Imagineering Inauthentic Legitimate Peripheral Participation:

An Instructional Design Approach for Motivating Computing Education

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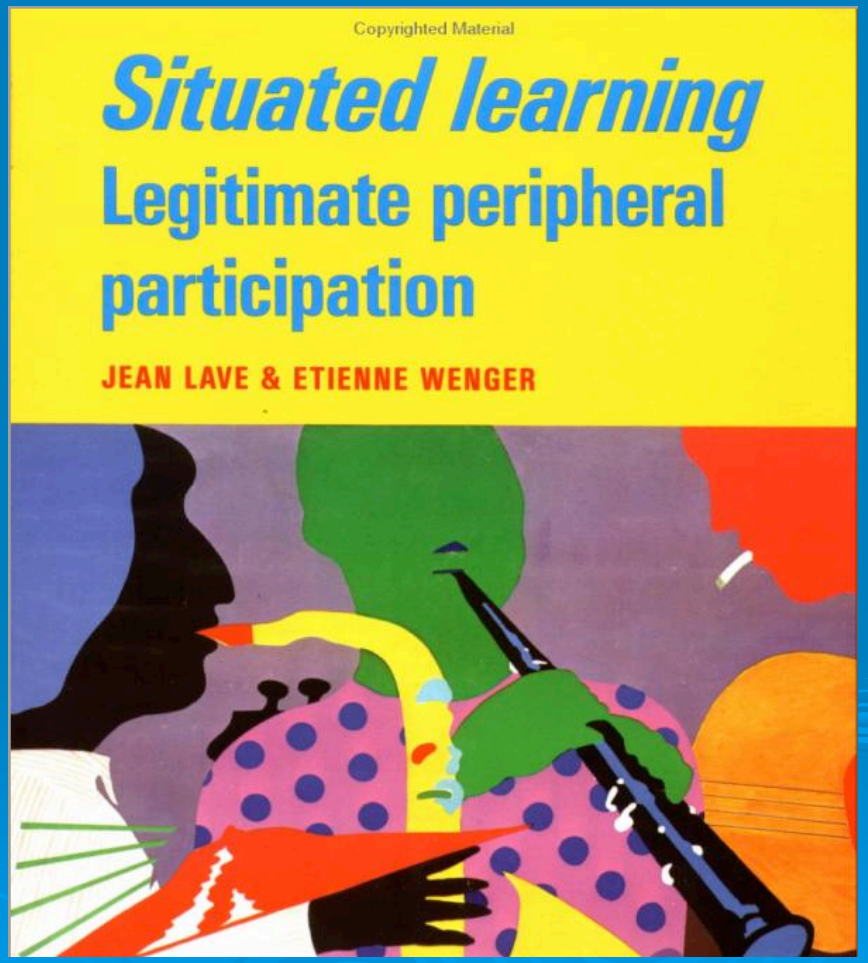
Story

- Legitimate peripheral participation as a theory of learning in a social context.
- Viewing instruction from an LPP lens.
  - Alignment and Authenticity
- Viewing formal CS education (instruction) from an LPP lens.
  - Challenge: How do we teach without an existing Community of Practice?
- Meeting the Challenge: Imagineering
  - Storytelling in three dimensions over time.
  - Using Media Computation as an example

Legitimate Peripheral Participation (LPP)

- Theory of learning from a social perspective
  - Compare to Piaget's assimilation and accommodation
- Seeks to explain *why* students learn and *how* they do it in informal settings.
  - Addresses issues of motivation and social context that are missing in most cognitive accounts.



LPP: About Joining a Community of Practice

- Learning is becoming a more central/connected part of a *community of practice (CoP)*.
  - CoP have practices and values, forms of communication, and ways of involving newcomers.
  - Students *want* to be part of CoP, so they engage in LPP.
- Learning process is legitimate peripheral participation.
  - Newcomers participate at the periphery, but doing useful things.
  - They observe, try, and get corrected.
  - Over time, they take on more roles and become more central to CoP => learning

Examples of LPP

- Positive examples:
  - East African Tailors
  - Midwives
  - Alcoholics Anonymous
- Negative examples:
  - Modern butcher apprenticeship

Formal Schooling? Instruction?

- Lave and Wenger do not apply LPP to formal schooling, but others do.
- Instruction that leads a student to a perceived valuable CoP is *aligned* (Joseph & Nacu)
- *Authentic* instruction is aligned.
  - Activities, topics, assessment, methods of inquiry (Shaffer and Resnick)

Assumption: LPP and Authenticity

- Our jumping off point:
  - LPP is an accepted, general theory of learning.
    - Coming from a social, motivation-oriented perspective.
  - Formal education (instruction) that has a hope of inculcating learning must be authentic.
    - Students must perceive that the education leads to a valued CoP.

Considering CS education from the LPP perspective

- When the Community of Practice is "professional software developers," there is no problem.
  - There is a real CoP to study, and we can teach in ways that are authentic for that CoP.
  - In fact, that's mostly what we do.
- When the Community of Practice is *not* professional software developers, there is a problem.
  - What community do students perceive?
  - For non-CS majors: In what CoP is programming or CS-literacy valuable?
  - Teaching computer science *without* a Community of Practice is inherently *inauthentic*

Solution: We have to tell a story

- Our problem:
  - Convey a sense of a CoP.
  - Explain how the instruction is authentic.
- Solution: Storytelling.
  - But it's storytelling that isn't just in printed word or film, not just in one place.
  - It's story-telling in 3-D over 10-15 weeks.

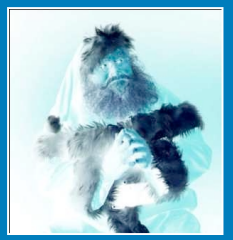
Disney's Imagineering

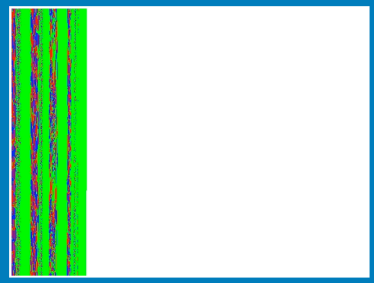
- Theme park design to provide insight into course design:

1. Start from the Story
2. Start from where the expectations are
3. Pay attention to Details
4. Where necessary, change reality
5. *Pay attention to Transitions*
6. *Make the Cast part of the Story*

Using Media Computation as Imagineering Case Study

- Two course sequence at Georgia Tech.
- Students learn traditional computer science topics, but in the context of media.
  - In CS1315, learn iteration, conditionals, and string processing by manipulating images, sounds, and HTML.
  - In CS1316, learn linked lists, trees, stacks, and queues by learning to implement simulations that drive animations.
- Proposed: They are successful.
  - Higher retention, transfer into computing, success in later CS classes




One piece of evidence on success of the class (CS1315): *Self reports of learning*

- A year after the course: “How has the course changed how you work with computers?”
  - “Definitely makes me think of what is going on behind the scenes of such programs like Photoshop and Illustrator.”
  - 'I understand technological concepts more easily now; I am more willing and able to experience new things with computers now’
  - 'I have learned more about the big picture behind computer science and programming. This has helped me to figure out how to use programs that I've never used before, troubleshoot problems on my own computer, use programs that I was already familiar with in a more sophisticated way, and given me more confidence to try to problem solve, explore, and fix my computer.’

1. Start from the Story

- Everything at Disney theme parks starts with a story.
- Even changes to vendor booths start from a story.
- Examples:
  - Tomorrowland
  - Big Thunder Railroad
  - Splash Mountain
  - Emporium

1. Start from the Story

- In CS1315, we tell a consistent story
  - All media are going digital
  - Digital media are manipulated in software
  - Knowing how to program is an advantage in a profession that manipulates media.
- In CS1316, it's all about the wildebeests and the villagers

2. Start from where the expectations are

"Just as Main Street, U.S.A. in the Magic Kingdom and Hollywood Boulevard at Disney-MGM Studios are not meant to represent factual history, but to evoke a collective cultural memory, the flavor of the 1920's mid-Atlantic coast is apparent at Disney's BoardWalk"

--Kurti, *Since the World Began*

2. Start from where the expectations are

- Partially, this is about peripheral participation
- These students have been peripherally participating in media manipulation culture
  - All collect media
  - Many use Photoshop
  - Some work with MIDI and sound (“Acid”)
- We start with the media and manipulations they know.

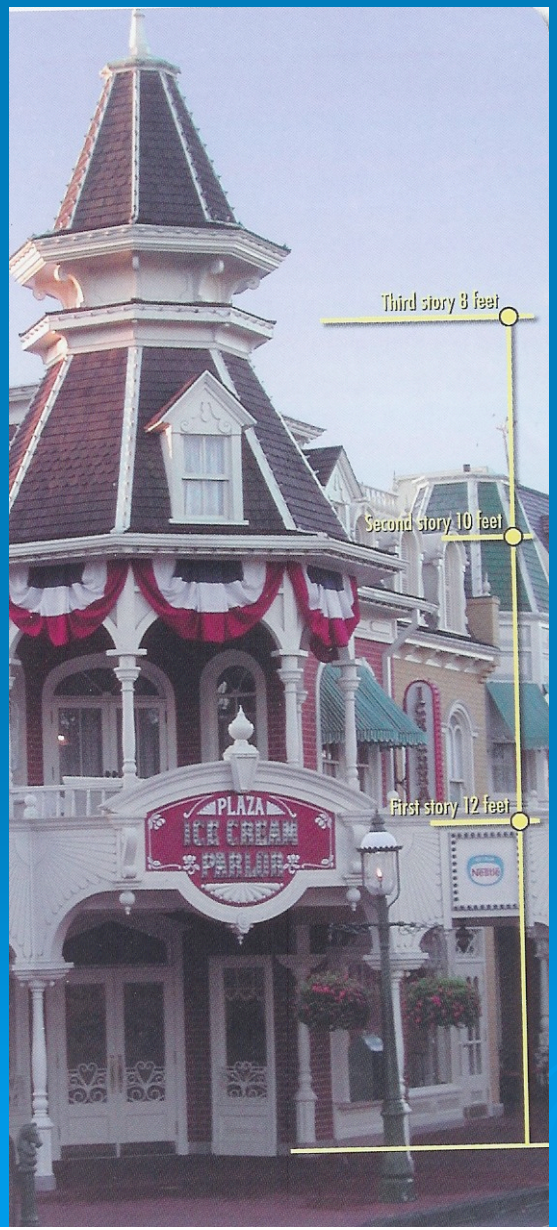
3. Pay Attention to Details

All the elements play off one another and feed into a consistent view.

3. Pay Attention to Details

- The **lectures**
  match the **book**
  which matches the **assignments** (which are about media manipulation)
  which match the on-line **Galleries**.
- The **examples** in the book used the same media as on the **CD** at the back of the book.
- The story is told consistently and are self-supporting pieces of evidence.
  - "Of course people manipulate media with Python! Go look at all the great things in the on-line Galleries!"

4. Where necessary, change reality



Three story buildings in Disney World aren't *really* three stories.

Another Example:
Cinderella's Castle

-The View

-The Tunnel

4. Where necessary, change reality

- Python does not support media manipulation.
  - So we wrote a set of libraries and tools.
  - We embedded them into the programming environment so that students never even see the media libraries being imported.
  - Now, obviously, Python supports media manipulation.
- Java's media support is complicated.
  - We never teach it.
  - We teach Picture, Sound, Pixel, and SoundSamples.

Conclusion

- Legitimate peripheral participation is an important learning theory
  - Explains issues of motivation and social context
- As computer science educators, we are at a “cutting edge” of a discipline.
  - The relevant Communities of Practice in some areas is nascent, or not yet existing.
- Designing curricula in this context is storytelling.
  - Imagineering offers some useful design principles to meet these challenges.

Epilogue: The Story May Not be the Impact

- There's evidence that students in CS1315 don't buy the story.
  - They don't buy that learning to hack media is useful for their career/profession.
  - But instead, they think it's part of being a media consumer.
- Suggestive evidence #1: Re-read those follow-up survey comments.
  - That's not about work. That's about life.
- Suggestive evidence #2: Students tell us that the homework is *not* relevant.
  - Not useful for work, but is useful for daily life

5. Pay Attention to Transitions

- Imagineers care about what you see *between* places.
  - Why are there water buffalo on top of the Tiki-Tiki room?
  - Why are the Thunder Mountain mountains scarier in Florida than California?

5. Pay Attention to Transitions

- At each new topic, we relate the transition to the story.
  - We don't start teaching string processing, we start teaching HTML.
  - We don't teach linked lists, we teach how to dynamically and creatively insert and remove media elements.

6. Make the Cast Part of the Story

All of the Walt Disney World employees are "themed," just as the buildings and attractions are, through the use of costumes and uniforms. The world's largest working wardrobe department creates and maintains costumes for employees—real and mechanical (including the Audio-Animatronics figures).

6. Make the Cast part of the Story

- Students become part of the story in lecture:
  - “This is a great collage on the Gallery this week. Who did it?
    You?
    How’d you do it? How’d you get this great effect?”
- TA’s get sucked in.
  - Some of the best media on the Gallery pages are by the TA’s (“as examples”)