course Guidelines

Academic Integrity

Some work in this course will be explicitly designated as partner work; for this work, collaboration expectations will be specified in the assignments. For the rest of the work, discussion with classmates may significantly further your understanding of the material, and I encourage you to talk to others about the readings and work. However, any work that you submit should be your own writing, and intellectual contributions of your peers should be noted. Some examples of ACCEPTABLE and ENCOURAGED collaboration:

- You read an assigned paper, but you don't understand some key aspects of the paper. You have a Zoom call with a peer to discuss the paper. You don't take any notes, but now you understand enough of the paper to answer the homework questions. You write answers to the questions by yourself and do not share them with others.
- You read an assigned paper, but you are skeptical about one of the claims in the paper. Does the paper really substantiate the claim? You have a Zoom call, and your friend explains how the paper justifies the claim. You write in your homework the concern you had, why it is mitigated, and the name of the friend with whom you worked to figure that out.
- You have an assignment to design a part of a user study. You write the study materials, but before you turn them in, you show them to a friend. The friend points out five grammatical mistakes and tells you that some of the instructions are confusing. You update the materials accordingly and write on your assignment who helped you.

Some examples of UNACCEPTABLE collaboration:

- You find part of the reading assignment confusing. You ask a friend for their answer to one of the reading questions and copy it into your own response.
- You have a meeting with a friend about a reading assignment. You take extensive notes and summarize the notes in your homework.

I encourage you to *not stress* about the reading assignments. I do not expect you to understand the whole paper. Write down questions for discussion and bring them up in the next class meeting. Other students are likely confused about the same points!

Reading Guidance

Many of you have not yet read original research papers. Here are some guidelines to use when reading assigned papers.

- Time-box your reading. This is a 1-credit course. My expectation is that you will spend 3 hours per week on the course, which leaves 2 hours per week for homework. You might spend 1 hour and 40 minutes reading the paper and 20 minutes reflecting on it and answering reading

questions. This means you will not be able to understand everything in the paper. You must prioritize which sections you will understand thoroughly and which you will skim.
- Read the abstract, which summarizes the paper.
- Read the introduction, which should tell you what you expect to find in the rest of the paper and why the rest of the paper is worth reading.
- Write down one or two essential questions to guide your reading: what are you hoping to learn from the rest of the paper?
- Look at the remaining sections, but focus on the sections that address those questions. Write down your own questions. Which terms did you not understand? Which claims are you skeptical of? What evidence might you accept to alleviate (or justify) your skepticism?

Names/Pronouns and Self-Identifications

The University of Maryland recognizes the importance of a diverse student body, and we are committed to fostering inclusive and equitable classroom environments. I invite you, if you wish, to tell us how you want to be referred to both in terms of your name and your pronouns (he/him, she/her, they/them, etc.). The pronouns someone indicates are not necessarily indicative of their gender identity. Visit trans.umd.edu to learn more.

Additionally, how you identify in terms of your gender, race, class, sexuality, religion, and dis/ability, among all aspects of your identity, is your choice whether to disclose (e.g., should it come up in classroom conversation about our experiences and perspectives) and should be self-identified, not presumed or imposed. I will do my best to address and refer to all students accordingly, and I ask you to do the same for all of your fellow Terps.

Communication with Instructor:

Email: If you need to reach out and communicate with me, please email me at mcoblenz@umd.edu. Please DO NOT email me with questions that are easily found in the syllabus or on ELMS (i.e. When is this assignment due? How much is it worth? etc.) but please DO reach out about personal, academic, and intellectual concerns/questions.
I will do my best to respond to emails within 24 hours. However, the COVID-19 crisis affects me as well as you, and it is possible that my schedule will be disrupted due to parenting responsibilities, etc.

ELMS: I will send IMPORTANT announcements via ELMS messaging. You must make sure that your email & announcement notifications (including changes in assignments and/or due dates)

are enabled in ELMS so you do not miss any messages. You are responsible for checking your email and Canvas/ELMS inbox with regular frequency.

Communication with Peers:

With a diversity of perspectives and experience, we may find ourselves in disagreement and/or debate with one another. As such, it is important that we agree to conduct ourselves in a professional manner and that we work together to foster and preserve a virtual classroom environment in which we can respectfully discuss and deliberate controversial questions.

I encourage you to confidently exercise your right to free speech—bearing in mind, of course, that you will be expected to craft and defend arguments that support your position. Keep in mind, that free speech has its limit and this course is NOT the space for hate speech, harassment, and derogatory language. I will make every reasonable attempt to create an atmosphere in which each student feels comfortable voicing their argument without fear of being personally attacked, mocked, demeaned, or devalued.

Any behavior (including harassment, sexual harassment, and racially and/or culturally derogatory language) that threatens this atmosphere will not be tolerated. Please alert me immediately if you feel threatened, dismissed, or silenced at any point during our semester together and/or if your engagement in discussion has been in some way hindered by the learning environment.

Final project components

Component	Percentage
Usability research question brainstorming	5%
Proposal	15%
Revised proposal	15%
Run study (describe results)	25%
Present study	15%
Final report	25%
Total	**100%**

Major Assignments

Reading reflections

- For each reading assignment, you will submit a *reading reflection*. These will take the form of questions that you should answer. The answers can be short; typically a paragraph or two for each question will suffice. The goal is to help deepen your engagement with the reading assignments, not to practice writing essays or research papers.

Homework Assignments

- These assignments will provide opportunities to practice using the techniques from class.

Course Project

- The course project is to design and run a usability study on a language or IDE feature of your choice. The project will be broken into components, shown at right.

Grading Structure

Meaningful participation requires contributing to the discussion. This might involve asking relevant questions, making suggestions, etc. Your role in the classroom is not merely to absorb material, but rather to *engage* with it. Challenge ideas. Identify limitations. Propose improvements.

You will earn up to 2 points in each class meeting for participation:
0 points: did not come to class.
1 point: attended but did not participate meaningfully
2 points: attended and participated meaningfully

Because reading assignments are critical preparation for class discussion, they *must be submitted before the start of class*. Unexcused late homework and projects will be penalized at 10% per day. In *exceptional* situations, I will reward self-awareness of personal schedule constraints by granting exceptions on a case-by-case basis.

Assignment	Percentage
Reading assignments	30%
Homework assignments	15%
Participation	15%
Final project (all components together)	40%
Total	100%

Grades

Final grades will include +/- descriptors.

Final Grade Cutoffs									
+	97%	+	87%	+	77%	+	67%	+	
A	94%	B	84%	C	74%	D	64%	F	<60.0%
-	90%	-	80%	-	70%	-	60%	-	

All assessment scores will be posted on the course ELMS page. If you would like to review any of your grades (including the exams), or have questions about how something was scored, please email me to schedule a time for us to meet and discuss.

I will use the following cutoffs as a guide. However, I may scale grades of individual assignments up as appropriate according to the difficulty of each assignment.

Course Outline

Note: This is a tentative schedule, and subject to change as necessary – monitor the course ELMS page for current deadlines. The schedule will change according to university closures and schedule changes as well as according to student interests.

Date	Topic for class meeting	Reading due	Due
1/29	Introduction to usability: definition, personas, methods overview.	(none)	
2/5	Paper discussion; qualitative studies	Andreas Stefik and Stefan Hanenberg. 2014. The Programming Language Wars: Questions and Responsibilities for the Programming Language Community. In Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software (Onward! 2014). 283–299. https://doi.org/10.1145/2661136.2661156	Brainstorm language usability research questions. In pairs.

Date	Topic for class meeting	Reading due	Due
2/12	Designing and running usability studies	Brad A. Myers, Amy J. Ko, Thomas D. LaToza, YoungSeok Yoon. Programmers Are Users Too: Human-Centered Methods for Improving Programming Tools. https://faculty.washington.edu/ajko/papers/Myers2016ProgrammersAreUsers.pdf	
2/19	Quantitative study design		Qualitative study proposal
2/26	Paper discussion	Stefan Endrikat, Stefan Hanenberg, Romain Robbes, and Andreas Stefik. 2014. How Do API Documentation and Static Typing Affect API Usability? In International Conference on Software Engineering (ICSE '14). ACM, 632–642. https://doi.org/10.1145/2568225.2568299	
3/5	Cognitive Dimensions of Notations	Thomas R. G. Green and Marian Petre. 1996. Usability analysis of visual programming environments: a 'cognitive dimensions' framework. Journal of Visual Languages & Computing 7, 2 (1996), 131–174.	
3/12	Technical approaches to usability: gradual typing	Video: ICFP 2018 keynote address, Ron Garcia: "Gradual Typing." https://www.youtube.com/watch?v=fQRRxaWsuxI	Cognitive Dimensions analysis practice
3/19	Spring break; no class		
3/26	Gender HCI: programming tools and gender?	Margaret Burnett, Anicia Peters, Charles Hill, and Noha Elarief. Finding Gender-Inclusiveness Software Issues with GenderMag: A Field Investigation. CHI 2016. ftp://ftp.cs.orst.edu/pub/burnett/chi16-GenderMag-fieldStudy.pdf	Revise qualitative study proposal
4/2	Natural programming	John F. Pane, Brad A. Myers, and Leah B. Miller. 2002. Using HCI techniques to design a more usable programming system. In Human Centric Computing Languages and Environments (HCC '02). 198–206. https://doi.org/10.1109/HCC.2002.1046372	

Date	Topic for class meeting	Reading due	Due
4/9		In-class usability study pilot	
4/16	Corpus studies	Beckman, Nels E., Duri Kim, and Jonathan Aldrich. "An empirical study of object protocols in the wild." European Conference on Object-Oriented Programming. Springer, Berlin, Heidelberg, 2011.	
4/23	End-user programming	No reading; material presented in class	Revise study design; run study.
4/30	Student-identified topic, or IDE integration approaches.	TBD	
5/7	Presentations of pilot studies		Prepare presentation

Resources & Accommodations

Accessibility and Disability Services

The University of Maryland is committed to creating and maintaining a welcoming and inclusive educational, working, and living environment for people of all abilities. The University of Maryland is also committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of the University, or be subjected to discrimination. The **Accessibility & Disability Service (ADS)** provides reasonable accommodations to qualified individuals to provide equal access to services, programs and activities. ADS cannot assist retroactively, so it is generally best to request accommodations several weeks before the semester begins or as soon as a disability becomes known. Any student who needs accommodations should contact me as soon as possible so that I have sufficient time to make arrangements.

For assistance in obtaining an accommodation, contact Accessibility and Disability Service at 301-314-7682, or email them at **adsfrontdesk@umd.edu**. Information about **sharing your accommodations with instructors**, **note taking assistance** and more is available from the **Counseling Center**.

Student Resources and Services
Taking personal responsibility for your own learning means acknowledging when your performance does not match your goals and doing something about it. I hope you will come talk to me so that I can help you find the right approach to success in this course, and I encourage you to visit **UMD's Student Academic Support Services website** to learn more about the wide range of campus resources available to you.

In particular, everyone can use some help sharpening their communication skills (and improving their grade) by visiting **UMD's Writing Center** and schedule an appointment with the campus Writing Center.

You should also know there are a wide range of resources to support you with whatever you might need (**UMD's Student Resources and Services website** may help). If you feel it would be helpful to have someone to talk to, visit **UMD's Counseling Center** or **one of the many other mental health resources on campus**.

Basic Needs Security
If you have difficulty affording groceries or accessing sufficient food to eat every day, or lack a safe and stable place to live, please visit **UMD's Division of Student Affairs website** for information about resources the campus offers you and let me know if I can help in any way.

Technology Policy
Since this is an online class, you will use a computer to attend class. Please refrain from self-distracting during class with social media, etc.

Participation

- Given the interactive style of this class, attendance will be crucial to note-taking and thus your performance in this class. Attendance is particularly important also because class discussion will be a critical component for your learning.
- Each student is expected to make substantive contributions to the learning experience, and attendance is expected for every session.
- Students with a legitimate reason to miss a live session should communicate in advance with the instructor, except in the case of an emergency.
- Students who miss a live session are responsible for learning what they miss from that session.
- Additionally, students must complete all readings and assignments in a timely manner in order to fully participate in class.

Course Evaluation
Please submit a course evaluation through CourseEvalUM in order to help faculty and administrators improve teaching and learning at Maryland. All information submitted to CourseEvalUM is confidential. Campus will notify you when CourseEvalUM is open for you to complete your evaluations for fall semester courses. Please go directly to the **Course Eval UM website** to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing through Testudo, the evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations.

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