Representation Technologies

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Representation Technologies

• Technology for representing and communicating knowledge

• All sources of knowledge not equally represented

• We must design for diversity in users, and in forms of knowledge
Outline

• **Awaaz.De**: Re-thinking UIs for content authoring by underrepresented groups

• **Local Ground**: Re-thinking data processes to support learning and access

• Can new forms and processes of knowledge representation lead to more equitable political representation?
Orality and Literacy

- Oral communities have distinct ways of representing knowledge.
- **Aggregative** - tolerant of repetition, redundancy and inconsistency.
- **Situational** - tied to specific situations and people; not abstract concepts.
- **Dialectic** - reinforced by dialogue.
You have reached Avaaj Otalo:
Press 1 to ask a question
Press 2 to browse questions
Press 3 to hear announcements
“I want to grow cotton. Which weather environment is best?”

Source: awaaz.de
“I am <> speaking from <>.
What is the best seed for summer bajri, and where can I buy it? ”
## Message List

<table>
<thead>
<tr>
<th>Date</th>
<th>User</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-04-07 16:44:23</td>
<td>1003</td>
<td></td>
</tr>
<tr>
<td>2011-04-07 15:54:23</td>
<td>1003</td>
<td></td>
</tr>
<tr>
<td>2011-03-10 04:13:30</td>
<td>1003</td>
<td></td>
</tr>
<tr>
<td>2011-03-10 03:57:12</td>
<td>1003</td>
<td></td>
</tr>
<tr>
<td>2011-01-01 03:41:44</td>
<td>1002</td>
<td></td>
</tr>
<tr>
<td>2010-12-01 08:50:12</td>
<td>9723887815</td>
<td></td>
</tr>
</tbody>
</table>

## Message Details

### Caller Details
- Number: 1003
- Name: Neil Patel (1002)
- District: 
- Taluka: 
- Village: 

### Thread
- 1003 - 2011-04-07 16:40:39
- Neil Patel (1002) - 2011-04-07 16:42:37
- Neil Patel (1002) - 2011-04-07 16:44:23
- Neil Patel (1002) - 2011-04-07 16:46:05

### Assigned Responders
- Neil Patel
- Paresh Dave
- Parina Samuel
- U.A. Parasara
- Manhar Patel

### Broadcasts

### Other Features
CALLER

EXPERTS

CALL

**Caller Details**
- **Number**: 9586481308
- **Name**: Vivek Nayak
- **District**: Bhavnagar
- **Taluka**: Vallabhipur
- **Village**: Rajgadh

**Thread**

Vivek Garg (9586481308) - 2010-08-08 12:59:51

Bharat Patel (9428826158) - 2010-08-09 20:05:42

Natu Thakkar (2737291211) - 2010-08-12 20:15:09

**Assigned Responders**
- Manhar Patel
- Bharat Rajgor
- Bharat Patel
- Sawani
- Borad

**Crop**: Cotton

**Topic**: Diseases

**Upload Response**
Hello! Farmer “Vivek” has asked:

<question>

Press 1 to listen
Press 2 to respond
Press 3 to forward
You have a new answer:

<answer>

Press 1 to listen

Press 2 to respond

Press 3 to save
Experiments

- Pilot Evaluation (Patel et al., CHI 2010)
- DTMF > ASR (Patel et al., CHI 2009)
- Peers > Experts (Patel et al., ICTD 2012)
- Impact Evaluation (Cole & Fernando, 2012)
7 Identical Tips by Scientists and Farmers

Tip 1: Vaccinations
Tip 2: Mealybug
Tip 3: Pest eggs
Tip 4: Root rot
Tip 5: Orchards
Tip 6: Soil testing
Tip 7: Animal feed

Retired agronomy professors

Farmers from diff districts
Tip #4: Root Rot

Hi, I am Dr. X, a retired professor from Y University.

All farmers would wish to have a bumper cotton crop. If we can avoid loss of production due to reduced plant stand, we can harvest more profit. The plant stand can be maintained by avoiding soil borne diseases like wilt and root rot...

To obtain more information about this topic, please call the following number XXX-XXXX.
Participants Received a Mix of Sources
Results

- 1883 calls
- 1316 completed
- 125 follow-ups

Follow-up Rate

Peer: 13%
Authority: 10%

(z = 2.08, p < .05)

ICTD 2012

w/ Patel, Savani, Dave, Shah, Klemmer
Possible Explanations

- Biased sample (AO users)
- Solidarity effect
- Social desirability
- Power to the peers!
Impact Evaluation

• Halfway through RCT w/ 1200 farmers
• 58% have called, 32% asked a question, and 16% have answered
• Treated farmers more likely to use more effective (and less harmful) pesticide
• Less likely to obtain information from input suppliers and other local sources

Cole & Fernando, 2012
Limitations

- Not everyone has used the service
- More educated farmers used the service more, and learned more from it
- Decision-making not affected by education
- No evidence of impact on knowledge, especially for less educated

Cole & Fernando, 2012
“Congratulations to Avaaj Otalo. I will be forever in your debt for the knowledgeable response you gave to my question, and Shankarbhai, the service you are providing here I pray to God that you keep offering just like it is. Farmers learn so much if an ordinary person is able to ask a question and you remember it and send me a message sitting at my house. In the seven years I have been farming this is the first and only time that I have received satisfactory information. Big up to you, and... I want to sow something now, so if I've got a little extra water, what should I sow?”
Awaaz.De: From Research to Practice

Number of employees: 4+
Number of calls: 600,000+
Outline

• **Awaaz.De**: Re-thinking UIs for content authoring by underrepresented groups

• **Local Ground**: Re-thinking data processes to support learning and access

• Can new forms and processes of knowledge representation lead to more equitable political representation?
Meta-Representation

• Unstructured knowledge must be processed for aggregation, comparison, filtering

• Requires translation to structured, quantifiable, categorical forms

• Ability to create and choose between representations is *meta-representational competence* (diSessa et al., 1991)
The instructional design was guided by an image of statistical reasoning as emerging from and enmeshed within a larger system of activity that we refer to as data modeling (Lehrer & Romberg, 1996; Lehrer & Schauble, in press). As Figure 1 suggests, data modeling is composed of two coupled systems of activity. The upper triangular region in the figure depicts the learning challenges and resources associated with the design of research. Designers confront challenges such as posing questions and identifying the nature of variables and their measures.

The lower triangular region encompasses analysis, depicted as an interaction among data structures, representations, and models of inference. Analysts confront challenges of imposing structure on data, of choosing displays to highlight aspects of structure, and of making judgments about phenomena in light of variability and uncertainty. Although the cycle as illustrated invites inference of linear progression, in practice, these components of data modeling are typically interactive. For example, attempting to develop a measure of an attribute often profoundly alters one's conception of that attribute.

To initiate students into practices of data modeling, we designed a hypothetical learning progression—a sequence of tasks, tools, activities, and forms of argument—aimed at supporting students' development of mathematical accounts of the inherent variability of measure. The learning progression was envisioned to unfold in three coordinated phases in the classroom. In the first, students all repeatedly measured the same object and designed a representation intended to communicate trends in the collection of measurements that they noticed. In the second, students used these displays to invent statistics. One invented statistic indicated the “best guess” of the measure of the attribute of the object and the precision of the measurements. Students explored the qualities of their invented statistics.
Step 1: Observe
Planning a Park
Nystrom Village Housing
Maritime Center
Nystrom Elementary
Martin Luther King Jr. Park
NURVE (Nystrom Urban ReVitalization Effort)
Help the Y-Plan understand your point of view by drawing on this map. Then visit: http://finalProject/print?id=in2p58wx

1. Mark your favorite place at Kennedy. Why do you like it?
2. Mark a place that isn't being used well. How you might improve it?
3. Mark a place that you've never noticed before today. Why do you think you haven't noticed it before?
Observation vs. Measurement
Local Ground

Projects  |  Views  |  Layers  |  Search

Satellite

Study

Hall

License

101

Pizza Line

Friends

Running

Graduation

Field

Random

Pre-School

Volleyball

Swimming

Kickball

Warm

Class of 2015

Kennedy High School Artificial Turf Field

Really hard.

Friends.

Science matters.

Study.

Pizza line, more.

Pizza.

Swimming.

Volleyball.

Pre-school.

Running.

Drama.

Smart.

Random.

License.

No license.

101.

Excited.

Want to have education in the field.

Running.

Class of 2011.

Fun.
Ambiguity vs. Precision
1. Mark your favorite place at Kennedy. Why do you like it?
2. Mark a place that isn't being used well. How might you improve it?
3. Mark a place that you've never noticed before today. Why do you think you haven't noticed it before?
Step 2: Measure
Verifying Groceries
<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Rating</th>
<th>Category</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Church St. Market</td>
<td>neg.</td>
<td>Liquor/ Convenience</td>
<td>Soda, juice, empty space, house supplies</td>
</tr>
<tr>
<td>2</td>
<td>Corner Fruit</td>
<td>OK</td>
<td>Corner</td>
<td>Sells mostly soda and cigs. Sunny D. no fruit.</td>
</tr>
</tbody>
</table>

When you're done drawing on the map, scan or photograph it and submit it to our website:
http://localground.org/upload, or email it to localground.uploads@gmail.com.
<table>
<thead>
<tr>
<th>Row Number</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Corner grocery</td>
</tr>
<tr>
<td>Rating</td>
<td>neutral</td>
</tr>
<tr>
<td>Category</td>
<td>corner store</td>
</tr>
<tr>
<td>Notes</td>
<td>sells mostly soda &amp; cigs, Sunny D, no fruits</td>
</tr>
</tbody>
</table>

Sells mostly soda and cigs. No fruits.
Automation vs. Participation
Create a marker by clicking on the map closest to where this observation took place.

Select the map image that matches this record

Attachment Name: None - Attachment dbpwzauw

Row Number: 2
California Counties

N County boundary

Oakland Food Retail Outlets by Rating

- Green: Positive
- Blue: Neutral
- Red: Negative
- Gray: Not Visited
Quantitative + Qualitative
Step 3: Visualize Air Quality in BART
Data + Context
Step 4: Interpret
Embarcadero vs. Pittsburg
Step 5: Present
Richmond Town Hall
Data vs. Politics
What is Data?

• Observation vs. Measurement
• Ambiguity vs. Precision
• Automation vs. Participation
• Qualitative + Quantitative
• Data + Context
• Data vs. Politics
Future Work

- Data literacy in K-12
- Impact on learning, agency
- Authoring data narratives
- More applications
- Public beta this summer!
Summary

- Paper kept things loose
- Accessibility + Expressivity
- Science + Advocacy
- Our data is “on Google”
- Data is a political process
Outline

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Thanks for all the fish!

DSC, Center for Cities & Schools, I-SEEED, OUSD, Lawrence Hall of Science

Neil Patel, Sarah van Wart, Christy McCain

Farmers of Gujarat and Youth of Richmond & Oakland!