DESIGNING COLLABORATIVE VISUAL ANALYTICS TOOLS
FROM SUPPORTING EXPERTS TO ENGAGING THE PUBLIC

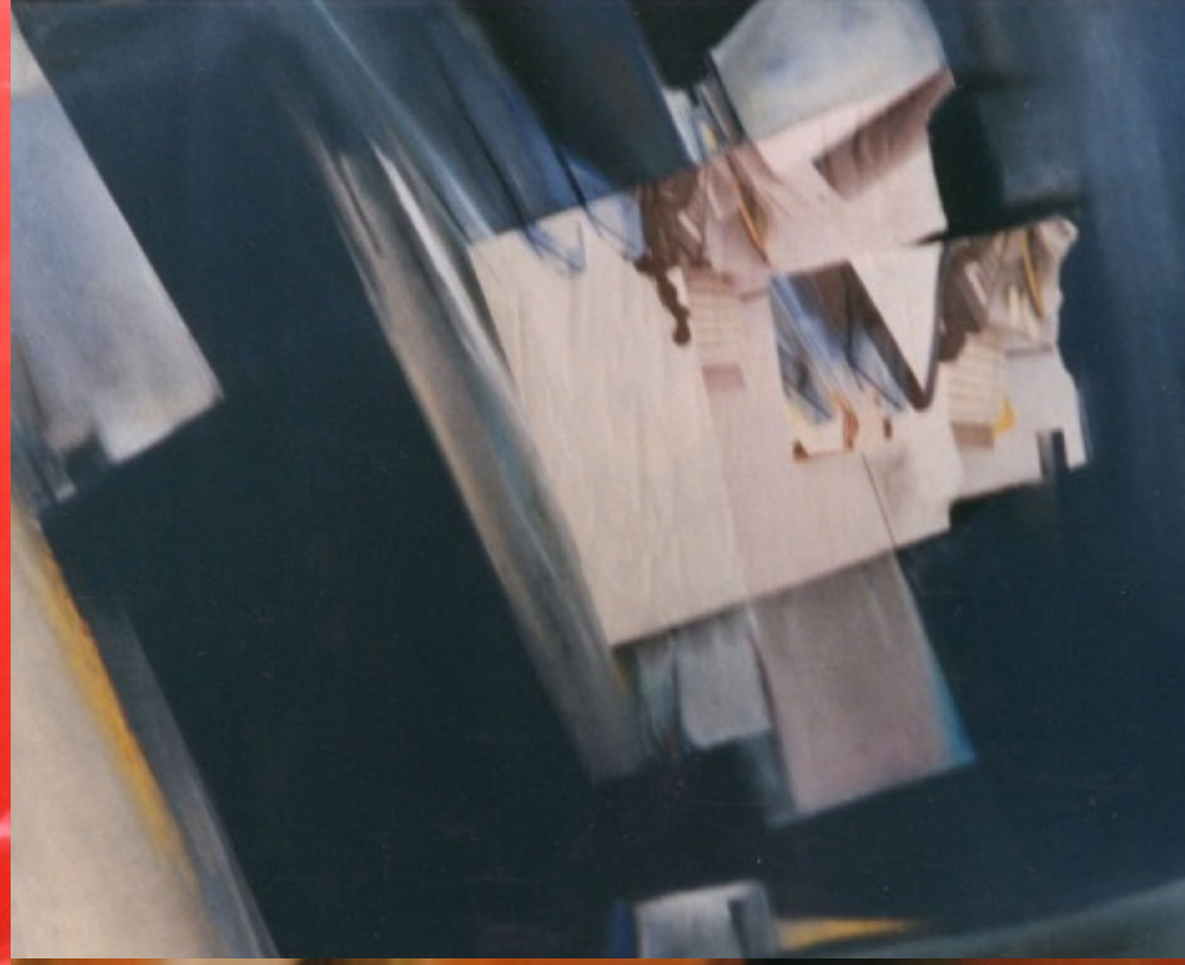
Narges Mahyar

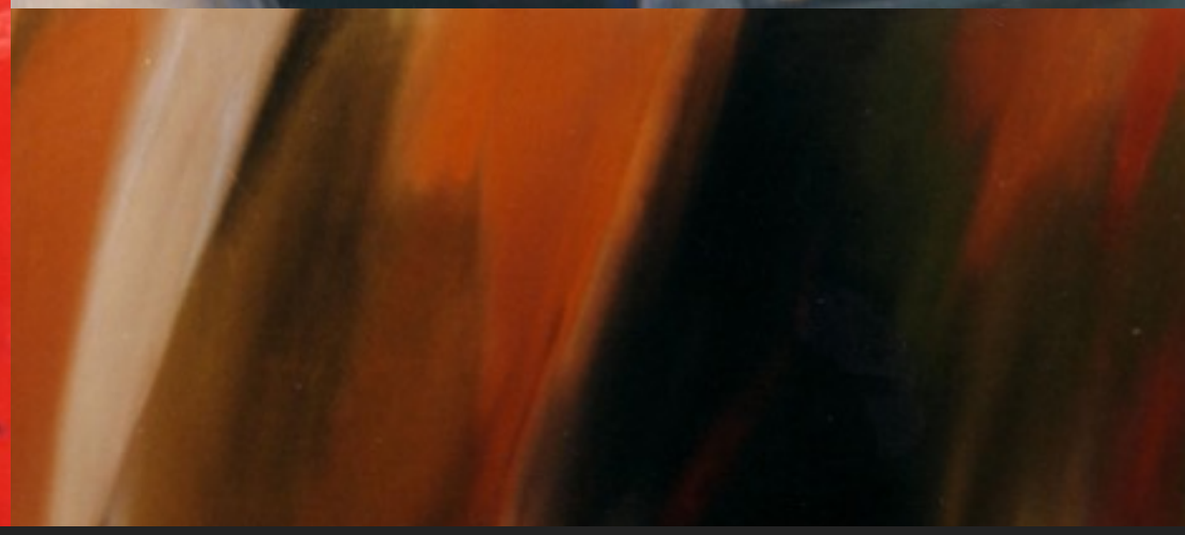
University of British Columbia

February 2016 @ UWB

INTERDISCIPLINARY BACKGROUND

- Electrical Engineering
- Fine Arts Background
- Information Technology
- Computer Science





How can we combine fine arts and computer science?

How can art make CS reach beyond CS audiences?

BIO

- I design, develop and evaluate novel visualization & interaction techniques to help people solve complex problems.
- Human-Computer Interaction (HCI)
- Collaborative Visual Analytics (CVA)
- Computer Supported Collaborative Work (CSCW)
- Visual Analytics (VA)

DOMAINS

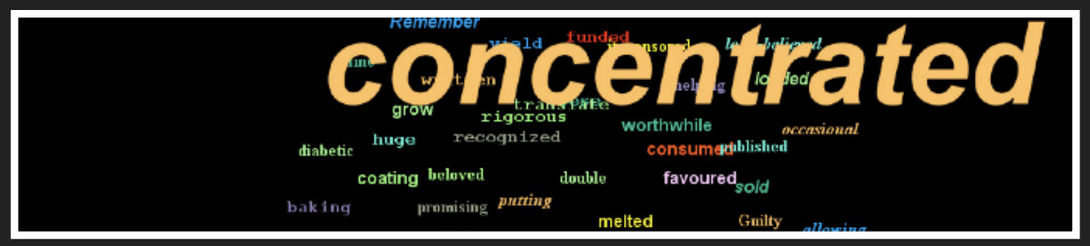
- Business Intelligence
- Intelligence Analysis
- Urban Planning
- Civil Engineering

MY RESEARCH APPROACH & METHODS

- Understanding the domain specific problems
- Designing visualization & interaction technologies
- Evaluating & analyzing the effect

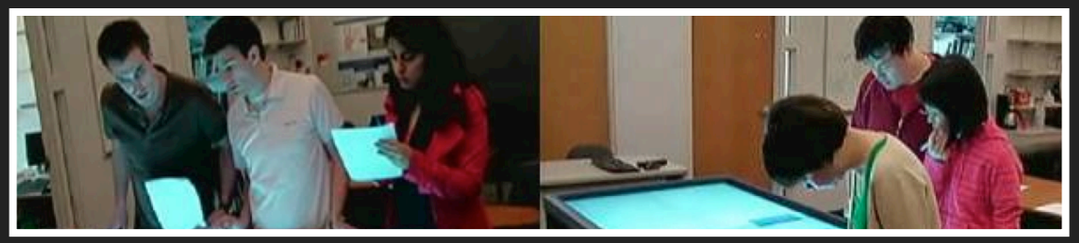
- Ethnography
- Observational User Study
- Case Study
- System Building
- Qualitative & Quantitative Evaluation

MY MAIN RESEARCH CONTRIBUTIONS



MSc., ICCC 2010

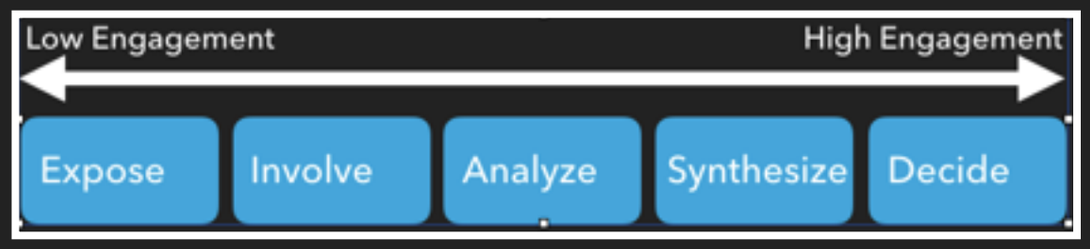
PhD, VAST 2014, Best Paper Award



PhD, VAST 2010, InfoVis 2012

Postdoc, CSCW 2015, City Life

PhD, HICS 2013, ITS 2011



Postdoc, IEEE VIS 2015, Personal Vis

OUTLINE OF THE TALK

- Collaborative Visual Analytics (CVA)
- A selection of my projects:
  - CLIP
  - Participatory Urban Design
- Contributions
- Vision & Future Directions

WHY COLLABORATE VISUAL ANALYTICS (CVA)?

- Collaboration:
  - Diverse backgrounds/expertise
  - Quality of work
  - Individual bias
  - Task Load

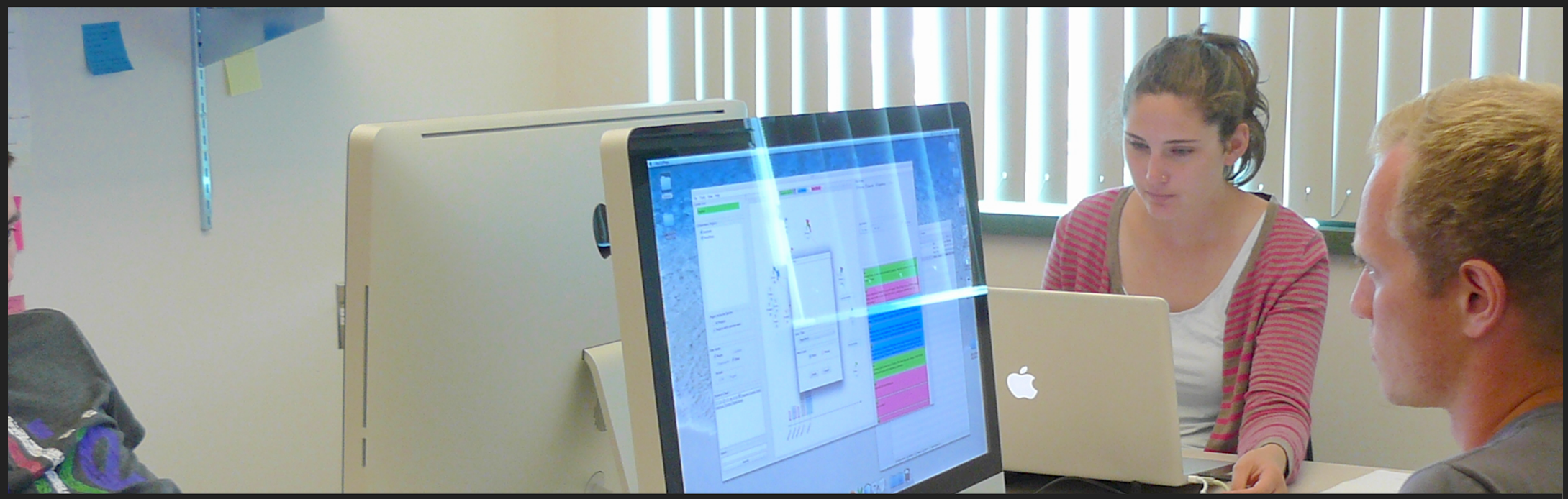
- Visual Analytics:
  - Visual representation & interactive exploration

COLLABORATIVE VISUAL ANALYTICS: CHALLENGES

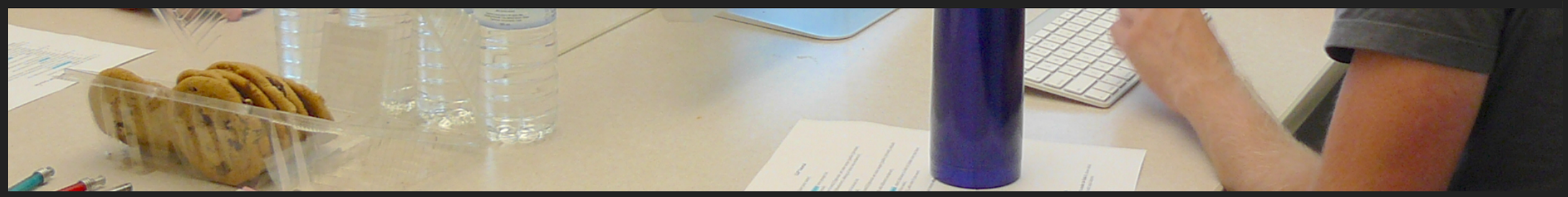
Users	Multiple backgrounds
Cognition	Foraging & sensemaking
Analysis results	Consensus, shared insight
Evaluation	Social interaction around data
Visual representations	Multiple displays, novel I/O

Isenberg et al., Infovis, 2012

CLIP (COLLABORATIVE INTELLIGENT PAD)



CLIP is a collaborative thinking space that helps people to record, organize, and share their externalizations.

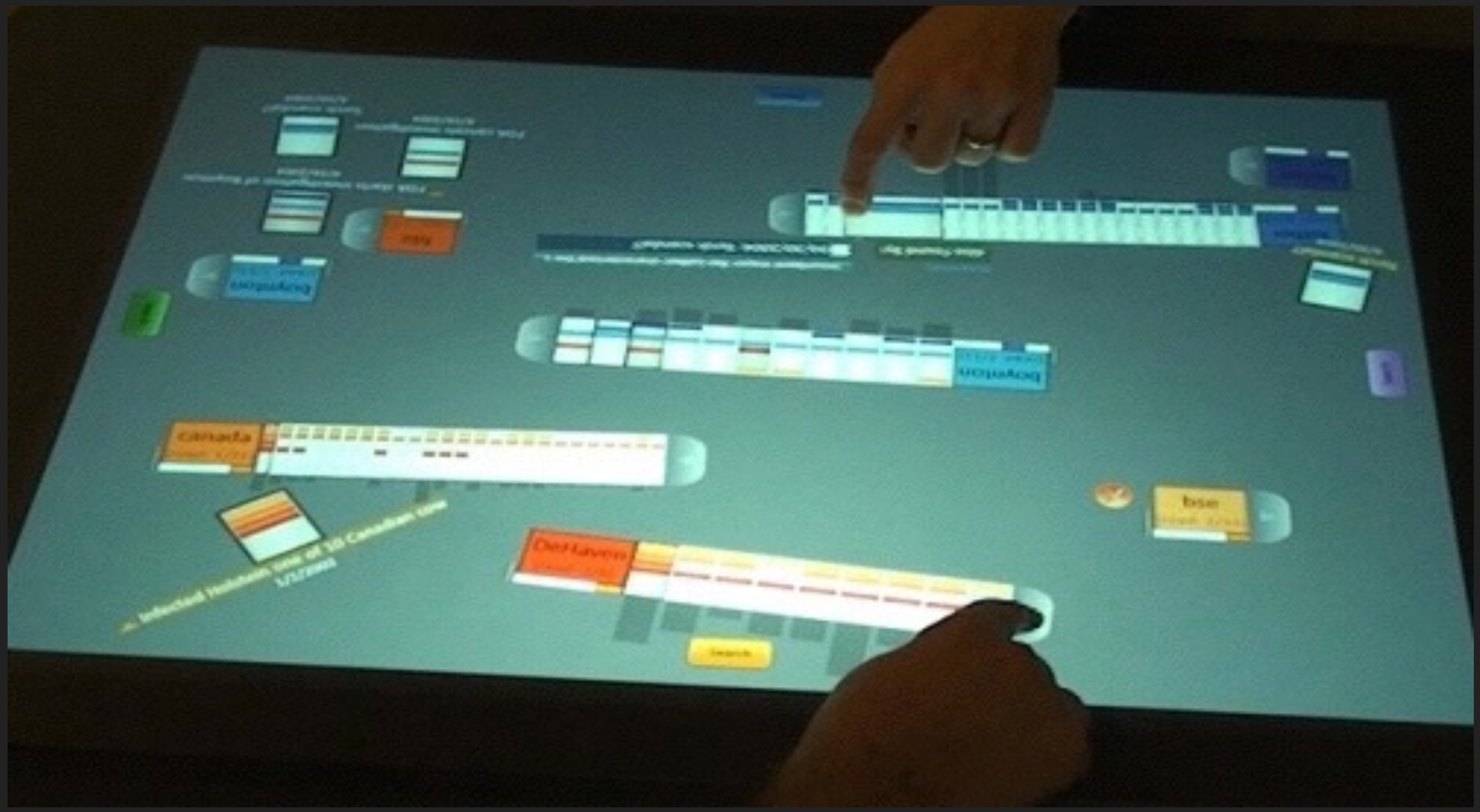


Narges Mahyar and Melanie Tory, "Supporting Communication and Coordination in Collaborative Sensemaking", IEEE Transaction on Visualization and Computer Graphics (VAST 14), 2014. [Best Paper Award]

RESEARCH PROBLEMS

- How to support collaborative sensemaking?
- How to support externalizations?
  - organize, record, and share findings, hypotheses, and evidence.
- Evaluate the effect on **awareness**, **communication** & **coordination**?

CAMBIERA: FOR COLLOCATED VISUAL ANALYTICS OF DOCUMENT COLLECTIONS



Isenberg & Fisher, 2012

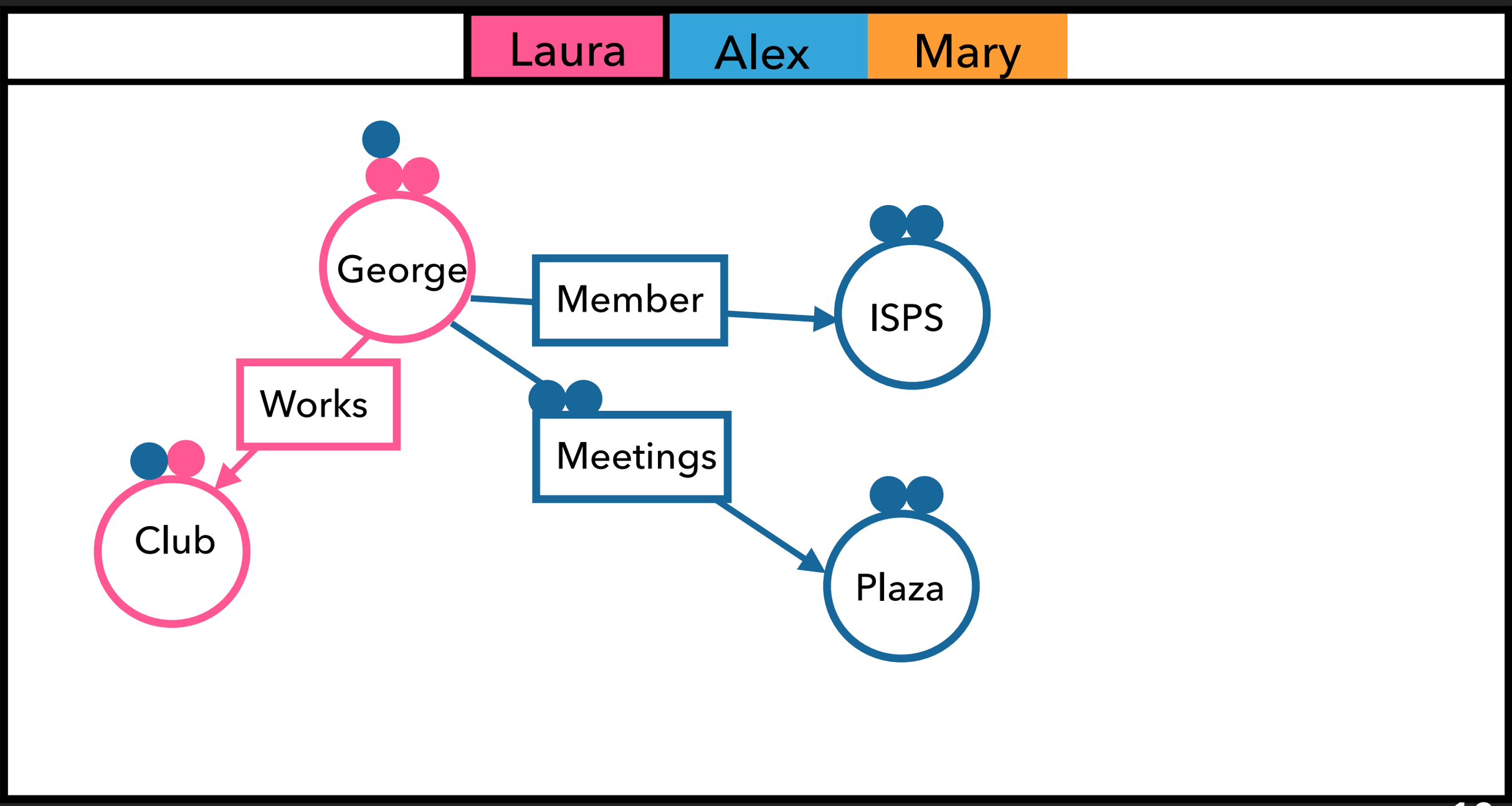
CONTEXT

- Task: VAST 2006 challenge, a mystery task
- Dataset: 240 documents
- Setting: Collocated collaborative analysis

LINKED COMMON WORK (LCW)

- **LCW**: automatically Identifying and visually representing similarities between collaborators' work
  - Partial merging
  - Full merging

PARTIAL VS. FULL MERGING



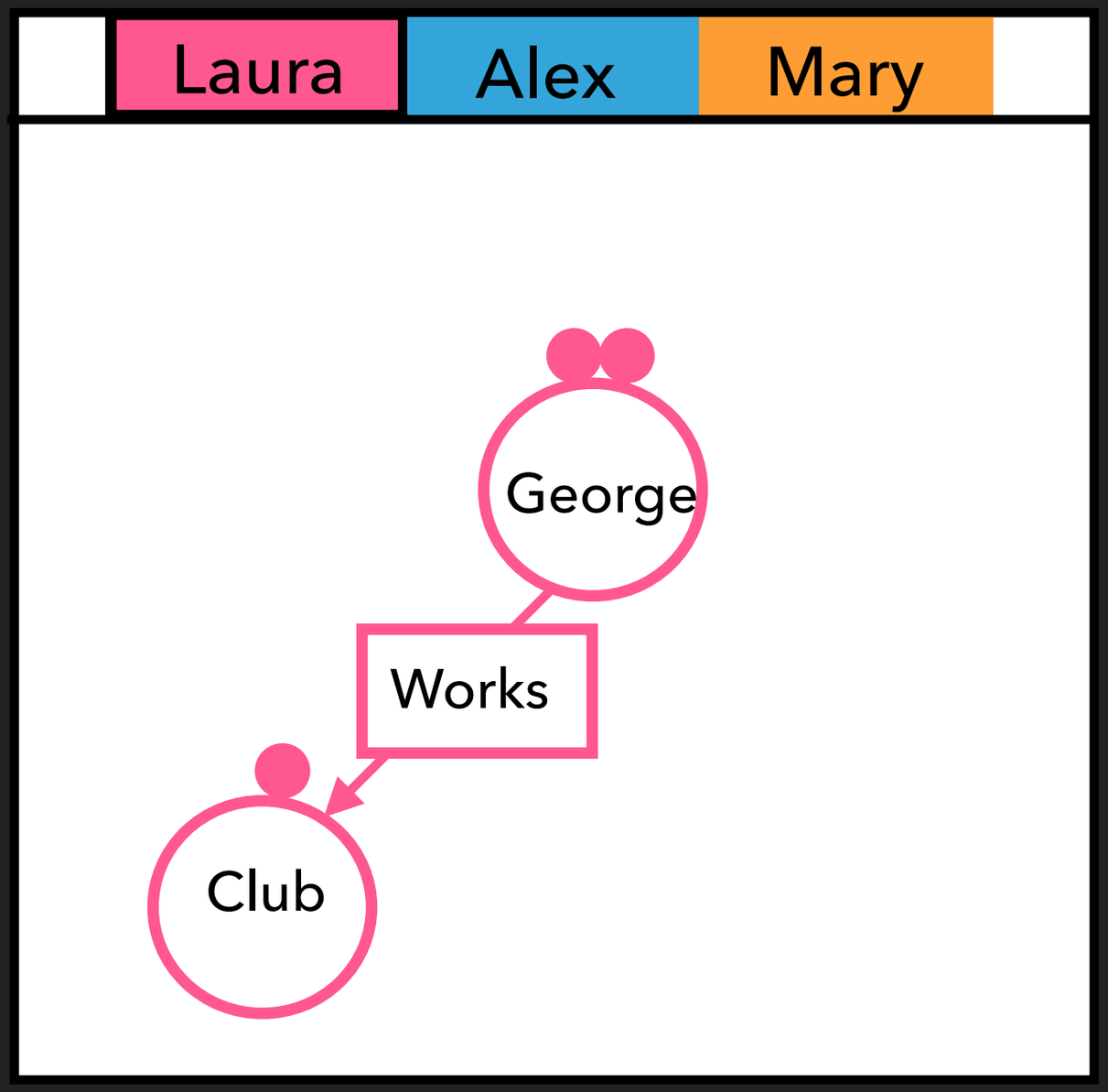
CLIP: VIDEO

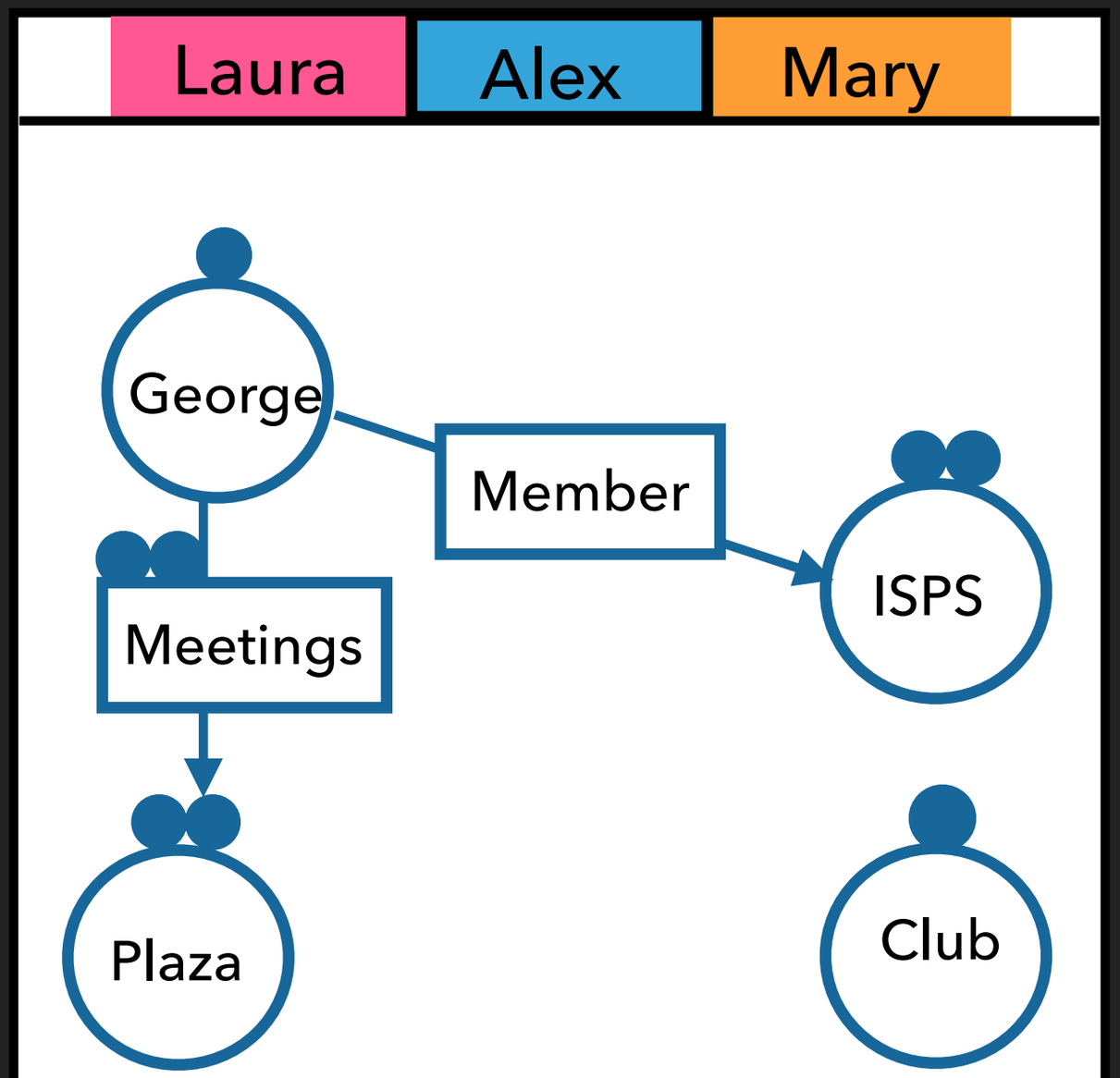

CLIP: A Collaborative Visual Thinking Space to Support
Joint Sensemaking

EVALUATION OF LCW

- Experimental comparison of CLIP to a baseline tool
- Baseline tool: CLIP without LCW

BASELINE TOOL





USER STUDY & DATA GATHERING

- 16 groups of 3, 8 groups in each condition
  - Worked for 90 minutes
  - Used CLIP or Baseline
- Followed by semi-structured interview

HYPOTHESES

- Linked Common Work will improve:
  - H1: Performance
  - H2: Communication
  - H3: Coordination
  - H4: Awareness

METRICS AND ANALYSIS

- Performance
  - Scoring scheme (from Isenberg et al., 2012):
    - Positive points for finding and connecting relevant facts
    - Negative points for incorrect hypotheses
- Number of key documents found (out of 10)

METRICS AND ANALYSIS: DEVELOPING NEW METRICS

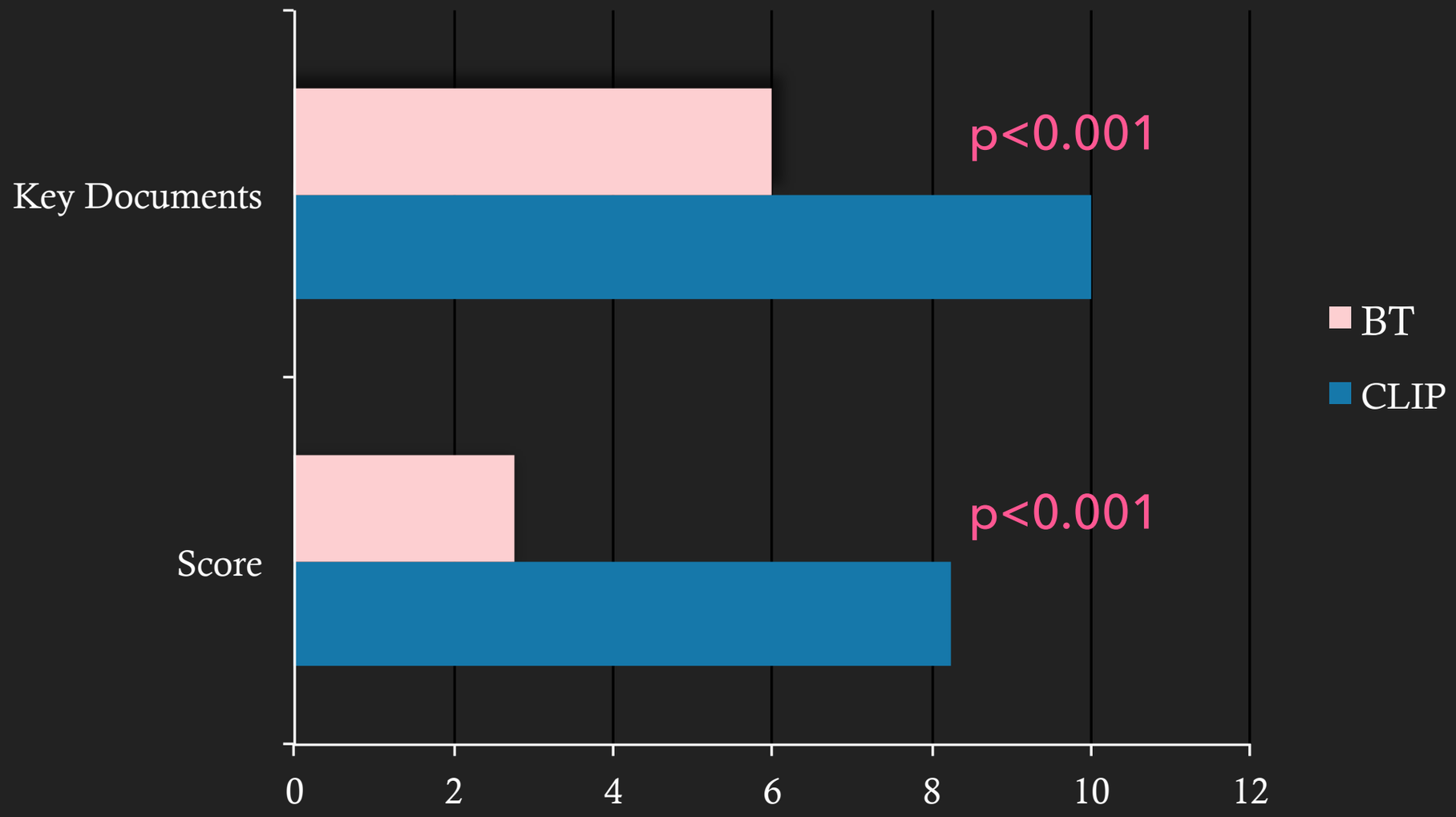
- Conversation analysis
  - Classified and counted statements of 7 different types
    - 2 coders, Krippendorff's alpha = 0.91
- Spent around 520 hours on data analysis

METRICS SCHEME

DH	Discussion / generating Hypotheses
RV	Referring to Visualization
CO	Coordination
SA	Seeking Awareness
VF	Verbalizing Findings
QF	Question about Findings
RU	Related but uncategorized

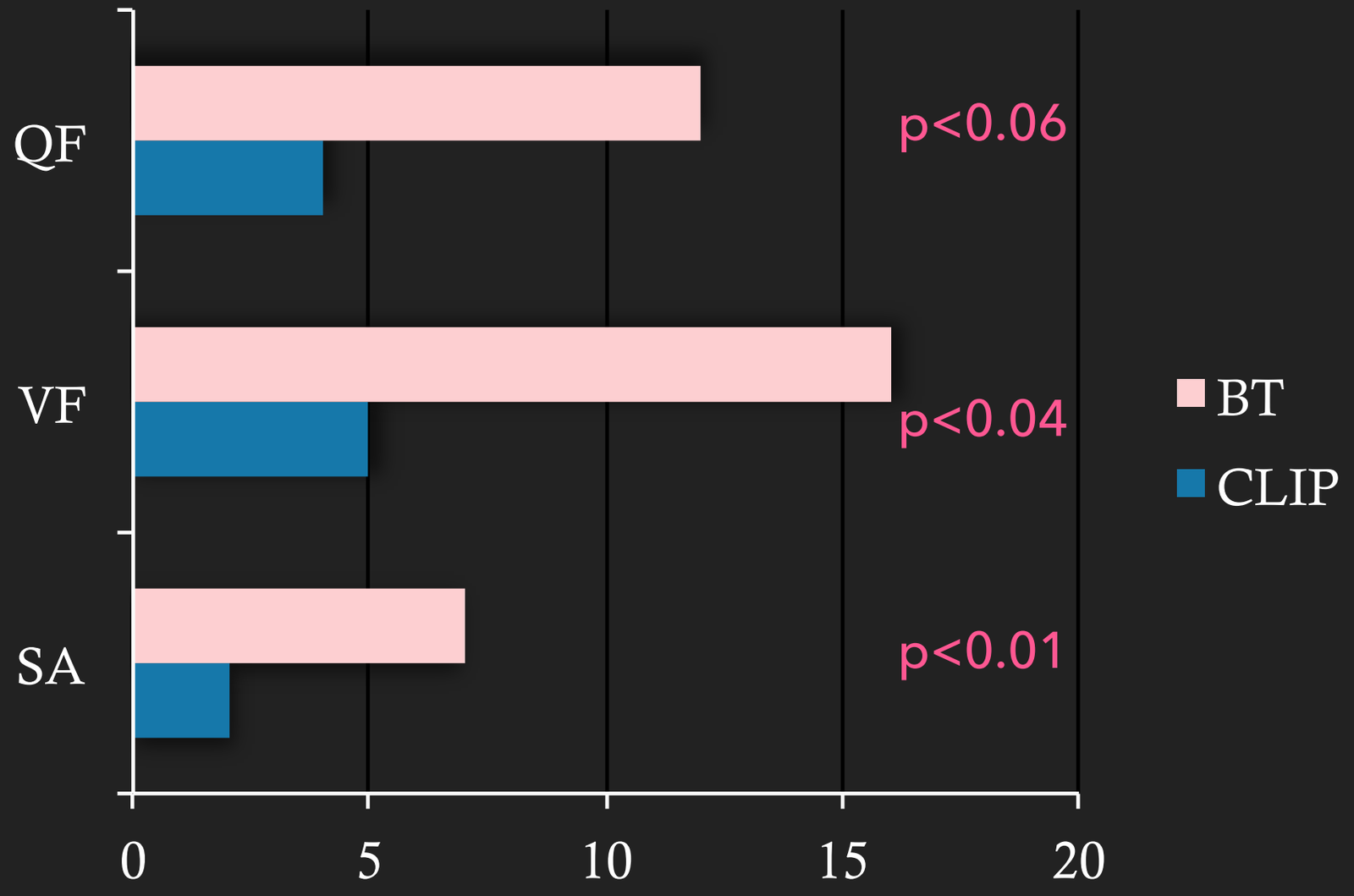
HYPOTHESES

H1: Better performance



HYPOTHESES

H4: Less reliance on verbal communications for awareness



FUTURE APPLICATIONS OF THIS PROJECT

- LCW for different domains, e.g. co-authoring documents
- LCW for different collaborative settings, e.g. distributed software development

PARTICIPATORY URBAN DESIGN

Ronald Kellett, Kellogg Booth, **Narges Mahyar**, "Collaborative Technology for Stakeholders Engagement in Urban Design", Information Technology and City Life Workshop, CSCW 2015, March 2015.

BEFORE I ARRIVED AT UBC: RESEARCH PROBLEM

- How to use visualization and collaboration technologies to increase public engagement?

DEPLOYED VERSION

- Multi-touch tabletop

- Large-screen wall displays
- Visualization for sustainability metrics

MY ROLE IN THIS PROJECT: NEW RESEARCH PROBLEMS

- What are the limitations of a single shared interactive display in supporting collaborative analysis scenario?
- What are the ways which we can design multi-display eco-system to better support multi-users' interactions?

MY ROLE IN THIS PROJECT: METHODS

- Observed the system in action
- Interviewed and closely worked with experts
- Led the design and mentored 2 students to develop new features
- Leading the evaluation: an observational study

DESIGN OBJECTIVES

- Personal displays
  - Individual space to explore and customize data
- Visual history
  - Record and review session history
  - Tracking the session, understanding decision making

INTEGRATING INDIVIDUAL DISPLAYS

- iPad 3D viewer app
  - Improve interactions with the 3D wall display
- iPad indicator app
  - Improve interactions with metrics
- iPad history app
  - Record and visually represent the interaction history

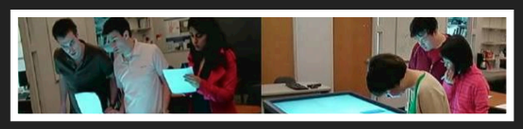
SUPPORTING GROUP DYNAMICS

INDIVIDUAL & GROUP DISCOVERY

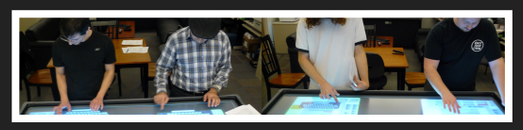
FUTURE APPLICATIONS OF THIS PROJECT

- Use of multi-display eco system for public engagement
- Evaluate the effects on:
  - learning
  - engagement
  - collaboration dynamics

MY MAIN RESEARCH CONTRIBUTIONS



- Critical role of note taking



- The effects of integrating record keeping into a CVA tool

- Introducing LCW method, new metrics for CVA

- Metrics for engagement

- Investigating a multi-display CVA tool for engagement

SHORT-TERM RESEARCH GOALS

- Visualization design for public engagement

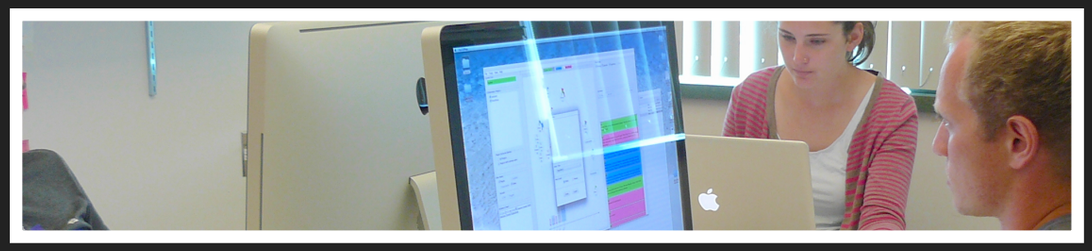
SHORT-TERM RESEARCH GOALS

- Understanding user engagement

Expose | Involve | Analyze | Synthesize | Decide

Narges Mahyar, Sung-Hee Kim, and Bum Chul Kwon, "Towards a Taxonomy for Evaluating User Engagement in Information Visualization", *Workshop on Personal Visualization: Exploring Everyday Life*, IEEE VIS 2015, 4 pages, 2015.

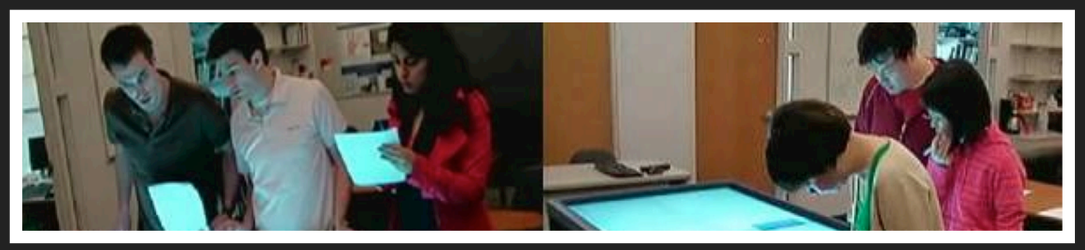
SHORT-TERM RESEARCH GOALS



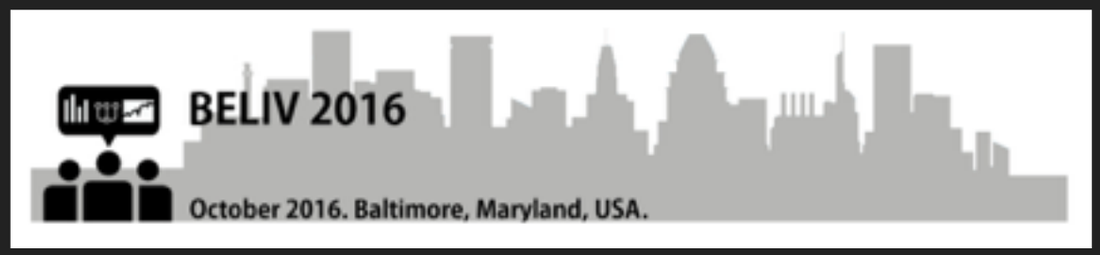
- LCW for different domains, e.g. co-authoring documents

- Use of multi-display eco system for public engagement

LONG-TERM RESEARCH GOALS



- Multimodal interaction for collaboration
- Note taking in different settings and domains
- Evaluation methods for InfoVis & CSCW



LONG-TERM RESEARCH GOALS

- Visual storytelling
- Visualization for personal discovery, e.g. health data
- Art and Media, e.g. interactive visual installation for personal & group discovery

VISION: MORE INTERDISCIPLINARY DESIGN FOR ENGAGEMENT

- Develop effective & engaging visualization techniques & collaboration technologies
- Develop theories about engagement
- Bring more design elements to CS
- Multi-touch surfaces potential
- Revisit principles and guidelines for CSCW

HOW I CAN CONTRIBUTE TO THE DEPARTMENT

- Interdisciplinary background in complementary areas: CSCW, VA
- Fine arts background: further contributions in HCI
- Strong history in interdisciplinary research: industry & academia

THANKS TO MANY

THANK YOU!

NARGES MAHYAR

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SLIDES, PAPERS, AND MORE:
WWW.CS.UBC.CA/~NMAHYAR

BACK UP SLIDES

OBSERVATIONAL STUDY

Narges Mahyar, Ali Sarvghad, and Melanie Tory, "Note Taking in Co-located Collaborative Visual analytics: Analysis of an Observational Study", *Information Visualization*, vol. 11, no. 3, pp. 190-204, July 2012.

Narges Mahyar, Ali Sarvghad, and Melanie Tory, "A closer look at note taking in the co-located collaborative visual analytics process," *IEEE VAST 2010*.

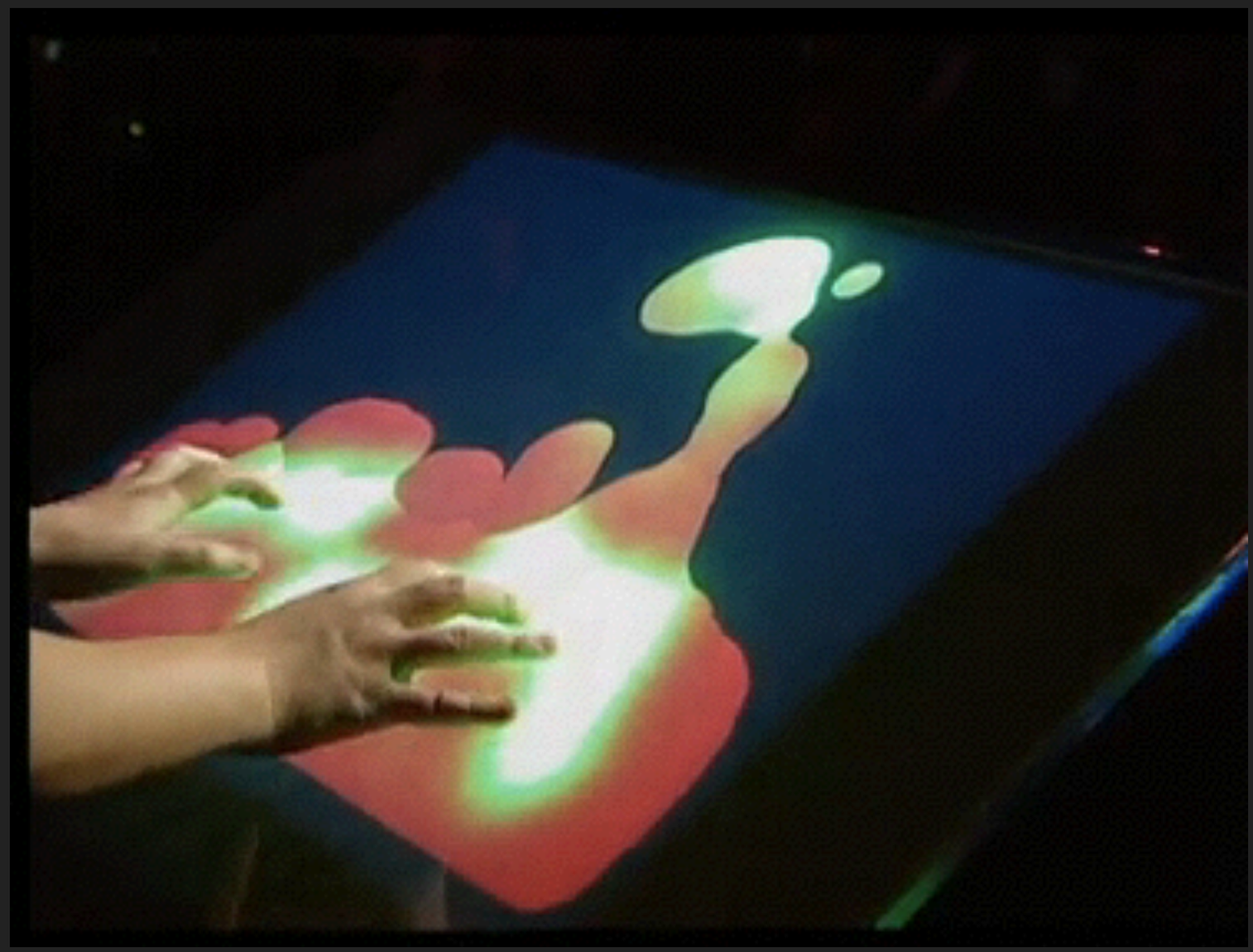
COSPACES (COLLABORATIVE WORKSPACES)

Narges Mahyar, Ali Sarvghad, and Melanie Tory, "Observations of Record-Keeping in Co-located Collaborative Analysis", *HICSS 2013*.

Narges Mahyar, Ali Sarvghad, Melanie Tory and Tyler Weeres "CoSpaces: Workspaces to Support Co-located Collaborative Visual Analytics," *DEXIS 2011*, Nov 2011.

This is the way we should be interacting with machines from now on!

Jeff Han, 2006




THE DUOMO

CLIP: RESEARCH PROBLEMS

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TEACHING PHILOSOPHY

- Engaging and motivating students
- Integrating research and teaching
- Providing a collaborative environment
- Being available and accessible
- Fostering creativity & respecting individual differences
- Developing critical thinking & reasoning

TEACHING EXPERIENCES

- TA : CS courses: instructor, marker, admin
- Guest lecturer: several HCI courses
- Fine art instructor
- Co-founder of Creative Children Institute

ACM ISS (INTERACTIVE SURFACES & SPACES), 2016