

Shared Display Interaction using Mobile Devices

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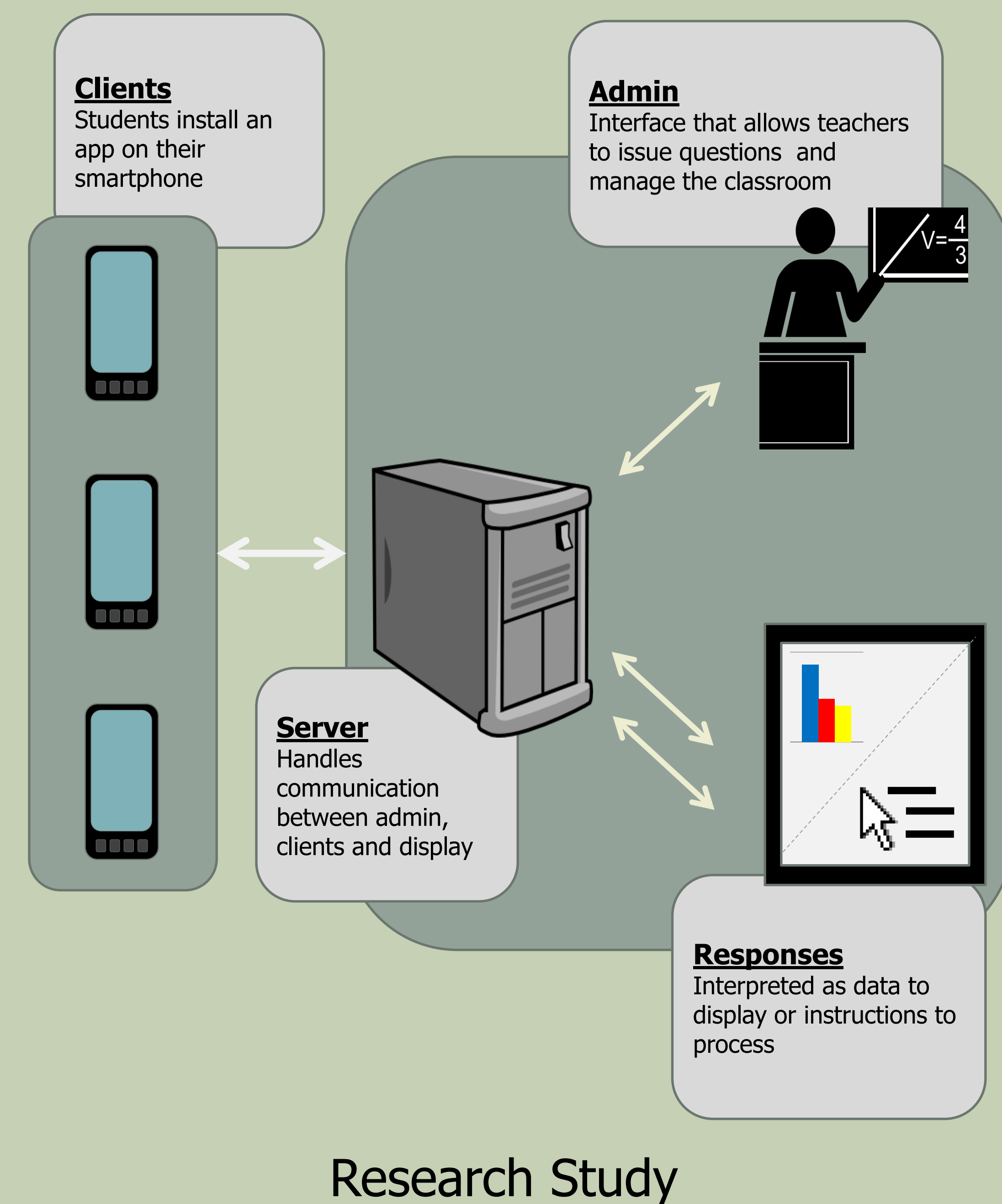
Collective Interaction Classroom System (CICS)

About:

- System that allows students using smart phones to send responses to a central display
- Similar to a Clicker system, but flexible enough to allow different interpretations of the student input.

Why it matters:

- Basic structure of the experiment was built around this flexible system to interpret multiple inputs from participants



Goal:

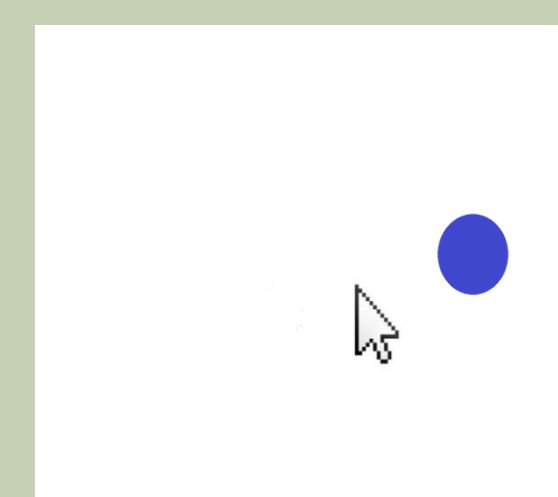
- Can a group of students effectively control a mouse pointer using a smartphone device?

Why it matters:

- If the performance of these techniques are good enough then the research can act as a foundation for further collaboration experimentation using mobile devices

Experiment:

- Participants complete a simple selection task
- 24 targets of varied size and distance
- Compare individual performance to groups of participants collectively using the mouse pointer



Definitions

Throughput

- Based on Fitts's Law which allows for comparison of input device performance for selection tasks
- $Difficulty = \log_2(Distance/Width + 1)$
- $Throughput = Difficulty / Selection\ Time$

Gain

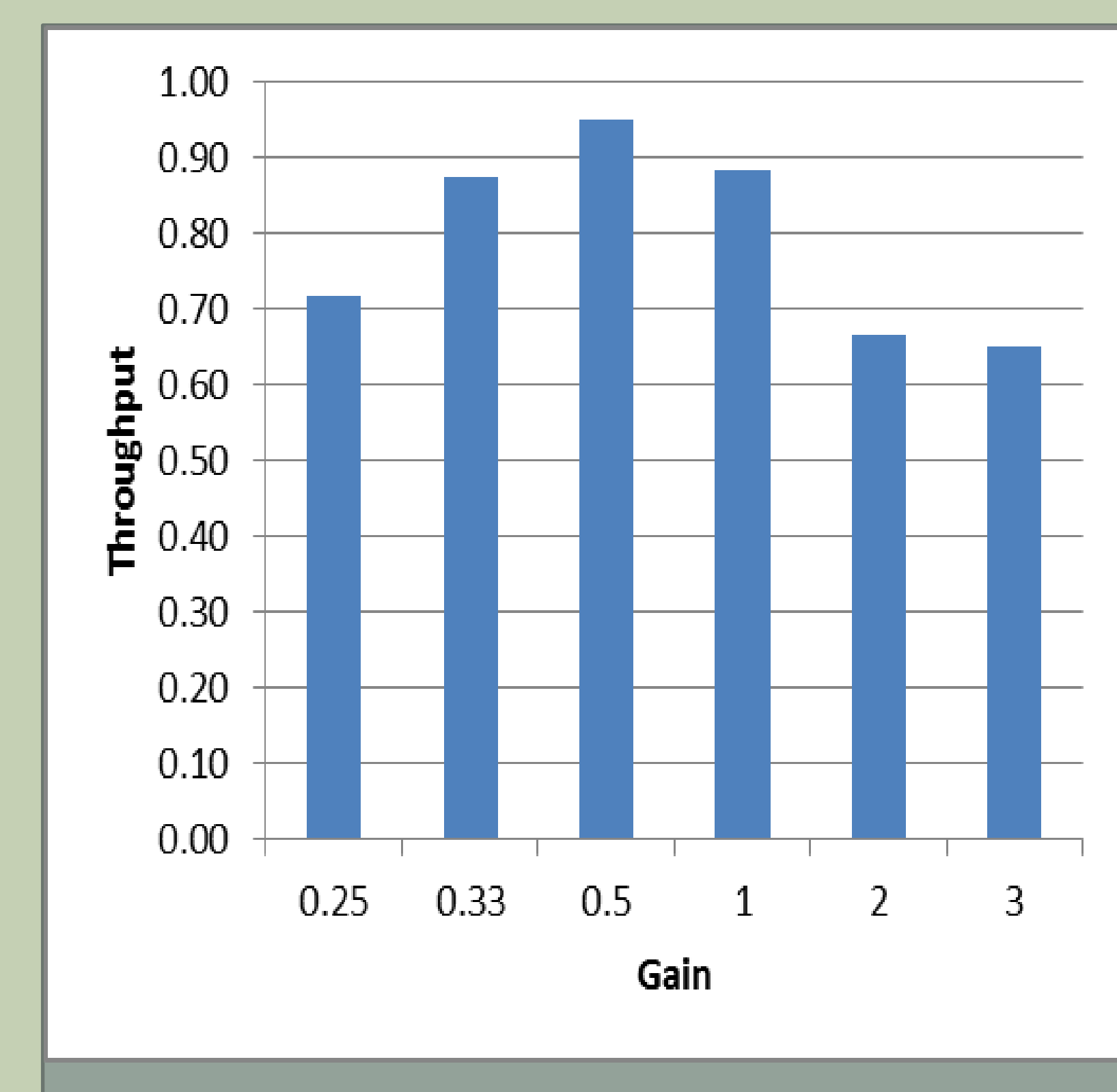
- Ratio of control input to mouse movement
- ~ Amount of influence an individual participant has on the cursor

Individual

Method:

- Acts as a baseline of performance to compare to the group experiments.
- The individual manipulated the cursor with a range of gains $\{1/4, 1/3, 1/2, 1, 2, 3\}$.

Results



Discussion

In both of the experimental techniques the Group was able to outperform the Individual with the same effective gain using certain tactics. This suggests that people are able to adapt to intuitively understand their contribution when using multiple input devices.

While the Compounded technique was able to outperform an Individual due to a distribution of participation, this strategy may not be viable with larger groups.

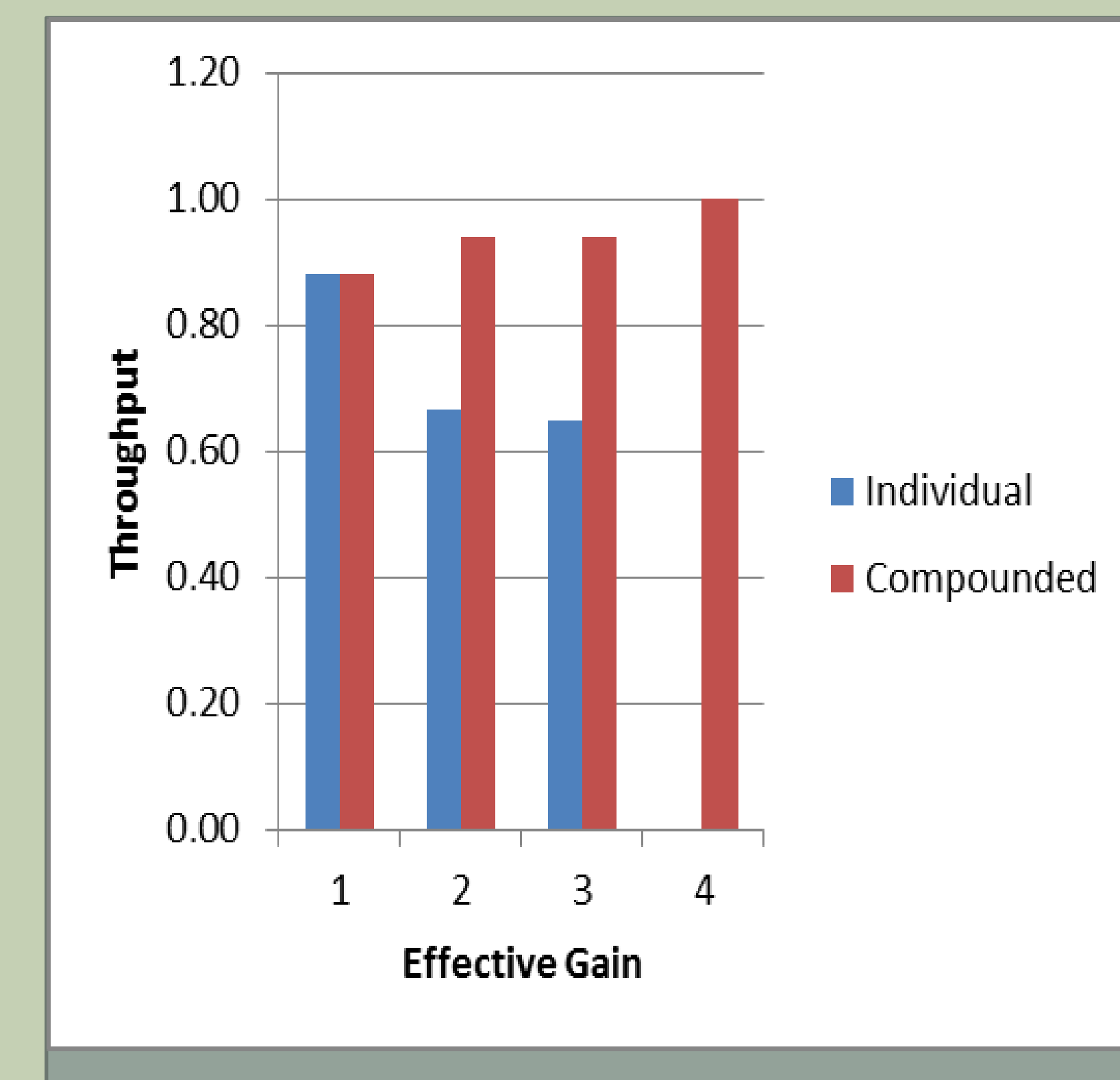
Techniques for Group Input

Compounded

Method:

- Participants worked in a group where each individual in the group has the base gain of 1.
- Simultaneous input is additive.
- Groups of $\{2, 3, 4\}$

Results



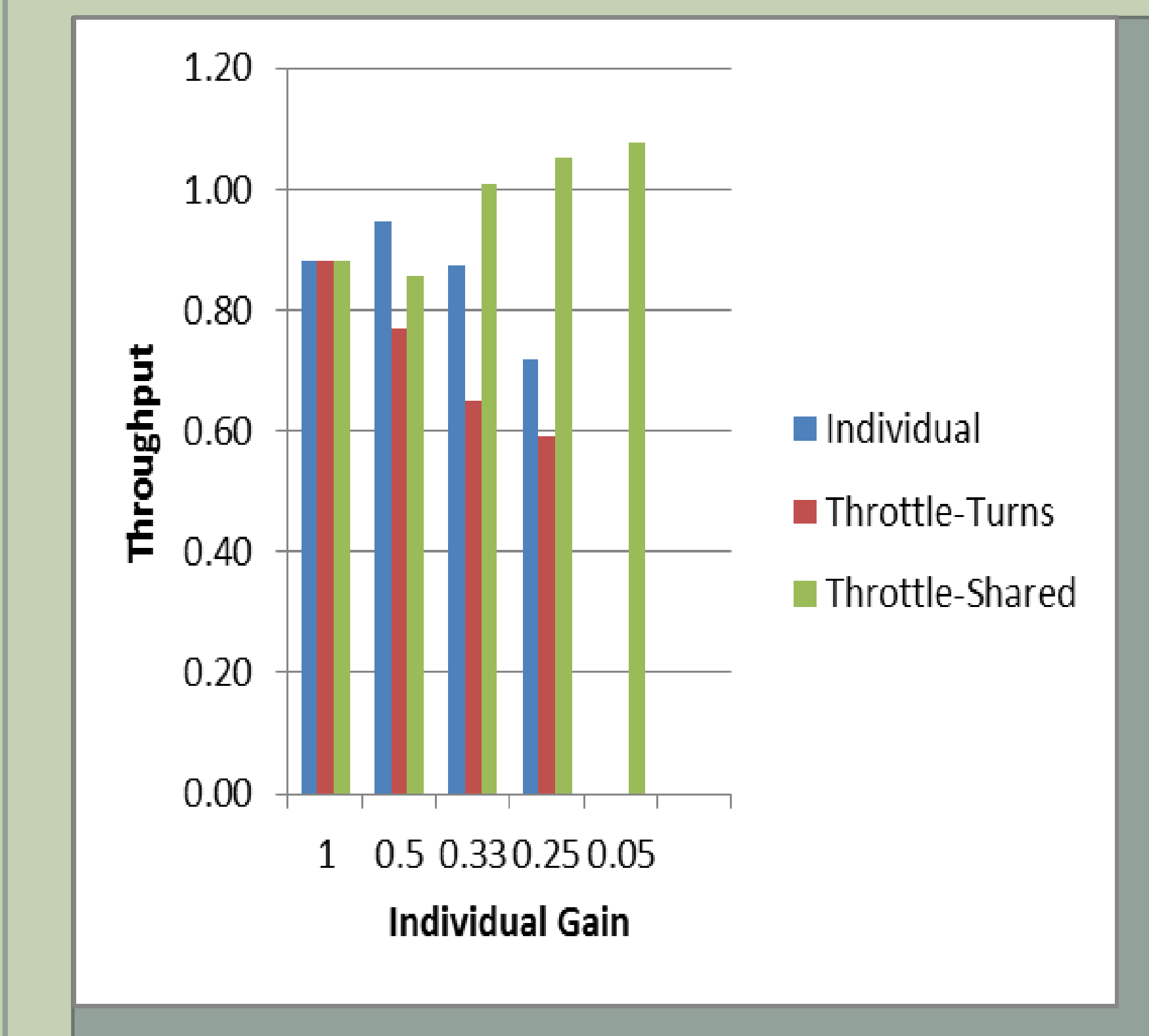
- Performance does not degrade with up to 4 users.
- Outperforms the Individual with the same effective gain.
- Evidence that the groups were self-regulating their input.

Throttled

Method:

- Participants worked in a group where the net gain for the group is 1.
- Individual influence was throttled based on number of participants (i.e. 2 participants = $1/2$ gain each)
- Groups of $\{2, 3, 4, 20\}$

Results



Turn-Taking:

- One participant controlling the cursor at a time and rotating control per target
- Did not perform as well due to a delay in determining who's turn it was

Shared Control:

- All participants would contribute until the cursor was close to the target, then one person would take control
- Performs better because a group has full movement and full precision

Impact

The research suggests that mobile devices can be successfully applied to group situations to promote collaboration.

It is expected that it will be used for classroom applications where divergent interests can be teased out and then discussed in open. In a collaborative work environment, a single individual in control would be a more productive option.