OBSERVATIONS OF RECORD-KEEPING IN CO-LOCATED COLLABORATIVE ANALYSIS

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Visual Record Keeping (VRK)

- VRK in VA context: Capturing analysis history & visually represent it.

- Many researchers have mentioned the advantages of record-keeping in visualization.

- Speculations:
  - More important in collaborative task.
  - Improving communication & dissemination.
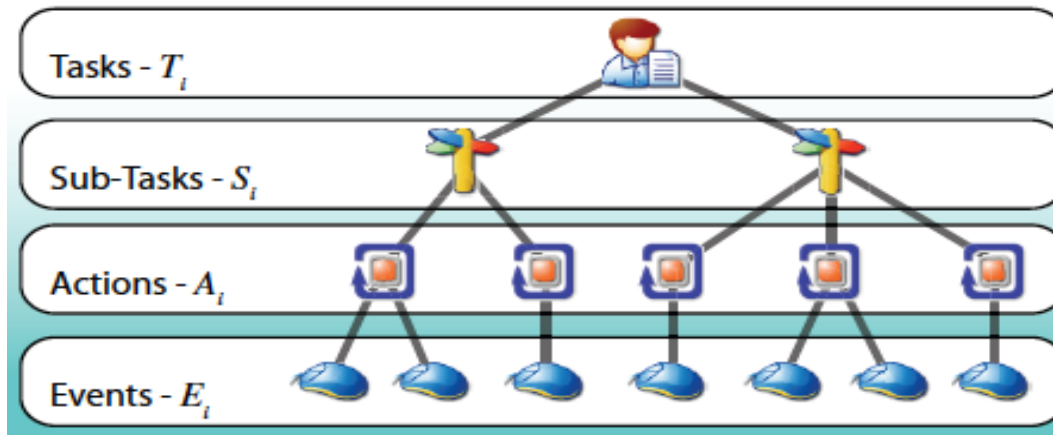
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Introduction

- Goal: study use of visual record-keeping in co-located collaborative setting on a tabletop, how people would use them, and what could be improved.

- CoSpaces: a system designed for co-located collaborative Visual Analytics on interactive tabletops.
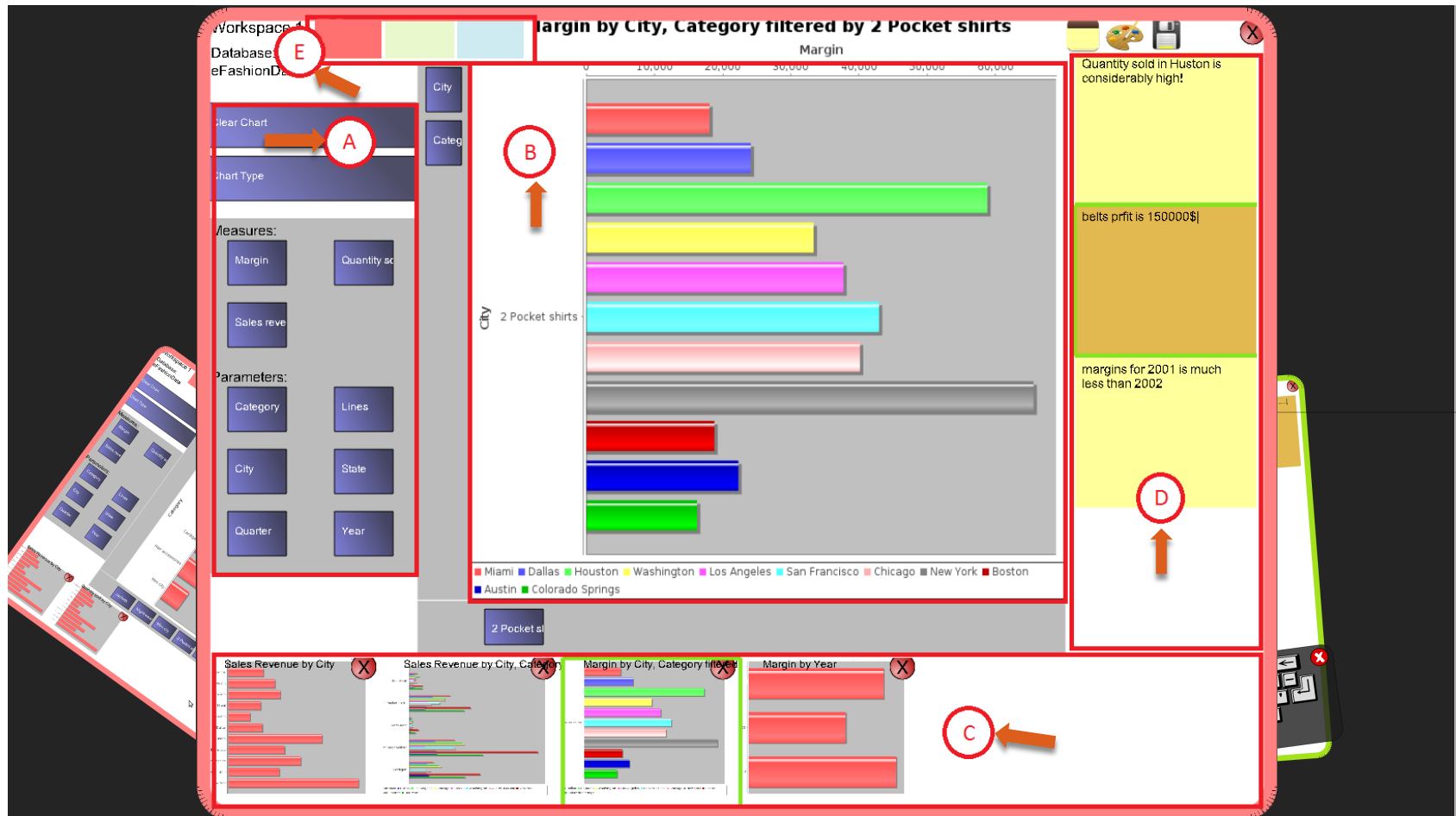
Analytic Activities & Actions

- □ Action layer carries information regarding users' analytic intention/s.

We identified actions on VRK:

- ❑ inferred intention/s related to them.
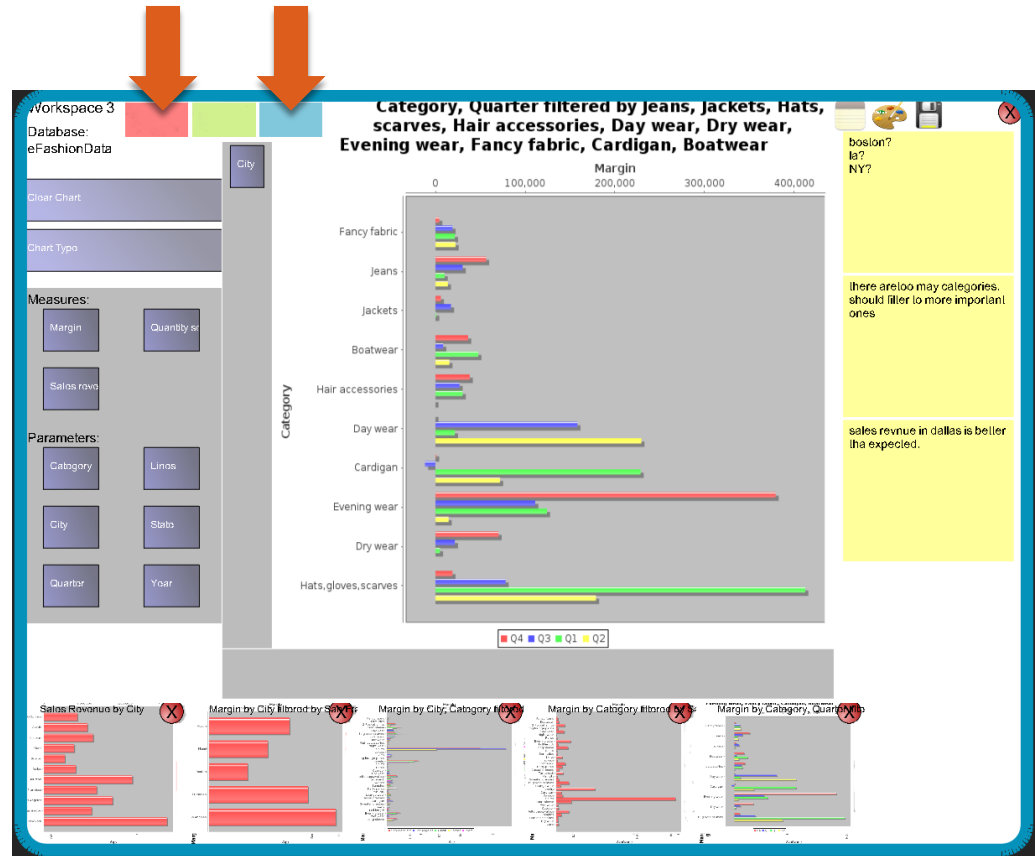- ❑ relations to analysis phases & collaboration styles.
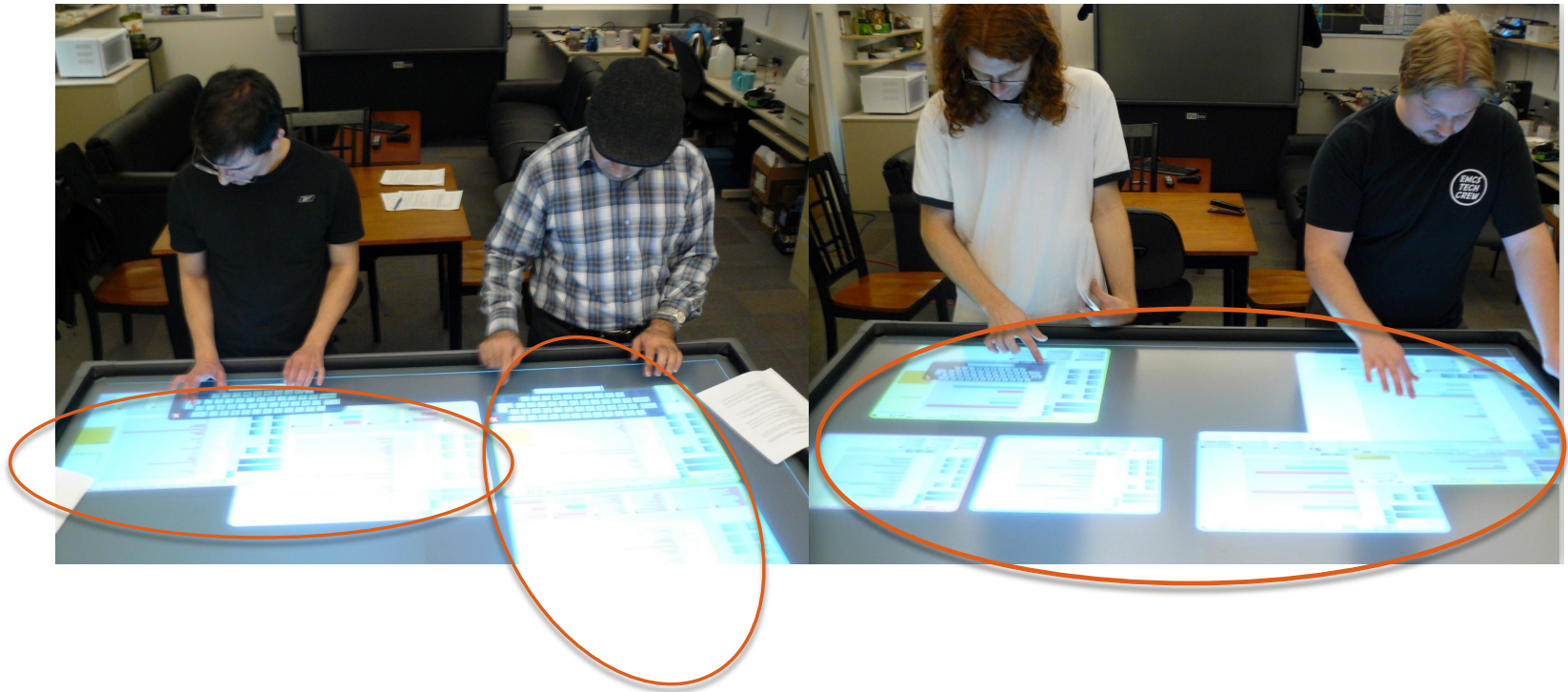
Worksheet

Remote Viewing

Facilitate Visual Analysis.

□ Substantial table real state + Worksheet flexibility facilitated analysis.

Support changes in collaboration

□ Supporting transient collaboration style

User Study

- 10 groups of 2

- Two tasks

- 20 and 40 minute sessions

- Follow up interview and questionnaire

- Captured video

- Logged history

- Two independent observers

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Findings

1. Actions on History

2. Actions and Collaboration Styles

3. Actions and Analysis Phases

   ❑ **Information foraging**: gathered insight through visual exploration

   ❑ **Discussion**: formed explanations and hypotheses around their finding

4. Record-Keeping Behaviours

5. Use of Tabs

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Findings: Actions on History

Actions	Description	#
Reload a Chart	Reload a previously created chart from the history, either the local history or a collaborator's history.	155
Review History	Review charts within the history, either the local history or a collaborator's history.	128
Manual save	Manually save a chart into the history pane.	102
Delete	Delete a chart from the history pane.	99
Note Taking	Write down notes in the note pane.	77
Review Notes	Review note(s), add to a note, and/or reload a chart linked to a note.	30
View Current Chart	View the collaborator's current visualization through tabs.	11
Copy Local	Copy a chart from a collaborator's worksheet to the local Worksheet.	4
Create External Worksheet	Creating a new Worksheet using a chart from the history.	3

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Findings: Actions & Primary Intentions

Action on History	Primary Intention	
Reload Chart	Review Existing Chart	▮2
	Reuse Existing Chart	43
Review History	Review Charts	102
	Looking for a chart	26
Manual Save	Managing History	102
Delete	Managing History	99
Note Taking	Record Personal Finding/Insight	74
	Record Discussion Outcome	3
Review Note	Reload a Chart Linked to a Note	18
	Revisit all Notes	5
	Use Notes to Support Discussion	5
	Revisit a Note	2
View Current Chart	View Current Chart	11
Copy Local	Transfer a Chart between worksh..	4
Create External Worksheet	Comparison between charts	3

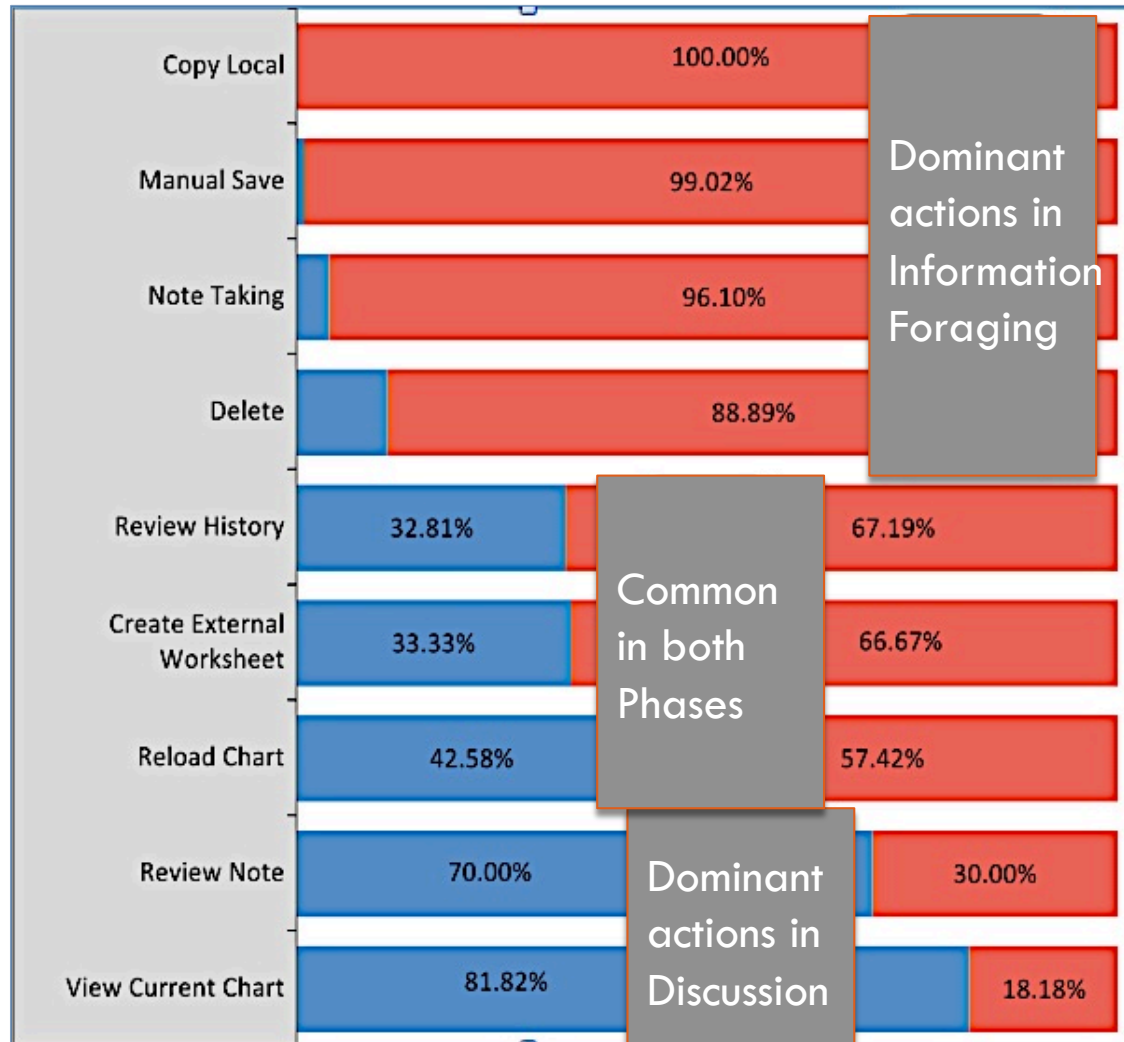University of Victoria

Findings: Analysis Phases & Intention

Eg. Reload a Chart:

- Information Foraging:
  - Review exciting chart (50)
  - Reuse existing chart (39)

- Discussion:
  - Review exciting chart (62)
  - Reuse existing chart (4)

Findings: Actions & Analysis Phases
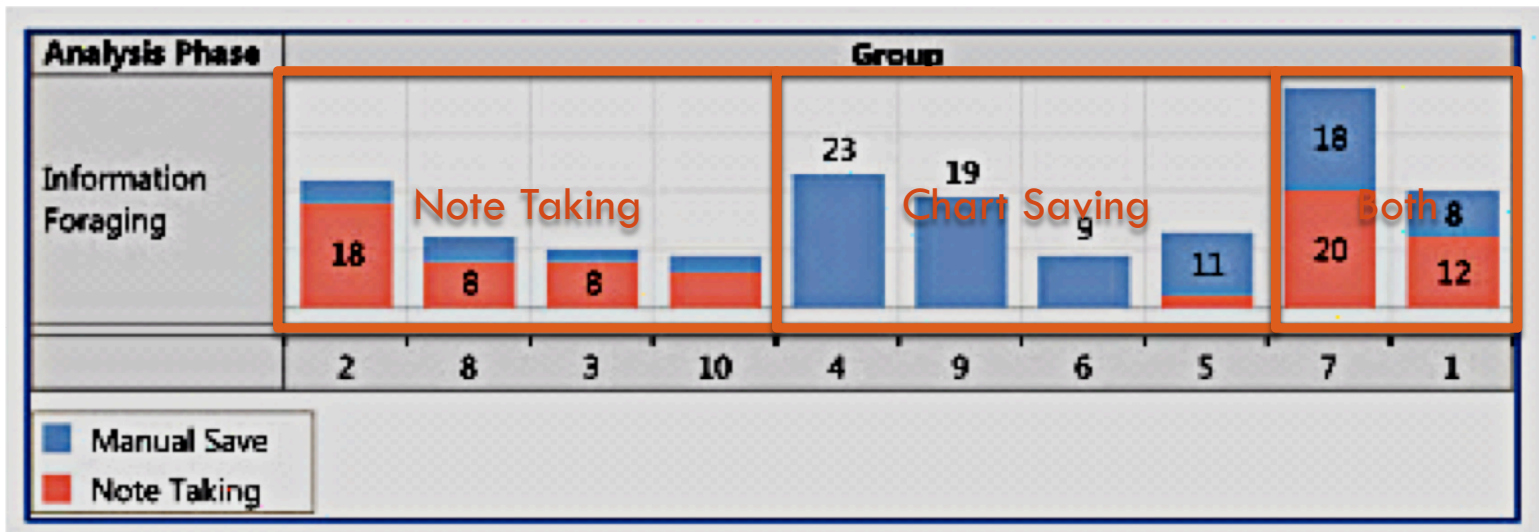
Findings: Actions & Collaboration styles

- Information Foraging: loosely-coupled
  - Goal: problem-solving.

- Discussion: tightly- coupled
  - Goal: decision-making.

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Findings: Record-Keeping Behaviours

Findings: Use of Tabs

□ Our observations corroborated our speculated benefits of using tabs for providing awareness.

"…real time update of [the] other's view was interesting, because [I] could keep [myself] updated all the time…".

"…being able to see others' workspaces, [and] keep track of them in own workspace" was one of the most useful features of the system."

□ Information Foraging (15): mostly took place in the middle of the phase.

□ Discussion (17): almost evenly distributed throughout the phase.

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Discussion

- The importance of VRK in collocated collaborative setting. Recorded material facilitated collaboration:
  - Gain awareness
  - Share work
  - Starting point for discussion

- Record-keeping played an important role in both information foraging and discussion phases of collaborative work.

- Types of actions and the reasons for them differed between the phases.

- Two different strategies for capturing findings: chart- focused versus note-focused approaches.

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Design Implication

1. Multiple History Views

   □ Select different history views: detailed, bookmarked, filtered and customized views.

2. Support for Sharing

   □ "Direct" and "Indirect" (remote, unobtrusive & non-interruptive)

   □ Support for History Management

   □ Customized view

3. Support for Note Taking & Reuse

   □ Note taking and reuse are two of the prevalent record-keeping actions

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Conclusion

- Nine actions on history & user intentions for each action.
- Actions and intentions varied depending on the analysis phase and collaboration style.
- Information foraging (Loosely Coupled):
  - Record findings, support individual analysis, and maintain awareness of others' activities.
- Discussion (closely coupled):
  - Present past findings to collaborators and to record discussion results.
- Remote view of another workspace was useful in both situations, but for different purposes.
- Note taking and the link between a note and its related chart was very useful.

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Generalizability & Future Work

- We expect actions and intentions would be repeated in other VA situations.

- Frequencies of actions & primary user intentions likely depend on system design and individuals.

- Future Work:
  - Investigate automatic recommendation of history.
  - linking notes based on their semantic relationships.

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Thanks for your attention!

For more information please contact me at

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Backup1 - Implementation

- CoSpaces is multi-touch application written in JAVA.

- Multi-touch for Java (MT4J) provides multi-touch functionality.

- Community Core Vision (CCV), TUIO.

- JFreeChart is used to create the graphical charts.

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Backup2- Tasks

- Participants performed two tasks.
- 20-minute introduction to the system and dataset,
- Task 1, 20 minutes, learned how to use CoSpaces.
- Task 2, 40 minutes, open-ended analytical question:
  "Assume you are a financial analyst of a clothing company that sells clothing. Following is a list of the most popular product lines are: Dresses, Sweaters, Outerwear, Sweat-shirts, Dress shirts, Accessories. You will look at the first three items (underlined) and your team member will look at the rest. Analyze the sales data and at the end prepare a report for your CEO"

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Backup3 – Data Capture & Coding

- ☐ Two experimenters observed the study and recorded notes independently.

- ☐ Recorded artifacts and notes.

- ☐ Gathered video recordings of each session

- ☐ Videotaped interview sessions and collected participants' notes and reports.

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Backup4 - Notes

☐ Many groups used the on screen keyboard to take notes (total of 71 times, used by 8 out of 10 groups).

☐ Participants mostly took notes while working individually.

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Backup5- History

- Participants frequently saved, reused and manipulated recorded items.

- Manually saved charts to the history 90 times.

- Reloaded items from the history pane 146 times.

- Reuse happened both during the analysis, when often working individually, and towards the end of the analysis session, when in a closer collaboration.

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Backup6- Findings: Note Taking
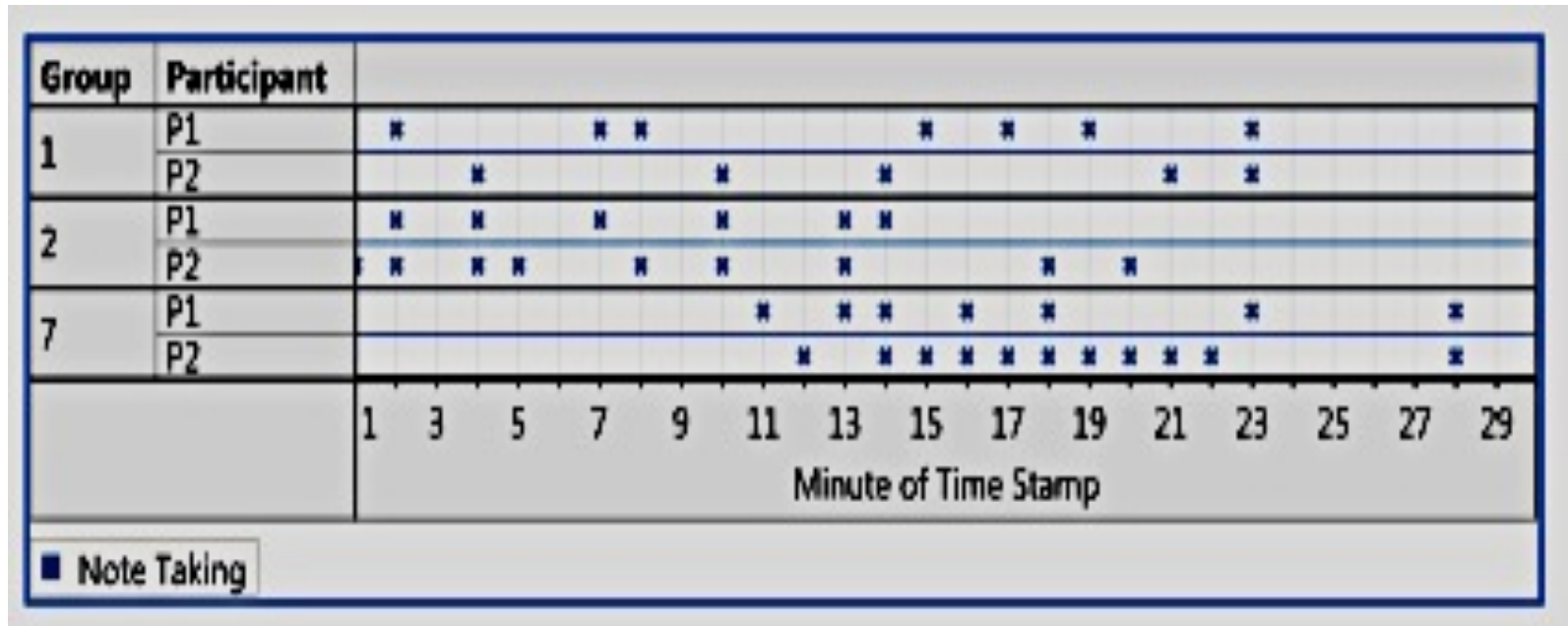
Backup7- Tools

- Example of tools (single user):
  - Tableau: record visualization states and visually browse, search, filter and reuse them.

  - Vistrails: scientific workflow, including data, visualizations, and the pipelines used to create the visualizations.

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Backup 8-Contribution

☐ Providing various views of recorded material.

☐ Showing manually saved rather than automatically saved items by default.

☐ Enabling user to review collaborators' work unobtrusively.

☐ Automatically recommending items related to a user's analytical task.

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