



# *Constructing activity awareness in CSCW*

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# Report Documentation Page

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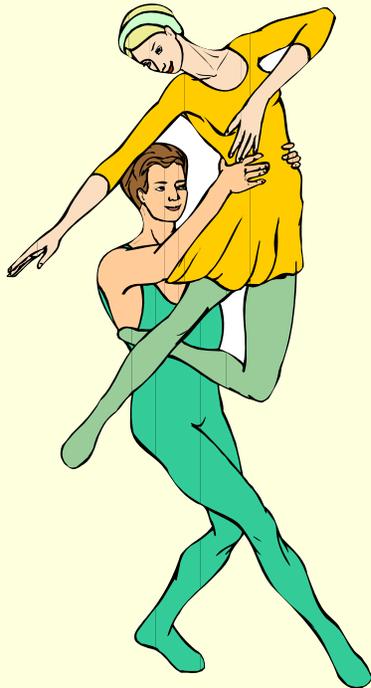


# *Collaboration is an intricate dance*

- Establish & maintain common understandings
- Negotiate & modify goals and plans
- Assign roles, decompose/divide/coordinate work activity
- Manage artifacts & other external resources
- Integrate perspectives, suggestions, & partial work products
- Improvise & coordinate as necessary
- Interpret & evaluate outcomes



# *Awareness in Collaboration*



- What is the other person doing and thinking?
- What is he/she paying attention to now?
- What does he/she expect me to do?
- What will he/she do next?
- Can I trust this person?



# *Awareness in Computer-Supported collaboration*

- Is anyone there? Who?
- Am I interrupting?
- What is his/her situation (materials, tools, knowledge)?
- When will he/she finish/reply/confirm?
- Is he/she monitoring me?



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# Chat Circles: Who is here? Who is working with whom?

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I'm kate

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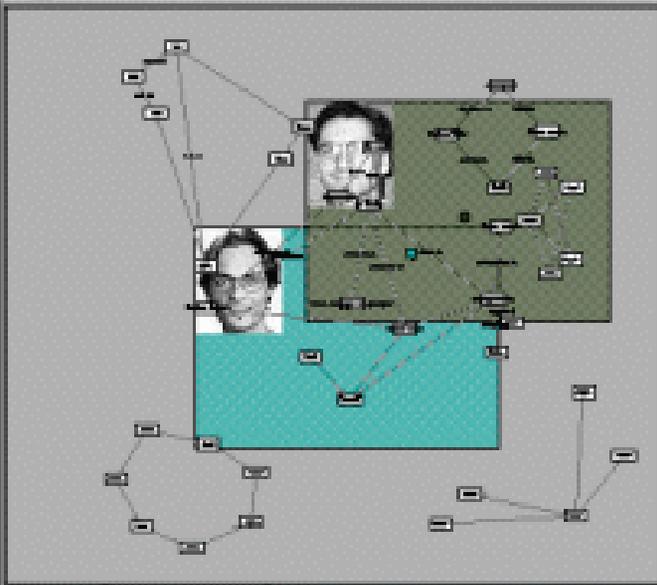
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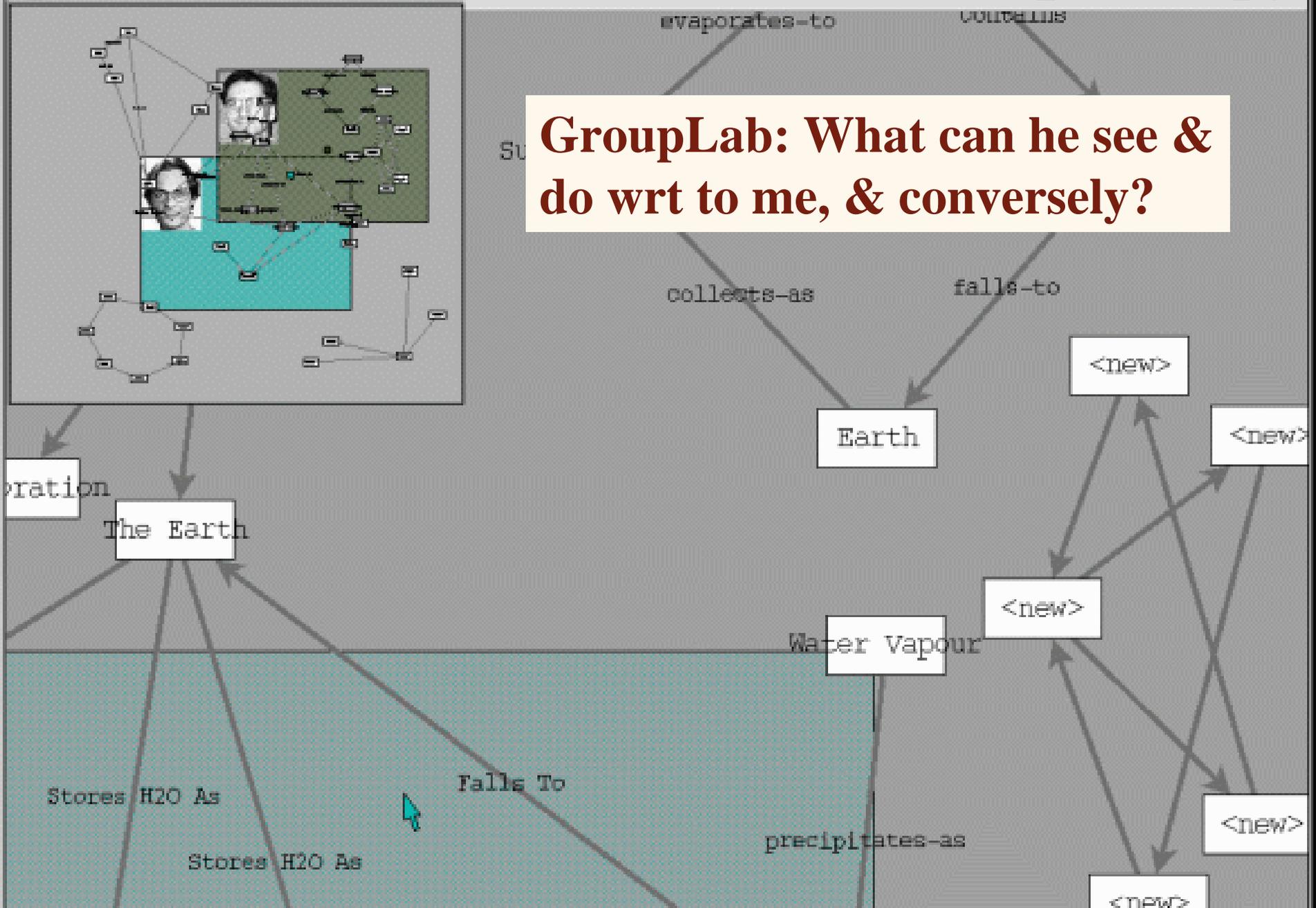
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**GroupLab: What can he see & do wrt to me, & conversely?**



**Clearboard: Where is he looking now?**





## *In this talk ...*

- *Beyond* awareness of presence, current action status, locus of visual attention
  - Presence awareness, social awareness, action awareness, workspace awareness, situation awareness
- The high, ragged regions of awareness
  - Longer term interactions in more complex and significant task contexts
  - Shared *activity* vs. shared *information*
- Implications for groupware design & evaluation



# *Shared Activity* *(Vygotsky)*

- Dynamically co-constructed
  - Shared goals & plans continually revised in action
- Articulated at multiple levels
  - Collective/individual, roles, POVs, divisions of labor
  - Continually renegotiated & evolving
- Includes tools, practices, norms & other resources
- Always involves learning and innovation



# *Activity Awareness*

- We stay on the same page
  - Testing, updating, resynchronizing
- We do this work together
  - Collective self-regulation, sharing praxis
- We are competent, trustworthy, adaptive
  - Taking initiative, relying on one another
- We take the risk to do better
  - Social modeling, emergent roles, informal learning, creativity, development



# *Common Ground*

<i>Common ground</i>	Protocol for continual testing and signaling of shared knowledge and beliefs



# Common Ground

- We test shared understandings to recognize and synchronize with potential collaborators
- Through testing and exploiting common ground, common ground is enhanced
- E.g., “Could we reach them via the Scotia Barrens?”

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## Common Ground





# *Communities of Practice*

<i>Community of practice</i>	(Tacitly) leverage and regulate shared praxis through enactment and improvisation
<i>Common ground</i>	Protocol for continual testing and signaling of shared knowledge and beliefs

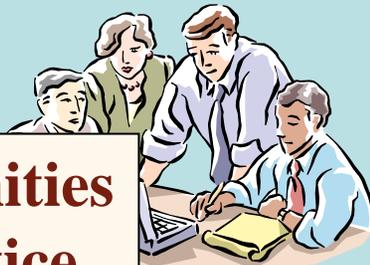


# Communities of Practice

- E.g., “We need that road” ⇒ “Where are the power lines, gas lines, ...” (to the public works specialist)

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**Communities of Practice**



**Common Ground**





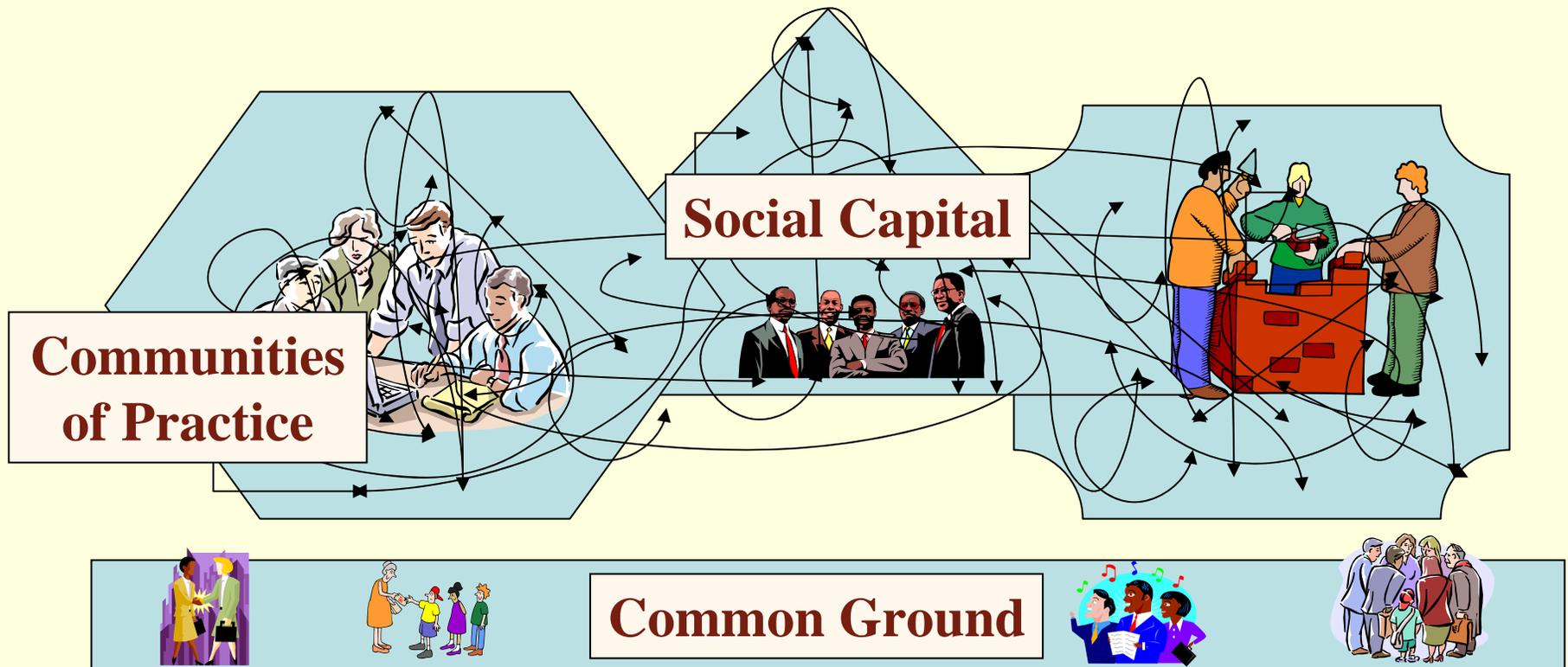
# *Social Capital*

<i>Social capital</i>	Nurture & exploit mutual interdependencies; access broader resource networks
<i>Community of practice</i>	(Tacitly) leverage and regulate shared praxis through enactment and improvisation
<i>Common ground</i>	Protocol for continual testing and signaling of shared knowledge and beliefs



# *Social Capital*

- E.g., “It might be more efficient to just bring those people out on your bulldozer.”





# *Human Development*

*Human development*

Reconcile different levels of performance and approaches to problems by synthesizing zones of proximal development

*Social capital*

Nurture & exploit mutual interdependencies; access broader resource networks

*Community of practice*

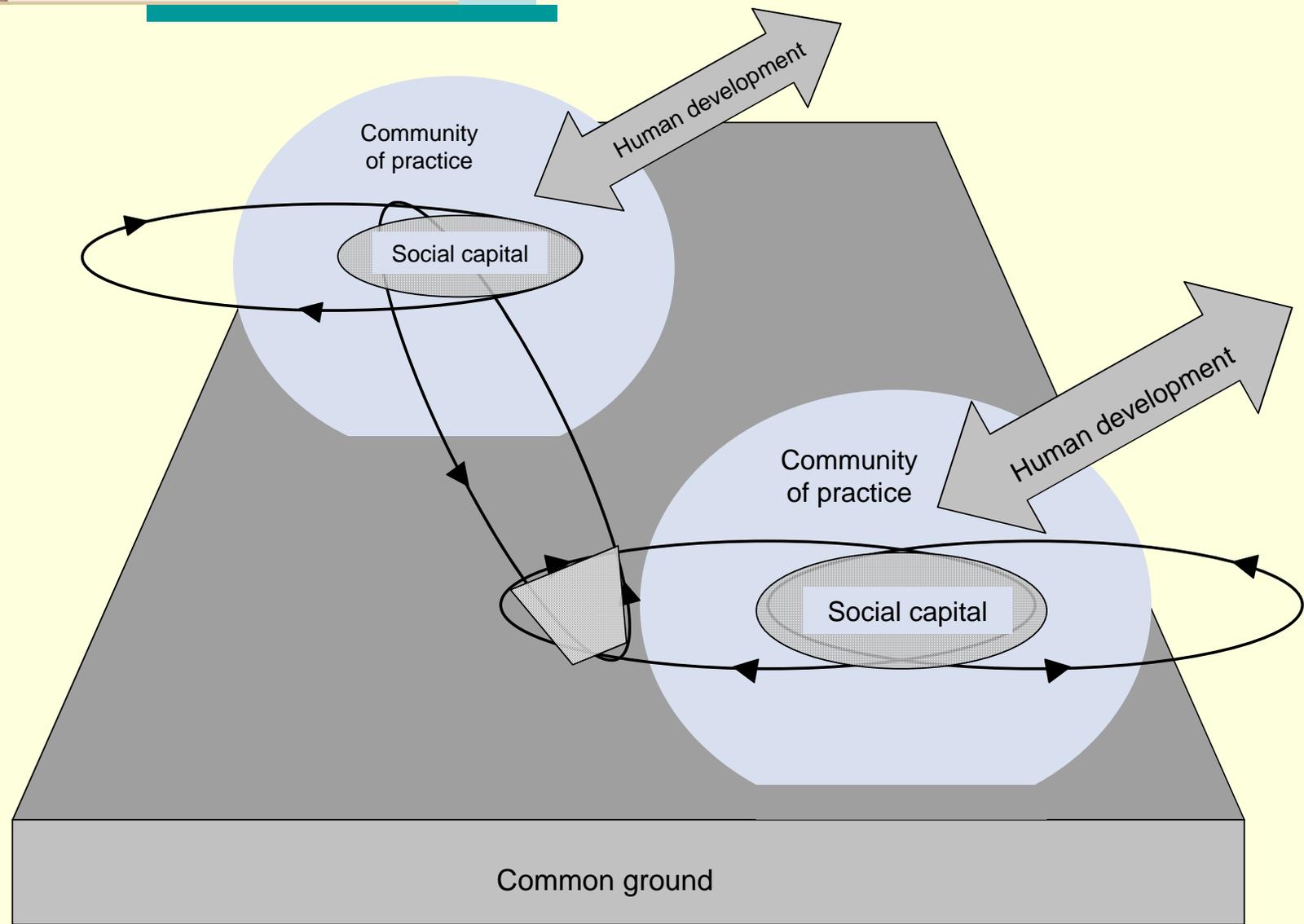
(Tacitly) leverage and regulate shared praxis through enactment and improvisation

*Common ground*

Protocol for continual testing and signaling of shared knowledge and beliefs



# *Building shared activity*





# *Implications for groupware*

- Technology design ideas
  - “activity” as a primitive system concept (e.g., versus “thread”)
  - Visualizations of activities, workspaces for activities
- Empirical concepts and studies
  - Experimental models, tasks, measures
  - Field studies, data coding, representations



# *Implications for technology*

*Human development*

Contrast individual capabilities, roles & achievements through time

*Social capital*

Aggregate and individuate contributions toward collective achievement

*Communities of practice*

Synthesize team members' behavior or decisions into best practices or patterns

*Common ground*

Public availability of shared information

- Public views of data
- Aggregate contributions

The screen displays a web application interface with several sections:

- Activity URLs**
- Deadlines & events**
- Friday, February 28**
  - Lab Div
- Friday, March 14**
  - Lab wrap up
- [Edit calendar](#)
- Online:**
  - quint (web)
  - Barbara Allen
  - Water Quality Testing (th)
  - Michelle Klinger
  - Teacher (th)
  - Team Link
  - Solid Waste Management (th)
  - Regen Gate
  - Solid Waste Management (th)
  - ...
- Solid Waste Management**
  - I Barton, T Johnson, E. Jones, E. Elliot
- How weather influences our environment**
  - L. Taylor, B. Lucas, S. Ryan, J. Blackburn, M. Killigan
- Water Quality Testing**
  - H. Alan, A. Bandy, M. McCool, J. Ogle
- Air Pollution**
  - E. Madhan, J. Dew, Cooper
- Solid Waste Management** (with a login form)
- Soil Army** (with a form)
- Select keyboard** (with a keyboard layout)
- Done**
- [Back to project home](#)
- [Launch Timeline](#)





- Summarize current project activity
  - Facilitate change inspection/verificatio

summary.rss

5 New, 25 Total

**Name: Calendar; Object type: Calendar** cganoe Aug 5, 03:25 PM  
Changes to the calendar in the last 7 days:  
"project video conference" is scheduled for 2:00 PM Thu, Aug 11, 2005; created at 3:35 PM Mon, Aug 8, 2005 by cganoe; [Read more...](#)

**Name: ThreeRoles; Object type: Web Page** cganoe Aug 5, 01:20 PM  
18 sentences added; 0 sentences changed. First 3 differences:  
""Engineer."  
"PNG"  
""ui\_engineer.";  
9 links added; 0 links changed. First difference:  
Engineer.PNG;  
0 embedded objects added/removed; 0 embedded objects changed;  
Last modified by cganoe [Read more...](#)

**Name: ui.png; Object type: Uploaded file** cganoe Aug 5, 01:05 PM  
Last modified by cganoe [Read more...](#)

**Name: ui\_team.png; Object type: Uploaded...** cganoe Aug 5, 01:05 PM  
Last modified by cganoe [Read more...](#)

**Search Articles:**  
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**Recent Articles:**  
All  
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Yesterday  
Last Seven Days  
This Month  
Last Month

**Source:**  
summary.rss

**Actions:**  
Mail Link to This Page



- Spatially integrate work and awareness support

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.



# *Empirical studies*

- Articulate testable hypotheses
  - Multiple levels of theory and method
- Experimental models
  - Synthesized breakdowns with confederates
  - Performance measures, protocol analysis, self-assessment scales, anaphoric/deictic reference
- Field studies
  - Critical incidents (collaborative breakdowns), discourse analysis, open coding of episodes



## *E.g., Common Ground*

- *A state*
  - Maximize explicitly shared information
- *A social protocol*
  - Jointly construct sufficient shared understanding
  - Filter non-essential information, provide details on demand (i.e., what should not be shared?)
  - Identify and exchange information held by only some team members
  - Annotate information sources (i.e., negotiate meanings)



CENTER FOR  
human computer  
INTERACTION

# *Emergency management scenario*

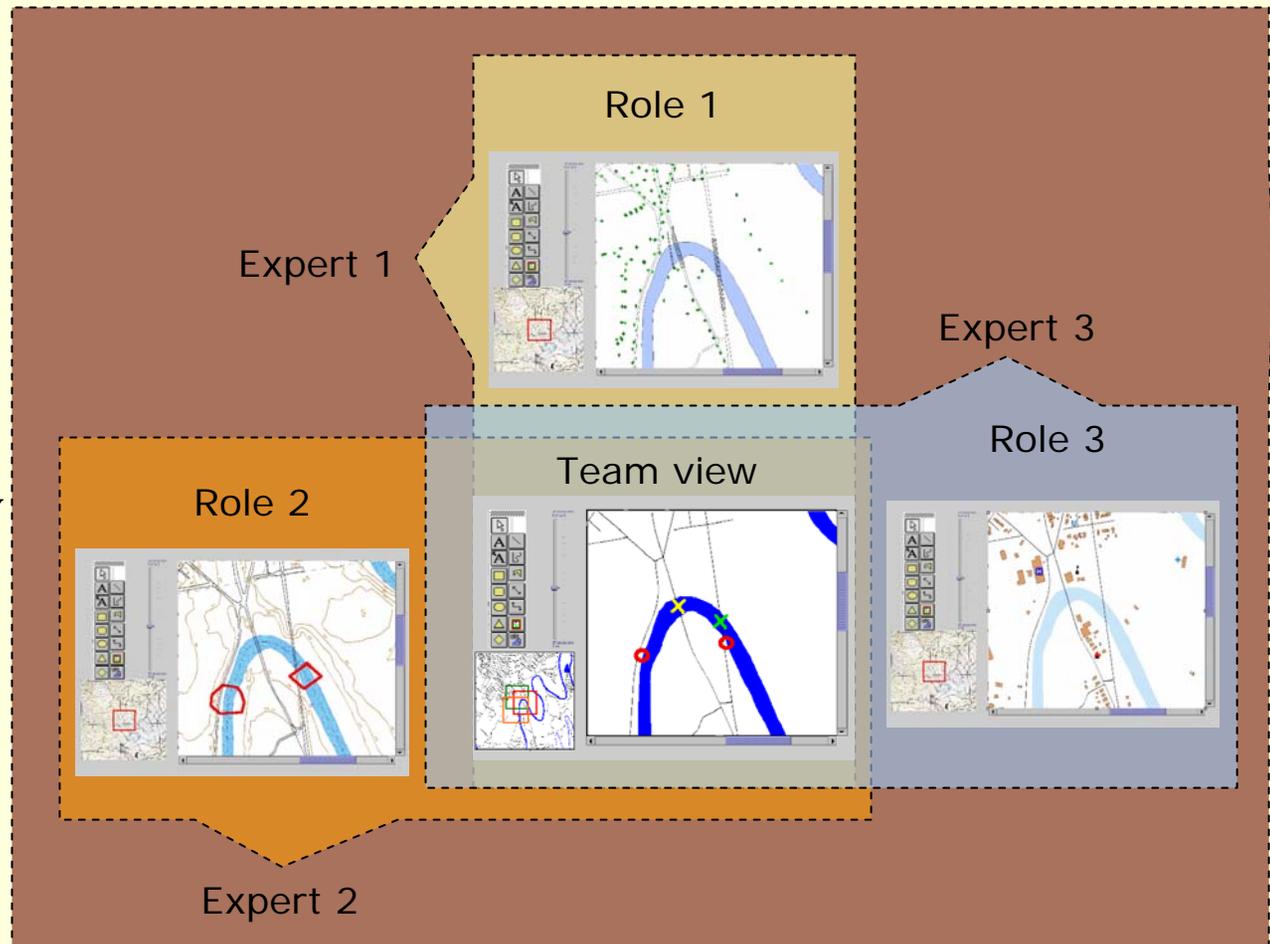
Rescue families

stranded by  
flood

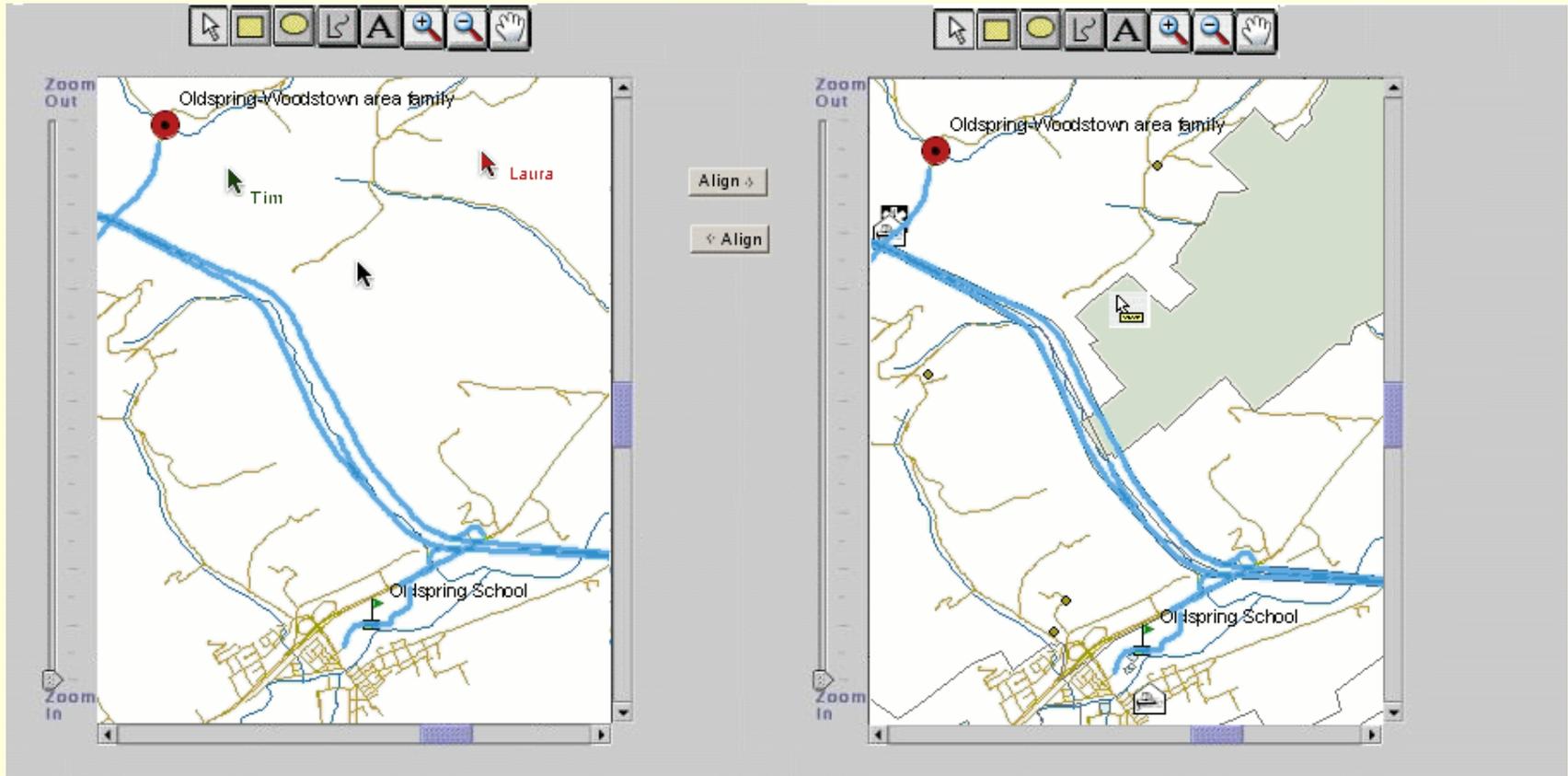
Role-specific  
map-views

Complementary  
knowledge

Team view is  
constructed  
jointly

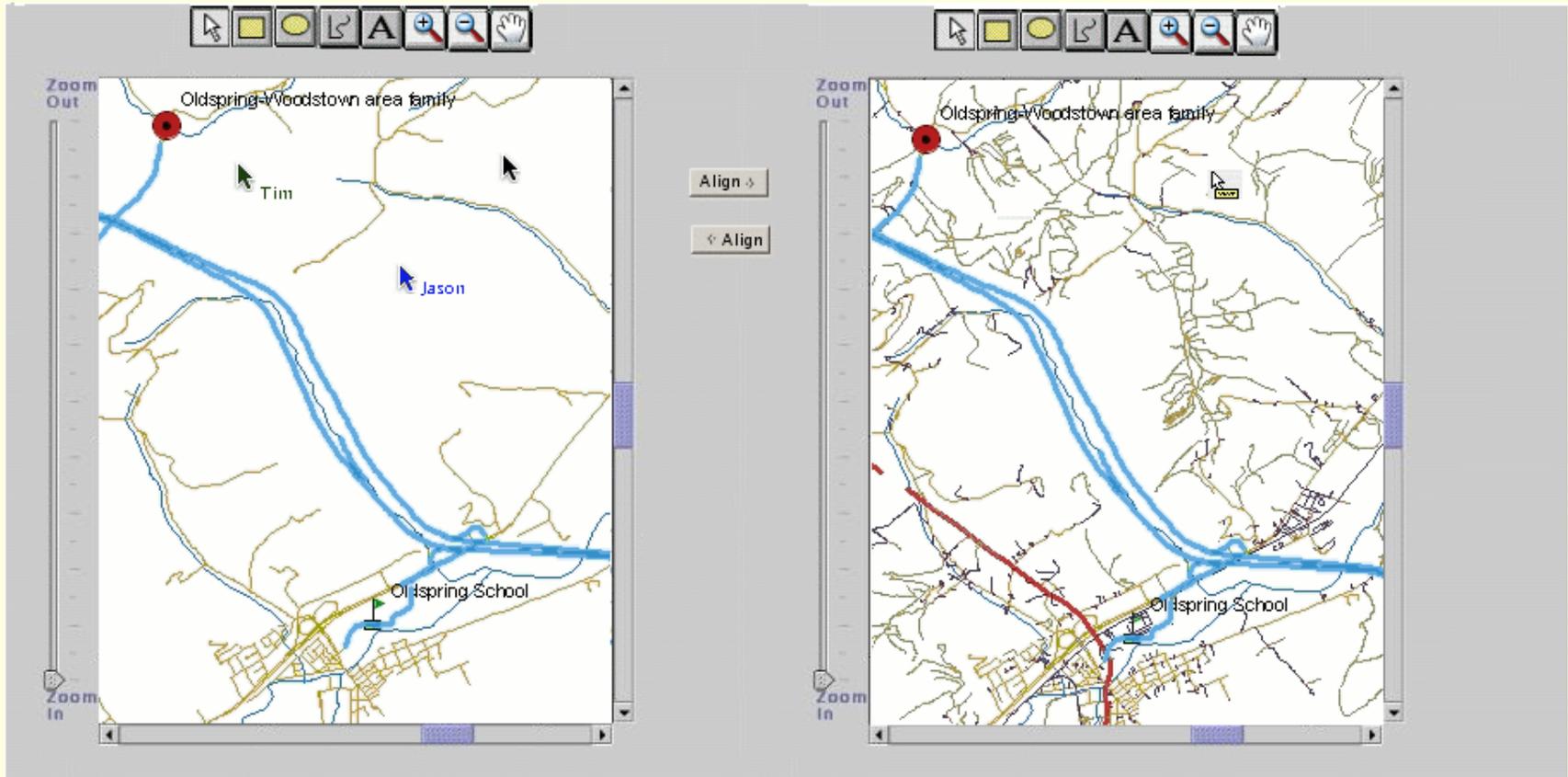


# Mass Care View



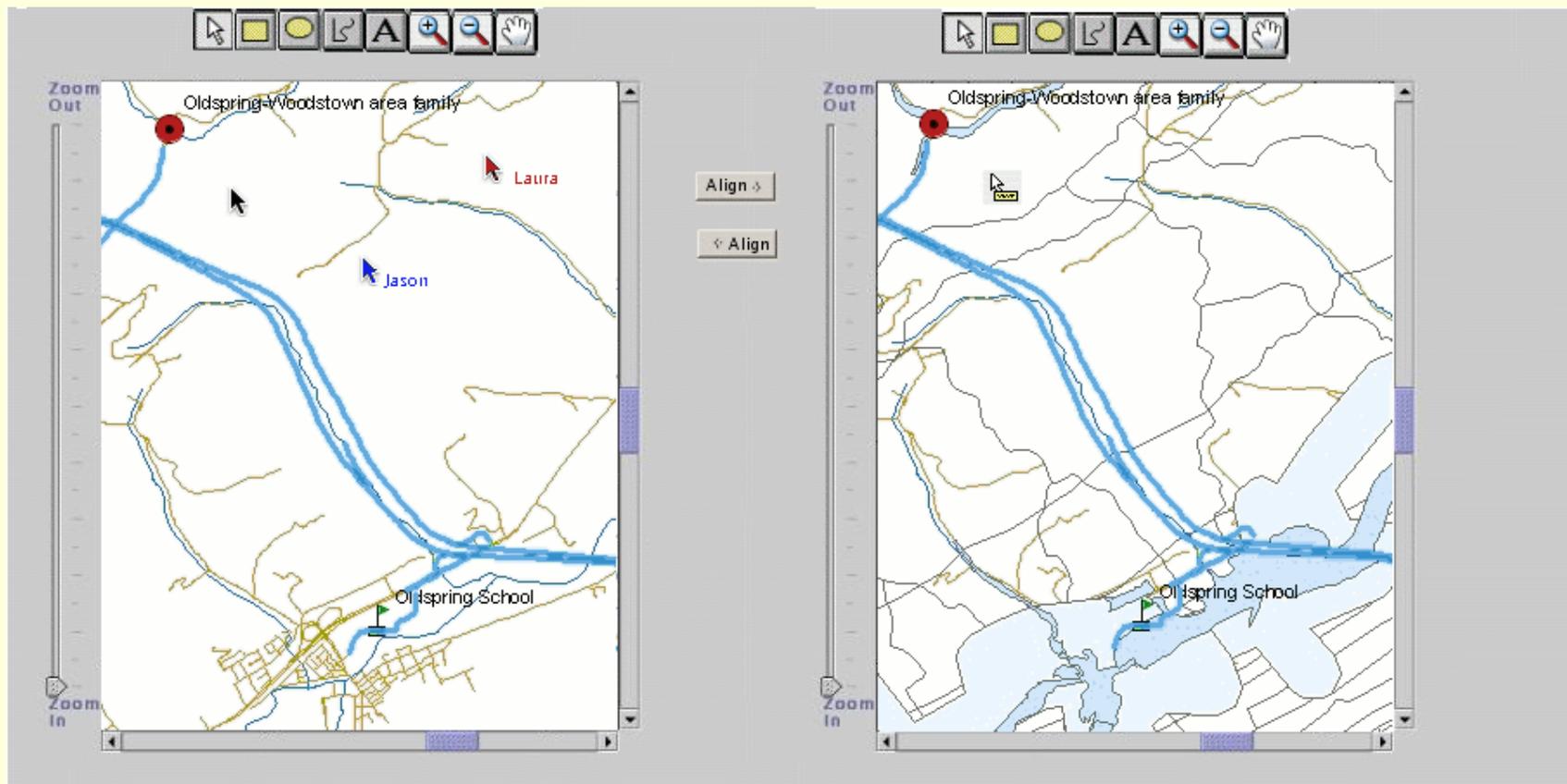
- Shelters, hospitals, schools, critical supplies, emergency vehicles

# Public Works View



- Utilities and roadway infrastructure

# *Environmental View*



- Waterways, flood plains, weather
- E.g., Old Spring School floods



# *Task design*

- *Task for the team*: build the best plan
  - Plan components (and major source of info)
    1. Identify Shelter (Mass Care expert)
    2. Route and Transport (Public Works expert)
    3. Timing/schedule (Environmental expert)
- Hidden profile
  - Information allocation among the 3 “experts” is biased both toward their unique expertise area and toward a particular non-optimal solution



# Hidden Profile

Plans/Roles	Public Works Route	Environment Time	Mass Care Shelter	Total Cons
A – unsh	$a_1^s$	$a_2^t a_3^r$	$a_4^s a_5^s a_6^r a_7^t$	7
B – unsh	$b_1^r b_2^r b_3^s b_4^t$	$b_5^r$	$b_6^s b_7^t$	7
C – unsh	$c_1^r c_2^t$	$c_3^t c_4^t c_5^r c_6^s$	$c_7^t$	7
D – sh	$d_1^s$	$d_1^s$	$d_1^s$	4*
D – unsh	$d_2^r$	$d_3^t$	$d_4^s$	
Total Knowledge	9	9	9	25

\* Optimal Plan: plan with the least number of Cons

\*\*Assumption: all Cons have equal strength & do not interact



# Hidden Profile

Plans/Roles	Public Works Route	Environment Time	Mass Care Shelter	Total Cons
A – unsh	$a_1^s$	$a_2^t a_3^r$	$a_4^s a_5^s a_6^r a_7^t$	7
B – unsh	$b_1^r b_2^r b_3^s b_4^t$	$b_5^r$	$b_6^s b_7^t$	7
C – unsh	$c_1^r c_2^t$	$c_3^t c_4^t c_5^r c_6^s$	$c_7^t$	7
D – sh	$d_1^s$	$d_1^s$	$d_1^s$	4*
D – unsh	$d_2^r$	$d_3^t$	$d_4^s$	
Total Knowledge	9 s = 3 r = 4 t = 2	9 s = 2 r = 3 t = 4	9 s = 5 r = 1 t = 3	25

\* Optimal Plan: plan with the least number of Cons

\*\*Assumption: all Cons have equal strength & do not interact



# *Examples of Cons*

1. Public Works expert

e.g., This route is an older street and has an obsolete *drainage system*

2. Environmental expert

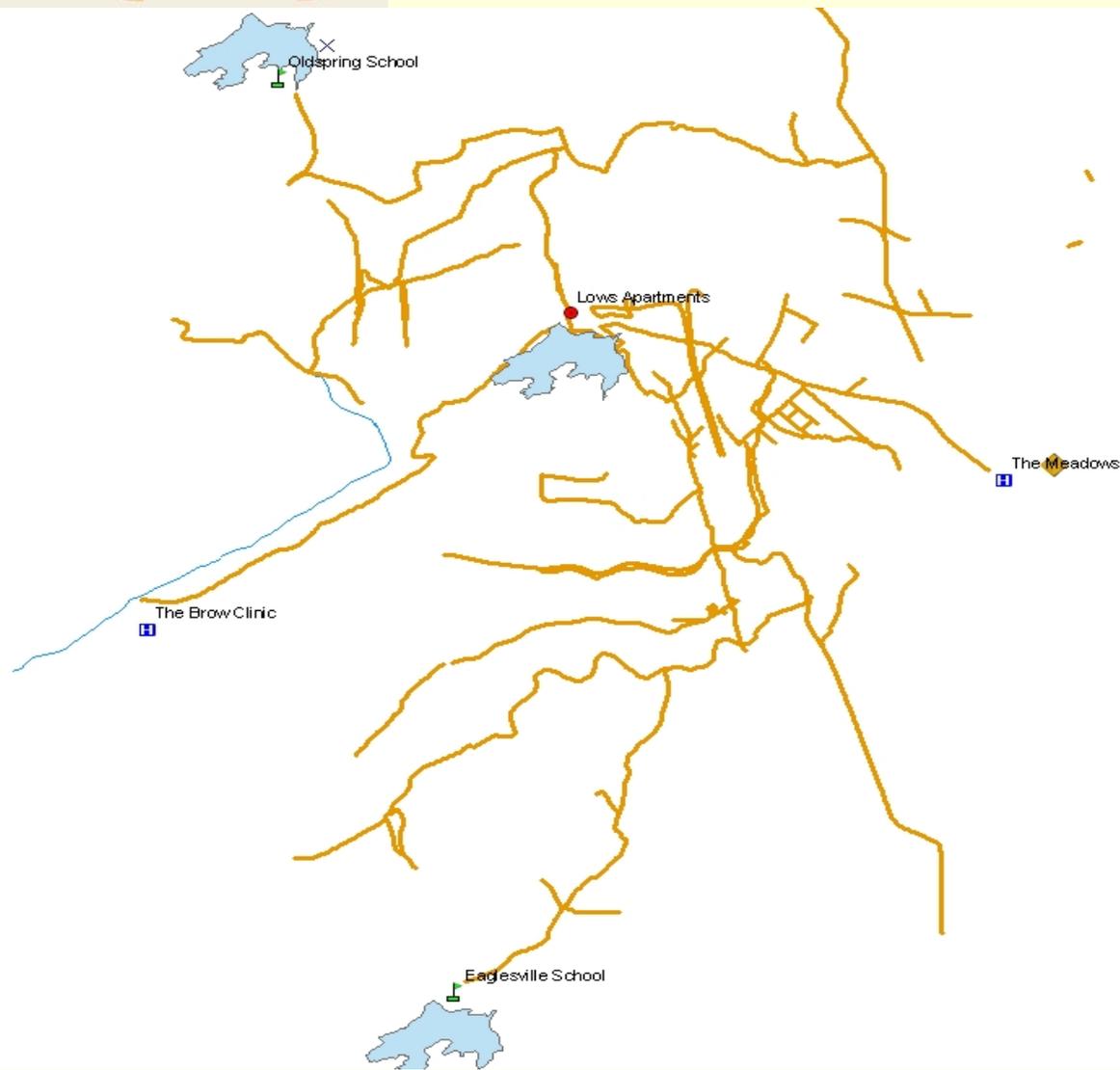
e.g., This route goes through a *floodplain*

3. Mass Care expert

e.g., There are no appropriate *vehicles* for this route



# E.g., Environmental Expert





# E.g., Environmental Expert



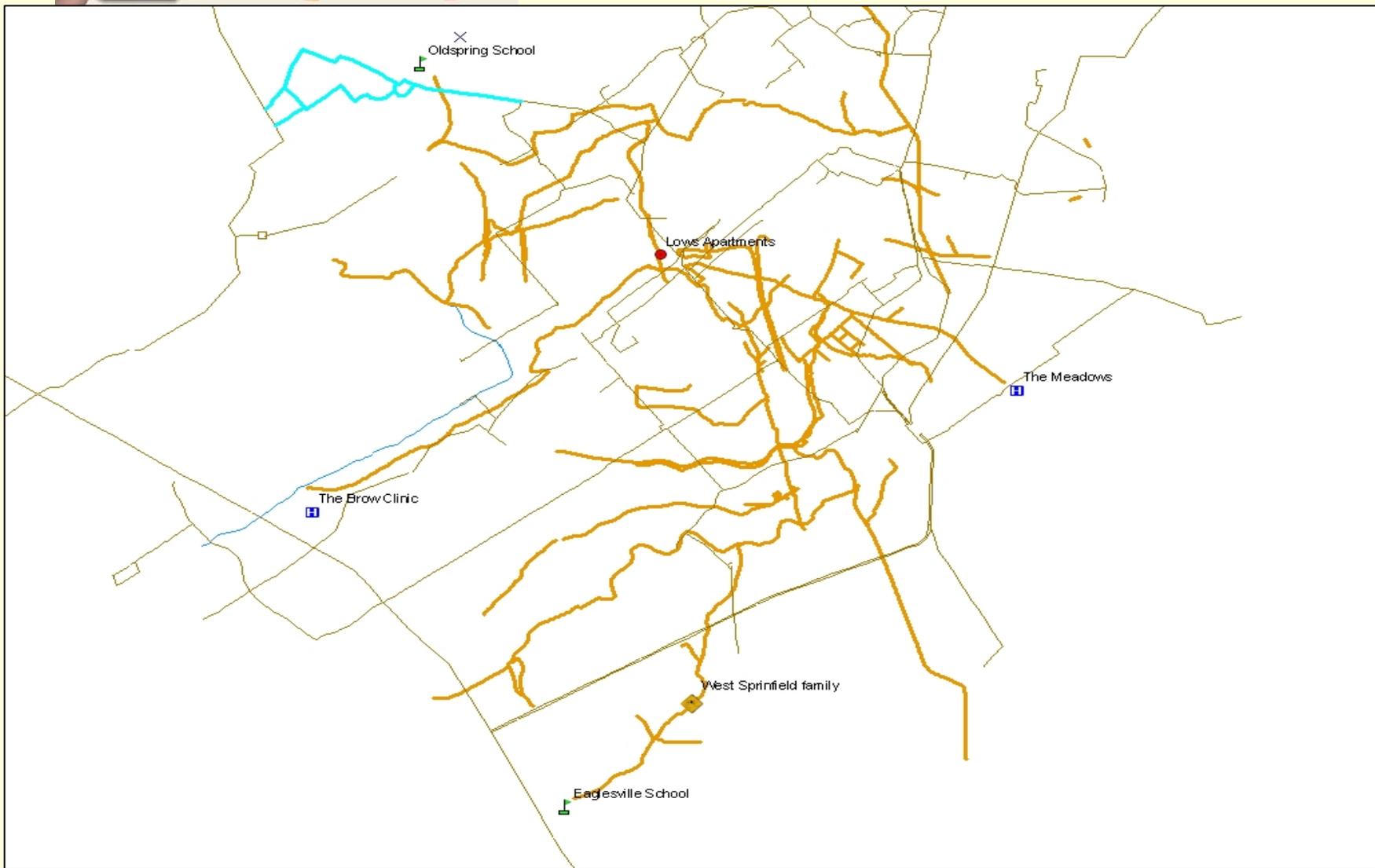


# E.g., Environmental Expert



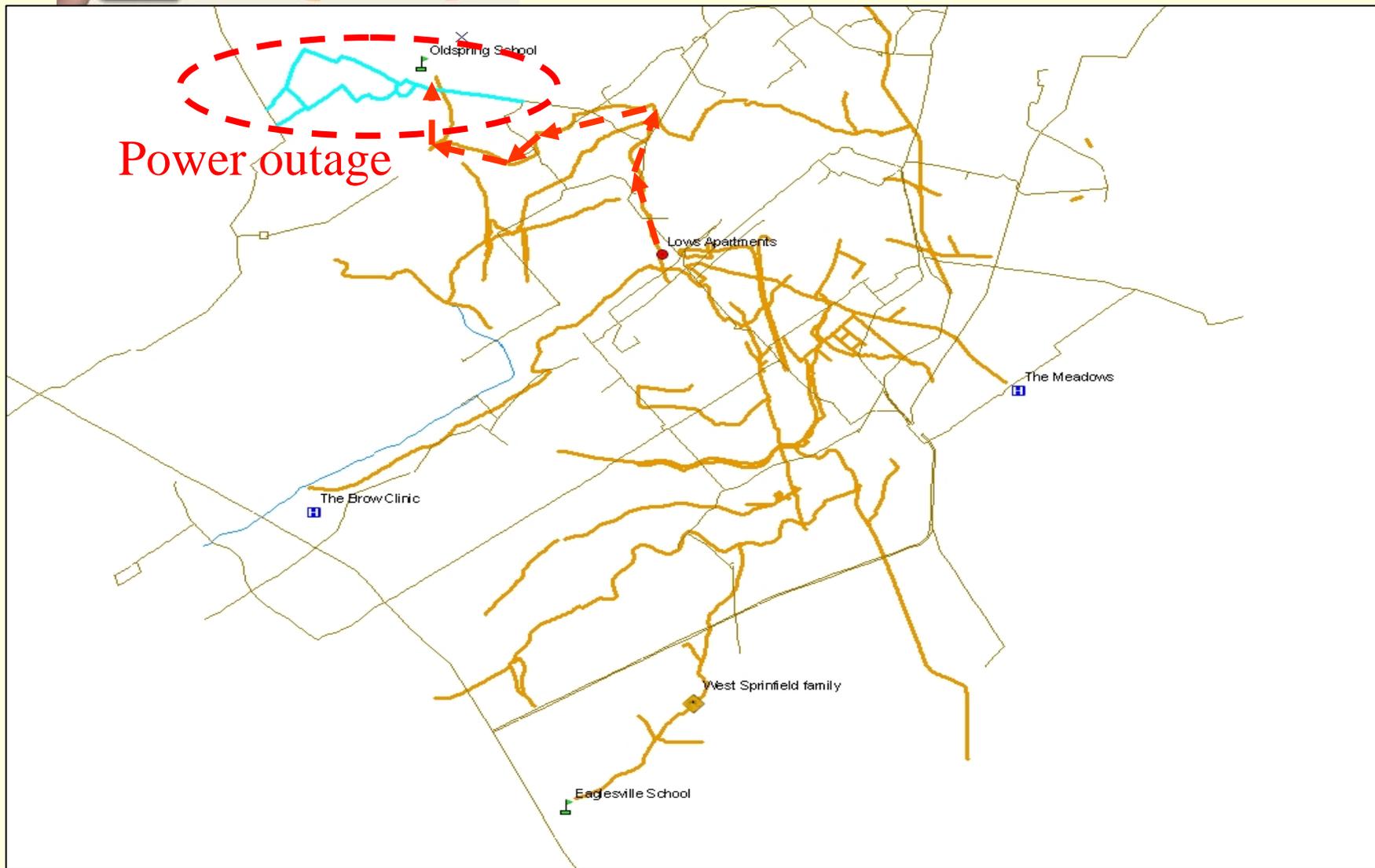


# E.g., Public Works Expert



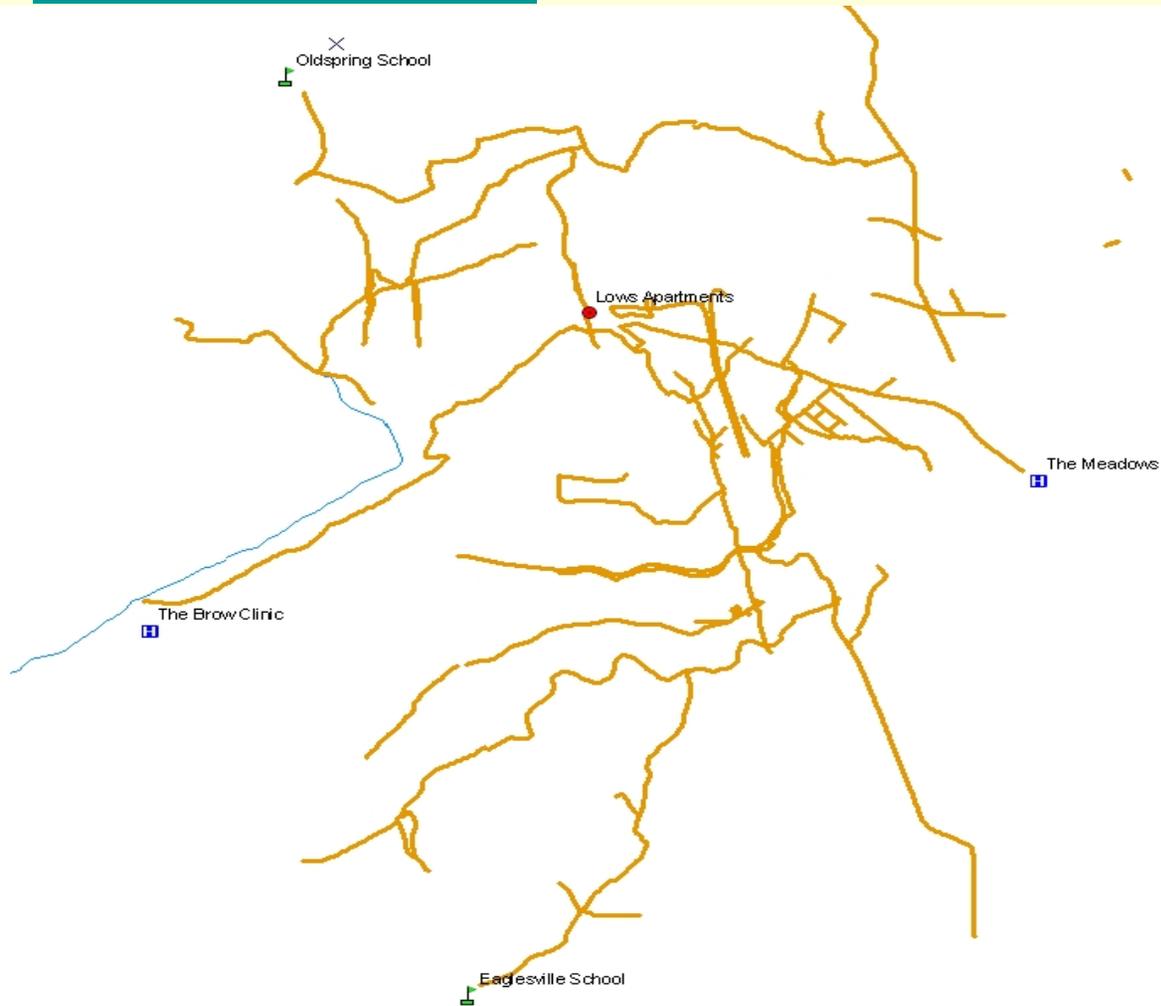


# E.g., Public Works Expert



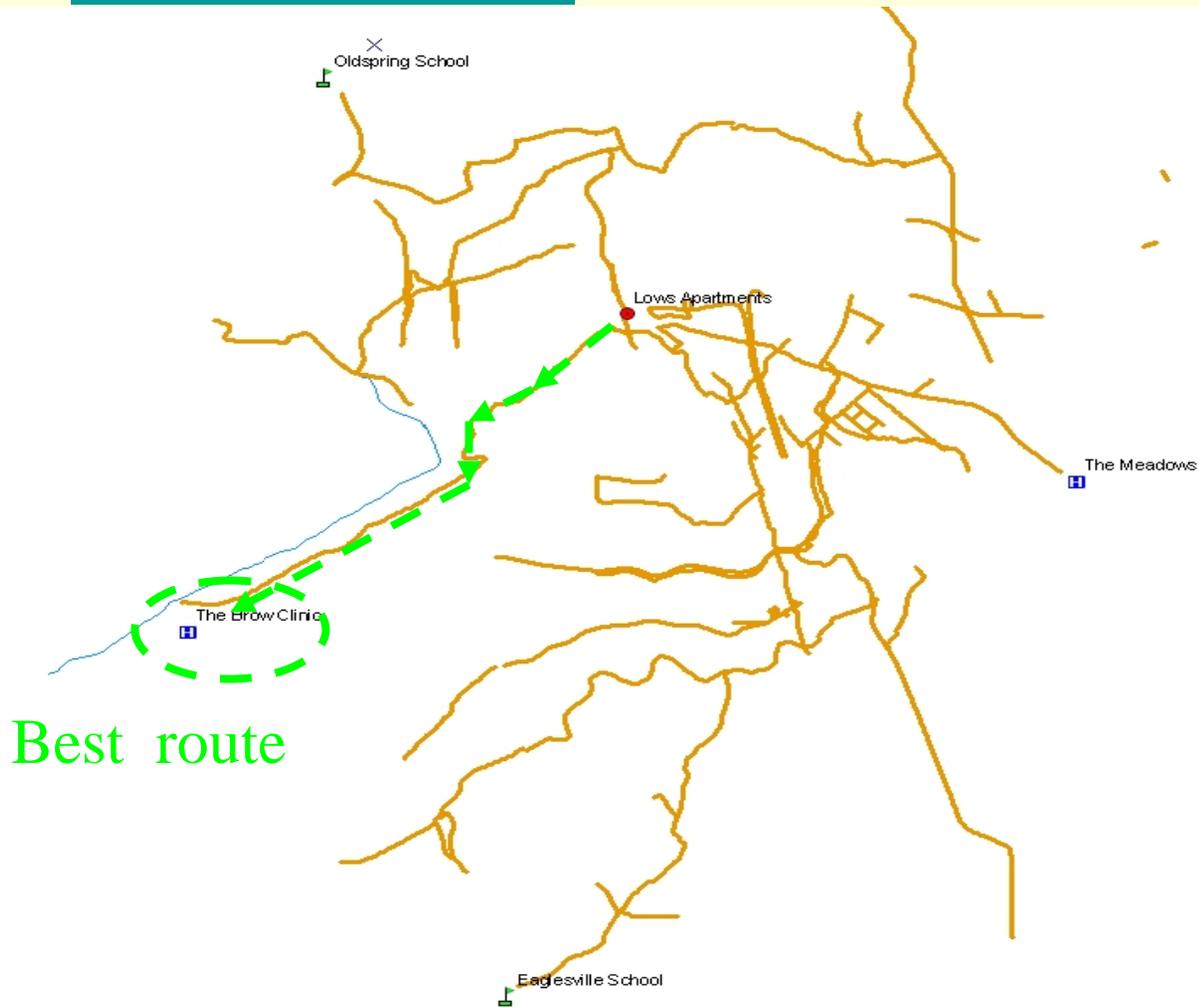


# Team View





# Team View





# *Measuring common ground*

- Psychometric scales
  - Communication, awareness, efficacies
- Linguistic-content analysis (Clark et al)
  - Deictic references, reference breakdowns
- Recall/cued recall for who did what, and why (Monk et al)
  - Convergence
- Performance
  - Time, output quality, satisfaction



## Goals

- Validate lab model wrt hidden profile results for this more complex task
  - Expert role manipulation - belief that self and others have valuable information and equi-status favor sharing
  - Critical perspective (ranking alternatives, differences of opinion, discussion at all) favors sharing
- Explore more complex/interesting tasks and instructional manipulations
- Explore alternative user interface designs



## *The intricate dance*

- Awareness in collaboration beyond radar views
  - Presence, current action, locus of attention
- Real shared activity seems more complex
  - longer term, ill-defined, social, developmental
  - Common ground, community of practice, social capitalization, human development
- This complexity also provides *resources*
  - Complementary knowledge, community formation, trust, human development



Collaborative work with Mary Beth Rosson, Craig Ganoë, Gregorio Convertino, Wendy Schafer, Helena Mentis, Amanda Walsh  
**Comments, Questions, Suggestions? Thanks!**



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