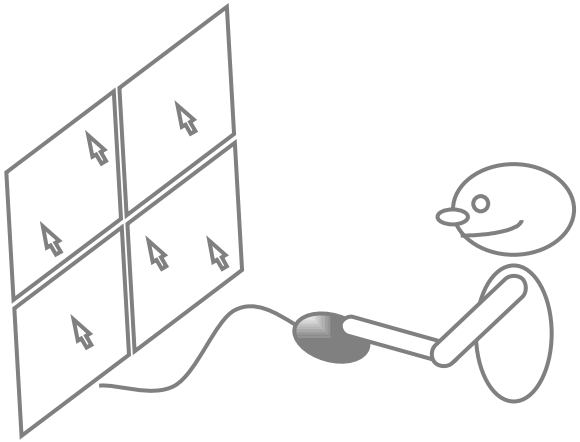
Ninja Cursors

Using Multiple Cursors to Assist Target Acquisition on Large Screens



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Outline

Background & Motivation

Our Method

Evaluation

Discussion & Future Work

Conclusion

Background

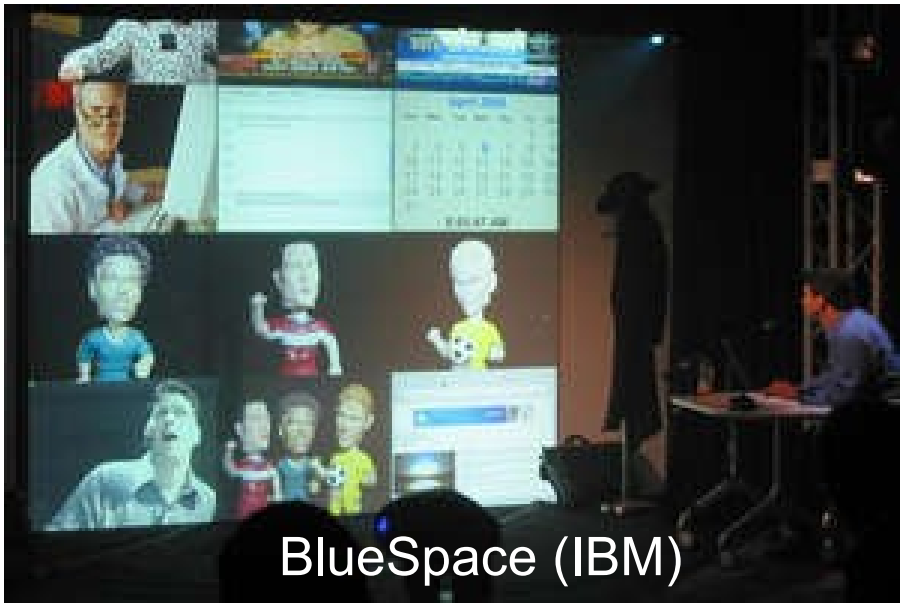
Large display

Background

Multi-display

Background

(Virginia Tech)



BlueSpace (IBM)

Larger screens

Problem

It is difficult to point to a distant object.

Introducing “ninja cursors”

Demo

Basic idea of “ninja cursors”

Cover the screen with multiple, synchronously moving cursors.

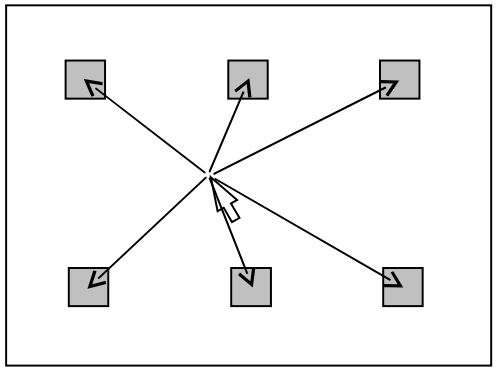
→ The user can use the nearest cursor.

Reducing the distance

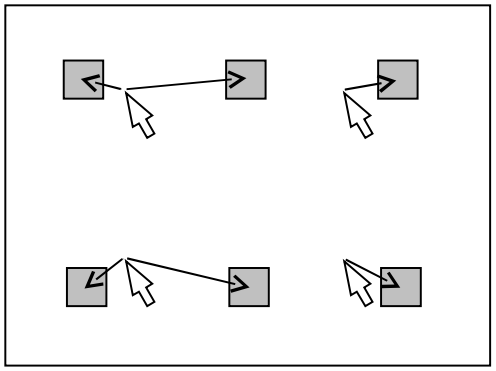
Average distance from the nearest cursor:

$$D \rightarrow \frac{D}{\sqrt{n}}$$

(n : # of cursors)



$n = 1$



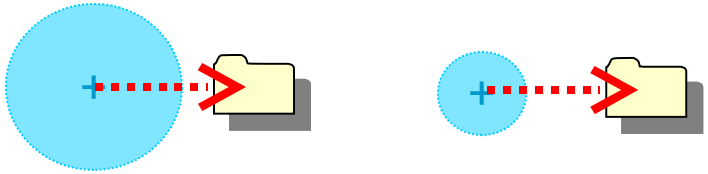
$n = 4$

Studies on target pointing

Target Size

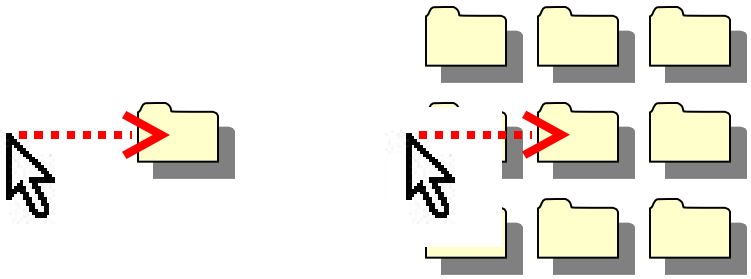
e.g., [Fitts 1954]

Cursor Size



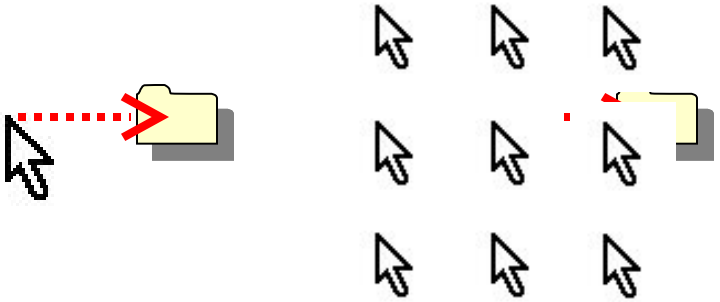
e.g., [Kabbash & Buxton 1995]

Target Density



e.g., [Guiard et al. 2004]

Cursor Density



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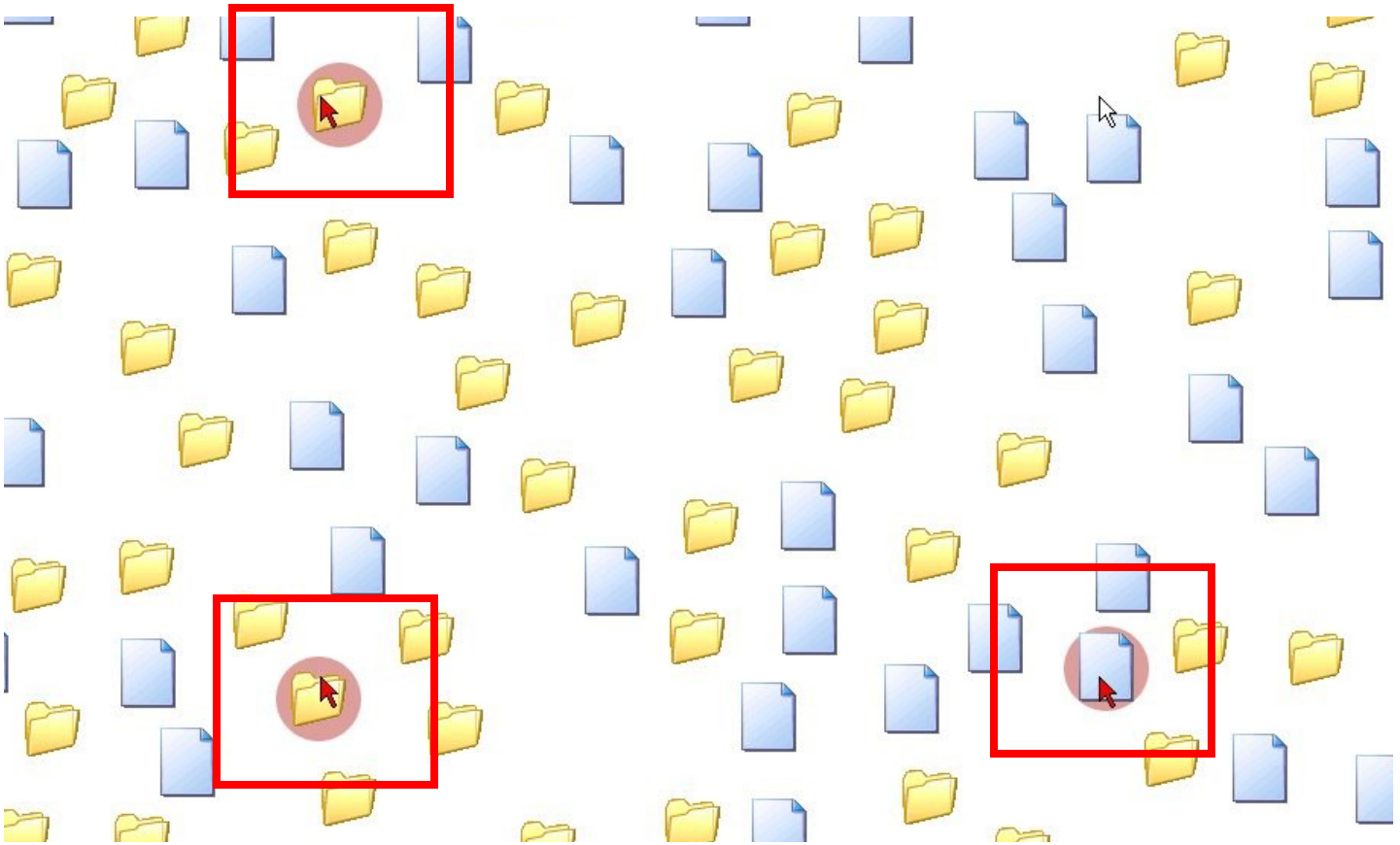
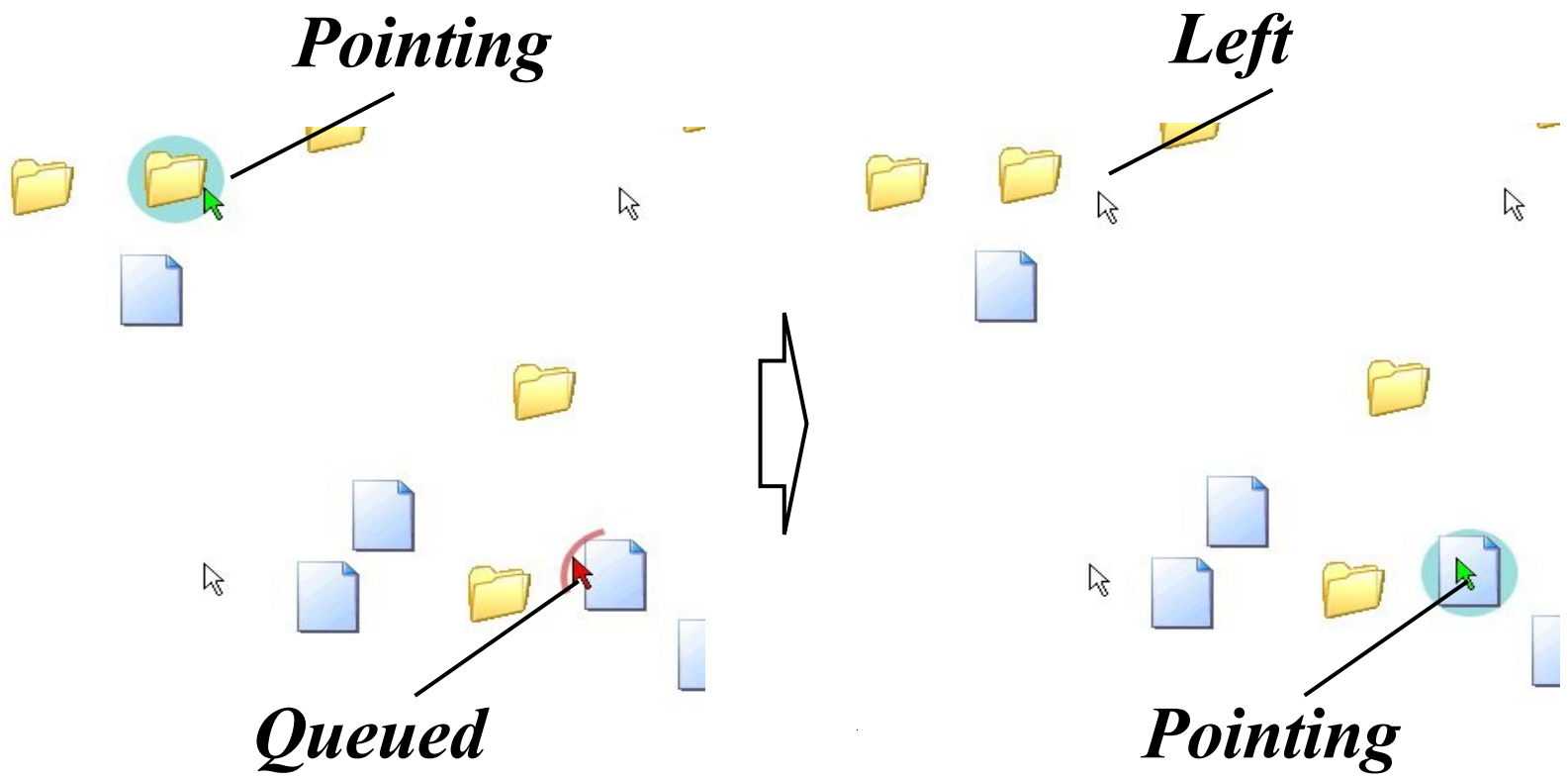
Ambiguity problem



What happens if multiple cursors point to multiple targets simultaneously?

Resolving ambiguity

Only one cursor can point to a target;
others are blocked and in the waiting queue.

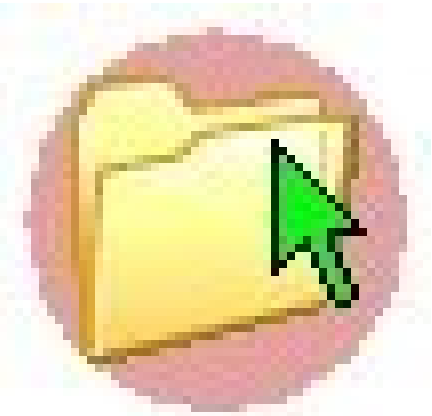


Resolving ambiguity

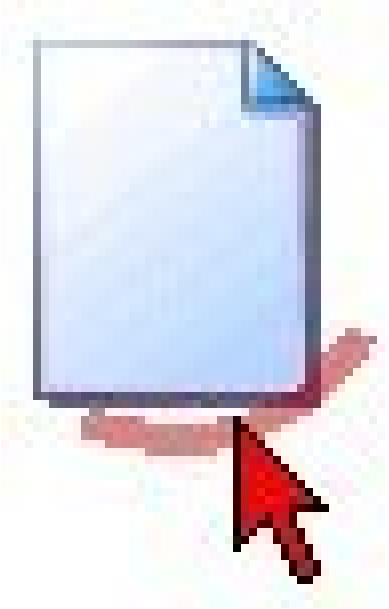
Demo

Visual feedbacks

Normal

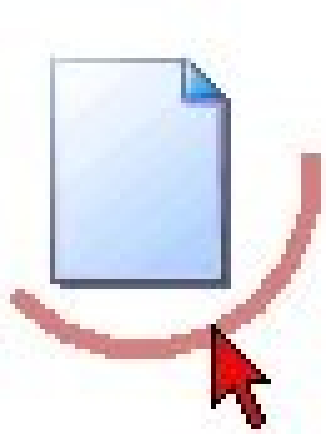


Pointing

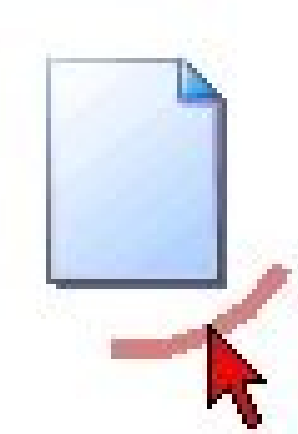


Blocked

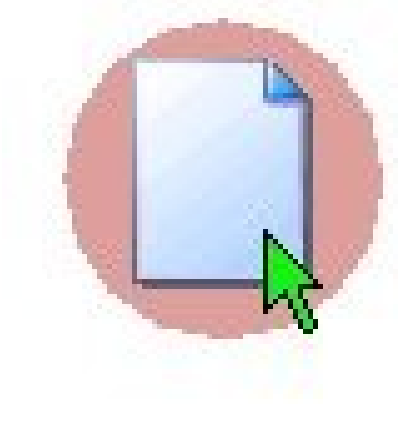
Visual feedbacks



Long waiting



Short waiting



Pointing

Outline

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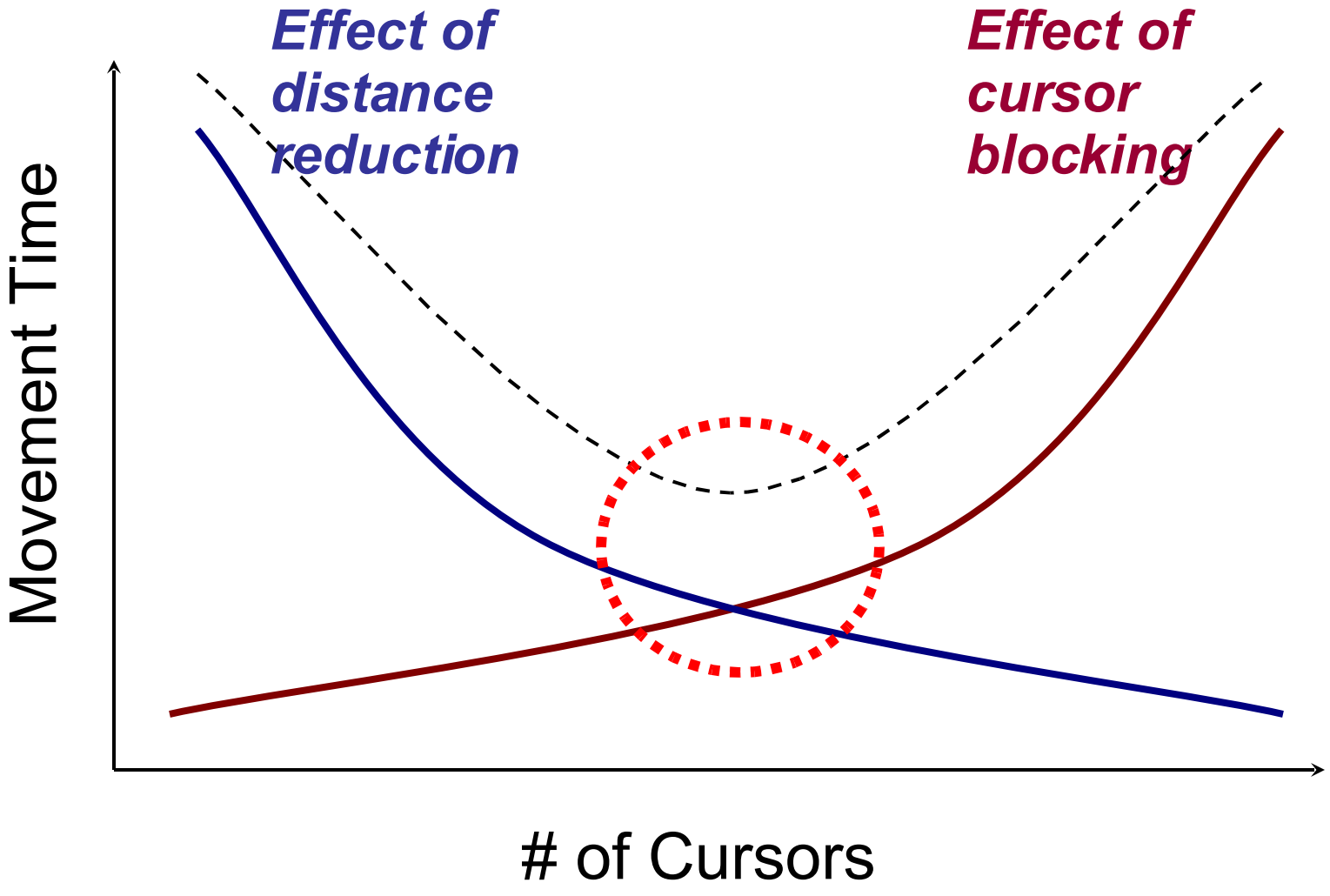
Conclusion

Goal

Determine how the cursor number and the target density affect the performance.

Hypothesis

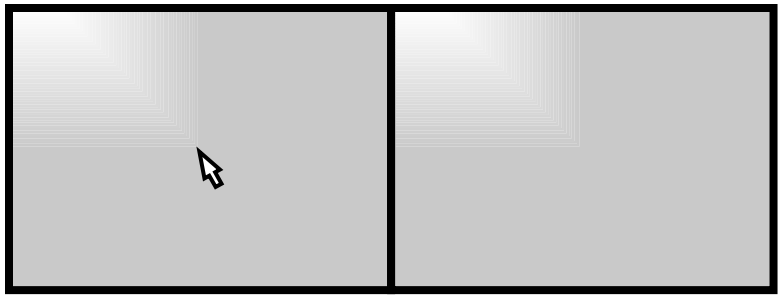

Effect of distance reduction
Effect of cursor blocking
Movement Time
# of Cursors

Design

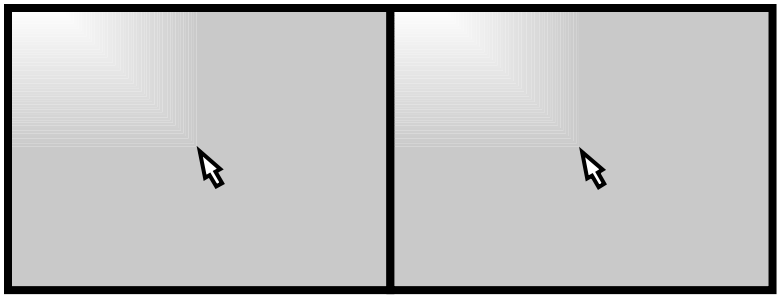
- ✓ 8 participants (within-participant)
- ✓ 4 cursor types×3 target numbers×3 target sizes
- ✓ 10 trials for each condition

Setup

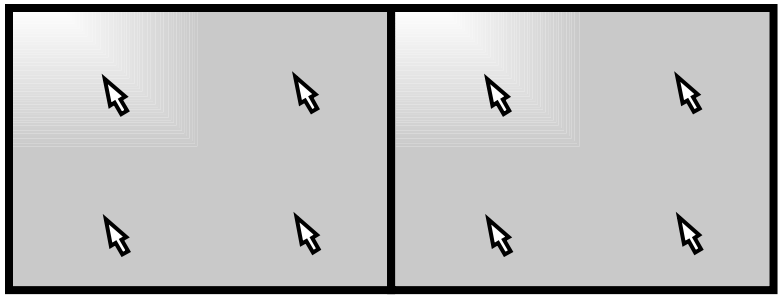
Cursor types



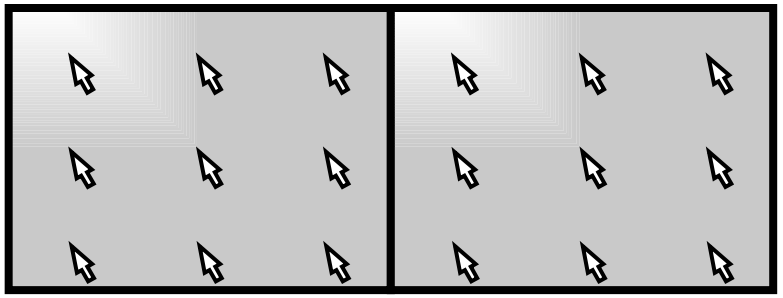
1 cursor
(standard cursor)



2 cursors

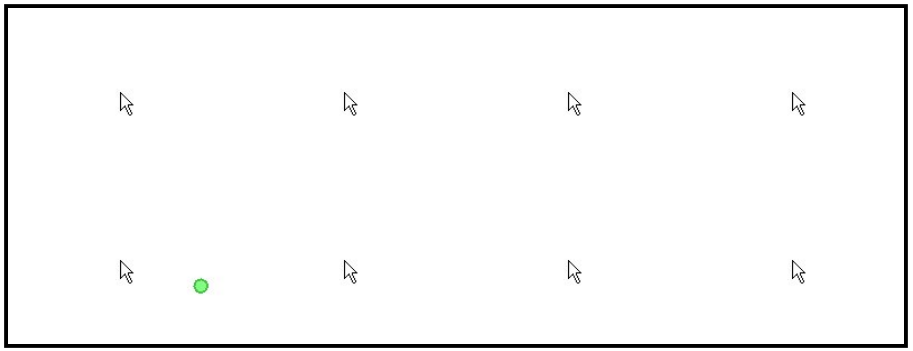


8 cursors

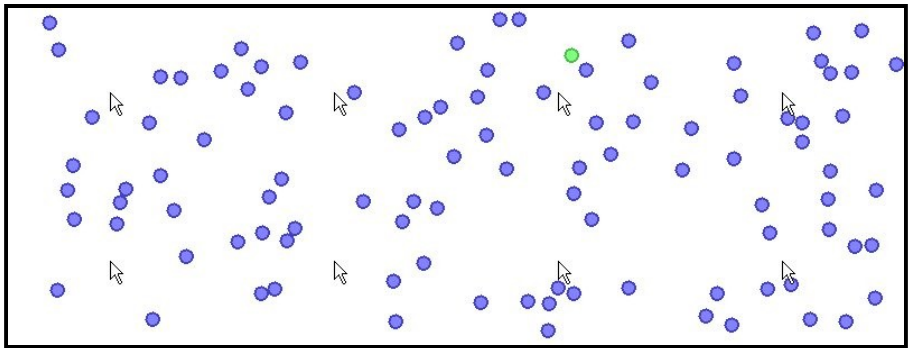


18 cursors

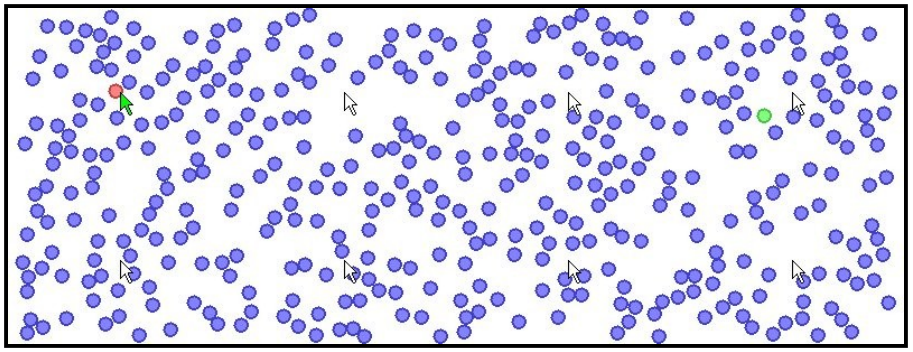
Target numbers



N = 1

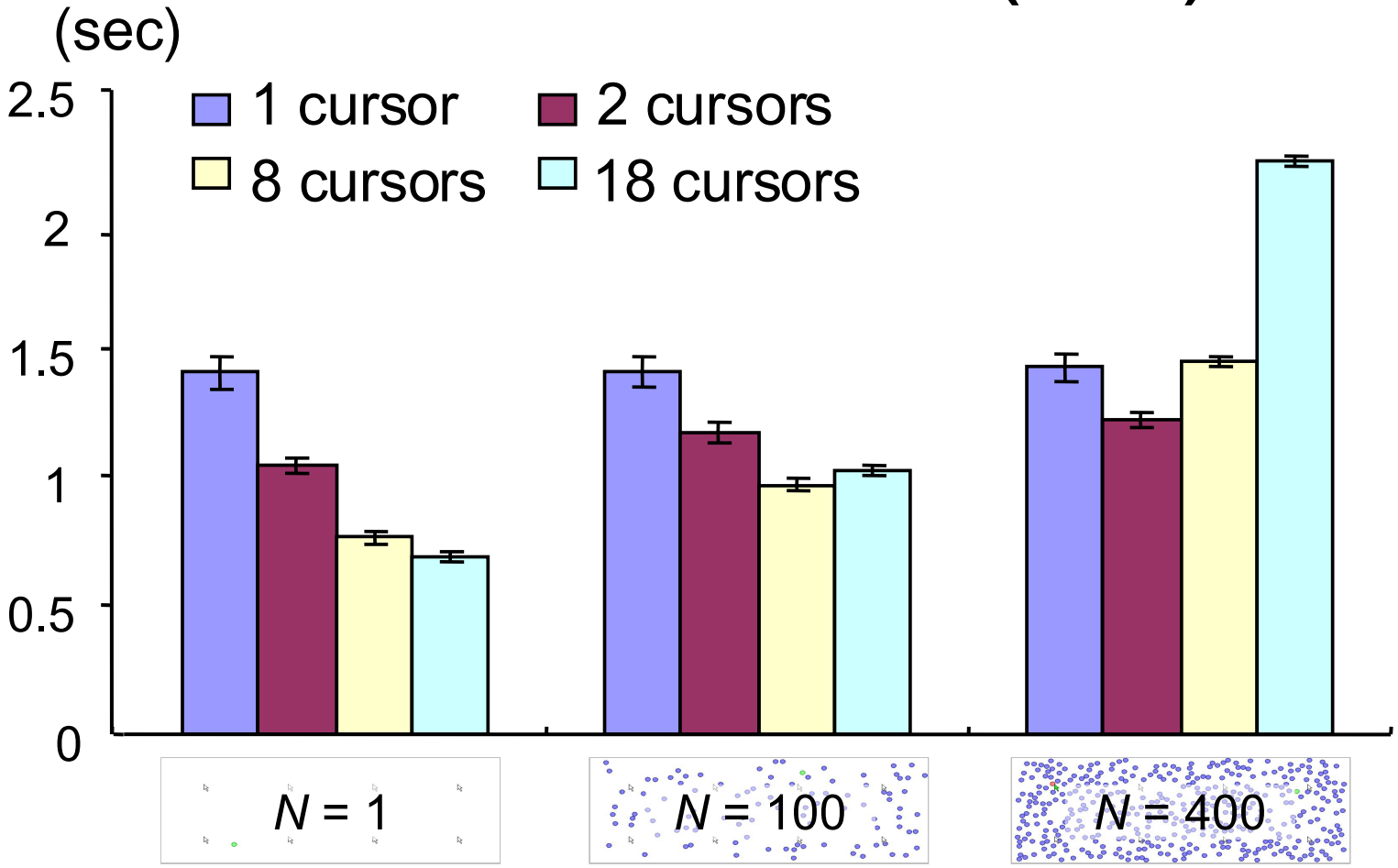


N = 100



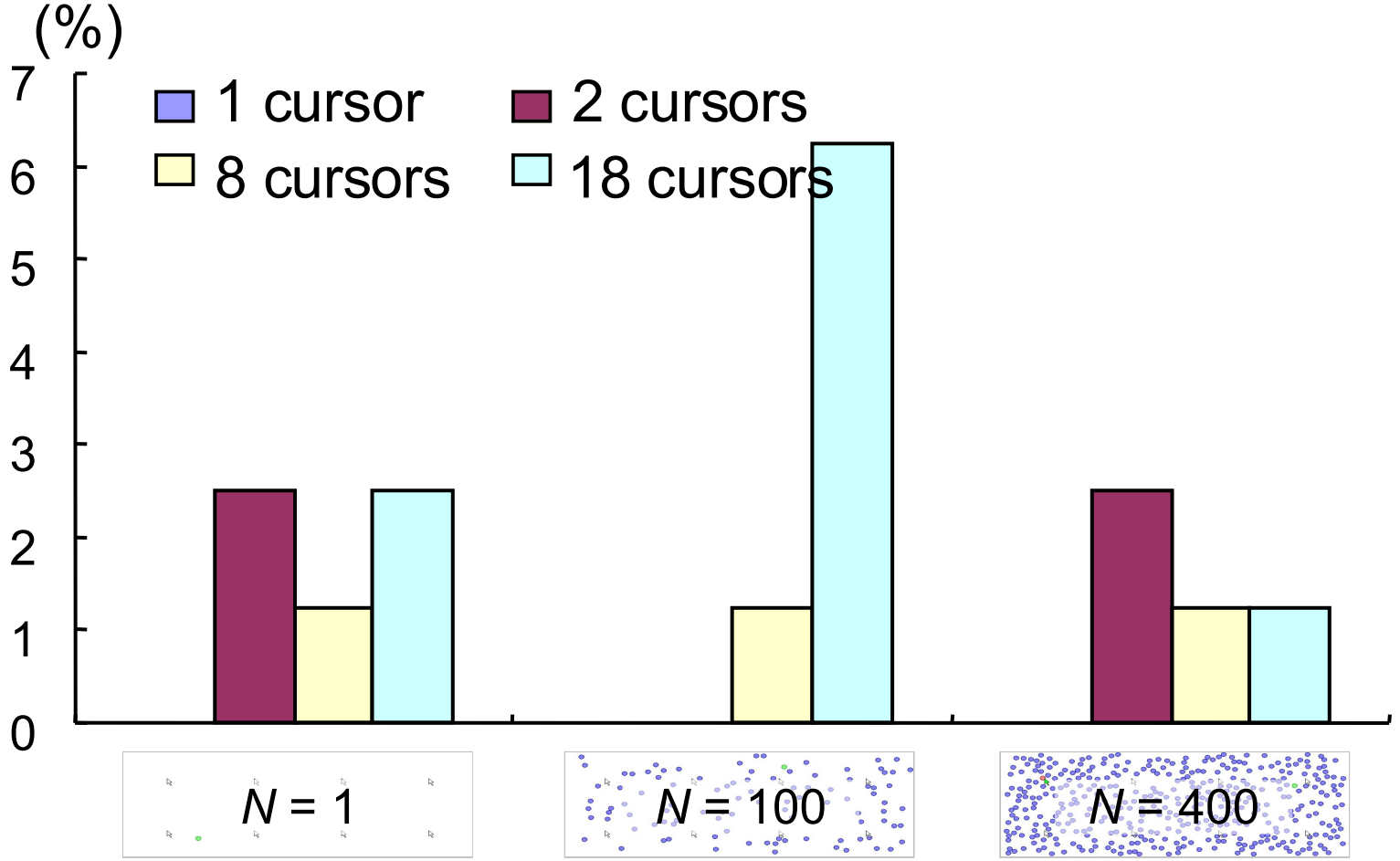
N = 400

Movement Time (*MT*)



N = 2, 8 worked well.

Error rate



No significant trend.

Feedback & observation

- ☞The participants annoyed by frequent waiting (*N* = 18)
- ☞The participants often used the second- or third-nearest cursor.

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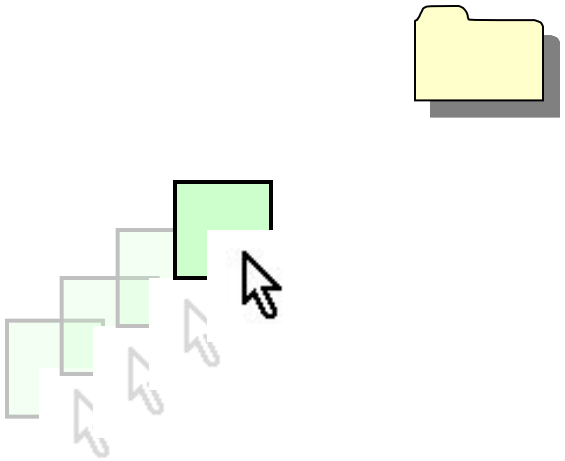
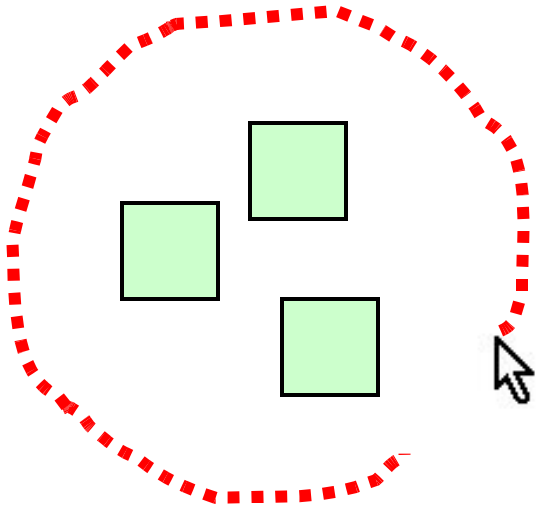
Advanced features



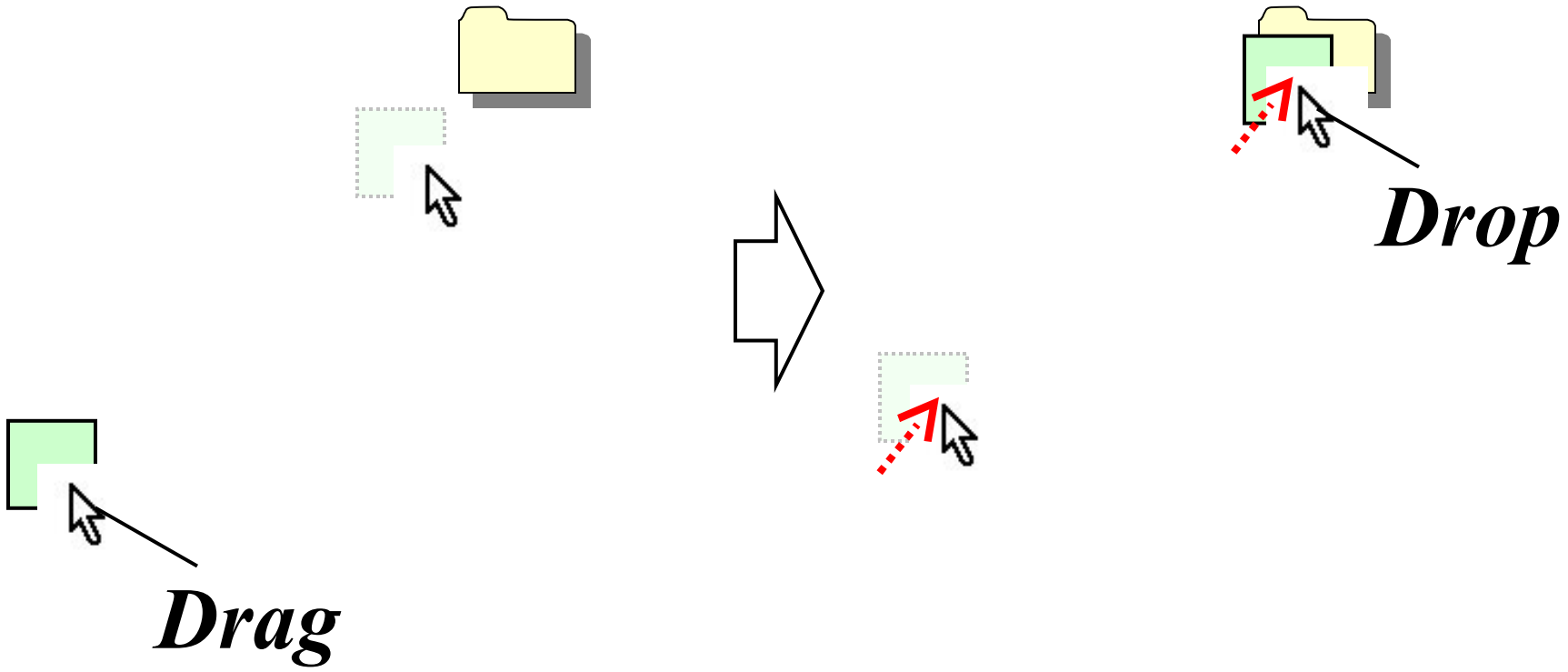
Drag & drop



Lasso tool

Drag & drop

Drag with a cursor, drop with another cursor

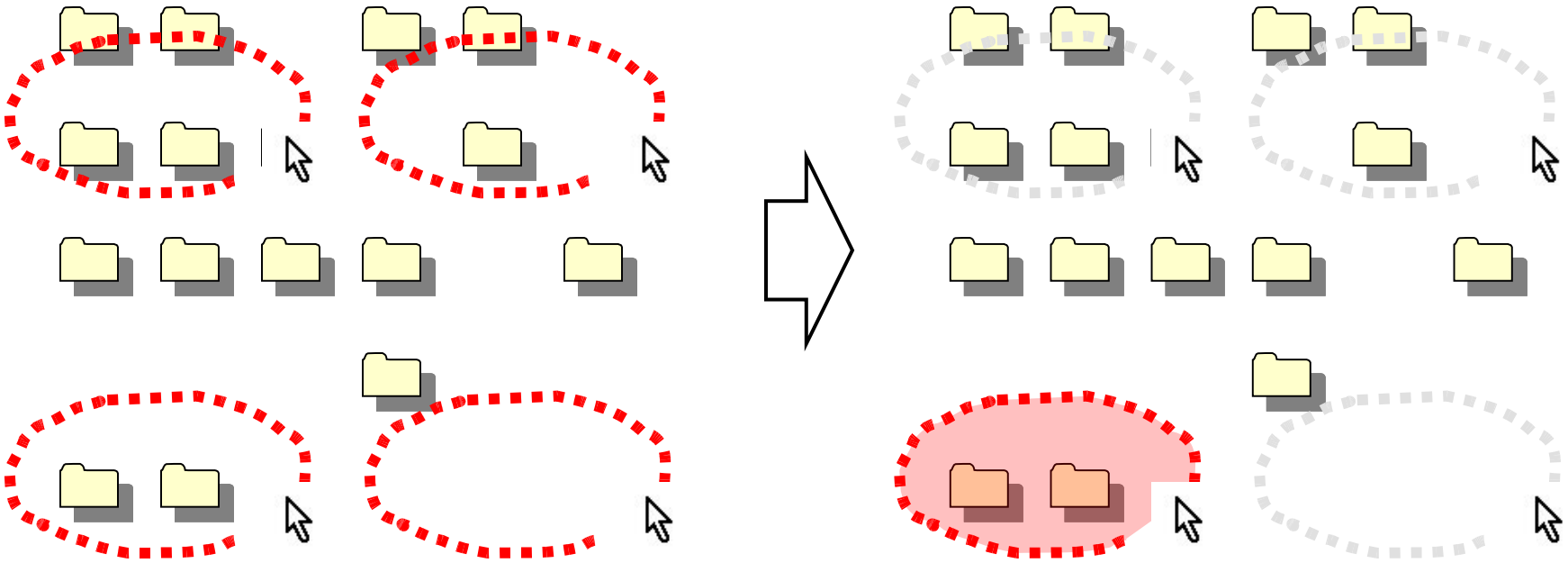


Drag & drop

Demo

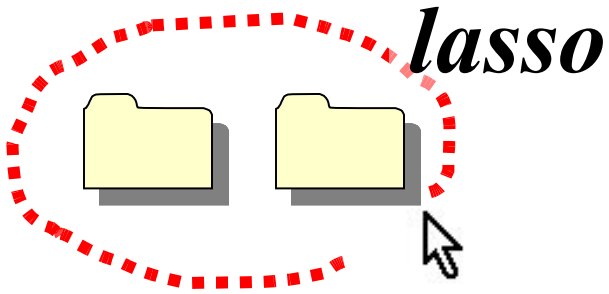
Lasso tool

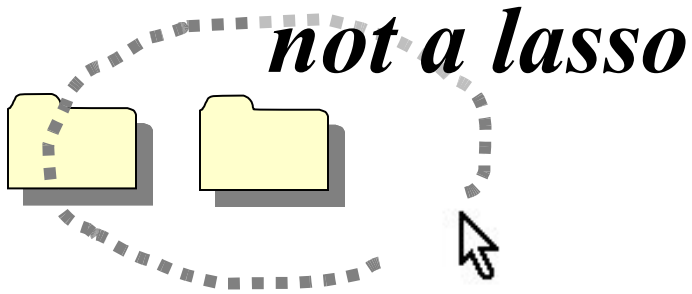
Resolving ambiguity by implicit rules



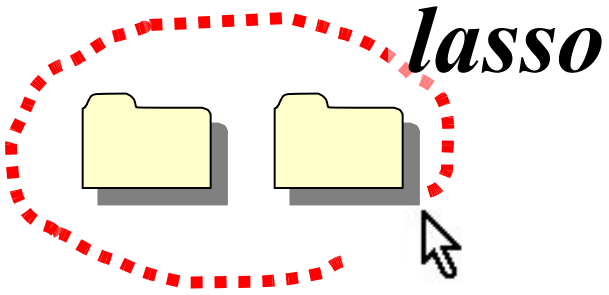
Lasso tool

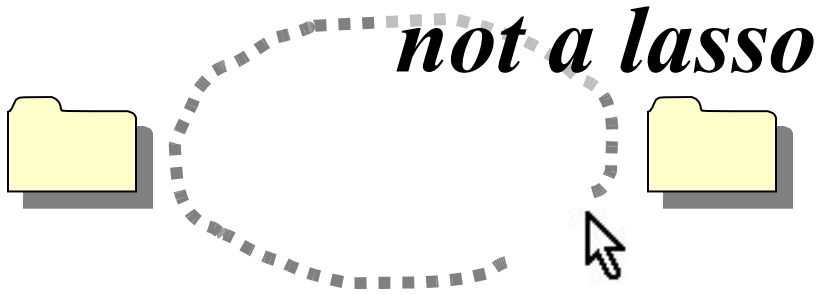
1. No lasso stroke ever intersects with targets.





2. Any lasso must contain at least one target.

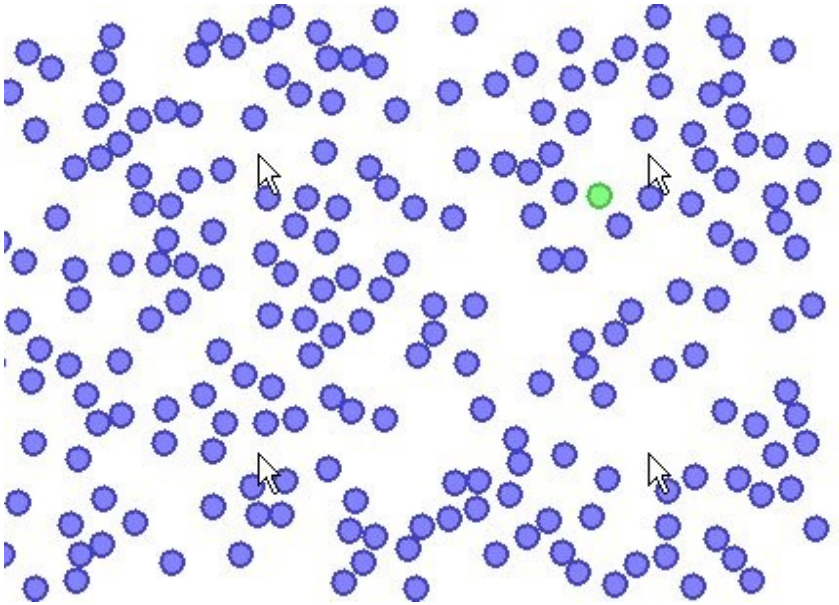




Lasso tool

Demo

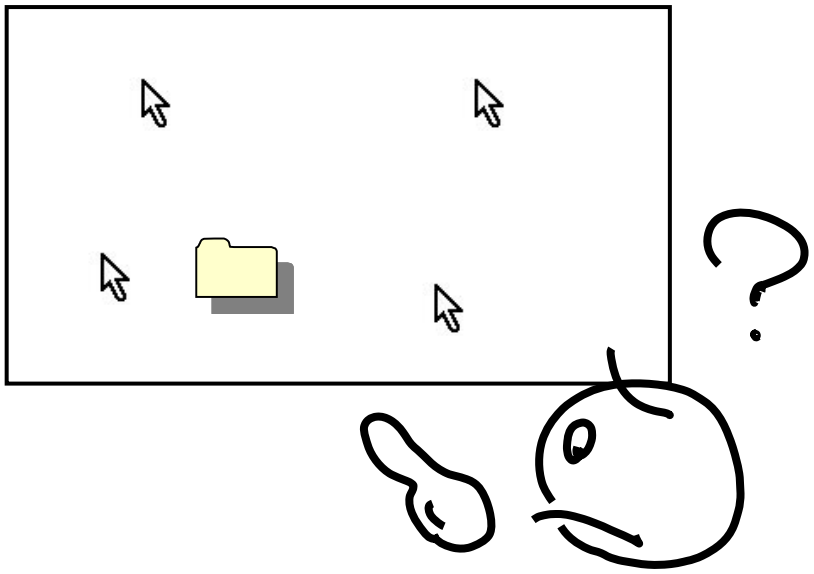
Limitations



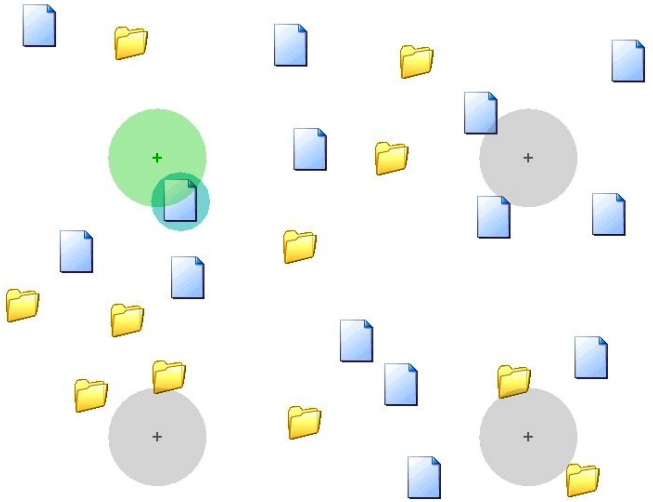
Dense targets increase the *MT* too much.

Direct pointing devices cannot be used.

Future work



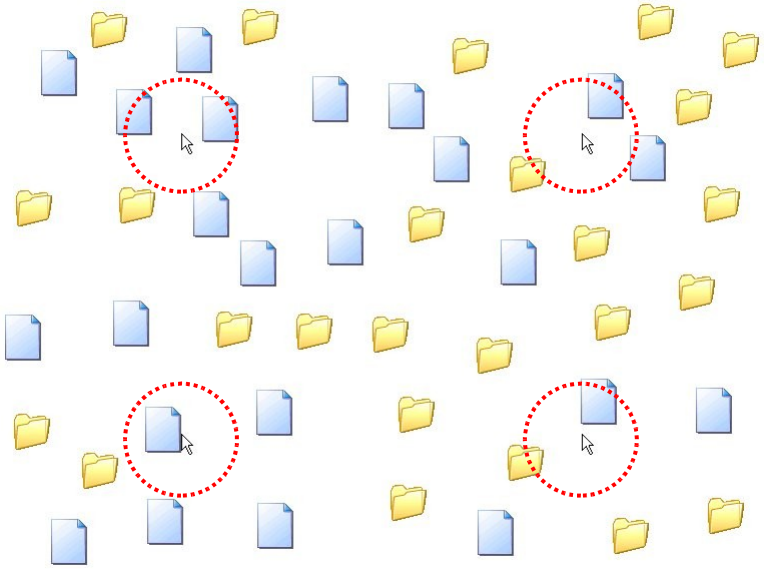
Measure
the decision time



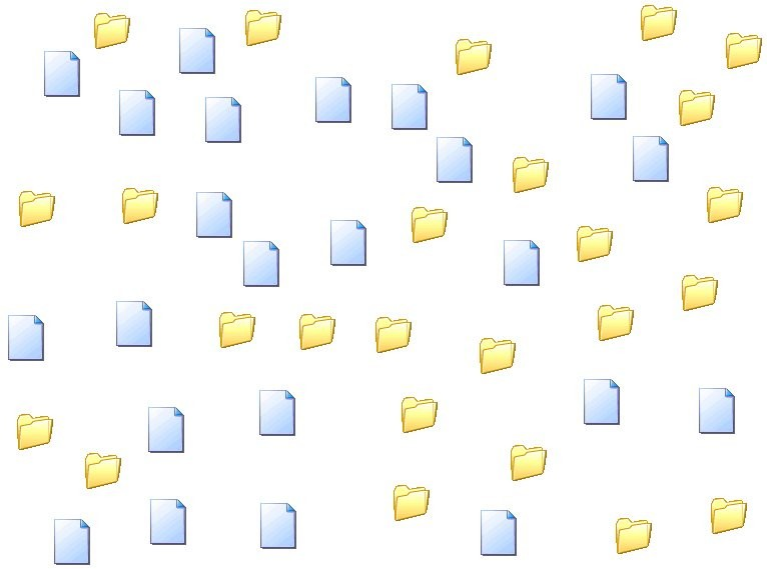
Combination with
other techniques

Decision time

Compare 2 configuration:



vs.



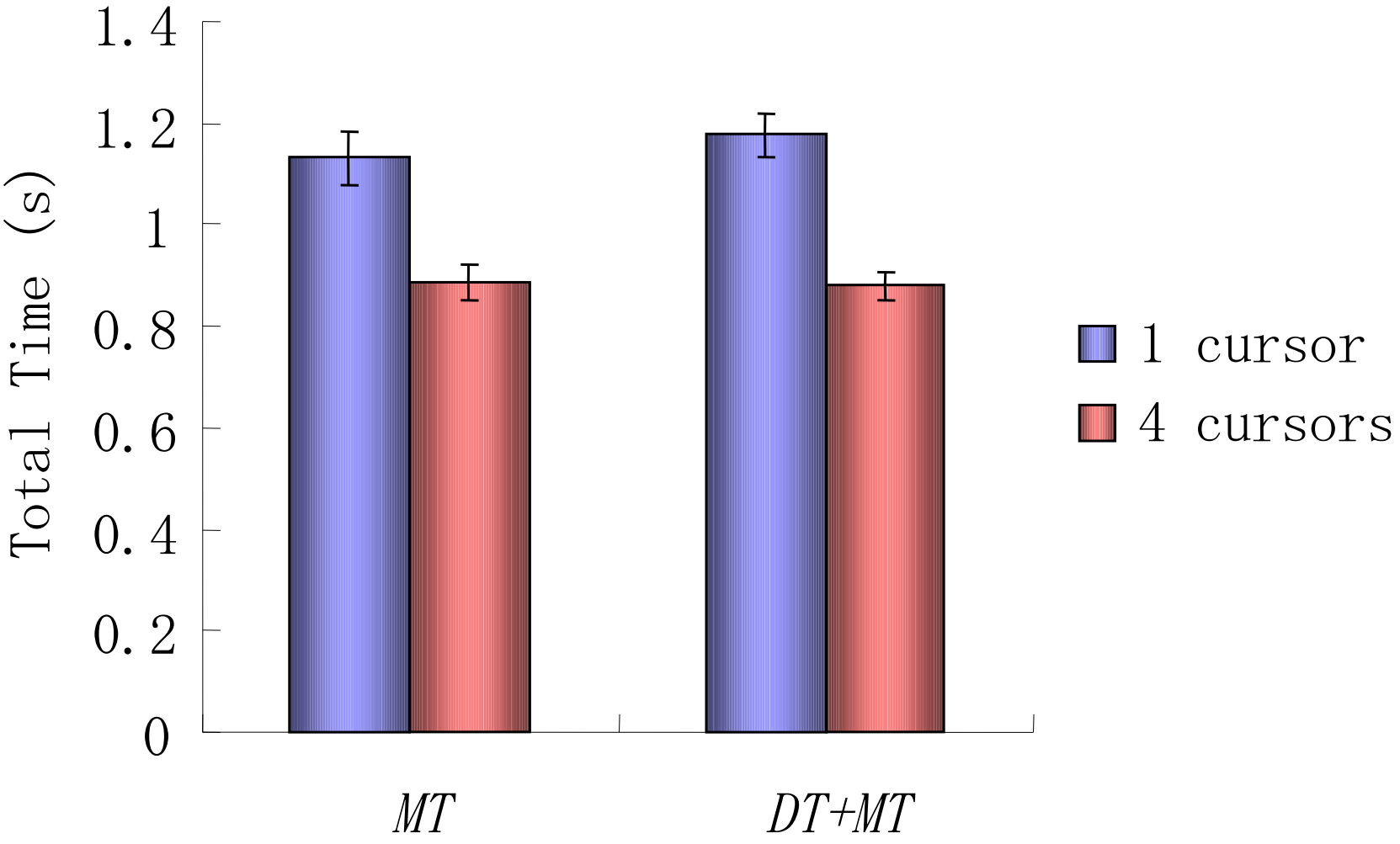
Cursors are visible even before each trial.

→ ***Total Time = MT***

Cursors are hidden until the start of each trial.

→ ***Total Time = DT + MT***

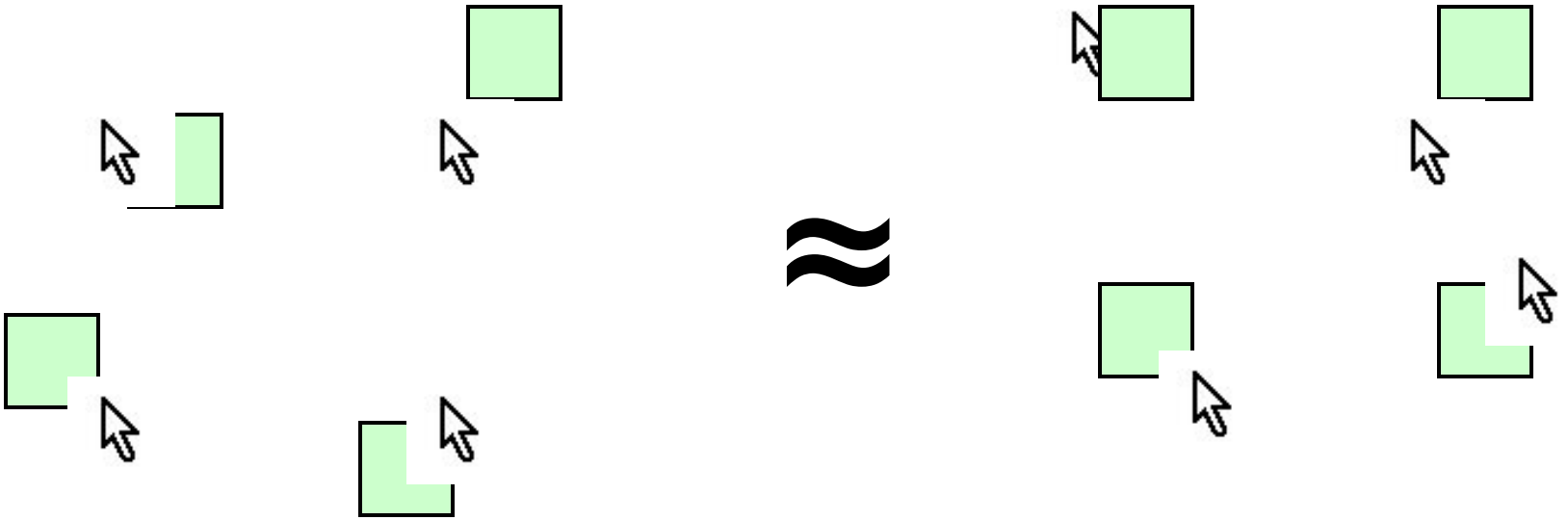
Decision time



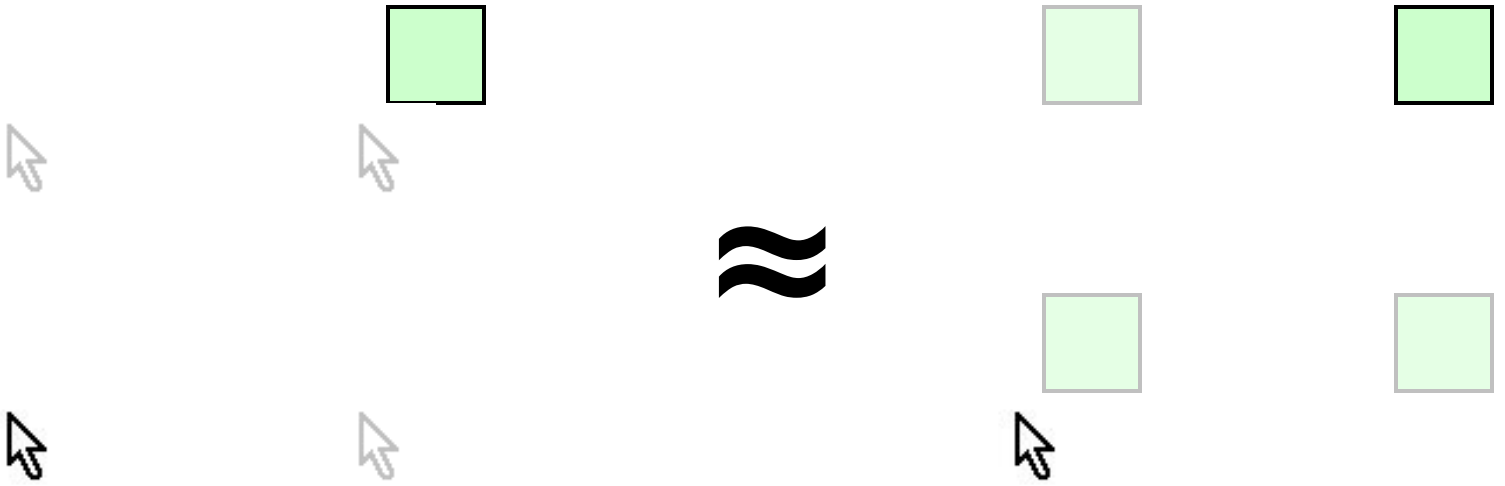
Regularly distributed targets

Regularly distributed targets

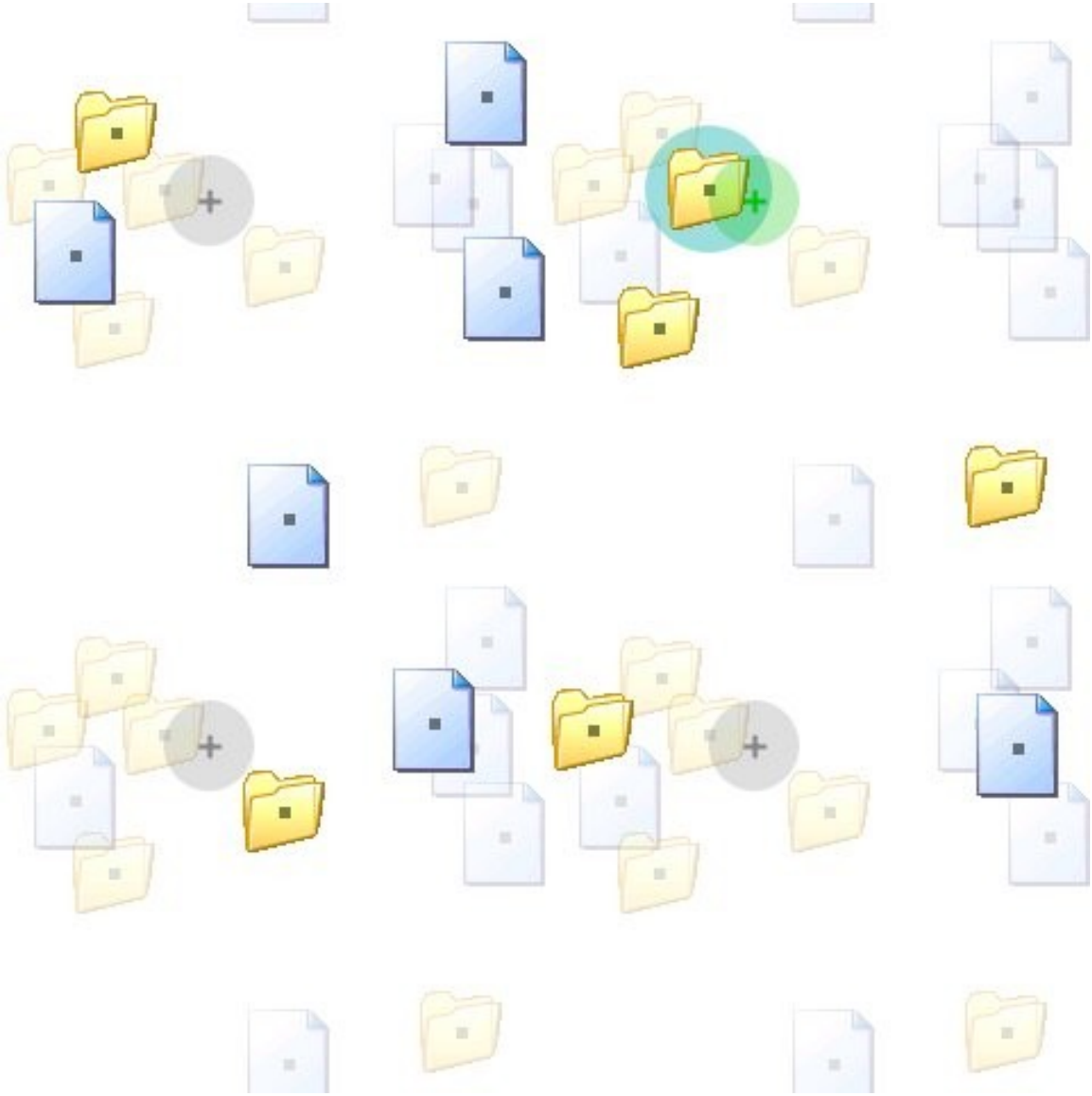
Regularity of cursors or targets



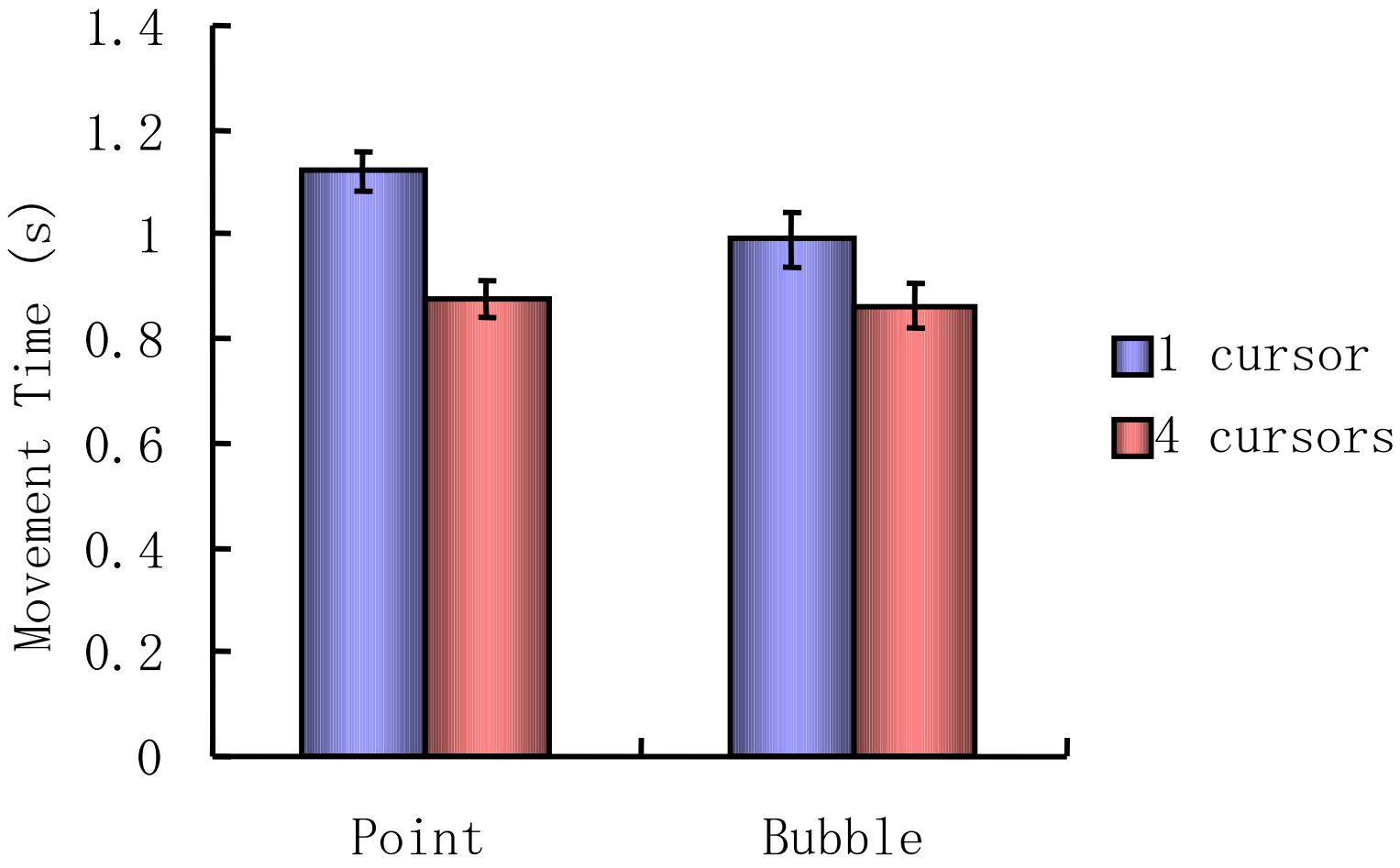
Extra cursors or extra targets



Bubbling ninja cursors

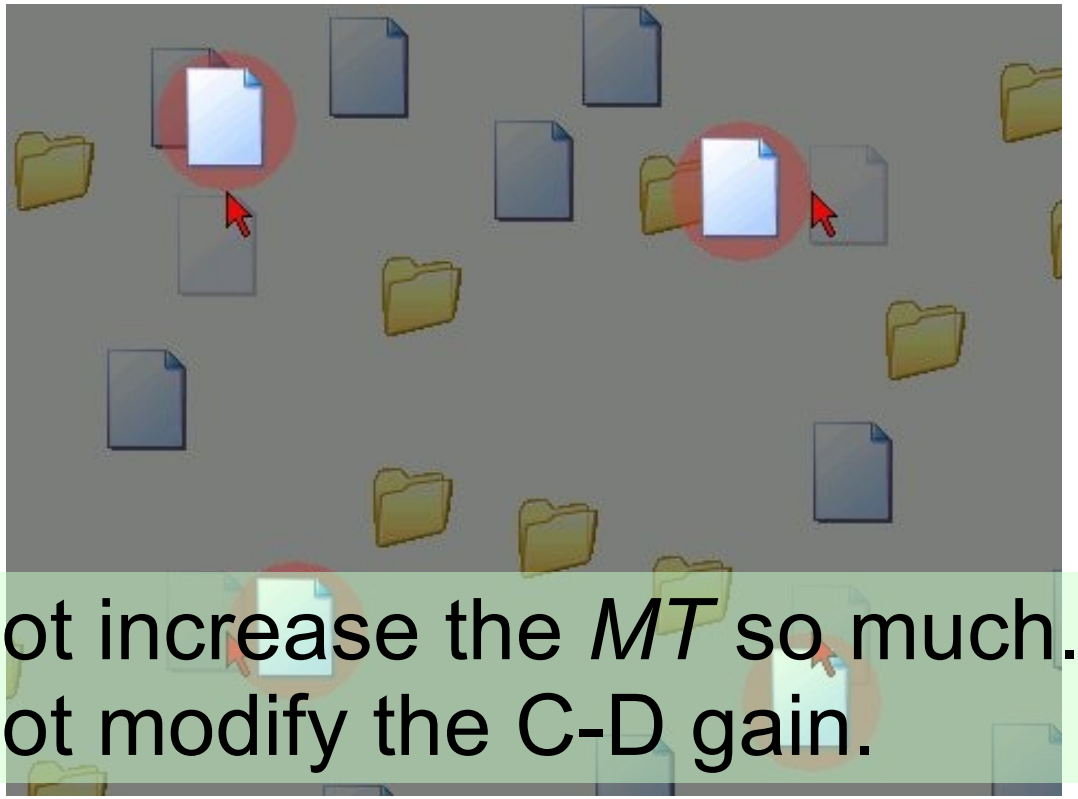


Bubbling ninja cursors



Post-selection method

Use a post-selection menu instead of a waiting queue.

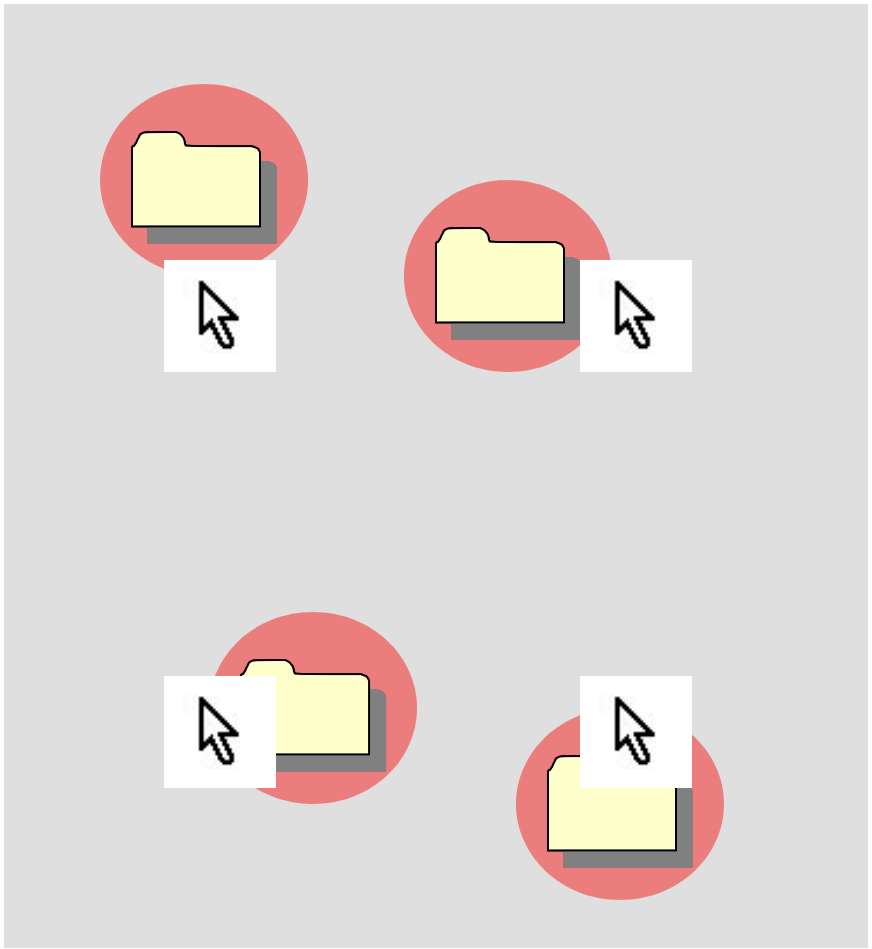


+ Does not increase the *MT* so much.
+ Does not modify the C-D gain.

Post-selection method

Demo

Post-selection method



Pie menu

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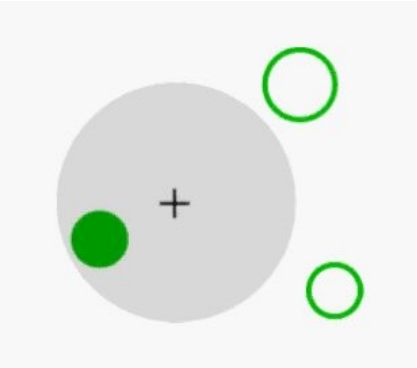
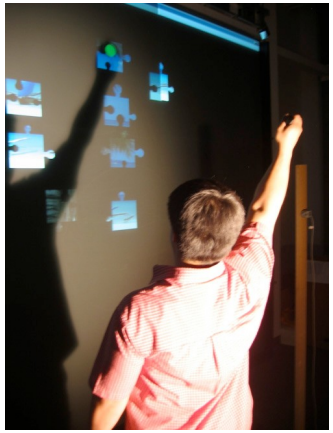
Related work



Bubble Cursor
[Grossman & Balakrishnan 2005]
→ Change the cursor size

Delphian Desktop
[Asano et al. 2005]
→ Jump the cursor



Shadow Reaching
[Shoemaker et al. 2007]
→ Use the shadow

Conclusion

- ✓ Ninja cursors
  - + Multiple cursors cover a large screen
- ✓ User study
  - + More cursors → efficient in sparse targets
inefficient in dense targets
- ✓ Advanced features
  - + Drag & drop, lasso tool

Thank you

http://www-ui.is.s.u-tokyo.ac.jp/~kobayash/ninja_cursors.html