UC San Diego
Cognitive Science

Devamardeep Hayatpur's Dissertation Defense

Visual Expressions of Program Behavior

Wednesday, December 2, 2026
1:00 - 3:00 pm, Design & Innovation Building, Room# 208
or https://ucsd.zoom.us/j/91727220031
Meeting ID: 917 2722 0031

Abstract:
Programmers inhabit a larger environment than their text-editors. They frequently reach for external implements like pen-and-paper, blackboards, and digital canvases. In this thesis, I study the external artifacts programmers produce, develop theories for why, and apply those theories to the design of new programming experiences.

First, I find that visual artifacts drawn by instructors tend to chunk multiple lines of code into one image. This is tension with the design of nearly all debuggers which show one program state per line of code. I use this insight to develop a multi-granular debugger which can aggregate execution across time steps. Then, I describe a large scale analysis and an interview study of so-called 'ASCII diagrams,' pictures programmers draw with text in code comments. I find that ASCII diagrams are professional artifacts, diverse in role and content, and used to support many steps in the software development lifecycle. In particular, these diagrams tend to show abstracted views of data, e.g., a list of memory pointers may be shown as a nondescript sequence of boxes. This might be easy to dismiss as laziness on the part of the programmer, but partial, incomplete representations can also help to abstract away from a concrete case to help visualize a whole class of data. Based on this observation, I developed a domain-specific-language for incrementally abstracting data structure diagrams from their raw values. Lastly, I describe how such raw values can be directly interacted with through a WYSIWYG user interface.

I conclude with notes for furthering creative expression in our programming environments and how we might empower students to critique and experiment with new programming ideas.

Committee members:
Dr. Haijun Xia (Chair) - UCSD Cognitive Science
Dr. Philip Guo - UCSD Cognitive Science
Dr. James Hollan - UCSD Cognitive Science
Dr. Nadia Polikarpova - UCSD Computer Science & Engineering