Comparison of Phone-based Distal Pointing Techniques for Point-Select Tasks

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DOWNTON ABBEY
SEASON 3
2. Episode 2 (Original UK Edition)
Downton Abbey, Season 3
TV PG
(Original UK Edition) With the future of Downton hanging precariously in the balance Violet and Mary conspire to show Downton to its best advantage and win a financial lifeline from Martha. Mrs. Hughes faces some worrying personal news and the new footman's progress rankles Thomas.
Released 1/6/13
48 minutes
PBS
1080p HD CC
(1409)
Preview
$2.99
Buy HD
Also Watched
modern family
revenge
THE OLBERT REPORT
THE SIMPSONS
SEASON TWENTY FOUR

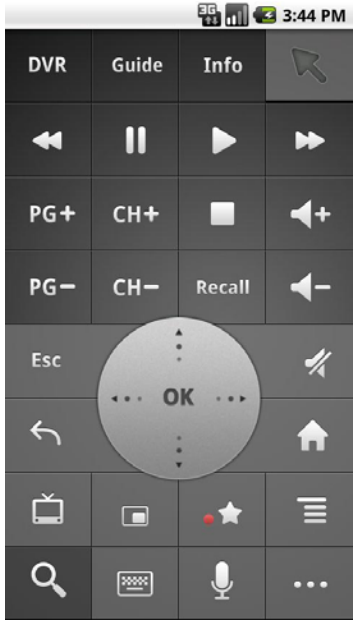

AT&T
replaytv
SONICblue
Pioneer
SONY
TV

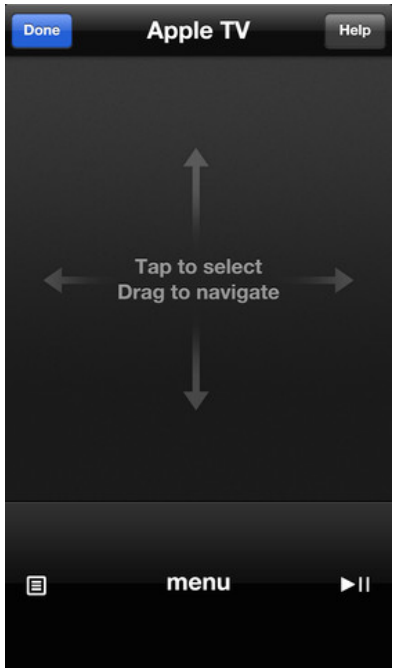
Phone

Touchscreen

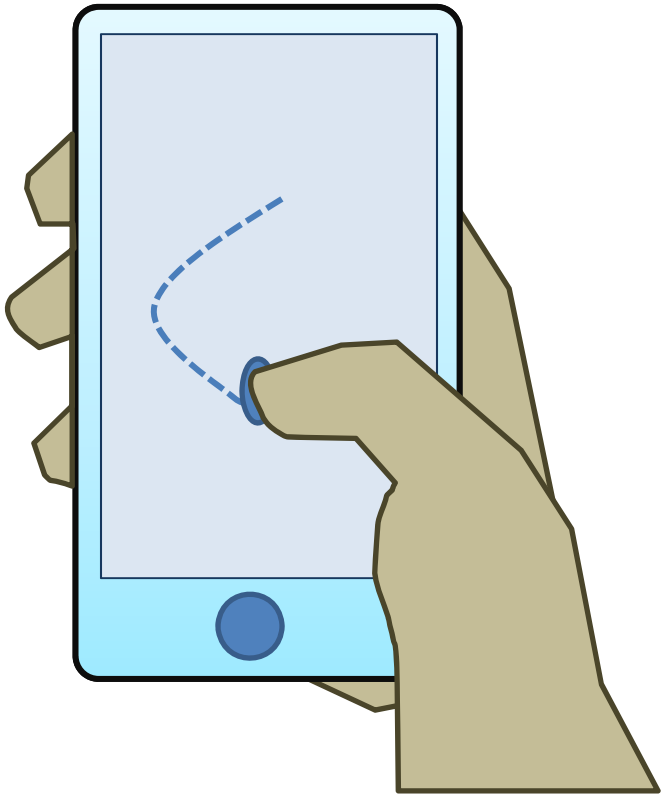
Accelerometer

Gyroscope

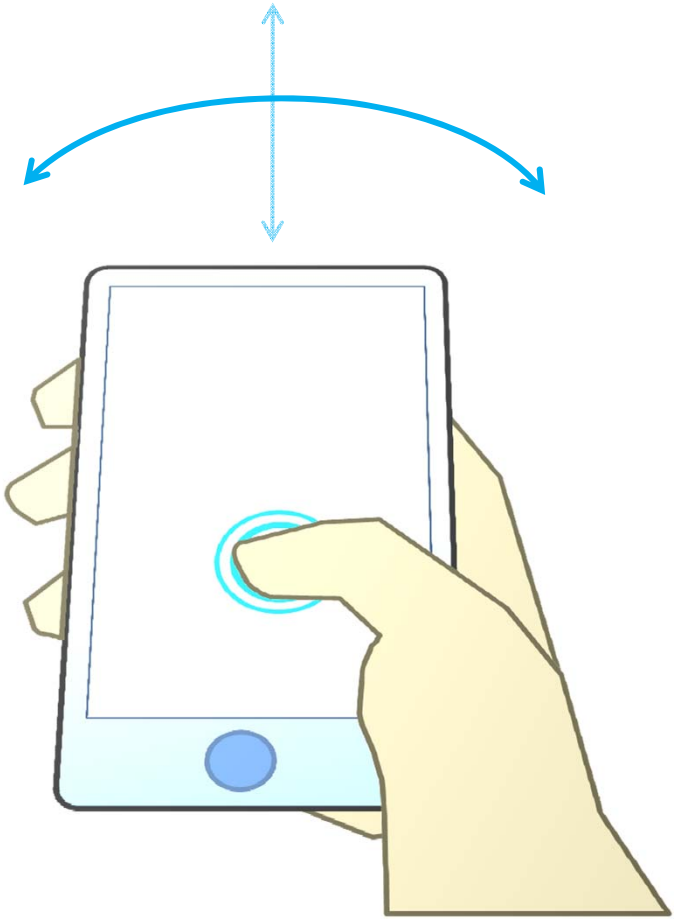




Input

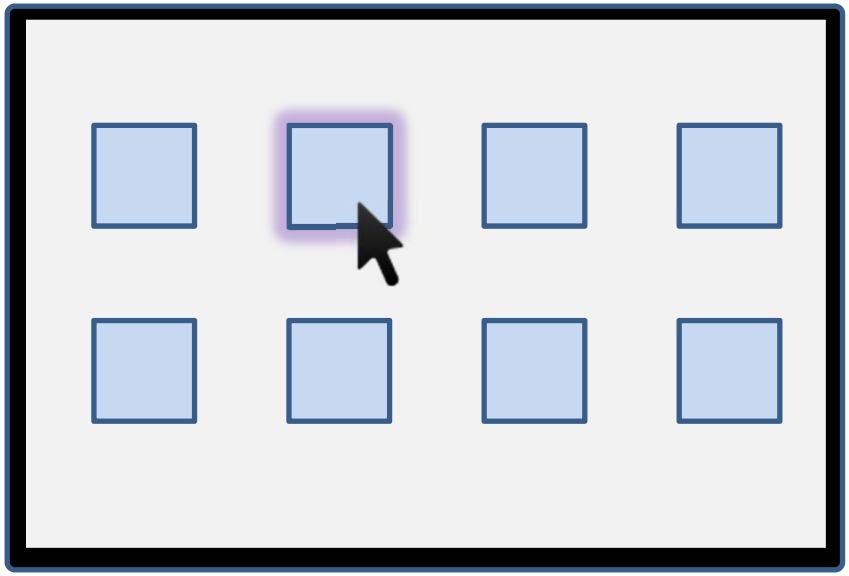


Touchpad

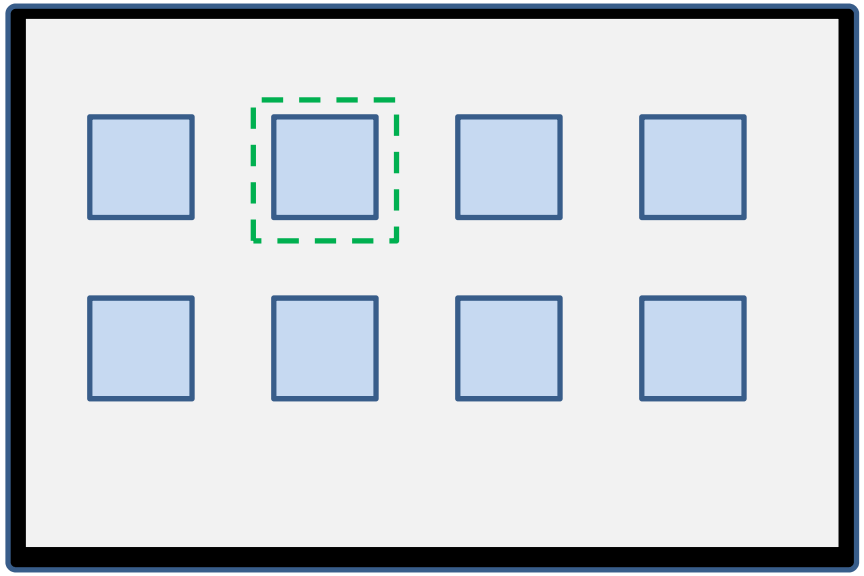


inAir

Feedback



Continuous



Discrete

Research Question

Study the relative merits of

Continuous vs Discrete feedback

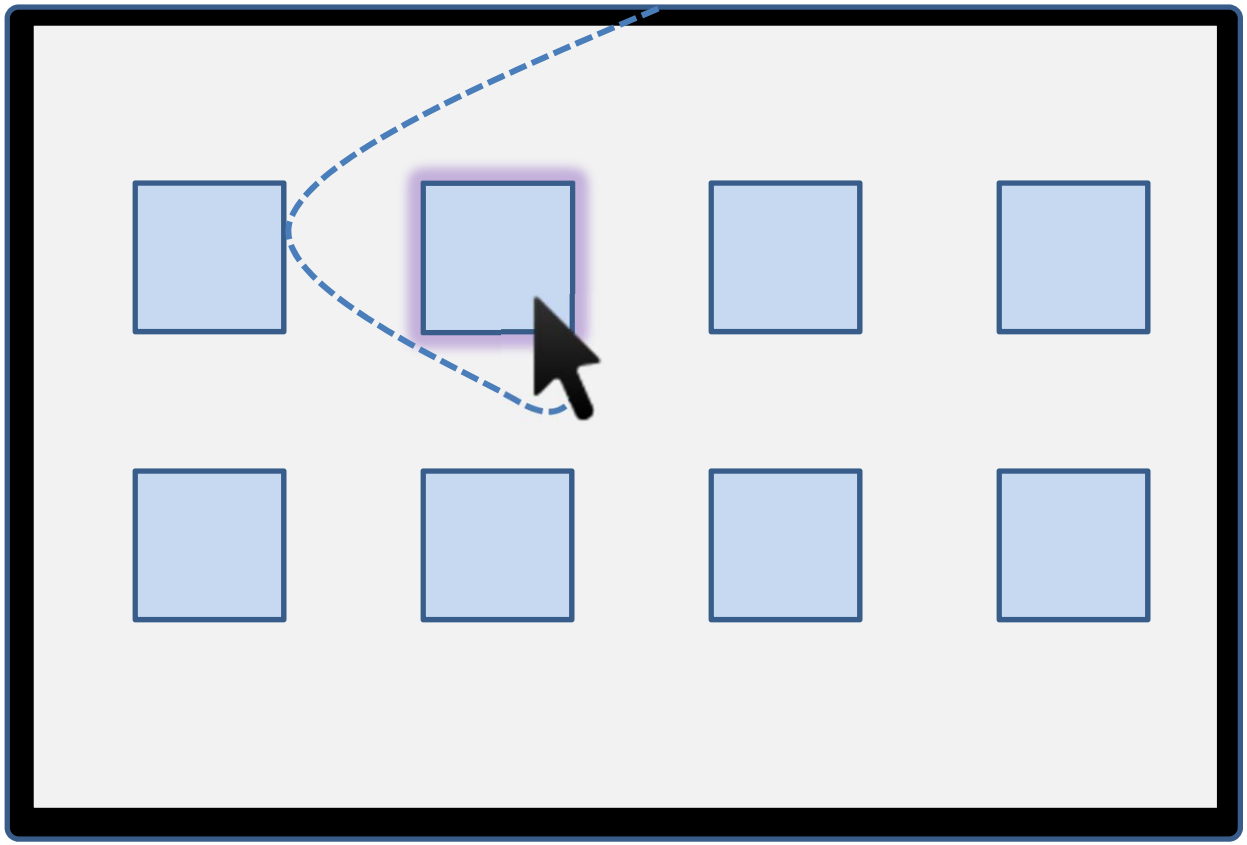
for pointing interaction,

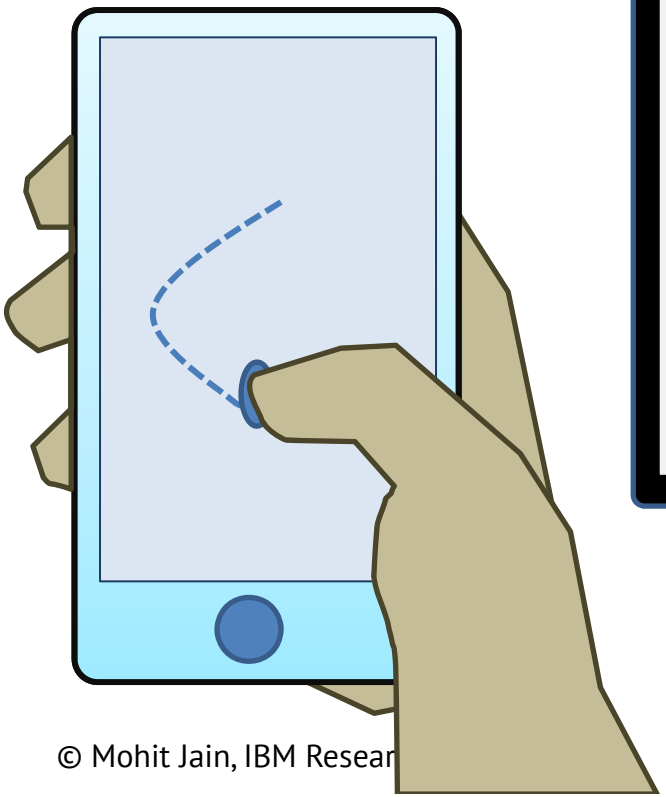
when input is provided through

Touch vs inAir movements

Continuous Touchpad (CT)

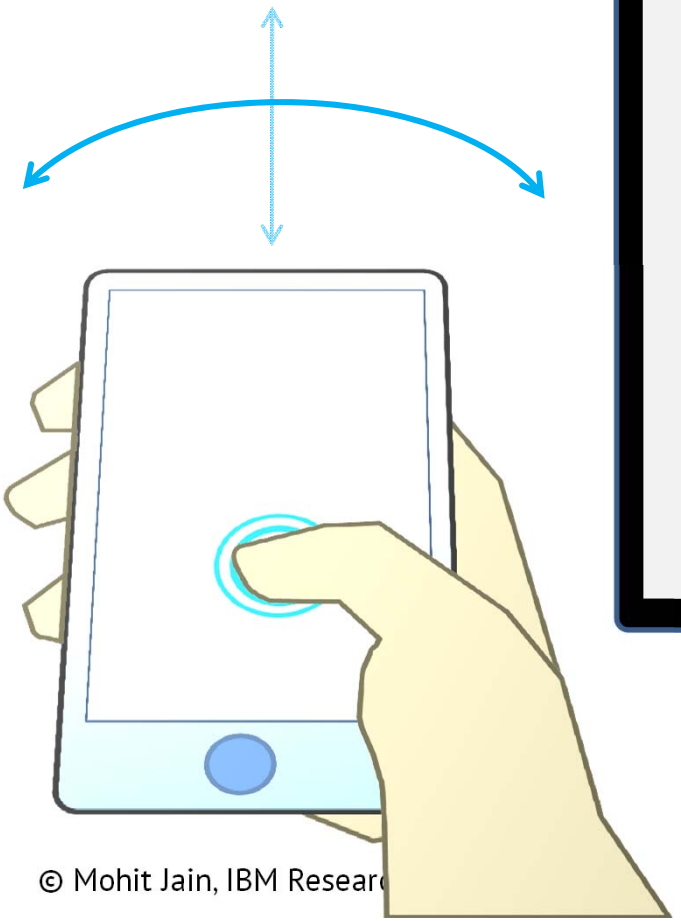
Phone's touchscreen acts as a laptop's touchpad, to move a cursor over the display

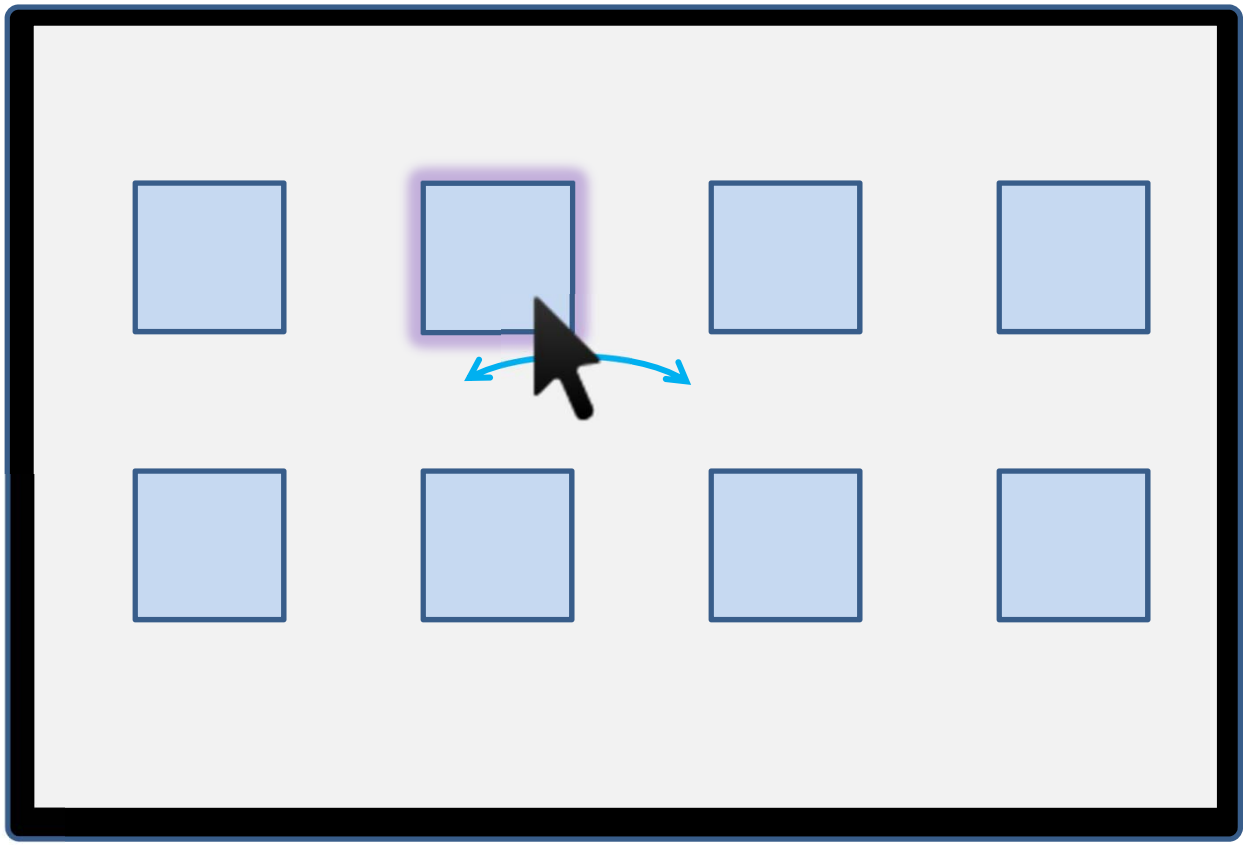




Continuous InAir (CA)

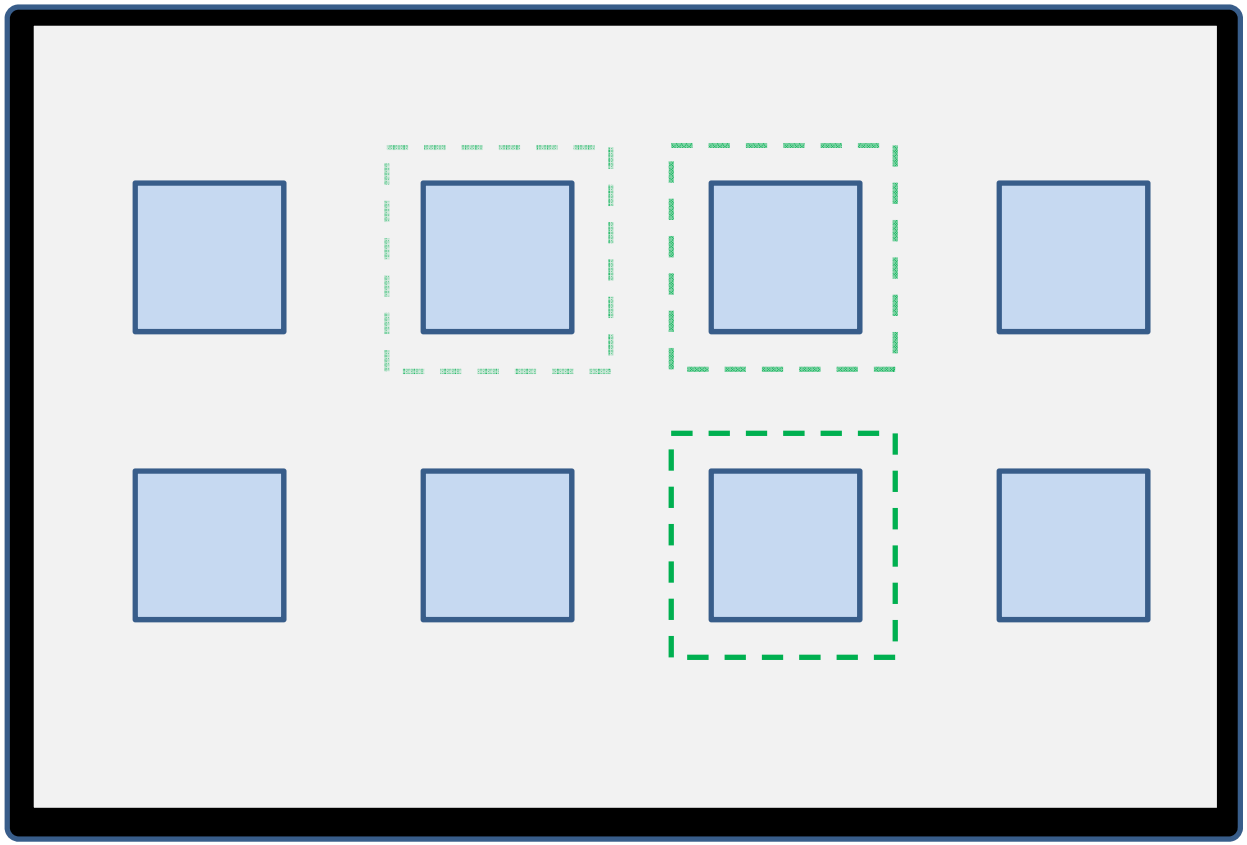
Phone acts as a laser pointer, to move a cursor over the display

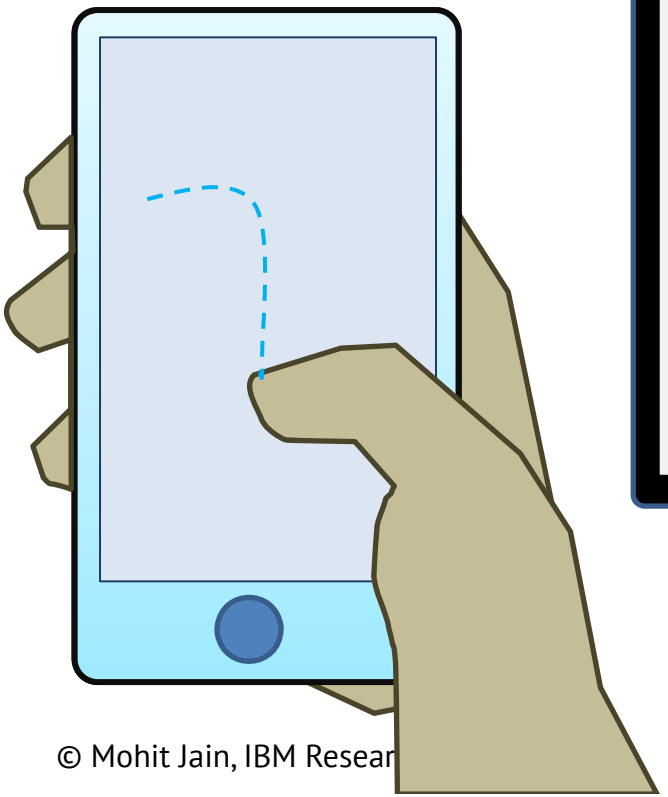




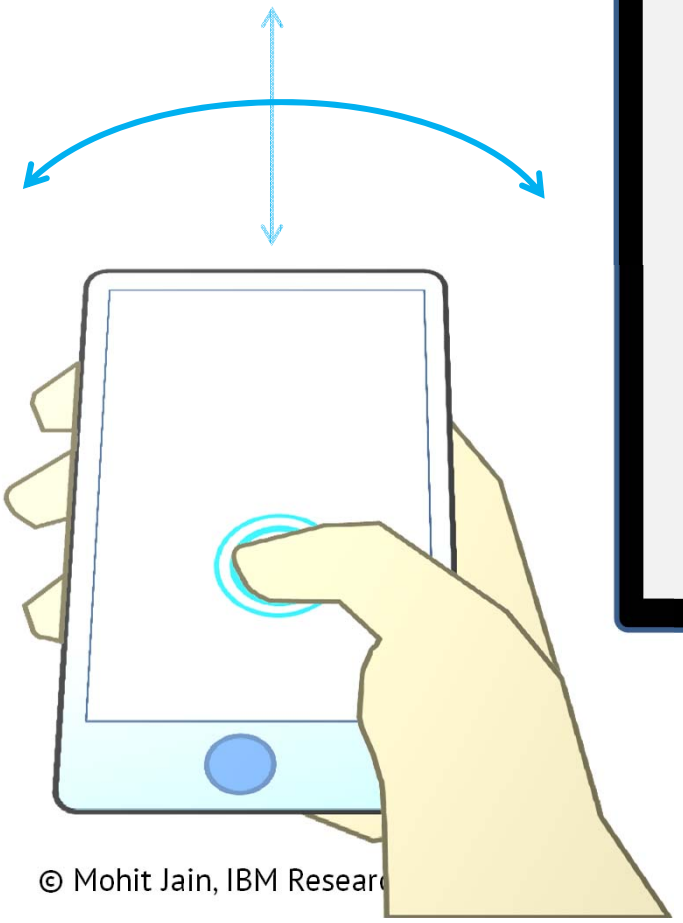
Discrete Touchpad (DT)

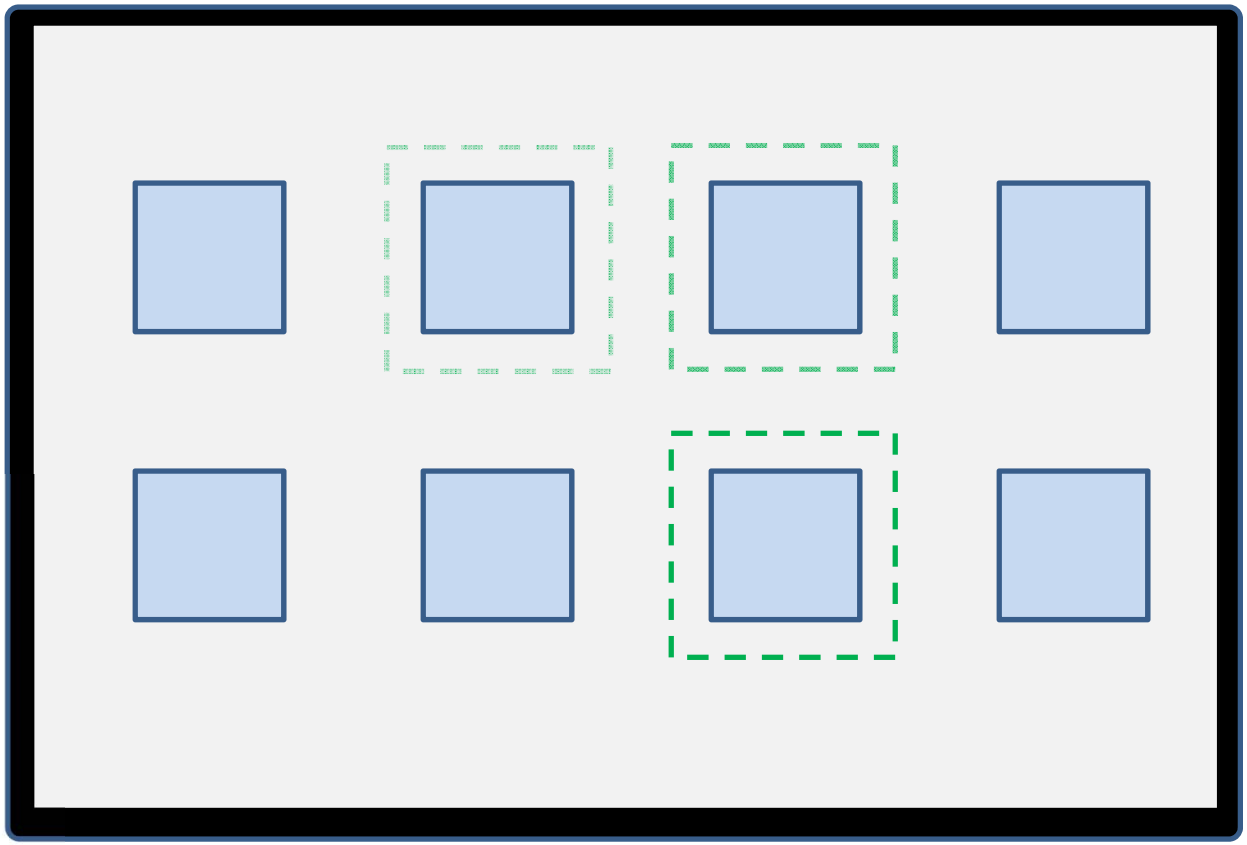
Same as CT, except that a discrete selection-block provides feedback (supports clutching)





Discrete InAir (DA)





Demographics

12 employees (all male, mean age 25.6 years, sd 3.4)

1 left-handed

All reported using computers for 8-10 hours a day

All but one had previously used a touchscreen phone on a regular basis for 6 months or longer

None had previously interacted with a distant display using a phone

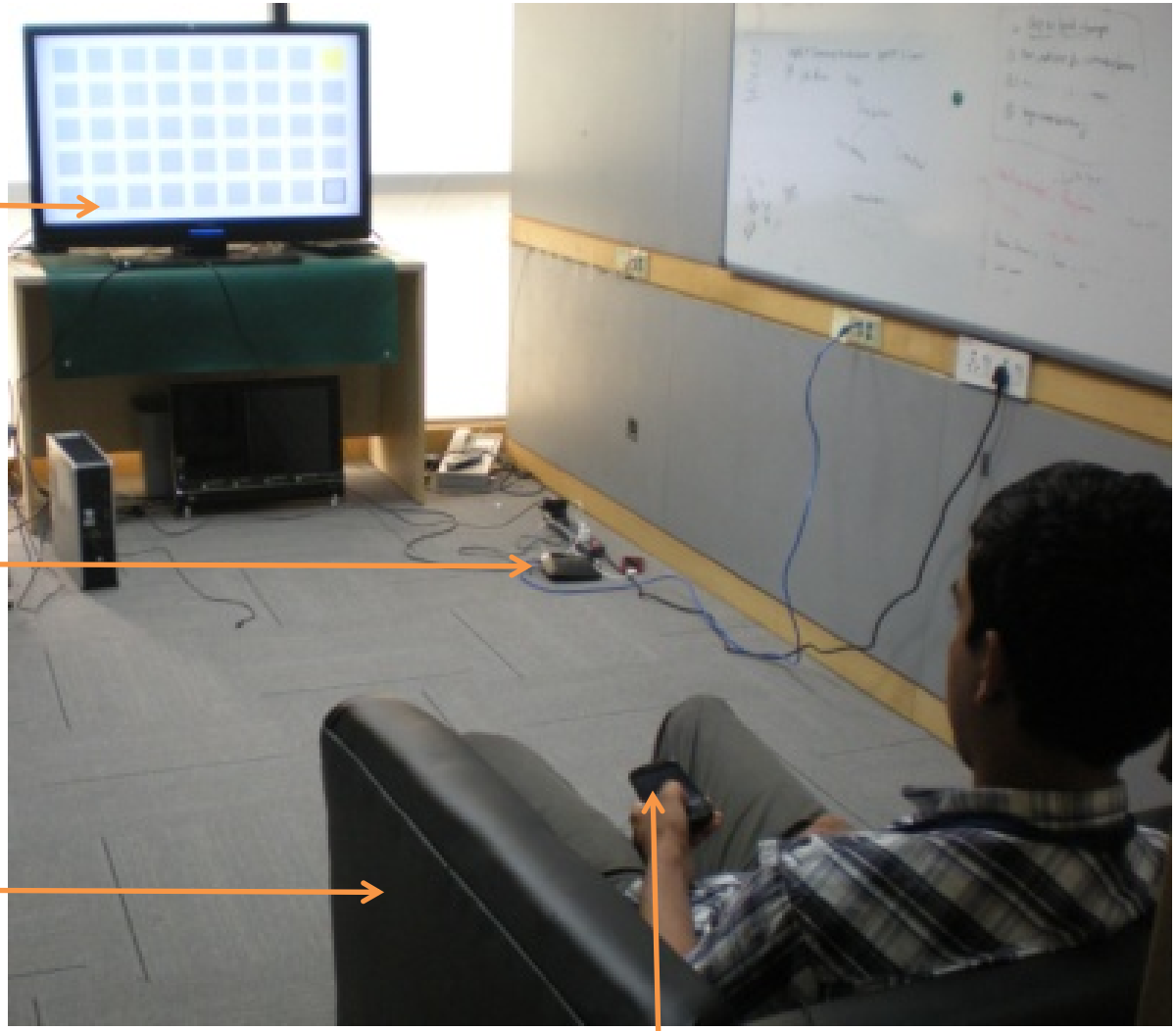
Rs 500 (~$10) voucher as reward

Setup

42” LCD display (1360×765) connected to a computer as an external monitor was used to simulate the iTV

Phone and computer interacted over a local wireless network

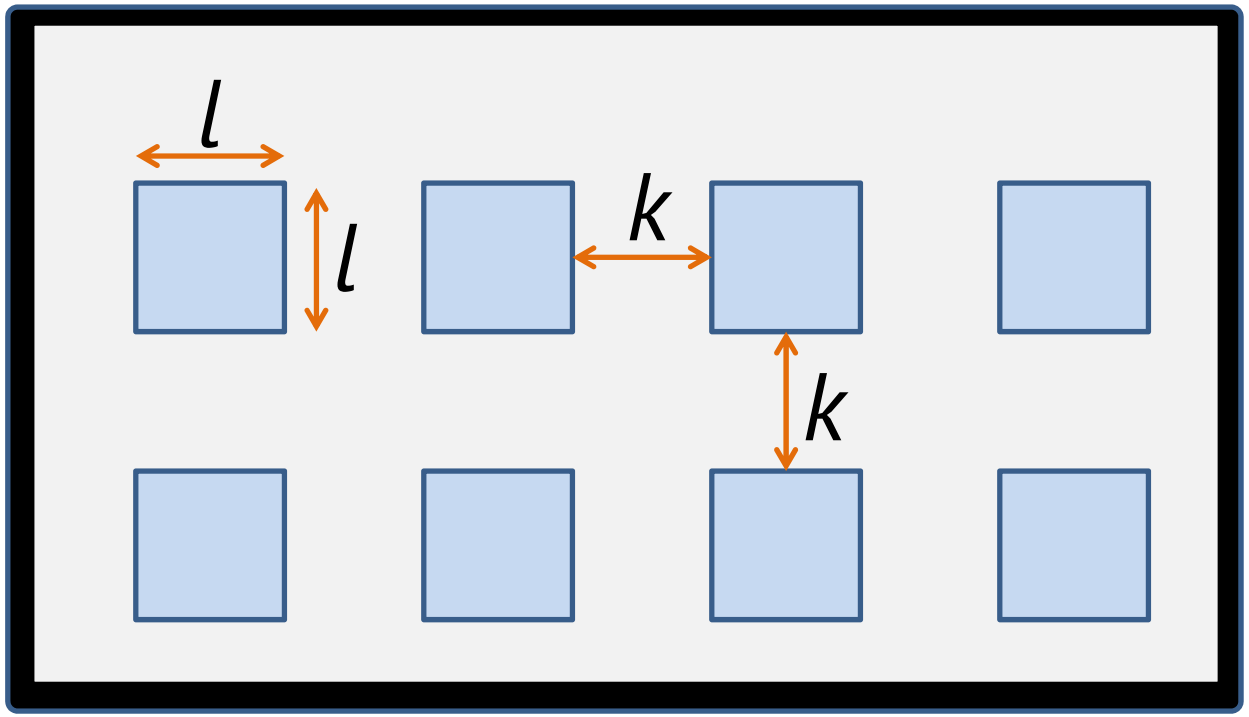
Sofa (with hand-rest) placed 10 feet from the display



iPod Touch 4th generation (display resolution: 960×640)

Method

Within-subject design



Input (2: Touchpad, inAir)

Item size ***l*** (3: 100, 60 and 40 pixels)

Feedback (2: Continuous, Discrete)

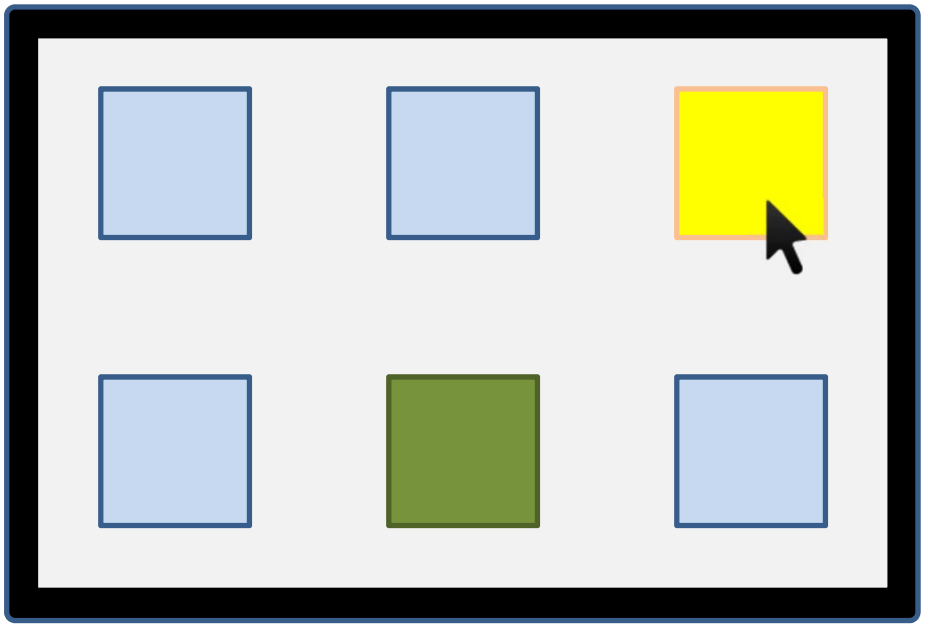
Gap ***k*** (3: 80, 40 and 20 pixels)

Procedure

Green New task's target

Yellow On hovering

Red On wrong selection



Facilitator demonstration

↓

Practice set (30 trials) with varying target density

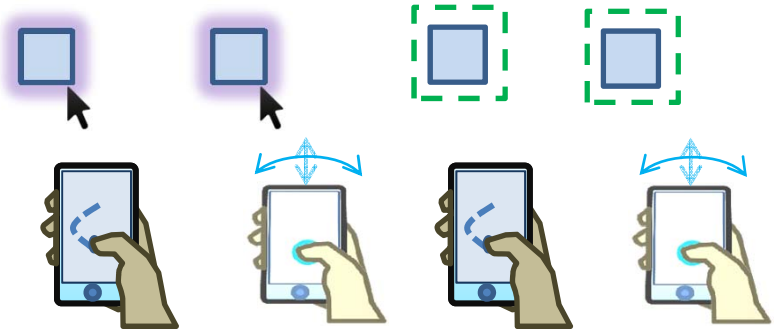
↓

Test set of 30 trials for each of the 9 layouts (4 x 9 x 30)

↓

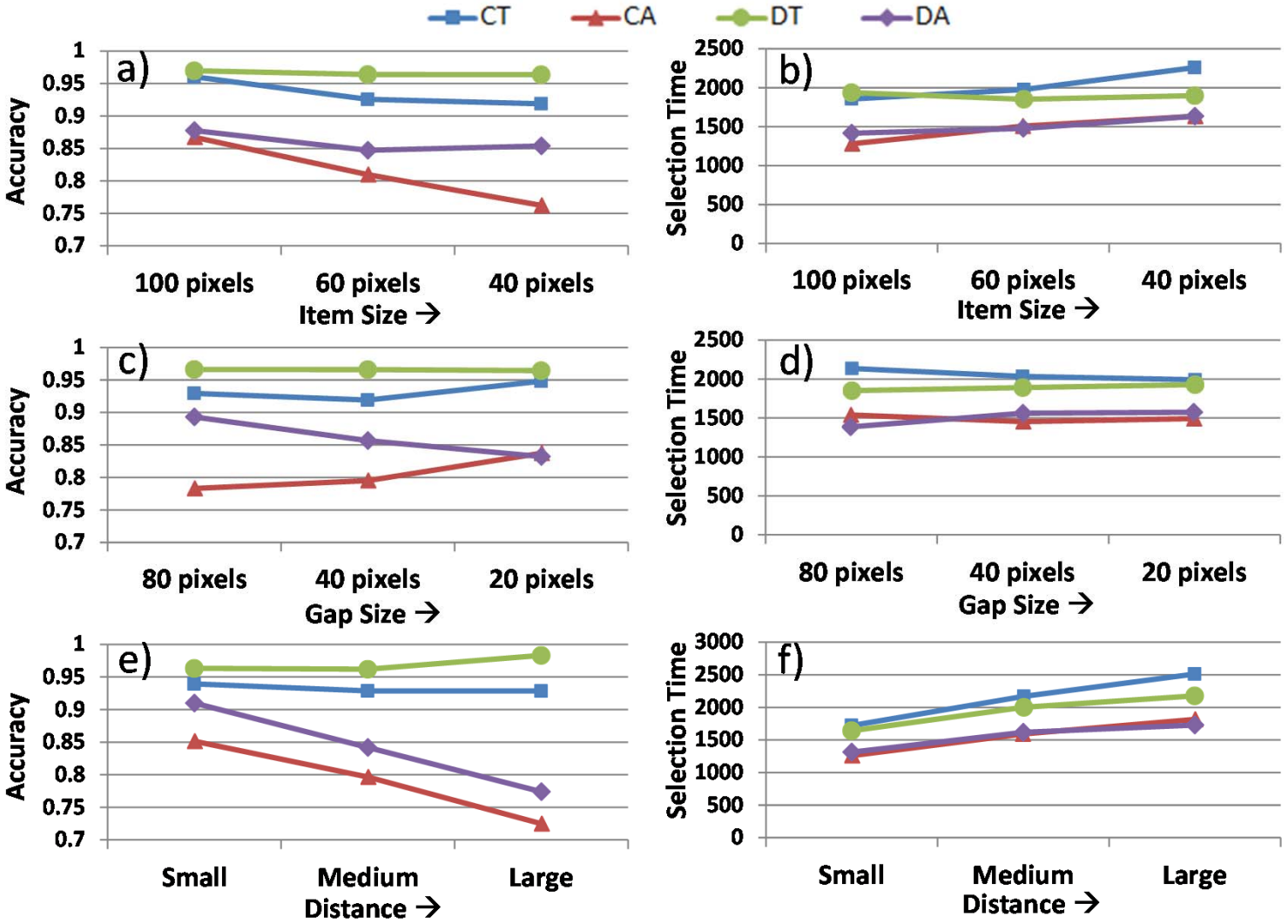
Rate the technique (NASA TLX on a 5-point Likert-scale)

Results: Speed & Accuracy

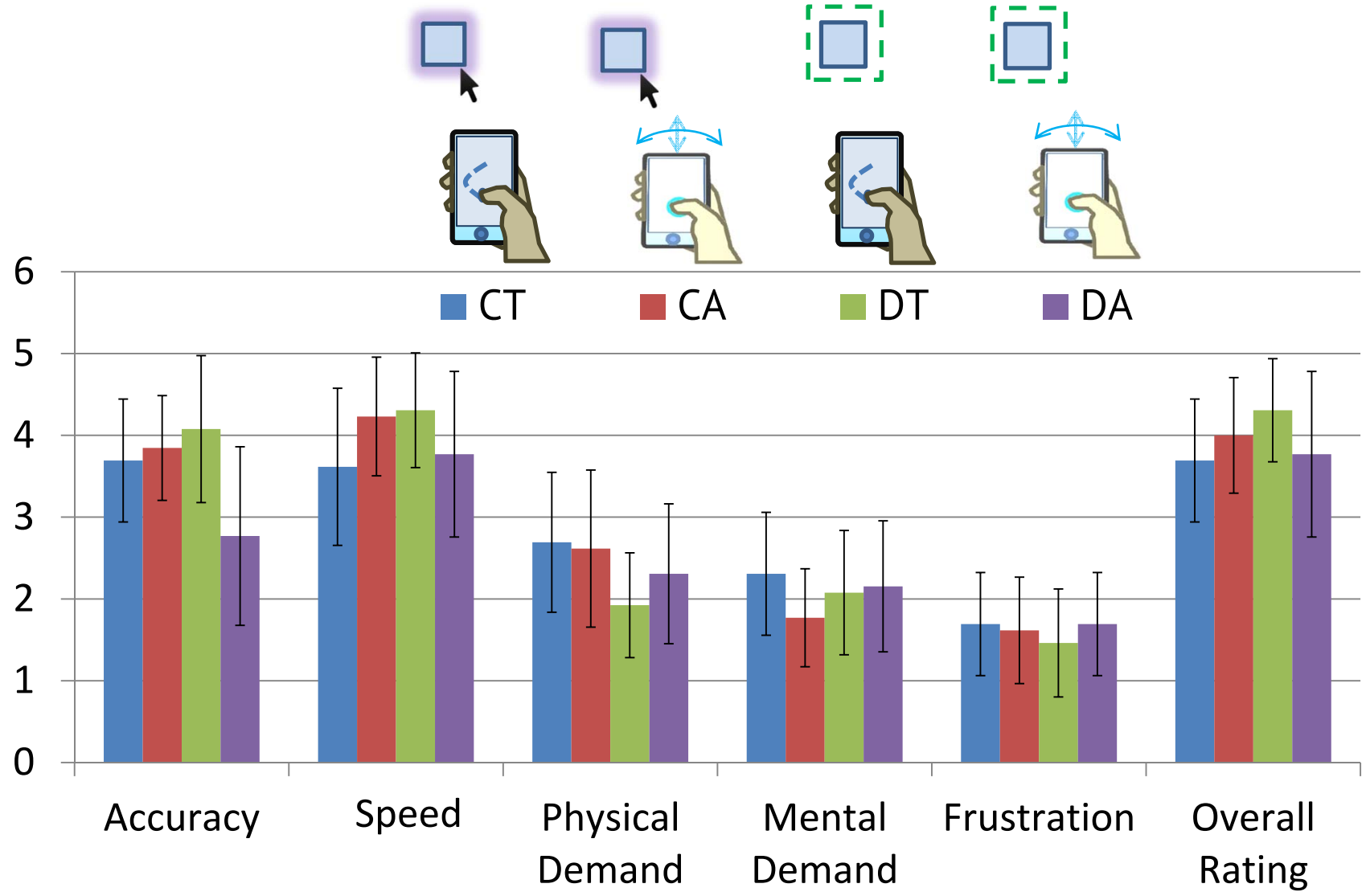


	CT	CA	DT	DA	
Accuracy	93% (7%)	81% (7%)	**96% (2%)**	86% (5%)	$F_{3,33}$=23.9 **p<0.001**
Selection Time	2047 (332)	**1491 (176)**	1894 (196)	1516 (200)	$F_{3,33}$=28.1 **p<0.001**
Errors	49% (6%)	140% (70%)	**4% (2%)**	16% (7%)	

Results: Speed & Accuracy



Results: Rating



Results

"hard to find the cursor when it has gone to the border of the screen" – **Continuous**

"selecting smaller targets is tough" – **Continuous**

"moving diagonally towards the upper-left of the touchpad was difficult using the thumb" – **Touchpad**

"tapping for selection resulted in slight phone movement, leading to erroneous selection" – **Continuous inAir**

"excellent speed", "reduce the sensitivity" - **inAir**

Design Implications

Layout Considerations

Touchpad: Put less-used items at the upper-left corner, as hard to reach

Continuous: Keep gaps between consecutive targets, to minimize overshooting errors

Finger-up Selection

inAir: Initiate inAir movements on finger-down, with finger-up for selection

Walk-up-and-use System

Require maximal accuracy with minimal learning; **Continuous Trackpad** seems like a wise choice

Thank You!

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