

Presence & Placement

Exploring the Benefits of Multiple Shared Displays on an Intellective Sensemaking Task

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Tech**



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Meetings

Collaboration

- More companies are using project teams
(Owens 2000, van Tuijil et al 2006)
- Knowledge workers spend up to half their workday away from their individual desks
(Rogelberg et al 2006)



Knowledge workers are spending more time in meetings + More information is being generated and accessed = ?



Owens 200
Van Tuijil et al 2006

Lyman et al 2003
IDT 2008

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Multiple Shared Displays

Related HCI Research on Meeting Spaces

- Developing interaction techniques
 - Interactive Workspaces [Johanson et al 2002]
- Improving tech infrastructure
 - obje Display Mirror [Newman et al 2006]
 - IMPROMPTU [Biehl et al 2008]
 - DICE [Golovchinsky et al 2009]



Related HCI Research on Large Displays

- Display placement
 - Proximity to displays [Hawkey et al 2005]
 - Positioning of displays [Su and Bailey 2005]
- Longitudinal studies [Huang et al 2006]
 - Four factors influencing adoption: form factor, public audience, outside personal workspace, and group-owned



Research Questions

Can a second shared display result in an improvement in the meeting experience, or is it distracting?

How do we evaluate aspects of collaboration with respect to shared displays?

Controlled Study Design

- Teams of 6 individuals
- Most studies use groups of five or fewer participants [Fjermestad and Hiltz 1997]
- Yet assistive technologies benefit larger group sizes [e.g. Valacich et al 1992]
- 105 participants
- Assigned to one of three conditions

Display Conditions

Single

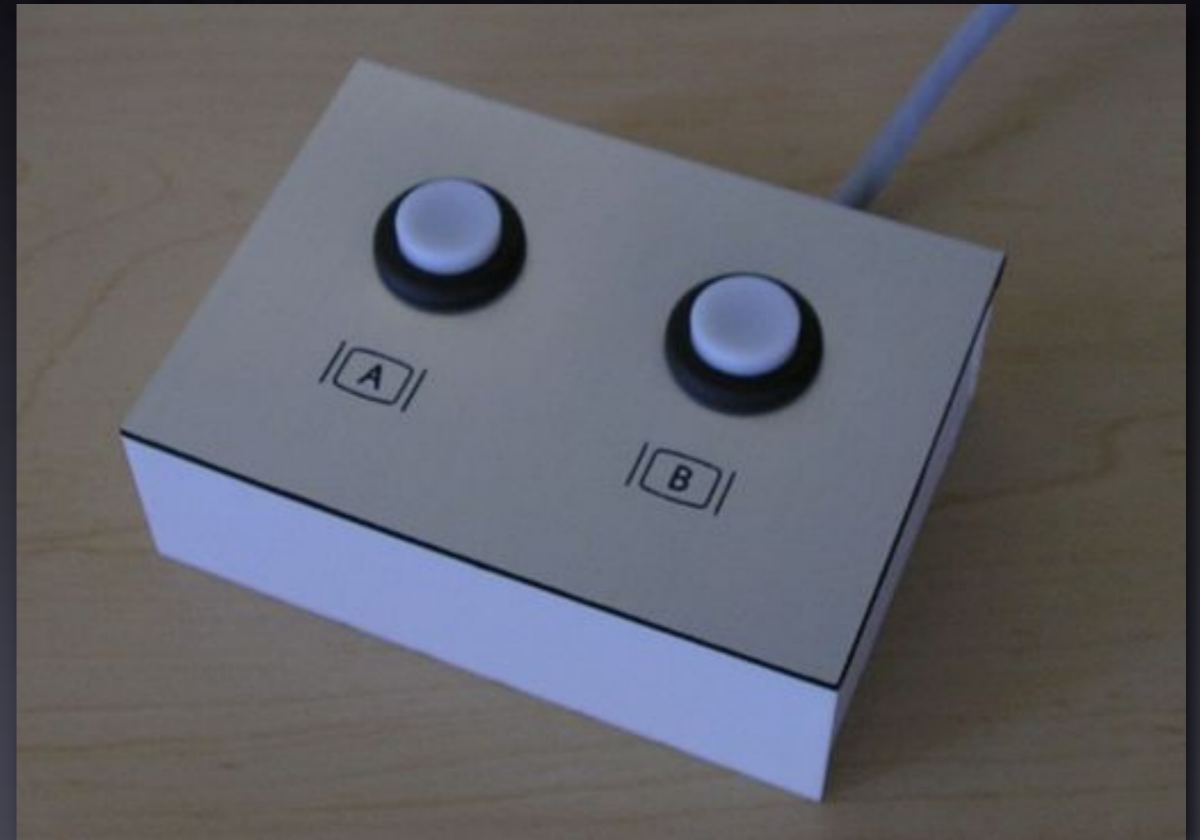
Side-by-Side

Opposing



Shared Display Interface

- Physical buttons controlling a programmable video matrix switch
- Visible status
- Simplify the routine act of showing information



Controlled Study Task

- Bonanza Business Forms Case (Jarvenpaa & Dickson 1988)
 - Profits are down, sales are up
 - Charts, information, and graphs
- Each participant had unique information
- Share information to reach a group consensus
- Non-trivial to solve
- Intellective sensemaking task

Sales Markets

Customer Base

- In recent years, Bonanza has attempted to diversify its customer base.
- Expansion into the small business market.
 - Rapid growth in this segment due to proliferation of desktop and laptop computers.
 - Bonanza success in this area is mainly due to its unique product, laser-cut forms for easy tearing.

4



Data Collection

- Combination of surveys, interviews, and transcribing video
- Video analysis (1-second sampling)
 - Identifying what, when, and where information was displayed
 - Identifying when someone wrote on the board
 - Identifying who spoke when
 - Identifying when and who pointed to a display

Evaluation Metrics

Can a second shared display result in an improvement in the meeting experience, or is it distracting?

Satisfaction

Surveys
Interviews

Collaboration

Surveys
Interviews
Gesture Rate
Whiteboard

Performance

Satisfaction Results

- Participants in the side-by-side condition self-ranked their satisfaction with the meeting process significantly higher than those in the single or opposing display configurations

$F(2, 103) = 3.610, p = .031$

- Participants in the opposing display found utility in having multiple displays
- Individuals in different conditions wanted different improvements

Collaboration Results

- Participants in the side-by-side condition ranked how their groups collaborated significantly higher than those in the single display $F(2, 103) = 3.733, p = .027$
- Participants in the side-by-side display configuration liked the ability to directly comparing information

Collaboration: Whiteboard



Groups using Whiteboard:

Single	4
Side-by-Side	1
Opposing	2

Collaboration: Deictic Gesture

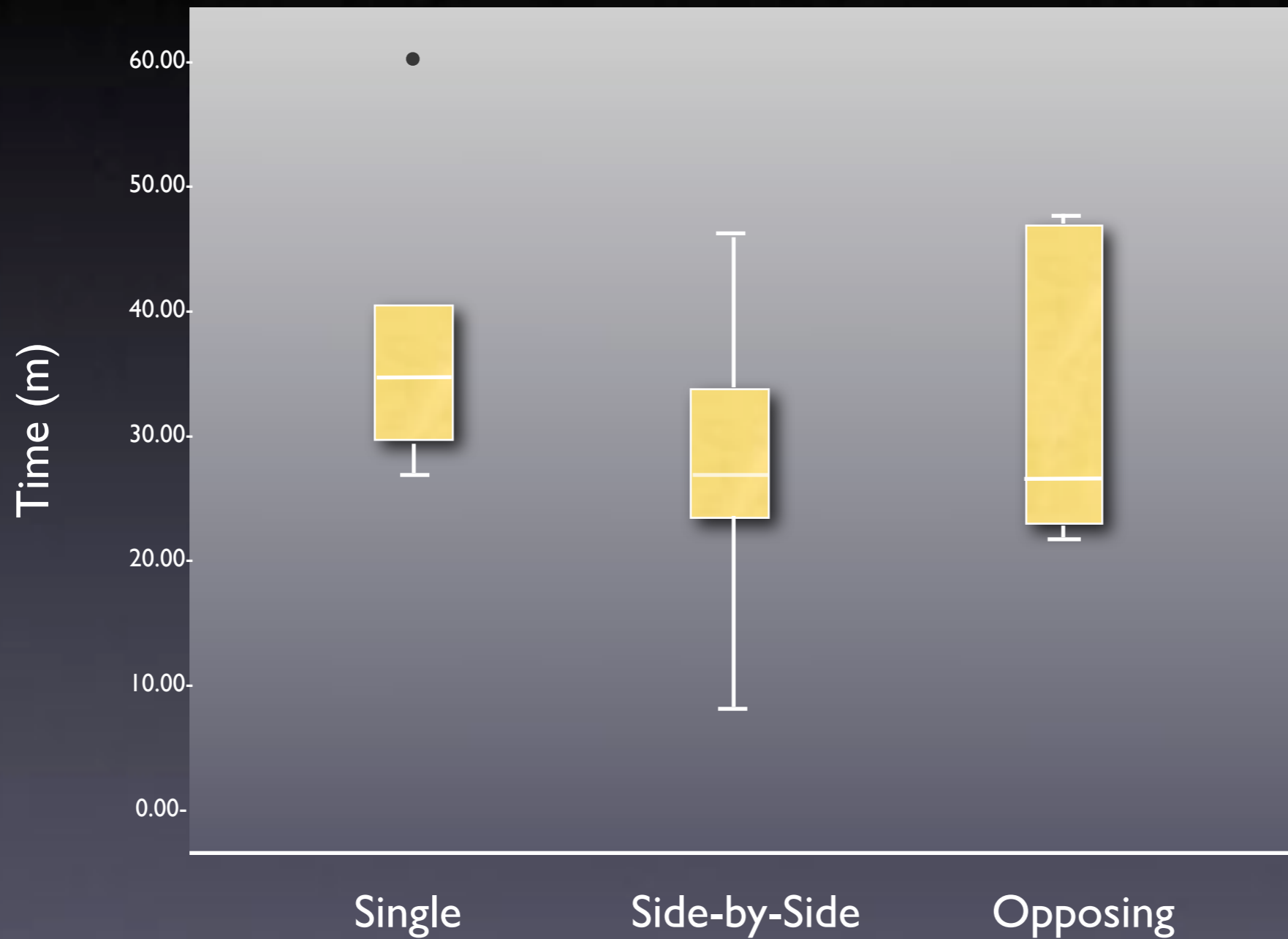


	Single	Side-by-Side	Opposing
Gestures per min	0.3	1.1	1.7
Average Duration (s)	2.8	2.2	2.7

Performance: Insight-Based Evaluation

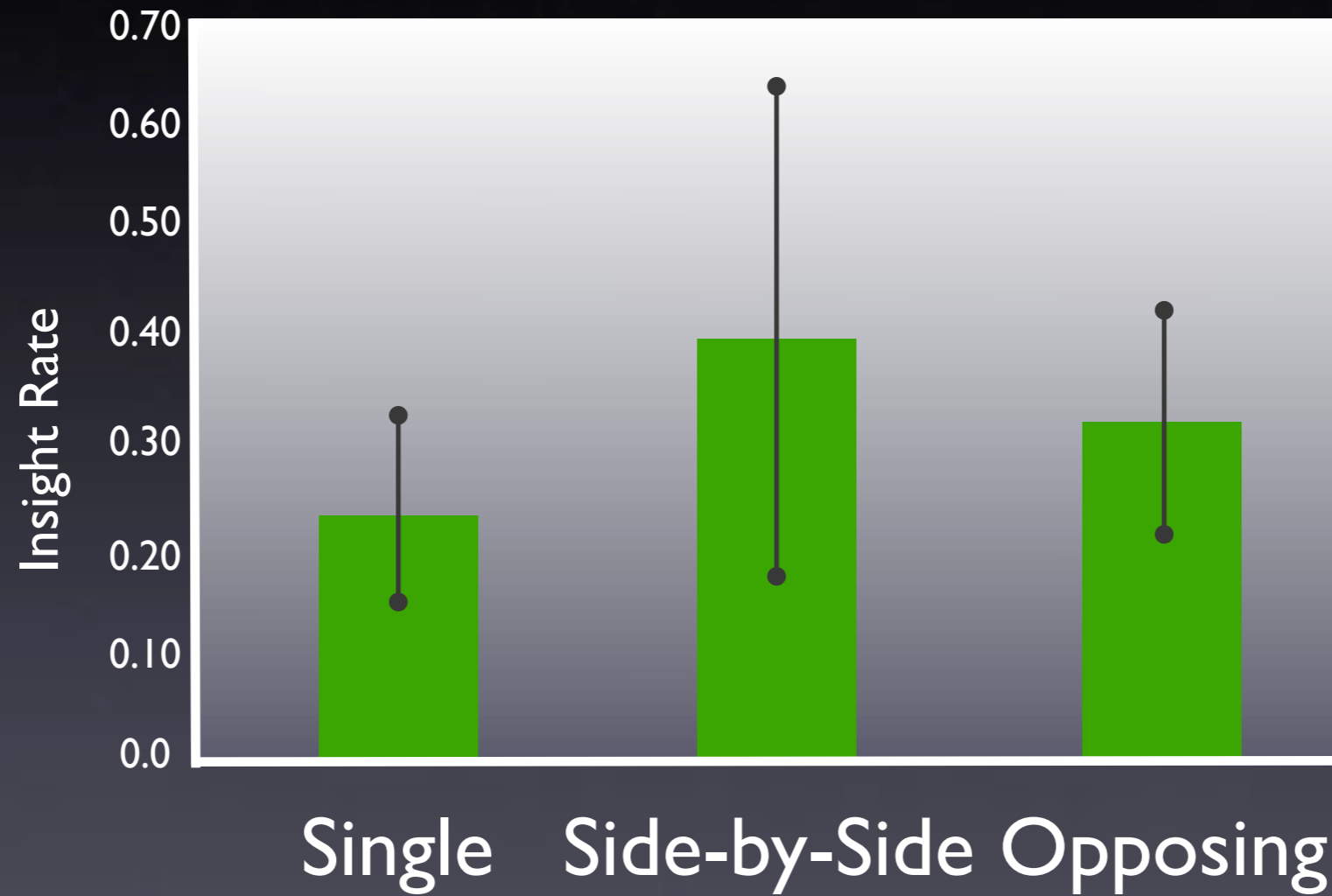
- Users perform a sensemaking task (Bonanza)
- Insight
Direct observation of data that is relevant to solving the dilemma posed in the Bonanza task
[based upon Saraiya et al 2005]
- Inferential Link
Correct inferences drawn between two insights
- Used domain experts to establish insight metrics

Time to Completion



Insight Rate

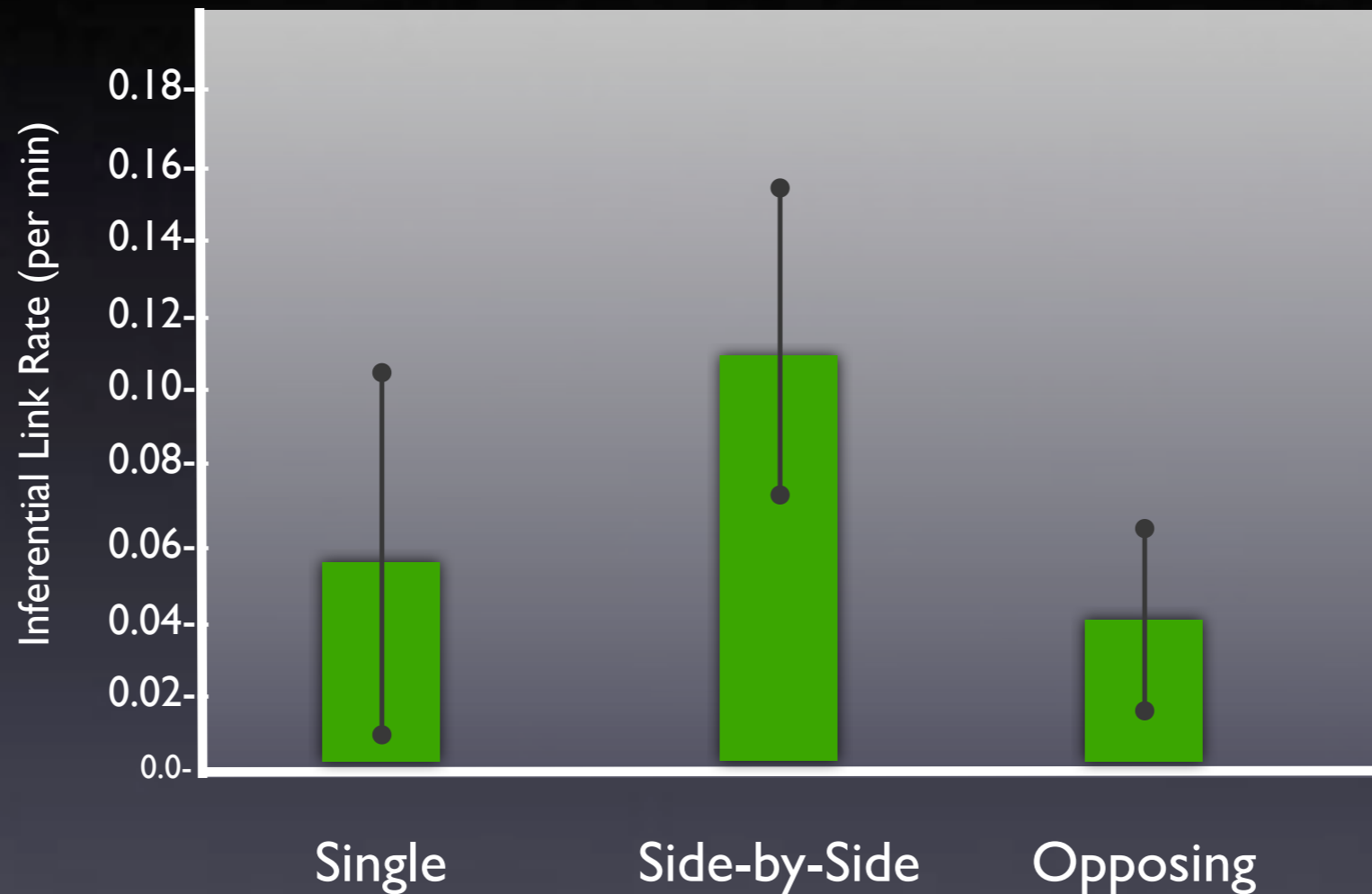
Insights
per min



Insight:

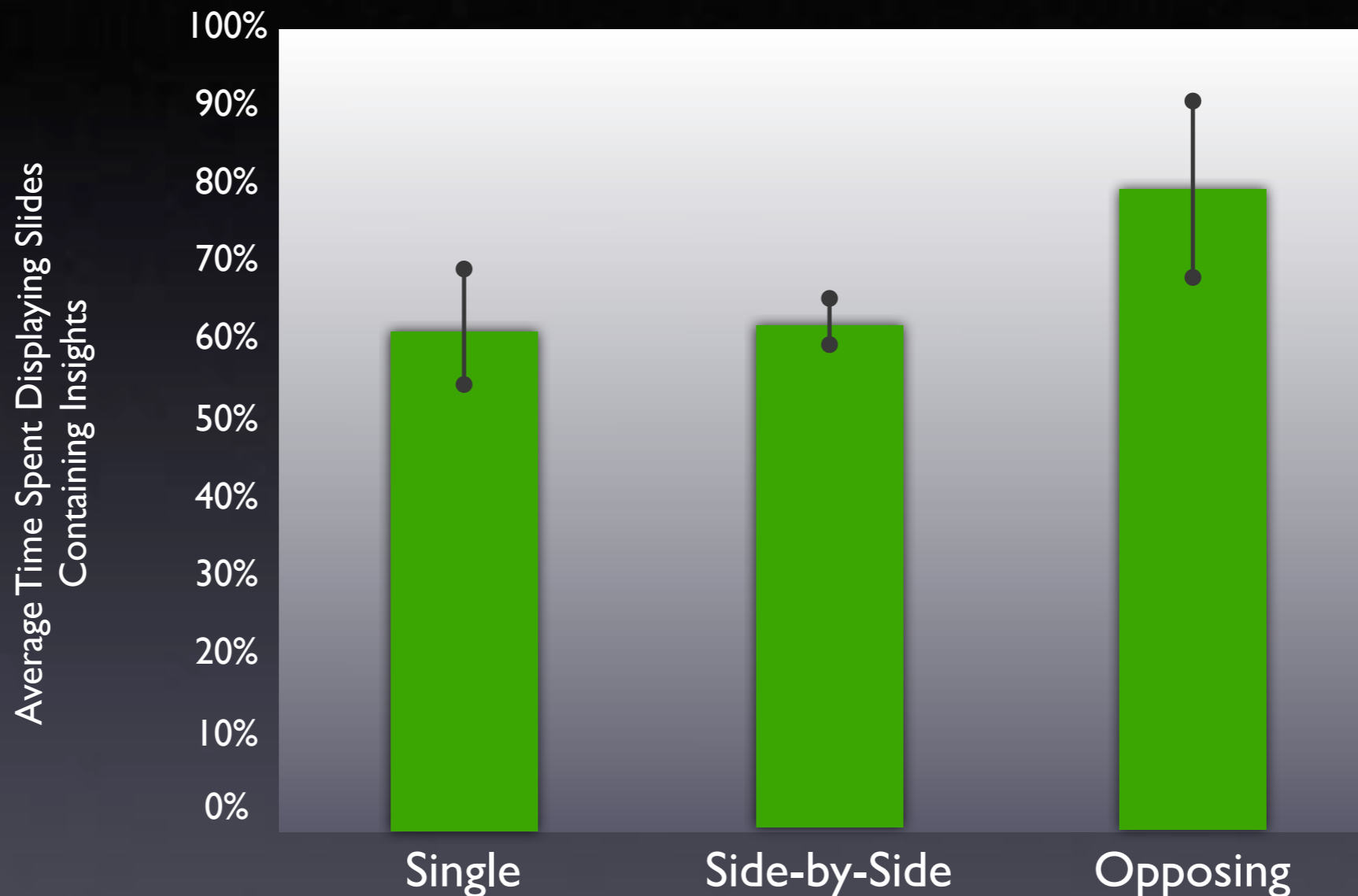
Direct observation of data relevant to solving primary task

Inferential Link Rate



- Significant difference in inferential link rate between side-by-side and opposing dual displays
 $F(2,17) = 4.773, p = 0.025$

Time Projecting Insights



- Groups under opposing dual displays spent significantly more time displaying slides on the shared displays containing insights $F(2,17)=8.099, p = .004$).

Resultant Themes

- Using multiple shared displays for exploration



“See the percentage of sales calls to healthcare is really high. Show me everything you have regarding healthcare.”

Resultant Themes

Using multiple shared displays to engage other participants

“That one kid in the group liked to talk and talk. When I had something I thought the group should see, it was easier to push the button up than to try and break in the conversation.”

“I think the girl who was the sales consultant spoke like twice the entire experiment. If she hadn't had put her slides on the other projector, I wouldn't have seen the health care problem in my slides”

Contributions

- Empirical research illustrating the presence and location of multiple shared displays influenced aspects of teams collaborating on a sensemaking task
- Method to engage shy participants
- Insight-based evaluation offers a useful way to evaluate team collaboration

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The background image shows the exterior of the Technology Square Research Building at Georgia Institute of Technology. The building is a multi-story structure with a prominent brick facade and large glass windows. A covered walkway with a white ceiling extends along the side of the building. In the foreground, there is a sign for the building and some greenery. The text is overlaid on the right side of the image.

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For Hire!

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