

Structured Interaction Presentation System

Steve Wolfman
UW CSE Educational Technology Group
<http://www.cs.washington.edu/research/edtech/>

1

Vision of the World

- 5-10 years in the future
- Students have wireless, handheld devices
- Many classes are taught as large lectures

2

Structured Interactions for Presentations (SIP): the Vision

Enable instructors to design computer-based presentations with interactive exercises in the same manner that they currently design passive presentations:

3

Structured Interactions for Presentations (SIP): the Vision

Enable instructors to design computer-based presentations with interactive exercises in the same manner that they currently design passive presentations:
by laying out groups of simple, well-understood objects on slides and collecting these into a presentation.

4

Outline

- Scenario
- Motivation
- Future Directions
- Open Questions

5

Example: America Before Columbus [Cross and Angelo]

6

Example: America Before Columbus [Cross and Angelo]

1. How many people lived in North America in 1491?
2. How many years had they been there by 1491?
3. What significant achievements had they made in that time?

7

Your Impressions of America Before Columbus

1. About how many people lived in North America in 1491?
2. About how many years had they been on this continent by 1491?
3. What significant achievements had they made in that time?

Your Impressions of America Before Columbus

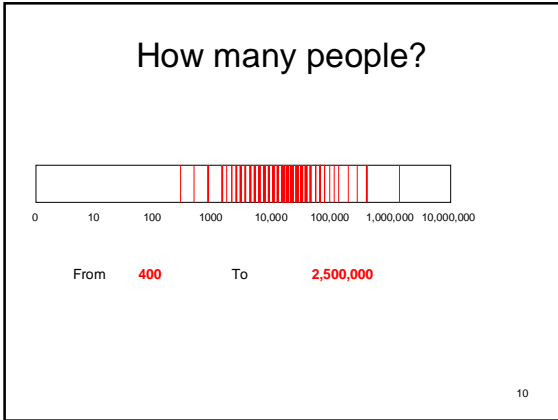
1. About how many people lived in North America in 1491?

% completed
2. About how many years had they been on this continent by 1491?

% completed
3. What significant achievements had they made in that time?

% completed

9



Features of SIP System

- Fluid integration of interaction exercises and results into the presentation
- Distinct views for student, instructor, and shared display
- Multiple perspectives on the same data
- Real-time and “archival” use of data
- Aggregation/processing of data

11

Outline

- Scenario
- Motivation
- Future Directions
- Open Questions

12

Key Elements of SIP

- Interaction
- Structure
- Computer support
- Presentation system

13

Key Elements of SIP

- **Interaction:**
Students thinking or problem-solving and communicating their ideas
- Structure
- Computer support
- Presentation system

14

Key Elements of SIP

- Interaction
- **Structure:**
Premeditated, instructor-initiated interactions with a clearly specified form
- Computer support
- Presentation system

15

Why Interact?

- Get students constructing knowledge
- Combat flagging attention
[McConnell's med students, Bligh's heart rate/memory]
- Address varied learning styles
[Felder's Learning Styles]
- Assess student understanding
[Cross & Angelo's "CATS"]
- Force articulation
[Singley et al.]

16

Interaction Helps Students

- Flexible instruction style increases students' understanding of and attention to class [ET Group]
- Engaging in structured interactions (Classroom Assessment Techniques) encourages metacognition [Schwarm & VanDeGrift]

17

Why Structure?

- Attain broader participation and more input
- Achieve specific goals
- Spread cognitive effort over planning time
- Mediate classroom activity
- Share activities across instructors and across terms

18

Why Computer Support?

- Administrative efficiency
- Data organization, persistence, sharing
- Scaling: aggregation and communication
- Enforce guidelines/policies
- New modalities

19

Why in Presentations?

- Unify design of classroom activities
- Facilitate “transitions” during class
- Simplify archival use
- Match what many instructors already do...

20

Question

- What are the three strongest motivating factors for you as a software developer

21

Tautologies?

◇ I don't jump off the Empire State Building implies if I jump off the Empire State Building then I float safely to the ground.

◇ $((\text{Smoke} \wedge \text{Heat}) \rightarrow \text{Fire}) \leftrightarrow ((\text{Smoke} \rightarrow \text{Fire}) \vee (\text{Heat} \rightarrow \text{Fire}))$

Defining Efficiency

- *Asymptotic Complexity* - how running time scales as function of size of input
- Why is this a reasonable definition?

23

Measuring Empirical Complexity:

Linear vs. Binary Search

- Find a item in a sorted array of length N
- Binary search algorithm:

	Linear Search	Binary Search
Time to find one item:		
Time to find N items:		

24

Outline

- Scenario
- Motivation
- Future Directions
- Open Questions

25

What's missing?

26

DESIGN

27

Constructing Structured Interactions

- Design exercise
- Interleave:
 - Lay out static elements
 - Lay out and name input widgets
 - Lay out and customize display widgets

28

How many people?

From To

Input Widgets

Free Text
Numerical
Multiple Choice
Checkbox

Display Widgets

Response List
Response from group
Line graph
Scatter graph
Numerical Statistic

How many people?

From To

Input Widgets

Free Text
Numerical
Multiple Choice
Checkbox

Display Widgets

Response List
Response from group
Line graph
Scatter graph
Numerical Statistic

How many people?

0 10 100

From To

Input Widgets	
Free Text	
Numerical	
Multiple Choice	
Checkbox	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

How many people?

0 10 100

From To

Some sort of Wizardy thing pops up:
Where would you like to get the data for this display?

NumPeople1491 – Numerical Input, Slide 7
NumYears1491 – Numerical Input, Slide 7
Accomplishments1491 – Free Input, Slide 7
Hand-enter data...
Choose later

Next >

Input Widgets	
Free Text	
Numerical	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

How many people?

0 10 100

From num To

Input Widgets	
Free Text	
Numerical	
Multiple Choice	
Checkbox	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

How many people?

0 10 100

From To

Some sort of Wizardy thing pops up:
Where would you like to get the data for this display?

NumPeople1491 – Numerical Input, Slide 7
NumYears1491 – Numerical Input, Slide 7
Accomplishments1491 – Free Input, Slide 7
Hand-enter data...
Choose later

Next >

Input Widgets	
Free Text	
Numerical	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

How many people?

0 10 100

From min To max

Some sort of Wizardy thing pops up:
What would you like to show in this display?

Maximum
Minimum
Average (Median)
Average (Mode)
More choices...
Choose later

Next >

Input Widgets	
Free Text	
Numerical	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

How many people?

0 10 100

From min To max

Input Widgets	
Free Text	
Numerical	
Multiple Choice	
Checkbox	
Display Widgets	
Response List	
Response from group	
Line graph	
Scatter graph	
Numerical Statistic	

FREE TEXT

INNOVATION: DIST. STUDENT COMPUTATION

37

“Solving” Natural Language

Problem: handling free text responses in class is impractical (~15 minutes for expert instructor)

Solution: “distributed student computation”

- allows rapid, in-class turnaround
- can be pedagogically sound

38

Significant Achievements

Get together with your neighbor and:

- rate the significance of each achievement
- note if an achievement repeats an earlier one

39

Significant Achievements

Get together with your neighbor and:

- rate the significance of each achievement
- note if an achievement repeats an earlier one

1. Those big mounds	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Somewhat Significant	<input type="checkbox"/> Very Significant	<input type="checkbox"/> Crucial	<input type="checkbox"/> Didn't happen in NA before 1492	Repeat of: <input type="text"/>
2. Hunting	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Somewhat Significant	<input checked="" type="checkbox"/> Very Significant	<input type="checkbox"/> Crucial	<input type="checkbox"/> Didn't happen in NA before 1492	Repeat of: <input type="text"/>
3. Sustainable living	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Somewhat Significant	<input type="checkbox"/> Very Significant	<input type="checkbox"/> Crucial	<input type="checkbox"/> Didn't happen in NA before 1492	Repeat of: <input type="text"/>
4. Bow & arrow	<input type="checkbox"/> Insignificant	<input checked="" type="checkbox"/> Somewhat Significant	<input checked="" type="checkbox"/> Very Significant	<input type="checkbox"/> Crucial	<input type="checkbox"/> Didn't happen in NA before 1492	Repeat of: <input type="text"/> 2
5. Automobile	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Somewhat Significant	<input type="checkbox"/> Very Significant	<input type="checkbox"/> Crucial	<input type="checkbox"/> Didn't happen in NA before 1492	Repeat of: <input type="text"/>

Significant achievements

- Hunting (Very Significant)
 - Bow & arrow
 - Efficient hunting
 - Weapons
 - Collective hunting strategies
- Those big mounds (Somewhat Significant)
- Woodcarving (Somewhat Significant)
- Automobile (Didn't happen in NA by 1492)
 - Space flight
 - Astral travel
 - Dumb assignments

41

INNOVATION: INTENTIONAL GROUPING

42

Intentional Grouping

Target specific goals when assigning groups:

- diverse perspectives
- avoid lone minority
- Jigsaw Learning

43

Research your estimate

Check the accuracy of your answers with a partner.

Check your device for your partner assignment.
Get together with your partner!

44

Research your estimate

Check the accuracy of your answers with a partner.

You are working with: **Rex Bone** (t-rex@cs.u.edu) [IM Rex](#)

Rex gave these answers:

1. About **3,500,000** people lived in North America in 1491.
2. They had been on this continent for about **1,000** years.
3. They had made these significant achievements:

Bow and arrow
Music
Fishing pole

45

INNOVATION: DATA RE-USE

46

Tie Data in to Later Interactions

47

What makes a good maze?

You can get to any part of the maze somehow!
There's a bunch of dead-ends.
There's an entrance and an exit.
You can solve it.
It's hard.
A BIG maze!
What does this have to do with anything?
At least a few choices on the way to the exit.
Just one right solution (and a hard one
The only good maze is a dead maze.
...

48

Equivalence Relations

An equivalence relation R must have three properties

- reflexive: for any x , xRx is true
- symmetric: for any x and y , xRy implies yRx
- transitive: for any x , y , and z , xRy and yRz implies xRz

49

Connecting Equivalence Classes with Our Ideas

Work with a neighbor to figure out how the ideas we came up with match up with the properties of our algorithm. (Skip the silly ideas!)

You can get to any part of the maze somehow!

Done Not a serious idea

Identity Symmetry Transitivity No extra unions

Just one solution (and a hard one)

Done Not a serious idea

Identity Symmetry Transitivity No extra unions

OPEN QUESTIONS

51

Outline

- Motivation
- Scenario
- Discussion
- Open Questions

52

Open Questions: Design

- What effective designs for student, instructor, and shared views exist?
- How will the instructor choreograph the different displays?
- What is the right tradeoff in generality vs. relevance and portability vs. ease of use for interaction elements?
- How can instructors express policies and constraints on interaction?

53

Open Questions: Experimental

- How do instructors with various backgrounds in interactive exercises make use of SIP's design affordances?
- How do students participate in computer-mediated structured interactions?
- What new patterns of interaction arise in SIP-enabled classes?

54

Open Questions: Algorithmic

- How can distributed and local human inputs be used to create a global ranking or partition of a set of data?
- What algorithms map reasonably and quickly from instructors' constraints on group assignment and student data to actual group assignments?

55

Where We Stand

- Assessing structured interactions in current classrooms
- Built SIP prototype inside MS PowerPoint
- Designed various SIP scenarios
- Designing data-driven SIP architecture

56

UW CSE Education Technology Group

- | | |
|--|--|
| Prof. Richard Anderson | • Ed Tech |
| Ruth Anderson | – Wireless presentation system w/handwriting |
| Justin Campbell | – Feedback system |
| Kate Deibel | – SIP |
| Tammy VanDeGrift | – Customized assignments |
| Steve Wolfman | • CS Ed |
| wolf@cs.washington.edu | – Classroom Assessment Techniques |
| Ken Yasuhara | – Gender and retention |
| | – Large class and distance learning issues |

<http://www.cs.washington.edu/research/edtech/> 57

SPARE SLIDES

58

Student Feedback is Out There

- Student-initiated, computer-supported feedback: ~1.2 comments/person/class [ET Group]
- Instructor-initiated, pen-and-paper "Classroom Assessment Techniques": ~0.1[[K]] comments/person in 2 minute exercise [Schwarm and VanDeGrift]

59