

# Narrating Data Structures: The Role of Context in CS 2

Lana Yarosh & Mark Guzdial  
Georgia Institute of Technology

# The Story

- Prior work on the role of context in CS
- A particular **contextualized CS 2 class**:
  - Curriculum & Population
  - Situated in comparison to other ways of teaching CS 2
- Our mixed-method approach to studying this class
- Role of Context:
  - Some students **don't want it**
  - **Interesting, but not relevant**
  - **Motivated** some students
  - Students noted a particular characteristic of context -- **narrative**

# CS + Context = ?

- Introductory CS classes may be too abstract<sup>1</sup>
- Incorporating context has had some success:
  - At Georgia Tech: Media Computation<sup>2</sup>, Engineering<sup>3</sup>, and Robotics CS 1
  - At Duke University<sup>4</sup>: Social Networking CS 1
  - At Evergreen College: Ecology CS 1
- What about CS 2?

1. J. Margolis and A. Fisher (2002)

2. A. E. Tew, C. Fowler, and M. Guzdial (2005)

3. A. Forte and M. Guzdial (2004)

4. Alt et al. (2006)

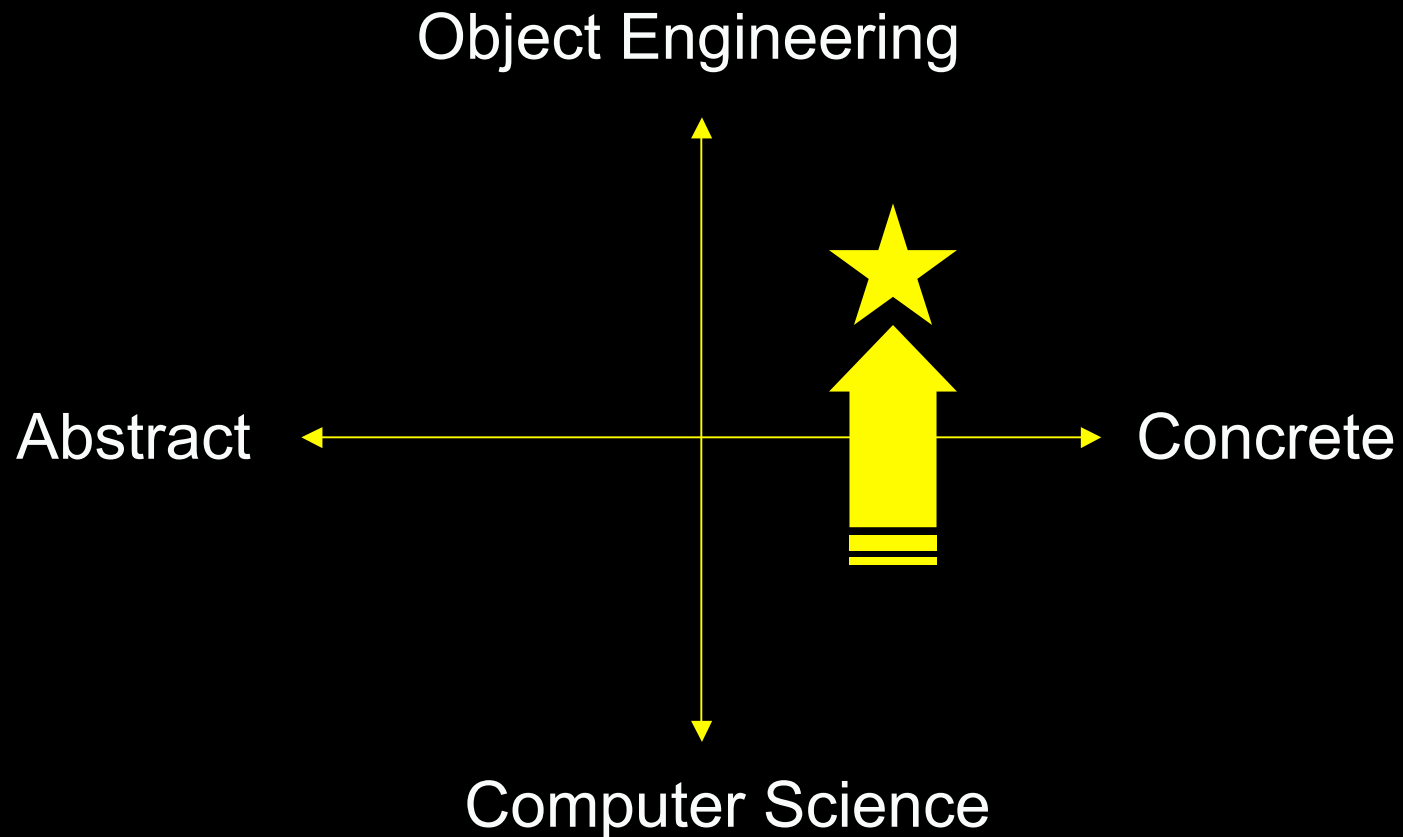
# CS 2 + Context = ?

- Research Questions:
  - Can context serve a motivating role for CS 2 students?
    - What is the role of narrative?
  - Do students view the trade-off between time spent on material and time spent on context to be worth it?

# Media Computation CS 2

- “**Bridge**” course between CS 1 and future CS classes
- Covers linked lists, trees, stacks, and queues in the context of **modeling media** and **creating simulations**
- First half of the class focuses on **implementing** data structures; second half focuses on **using** them

# Lister et al. Dimensions of Variation in Teaching a Data Structures Class<sup>1</sup>



1. R. Lister, I. Box, B. Morrison, J. Tenenberg, and D. S. Westbrook (2004)

# Driving Question: How Did They Do That?



# Class Demographics

- 186 students
- Representing 14 majors
- Ethnicity and gender representative of overall university population.

# Methodology



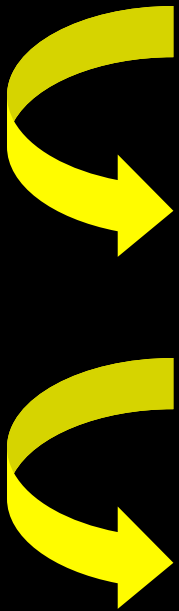
- Formative
- Survey: Multiple Choice + Free Response
- 62 participants



- Gathering Qualitative Themes
- Semi-Structured Interview
- 7 participants



- Testing Themes
- Survey: Likert-Type Scales + Free Response
- 91 participants



# Methodology



Students listed “working with images,” “playing with sound,” etc. as their favorite aspects of the course



“You never want to do homework, but this actually has some entertainment value that comes out of it...”

“...I think some of the stuff we’re doing is very interesting...”



Working with media makes this class more interesting.

(5-point Likert-type scale: Strongly Disagree to Strongly Agree)

# Some Students Don't Want The Context

From Interviews:

“...I don't need to make pretty pictures, I need to be able to perform calculations...”

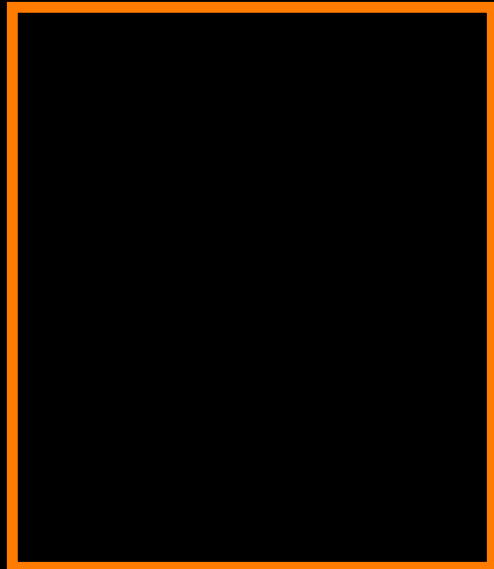
“I like all the concepts covered in the class, I just wish they were covered a little better, and I wish there would have been more concepts and less [media]...”

“I feel that we diverged a lot from the ‘computing’ part of computer science and ended up in a lot more artsy stuff...”

# Some Students Don't Want The Context

Survey Statement:

Working with media is a waste of time that could be used to learn the material in greater depth.



# Context Seen As Interesting, But Not Relevant

From Interviews:

“... I think working with these different pictures and things – maybe that’s why we do it. I think for me maybe it sacrifices a little relevancy and makes up for it in interesting material.”

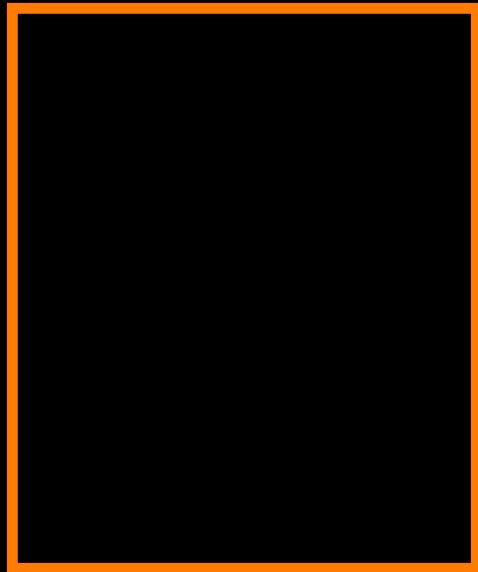
““I guess, to me, some of the things we’ve been doing manipulating an awful lot of images, it’s interesting, but to me, not as relevant.”

“... they try to make [the context] something interesting, which I have a lot of respect for ... but, I just think sometimes that it’s less relevant.”

# Context is Interesting...

Survey Statement:

Working with media makes this class more interesting.



# ...But Not Useful

## Survey Statements:

Working with media makes this class more useful to me.

only 45% agreed or strongly agreed

This class is useful in my life outside of class.

only 42% agreed or strongly agreed

This class is useful to passing future classes in my major.

only 46% agreed or strongly agreed

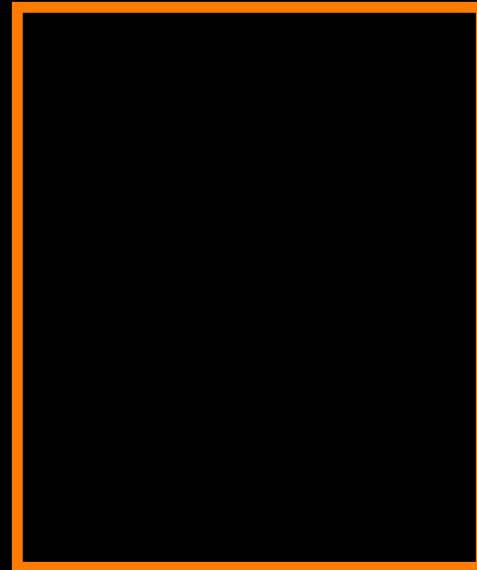
This class is useful to my future career.

only 49% agreed or strongly agreed

# Trade-Off

Revisiting Survey Statement:

Working with media is a waste of time that could be used to learn the material in greater depth.



# Context Motivated Students

From Interviews:

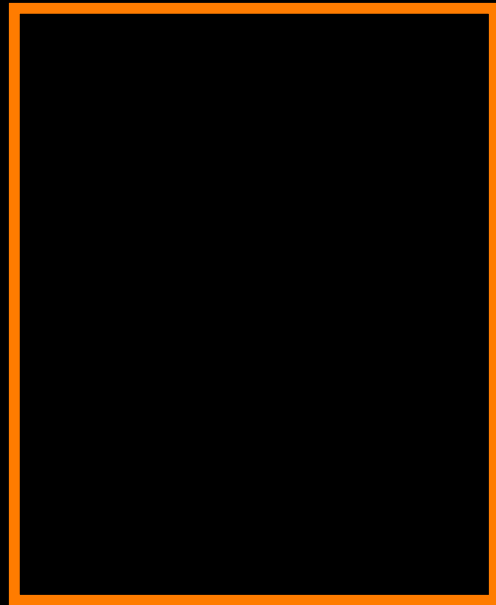
“... for the animation that time, I had a story going on, so I wanted all the elements there. It was more interesting to do something extra [on that assignment], then just to do the minimum that was required...”

“I really enjoyed doing the homework on weaving, where you'd take bits and pieces of sound and weave it together and manipulate the music to kind of get it in an arrangement that you like and just messing around with that. That was enjoyable — I spent a good amount of time doing that homework. I did more than the minimum...”

# Context Motivated Students

Survey Statement:

There was at least one project that really excited me.



# Context Motivated Students

Survey Question:

Have you ever done work above and beyond the strict requirements of the assignment (for example, making your homework “cool”)?



# Students Recognized and Followed The Narrative

Recognized a Beginning:

“I thought analogies like that are good. I attended the class a lot at the beginning of the semester [for these].”

“It made me interested enough to try learning this computational media stuff at the beginning...”

# Students Recognized and Followed The Narrative

Recognized a Climax:

“[The story] makes it more fun to see the result. The animation was exciting, really exciting to see.”

“...being able to coordinate the sounds with the images and the images moving... I felt like that tied everything together, so that was pretty neat...”

“...simulation [was my favorite project] as it is the goal of the course...”

# Students Found the Narrative Motivating

From Interviews:

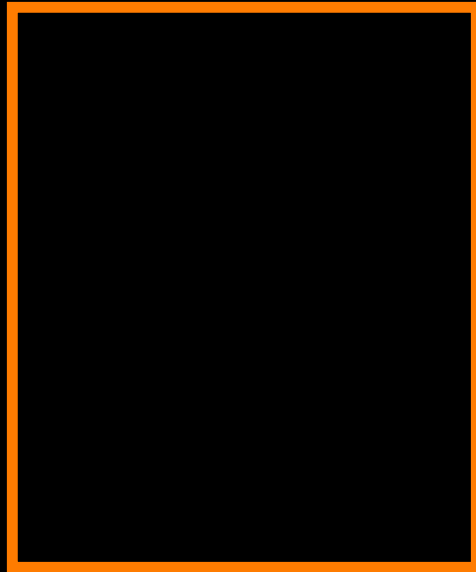
“...some of the things [the professor] was talking about, that I was really fascinated by, about how the Lion King animations stuff worked, was neat to me...”

“It made me interested enough to try learning this computational media stuff at the beginning...”

# Students Found the Narrative Motivating

Survey Statement:

The Lion King wildebeest metaphor was motivating.



# Students Who Were Motivated by the Narrative...

56% of the students agreed or strongly agreed that the Lion King metaphor was motivating.

These students were much more likely to agree with the statement: “**Real media professionals use techniques we covered.**” ( $r(84) = 0.40, p < 0.01$ )

They were also more likely agree with: “**There was at least one project that really excited me.**” ( $r(84) = 0.21, p < 0.05$ )

# Revisiting The Questions

- Can context serve a motivating role for CS 2 students?
  - What is the role of narrative?
- Do students view the trade-off between time spent on material and time spent on context to be worth it?

# Role of Context

- Some students **don't want** context anymore, however most found the context **interesting**.
- Most students **willing to make the trade-off** between context and learning the material in greater depth
- Students were **excited by projects** and willing to put in **more work than was required**, even though the majority did not see the class as being useful.
- Students view context as an opportunity to do something **different** – interesting but not directly related to their goals

# Narrative as Context Characteristic

- The Lion King story tied the projects into a **coherent whole**
- It allowed the students to suspend their disbelief to **believe in the authenticity** of the material
- MAYBE, it helped learning by providing an **organizational structure** for knowledge
- As always, not everybody “**buys-in**” to the story

# Take-Away Points

- Summary:
  - Context was **motivating**, but **not relevant**
  - Some students **didn't want** context, but **most were willing** to spend the time on it
  - A narrative context can provide **structure** and maybe increase a sense of **authenticity**
- What's Next?
  - **Role of narrative** in a CS class
  - Effect of context and narrative on **learning outcomes**
  - Role of context for **Computer Science majors**

Questions?