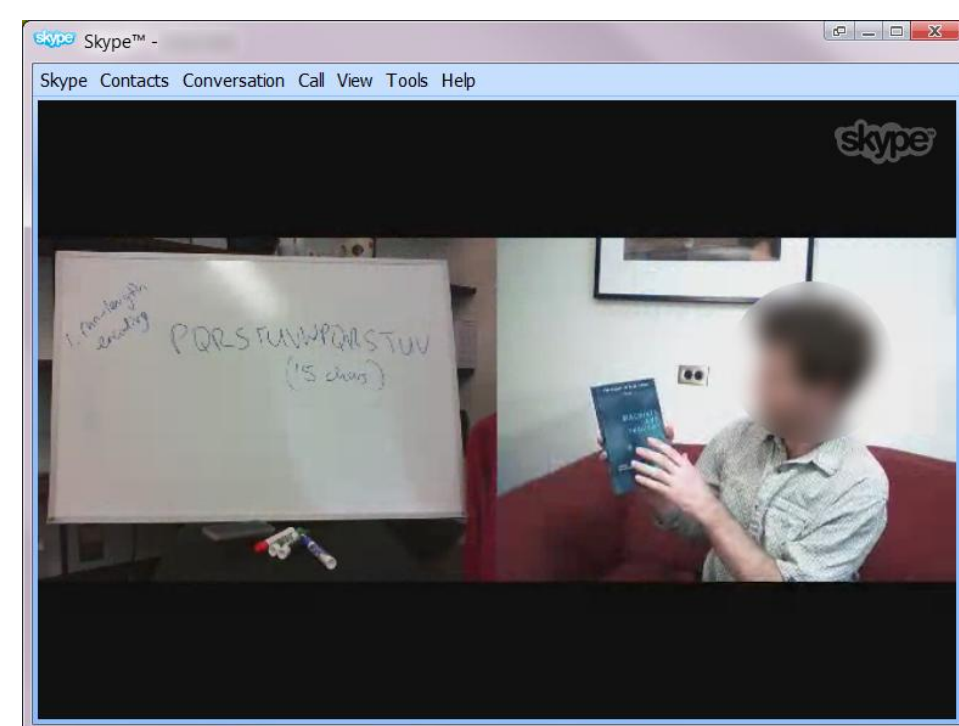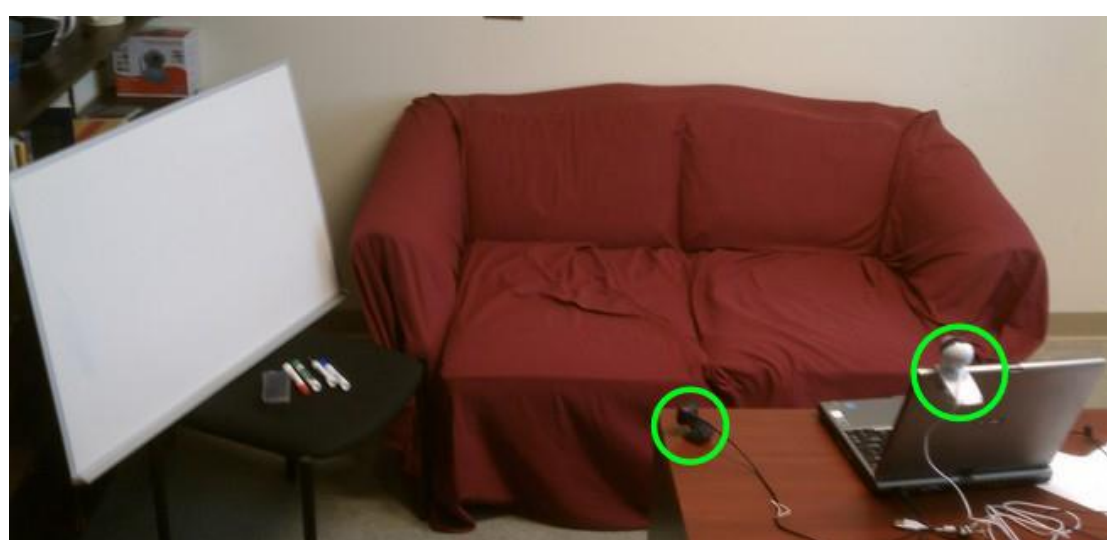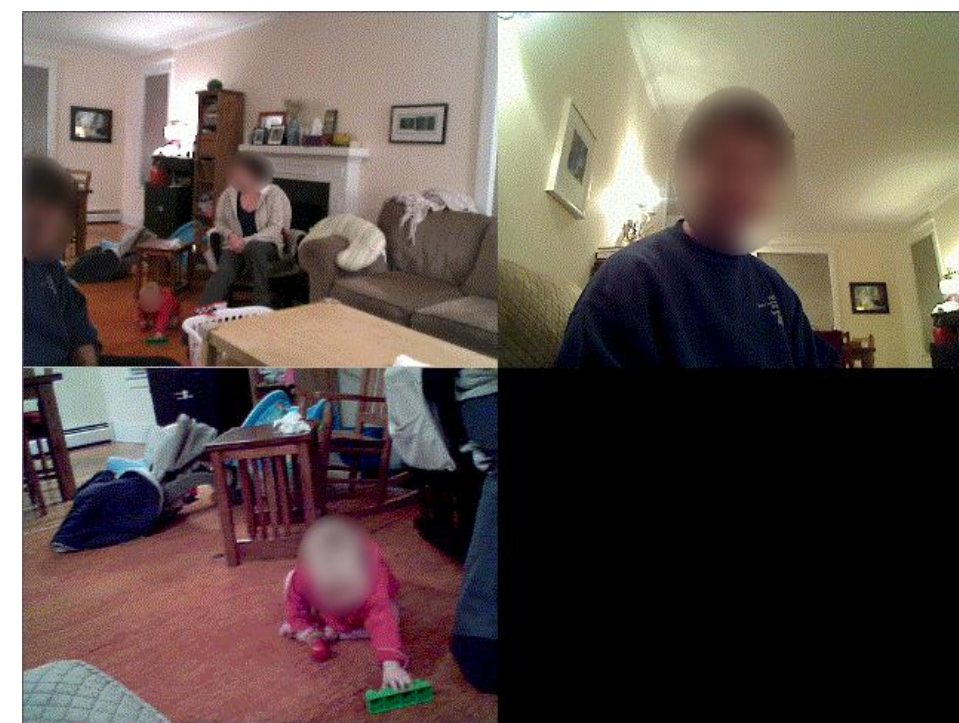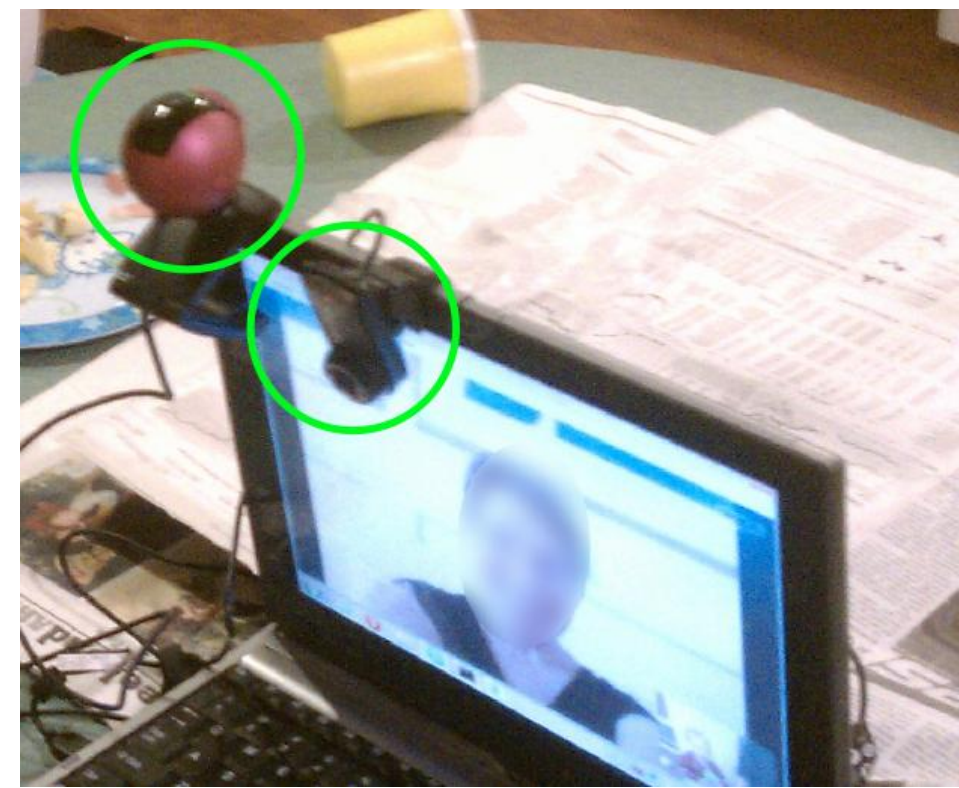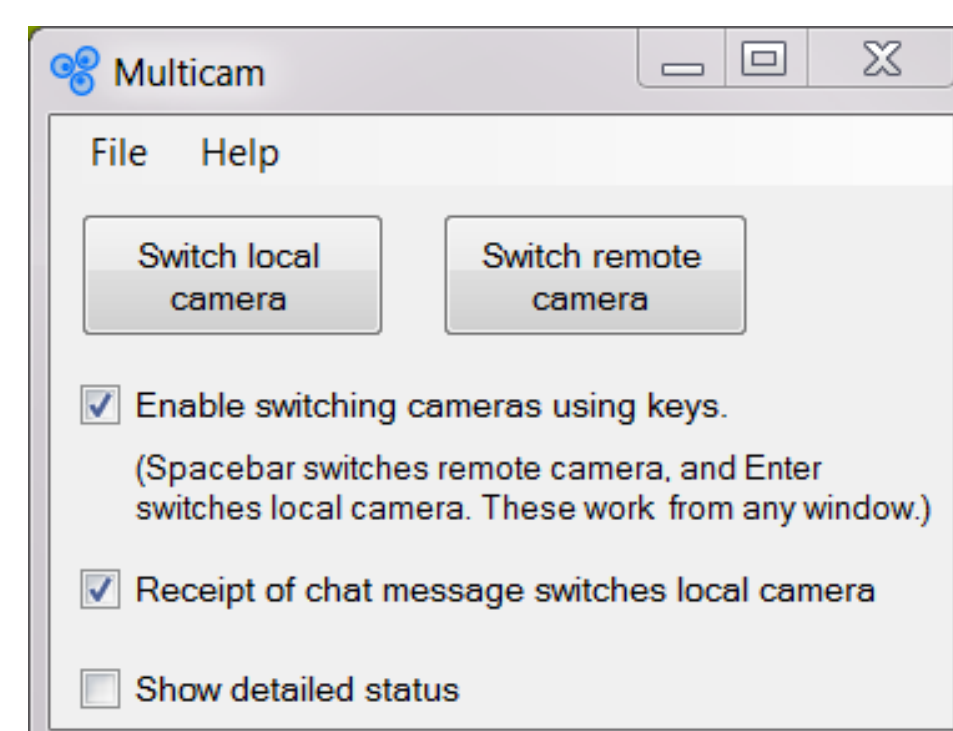# Video Chat with Multiple Cameras

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1. Main tool for this investigation: *MultiCam*, a new video chat plugin

- MultiCam permits use of two or more webcams simultaneously for video chat in existing chat software (e.g. Skype)
- Typical usage scenarios:

- Important novel feature: participant at one end can *switch views at both ends* of conversation (between tiled views above and full screen view of any individual camera):

2. Research questions

1. Is *multiple-camera video chat* useful and/or desirable?
   - Answer: Yes, for certain scenarios
2. Is *remote control* of the viewpoint useful and/or desirable?
   - Answer: In many cases, no. But a minority of users prefer remote control in at least some scenarios.
3. Is multiple-camera video chat feasible on commodity hardware, using existing consumer chat software (e.g. Skype)?
   - Answer: Yes, but with some caveats

3. What is the novel contribution?

The three research questions above are novel in the context of consumer video chat.

- Multiple cameras are common in virtual reality and commercial videoconferencing systems, but this is the first rigorous analysis of the utility of multiple cameras for consumer video chat

4. Results:

Summary of experience with MultiCam:

- First four figures in panel 1 show the most useful configurations for common consumer chat scenarios (i.e. chatting with friends and family)
- Remote participants rarely use the novel "switch camera" feature, but local camera-switching occurs frequently
- Substantial positive feedback, and promising download rate (hundreds per month), suggest that use of multiple cameras enhances enjoyment of video chat

4b. Results (continued from previous column)

- Formal user study analyzed utility of the novel remote camera-switching feature
  - 23 participants in three continents, ages 20-70 (median 40)
  - Employed the whiteboard lecture scenario with a "speaker" and a "listener" (panel 1, bottom 2 figures)
 - For this scenario, most listeners prefer speaker-control of the camera view:
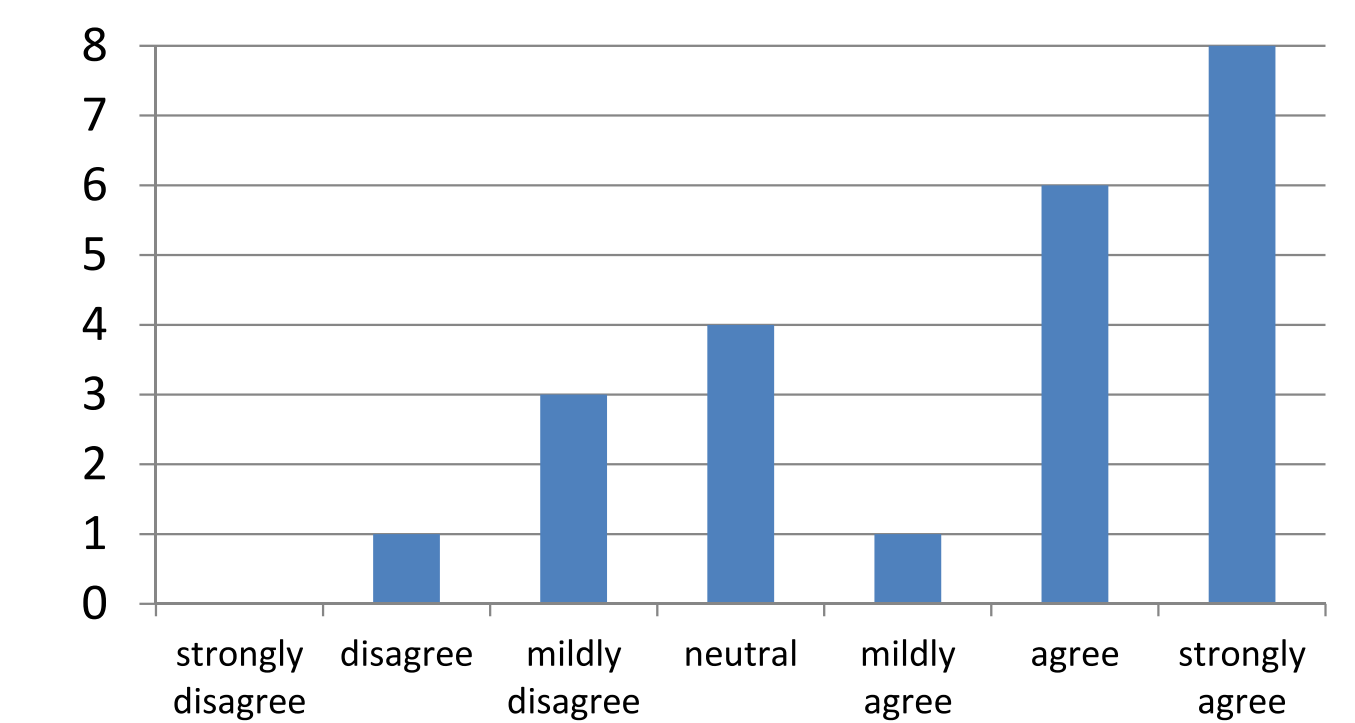
  - BUT, 18% of listeners preferred listener-control of camera view, suggesting it is a valuable optional feature
 - Theme analysis of user comments:

Advantages of speaker control of viewpoint	• listener can concentrate more easily if speaker is switching
	  — listener not distracted by thinking about switching cameras
	  — if listener switches, often loses a few seconds' concentration during the switch
	• speaker can anticipate the need for a switch and thus switches at the right time

Advantages of listener control of viewpoint	• listener has control over the experience • listener can go back to the whiteboard when desired

- Benchmarks assessed feasibility on commodity hardware
  - With up to 4 cameras, CPU usage and frame rate are generally acceptable:
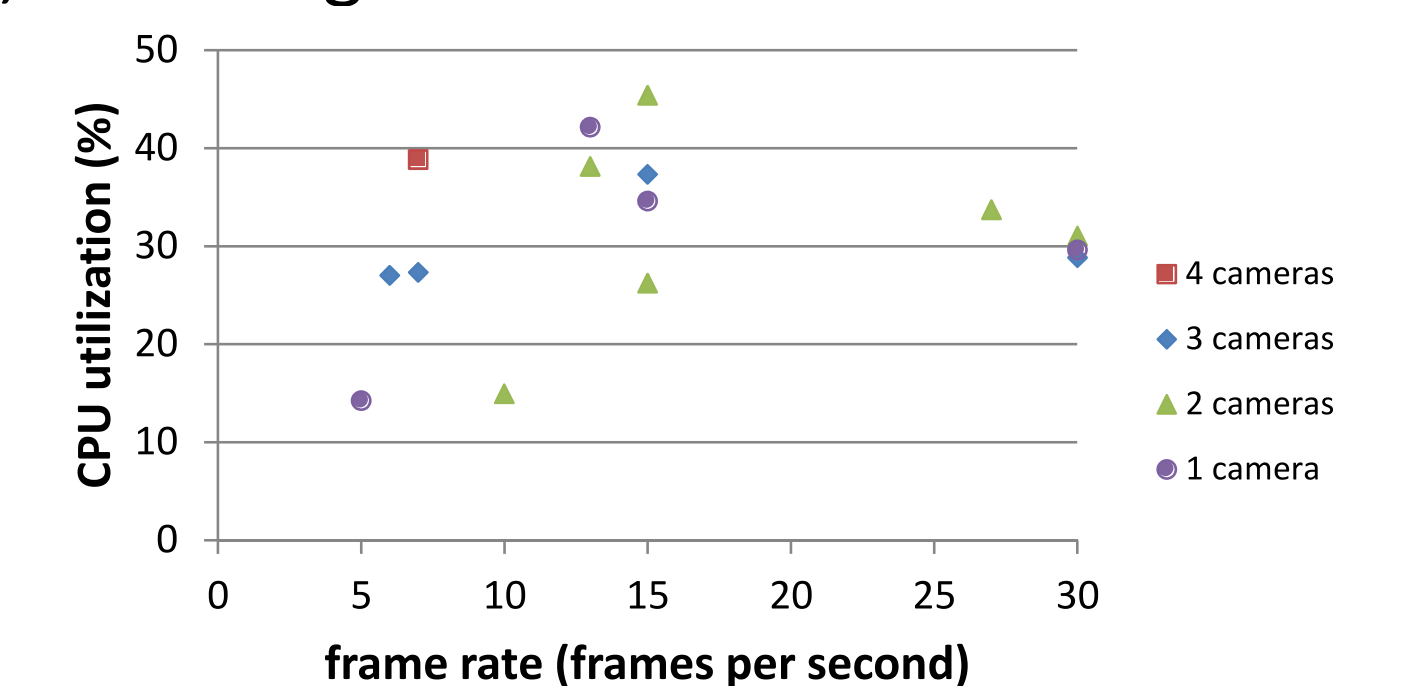
  - Using multiple cameras generally has little effect on display latency:
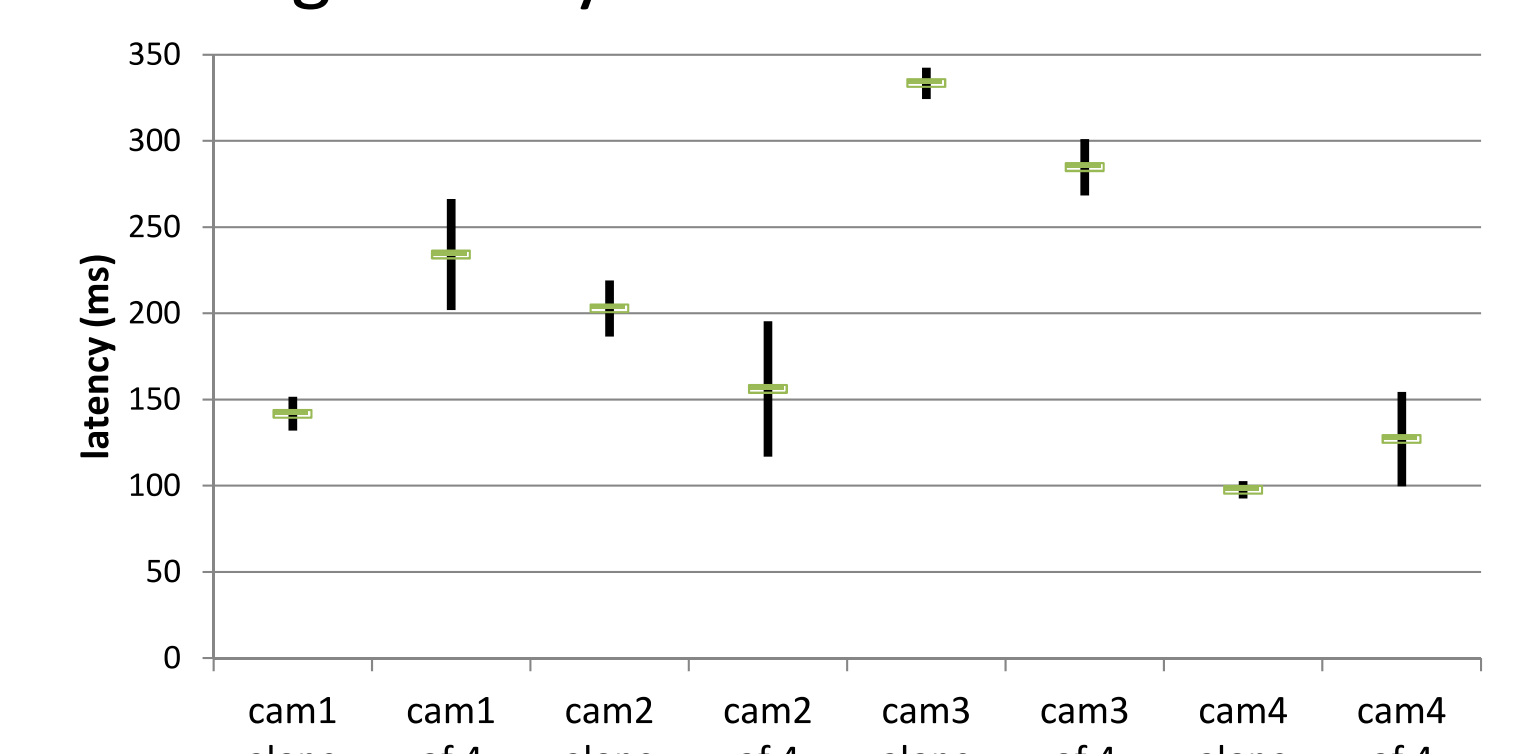
5. Conclusions: see "2. Research questions" above