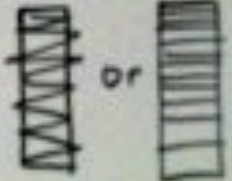
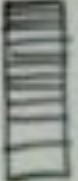


Designing Interactions for Novel Haptic Technologies

Vincent **Lévesque**
Postdoctoral Research Scientist
Immersion Corp.

Rate Control

 or  - engage to 30% release
- realism
- stiffness



- better visuals?

- pref + desc
- present w/ visuals



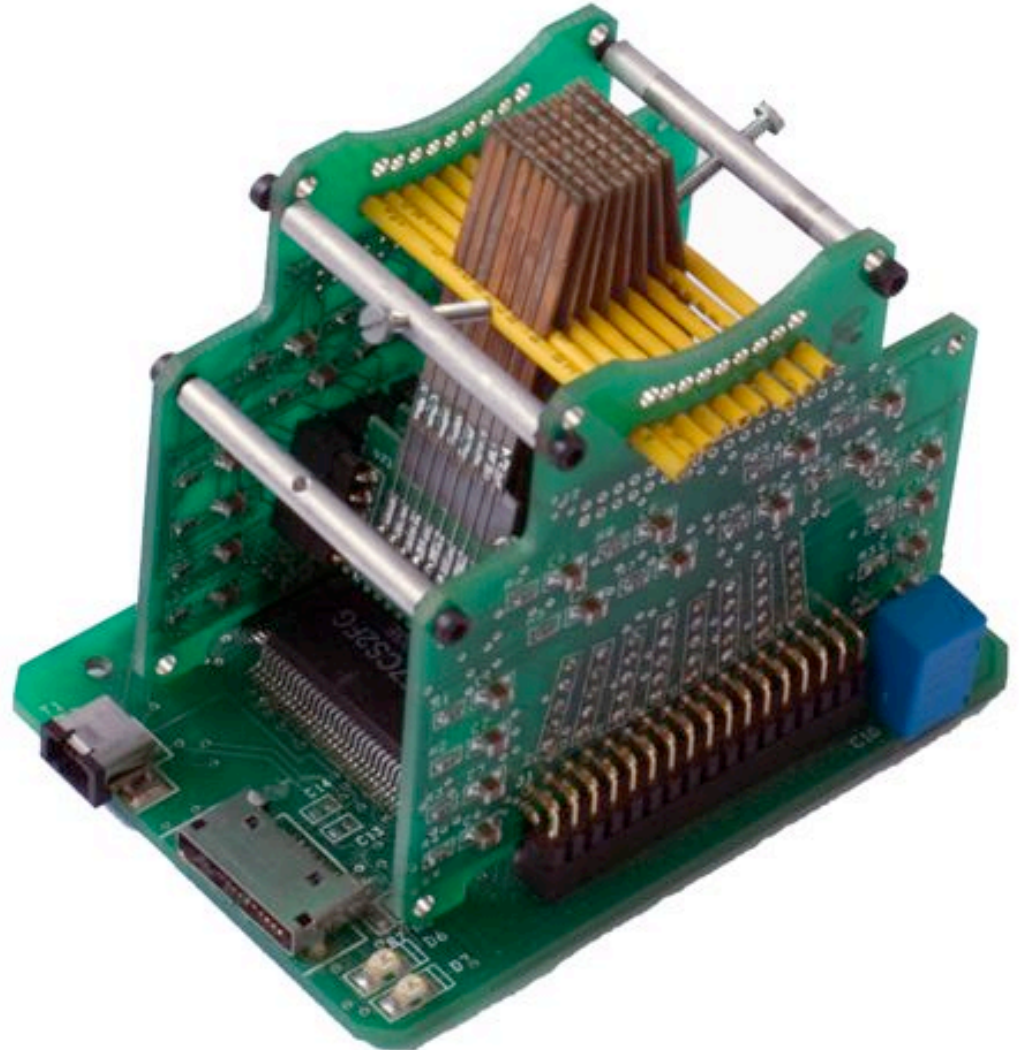
Novel Haptic Technologies

Challenges

hardware design

psychophysics
& human factors

applications



Novel Haptic Technologies

Typical Approach

1 – optimize hardware design

**2 – study psychophysics
& human factors**

3 – investigate applications



A photograph of a workshop or laboratory desk. The desk is made of light-colored wood and is cluttered with various items. On the left, there is a computer mouse and a keyboard. In the center, there is a red mousepad and a black mouse. To the right, there is a small metal frame on a wooden base, possibly a scale or a measurement device. The background shows a white wall with some papers or notices pinned to it.

Great but...

slow process

applications come late

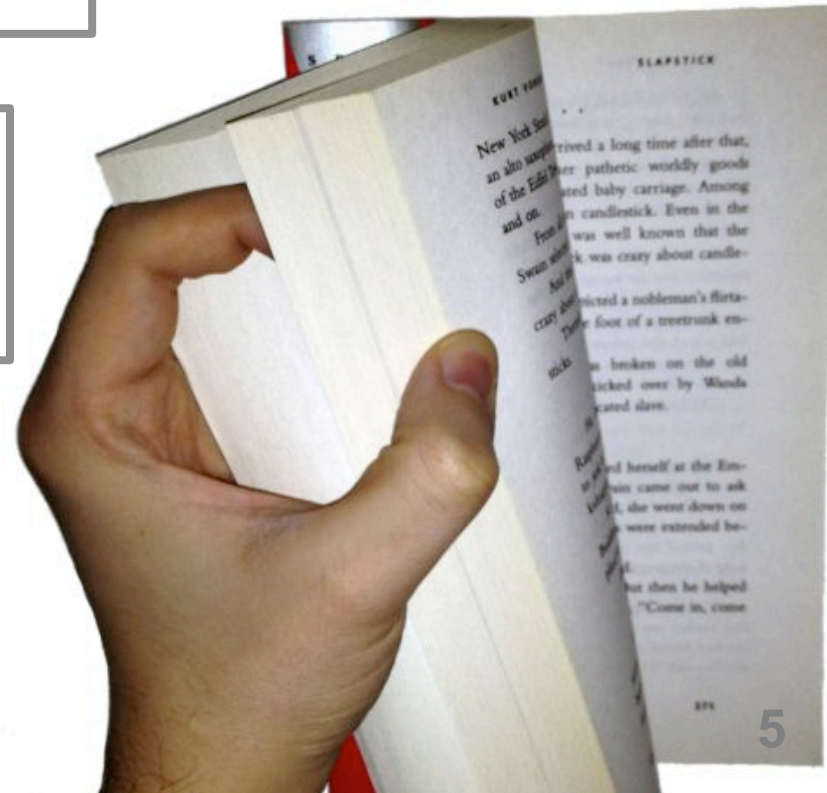
risk of abandonment

Alternative Approach

Sneak peak to the end...

consider applications early

**justify investments in
hardware design
& human factors studies**



My Experience...

Laterotactile Displays

tactile graphics

Braille

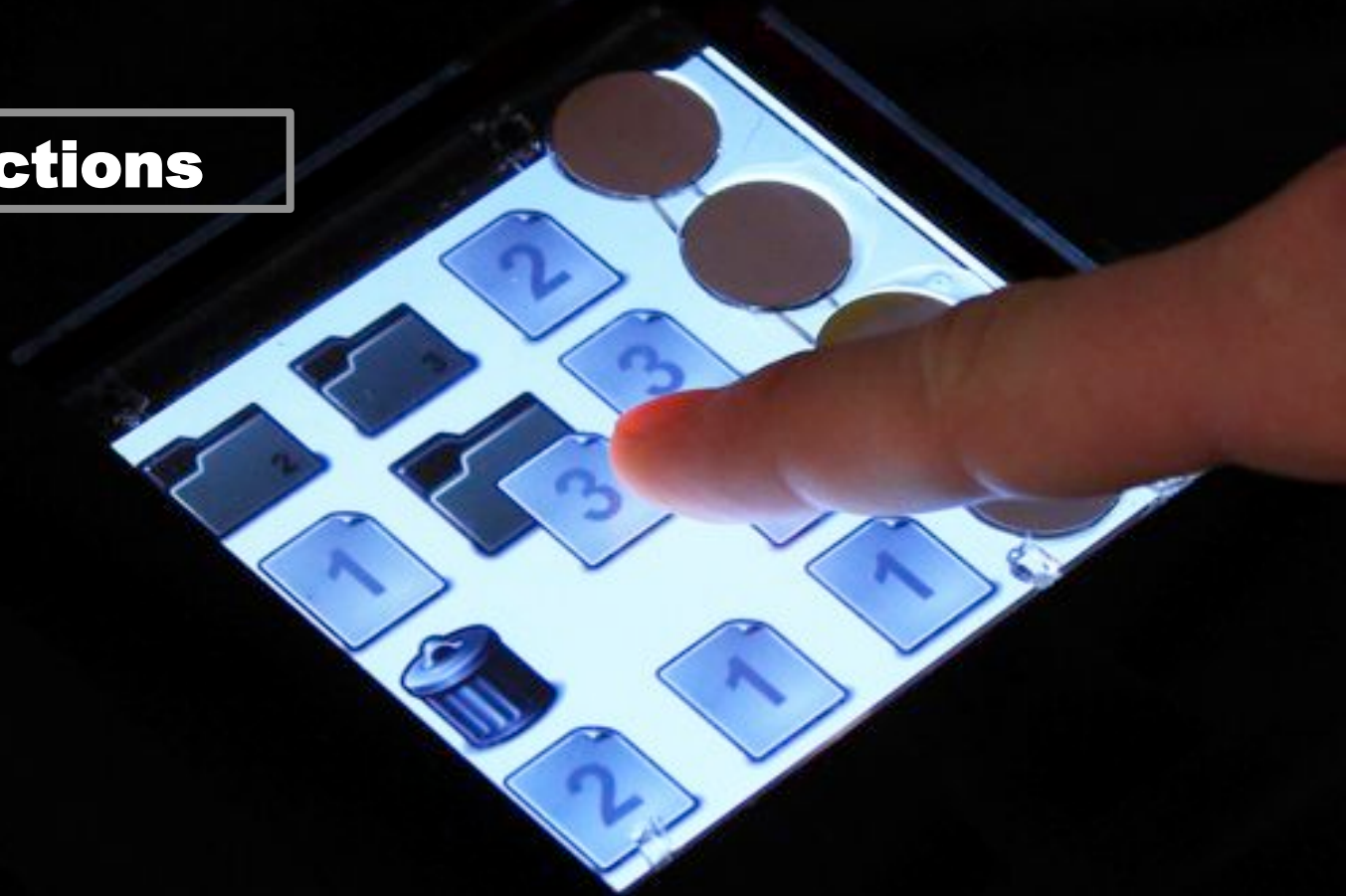


McGill

My Experience...

Programmable Friction

touch interactions



Collaborators: Karon MacLean, Ed Colgate, Michael Peshkin, Andy Cockburn,
Louise Oram, Nicolas Marchuck, Dan Johnson

Programmable Friction



N. Marchuk, J. E. Colgate, M.I Peshkin (2010) Friction Measurements on a Large Area TPaD, Proc. HAPTICS'10.



applications?

psychophysics?

hardware refinements?

Where do we start?

Collaboration

Hardware Design

**Ed Colgate, Michael Peshkin,
Nicolas Marchuck, Dan Johnson**



Interaction Design



**Karon MacLean, Andy Cockburn,
Vincent Levesque, Louise Oram**



Inspiration

Everyday Interactions

Inspiration

Touch Interactions



8

15
30
45

BRAIN STORMING SESSION

9

15
30
45

10

15
30
45

11

15
30
45

12

15
30
45

13

15
30
45

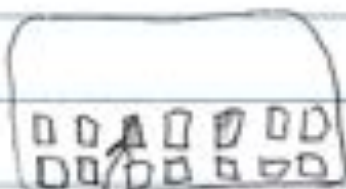


Brainstorming

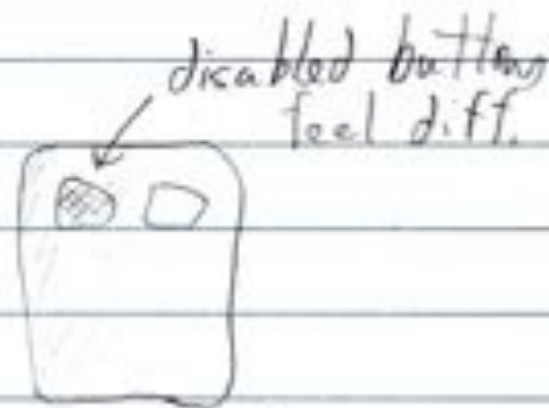
Make some regions more touchable than others



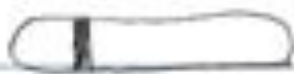
Use textures to mark regions => language



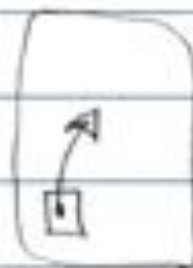
mark some keys



indicate progress/
action registered

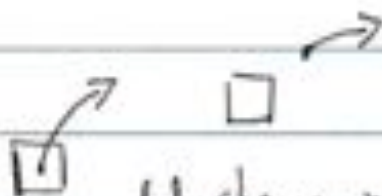


clicks on tx



feel motion

feedback when
action fails



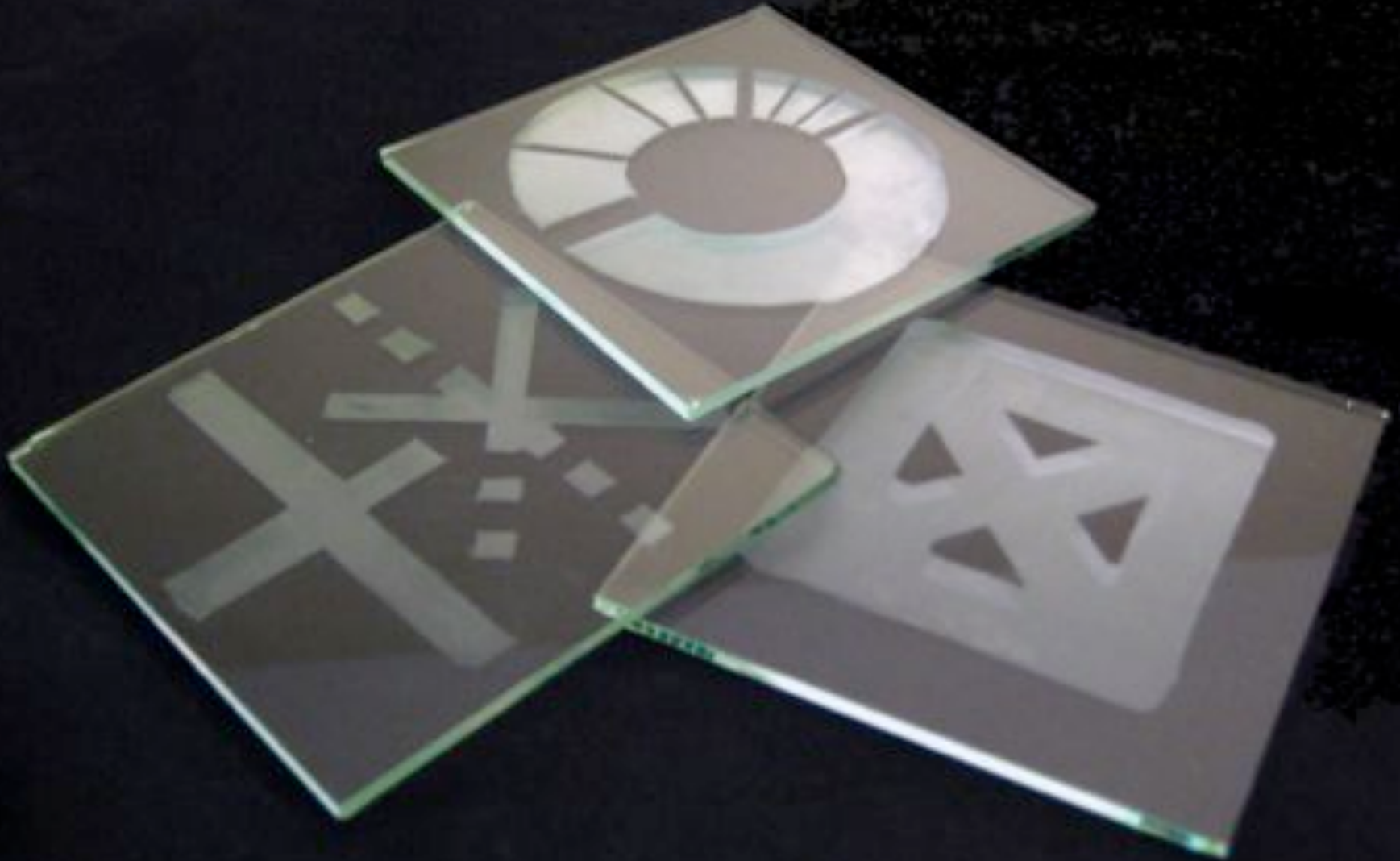
feel changes when
obj. dropped



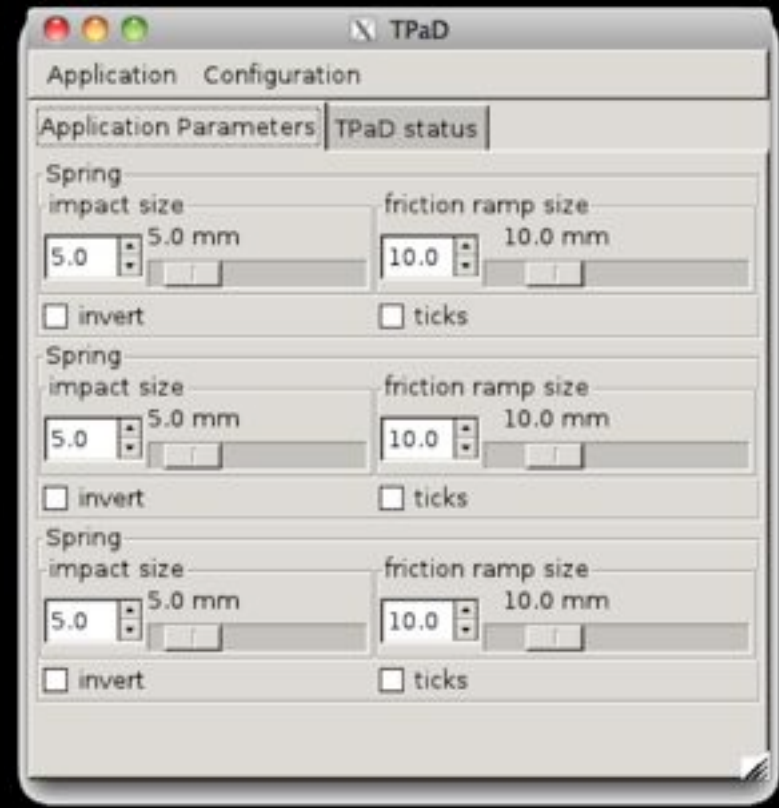
someone
else touches
it

Sketching

Low-Fidelity Prototyping



Software Sketches



Experiments

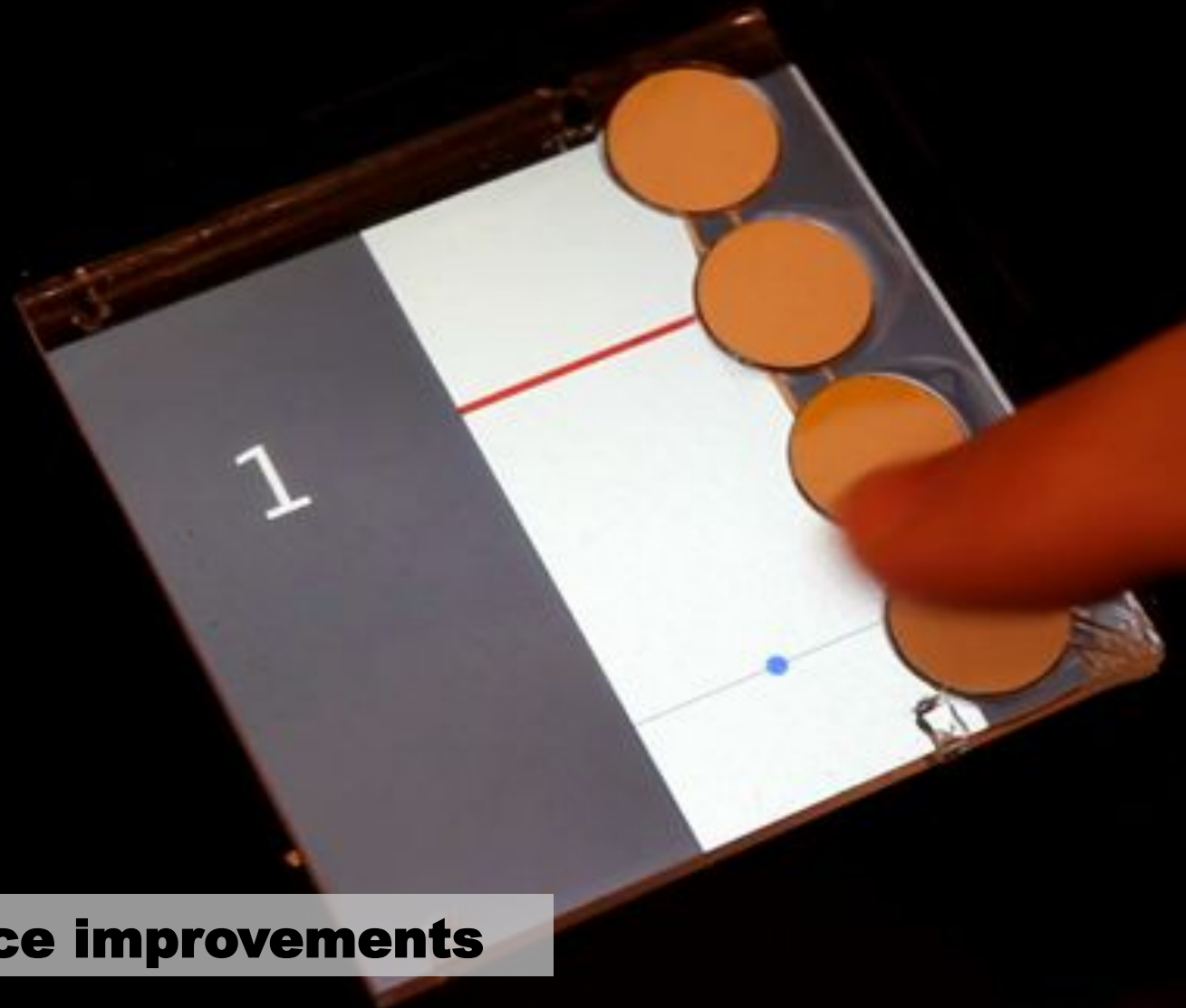


Performance
studies 1-3



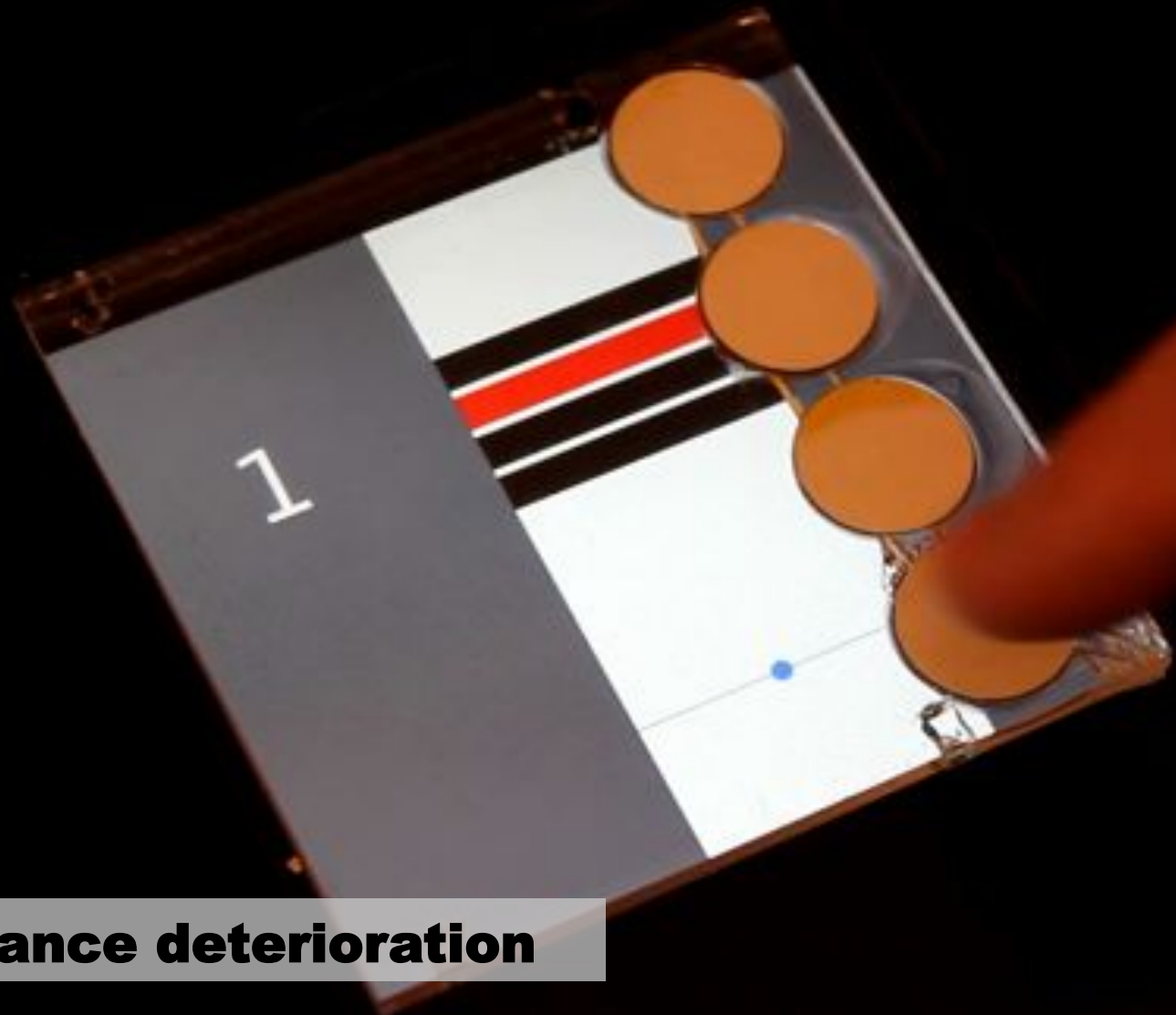
User Experience
study 4

Target Selection Study 1



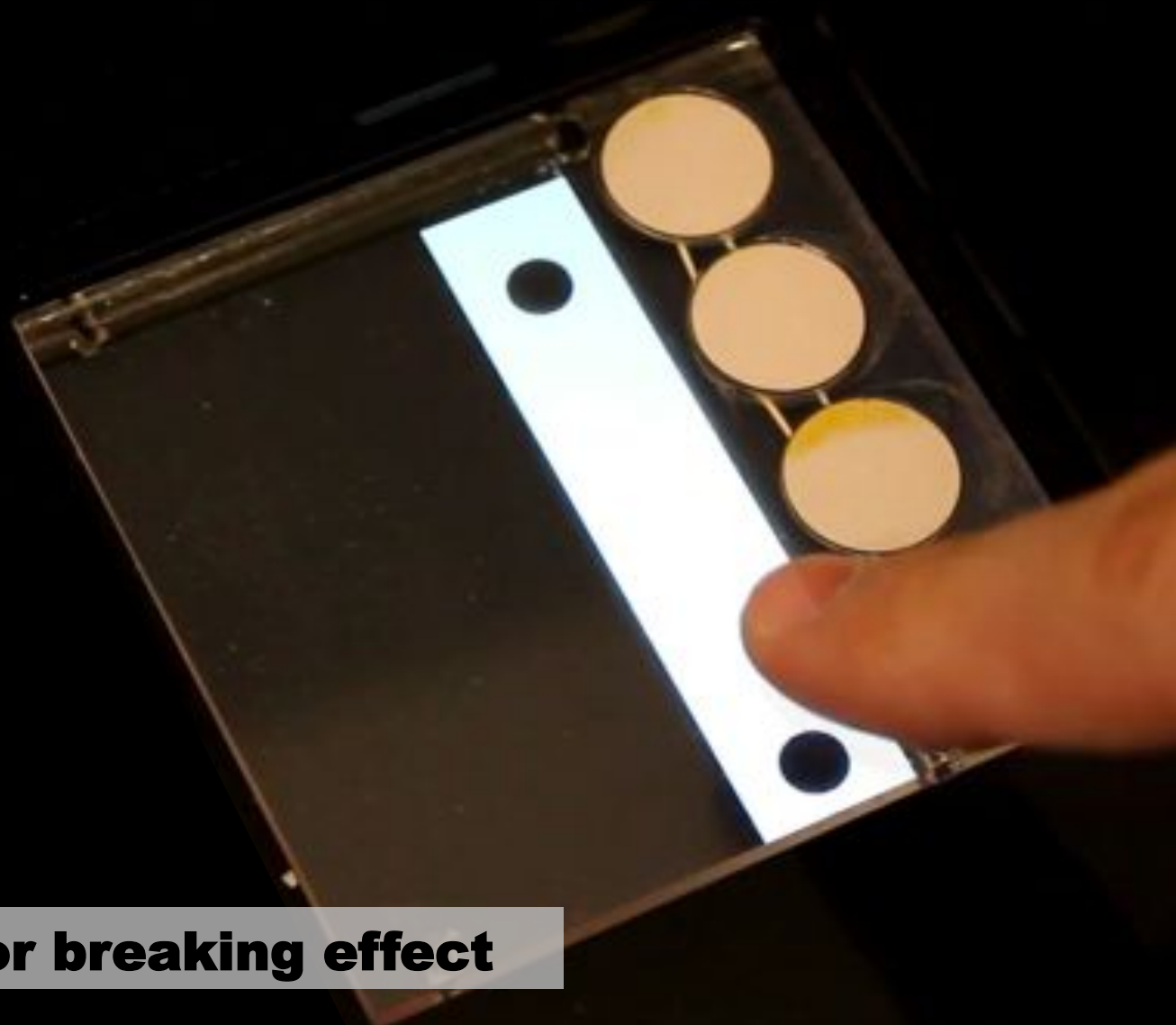
→ performance improvements

Effect of Distractors Study 2



→ no performance deterioration

Mechanical Effect Study 3



→ **evidence for breaking effect**

User Experience Study 4

12 participants

4 applications

alarm clock

file manager

game

text editor

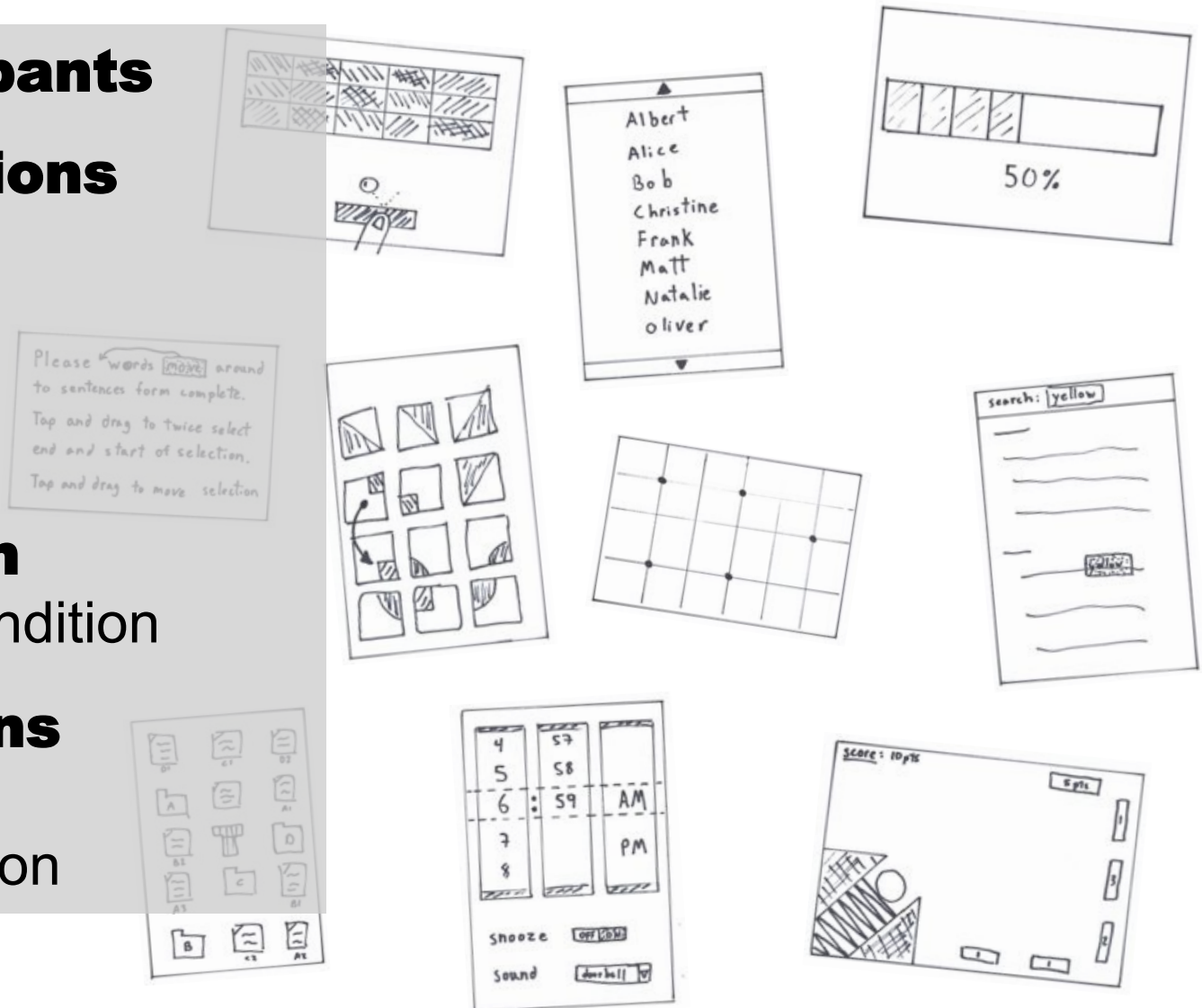
interaction

2 min per condition

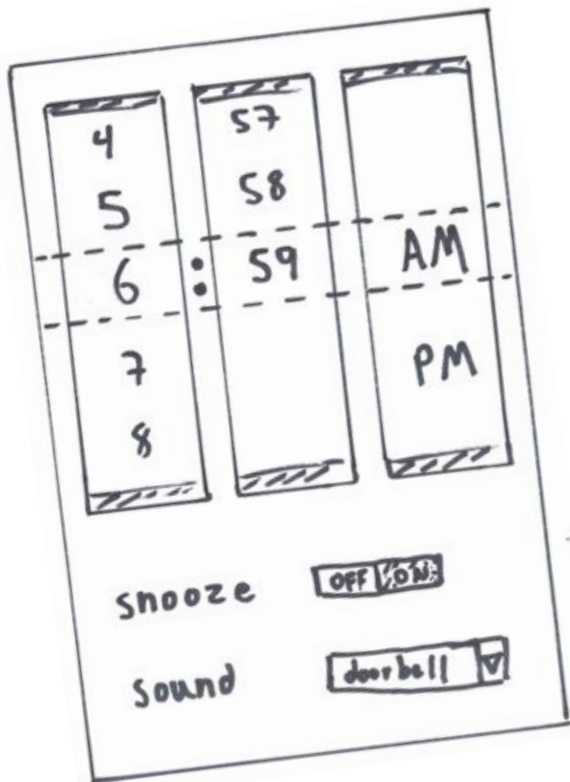
2 conditions

high friction

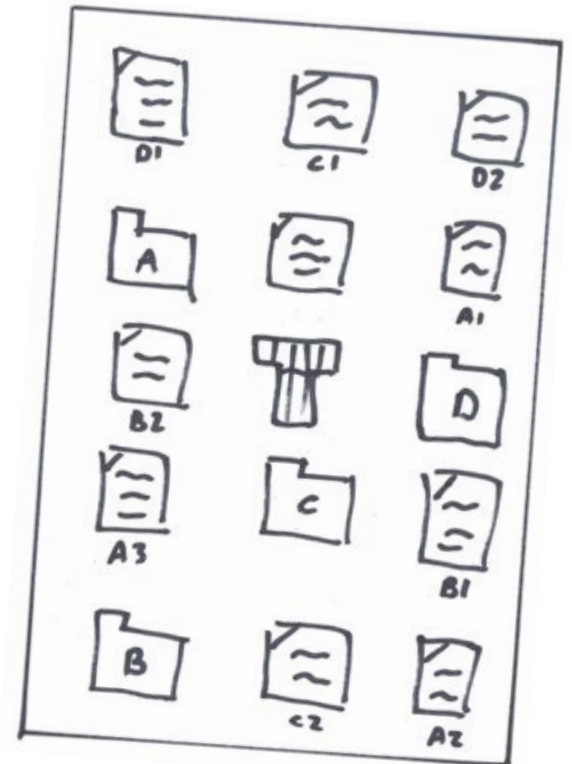
variable friction



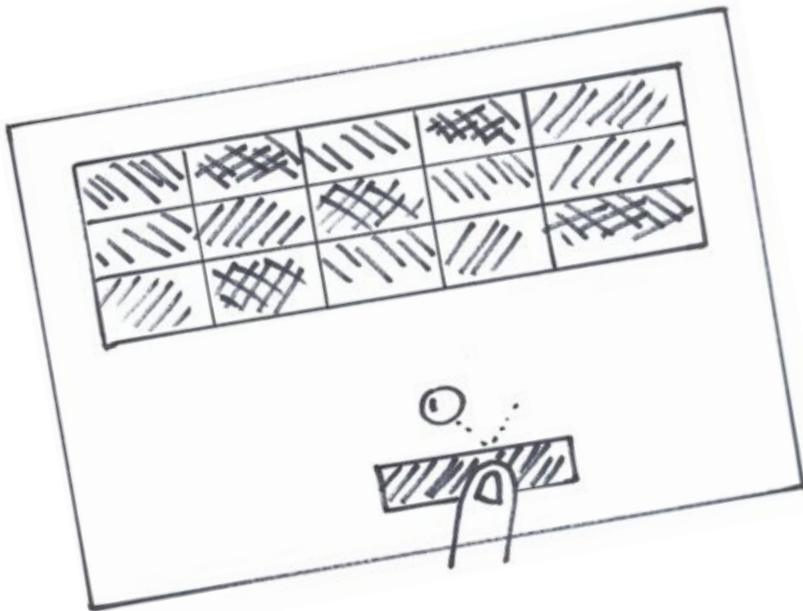
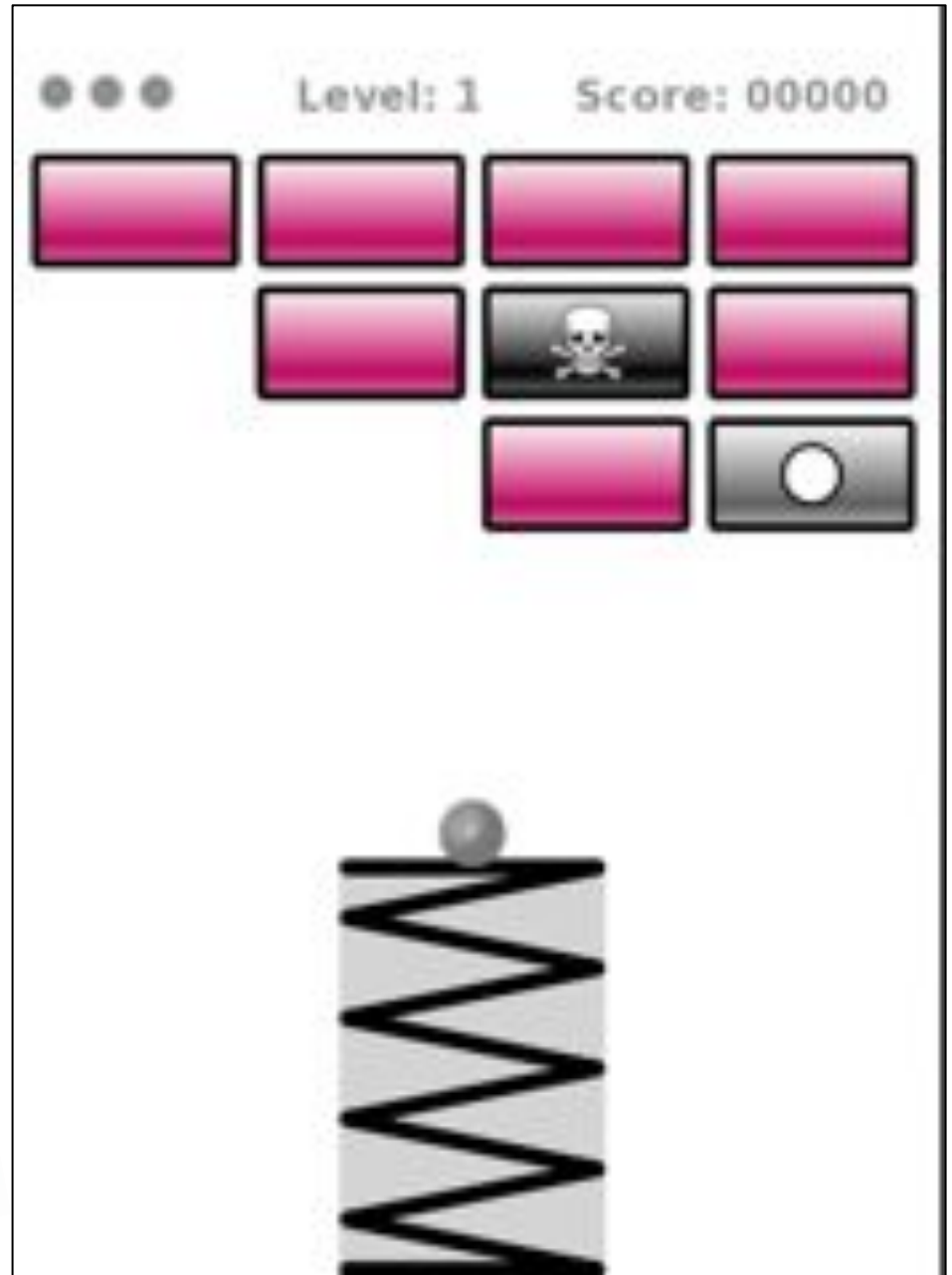
Alarm Clock



File Manager



Game



Text Editor

she saw a boy eat his
blue hat while his sister
put on her apple red
before to school going

Please ← words **move** around
to sentences form complete.
Tap and drag to twice select
end and start of selection.
Tap and drag to move selection

Questionnaires

User Engagement (10 Questions)

based on validated scale (O'Brien & Toms, 2009)

Tactile Feedback (7 Questions)

Comparison (5 Questions)

Final Questionnaire (2 Questions)

Results

positive or neutral on most ratings

Interviews

“When I was moving the words against something, I could feel something squeeze back.”

(P3, Text Editor)

“I think it gives me accuracy, [...] if I closed my eyes I would be able to predict the amount of scrolling that I do.”

(P5, Alarm Clock)

“This is nice... it makes things a lot more interesting.”

(P3, Game)

Conclusion

Performance

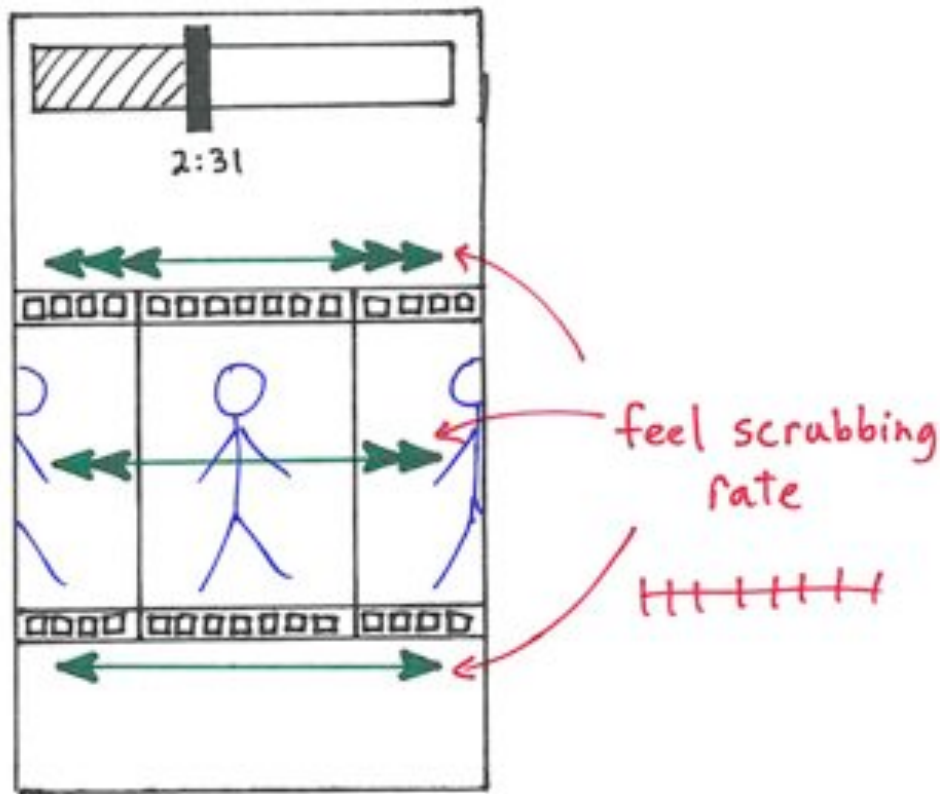
improvements in target selection
no deterioration with distractors



User Experience
positive impact on enjoyment,
engagement and realism

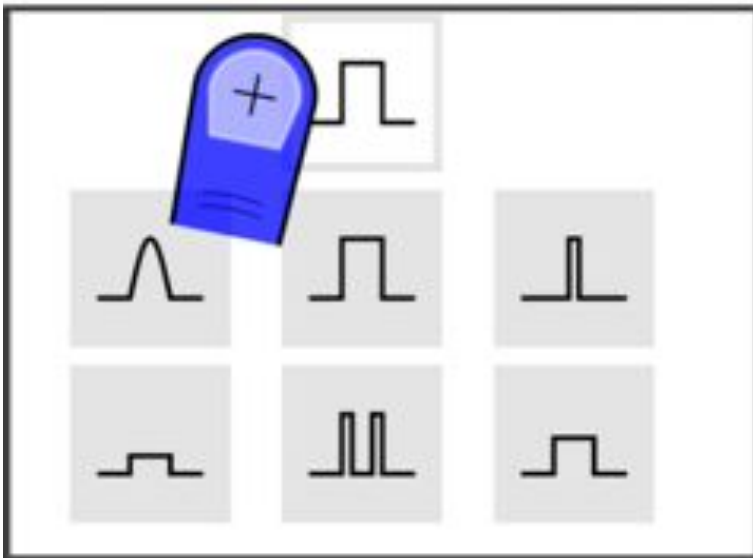
Second Iteration

Scrolling Interactions

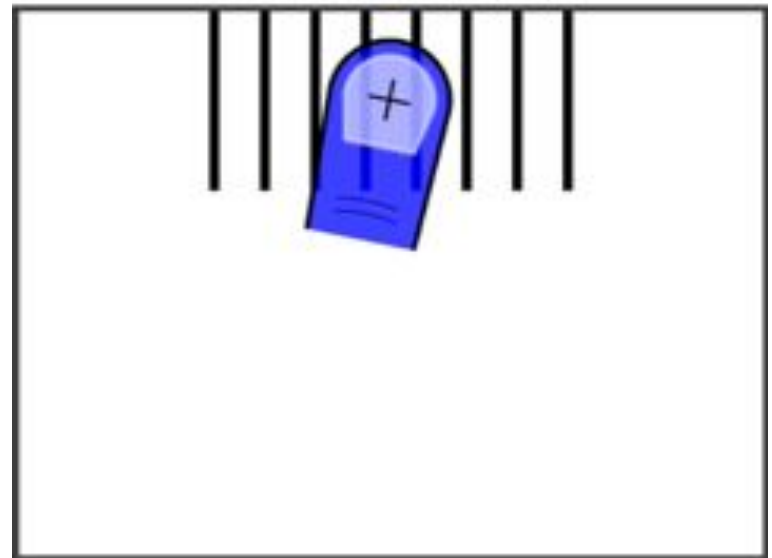


Short Experiments

1 – detent identification

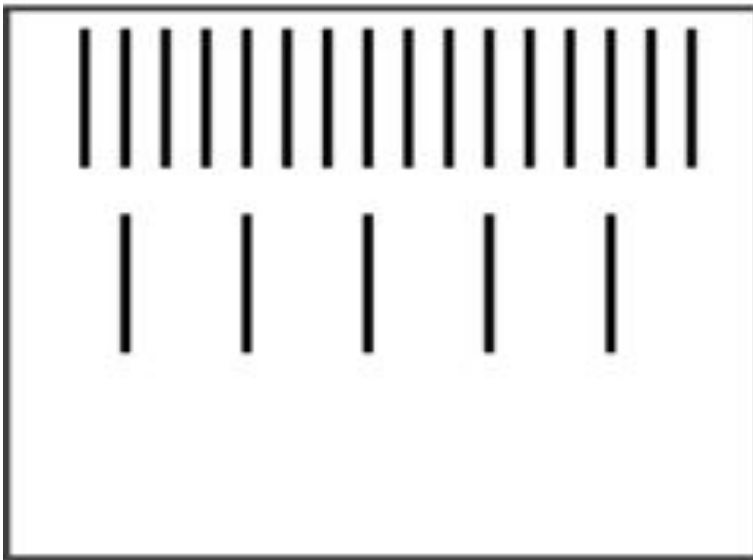


2 – detent counting

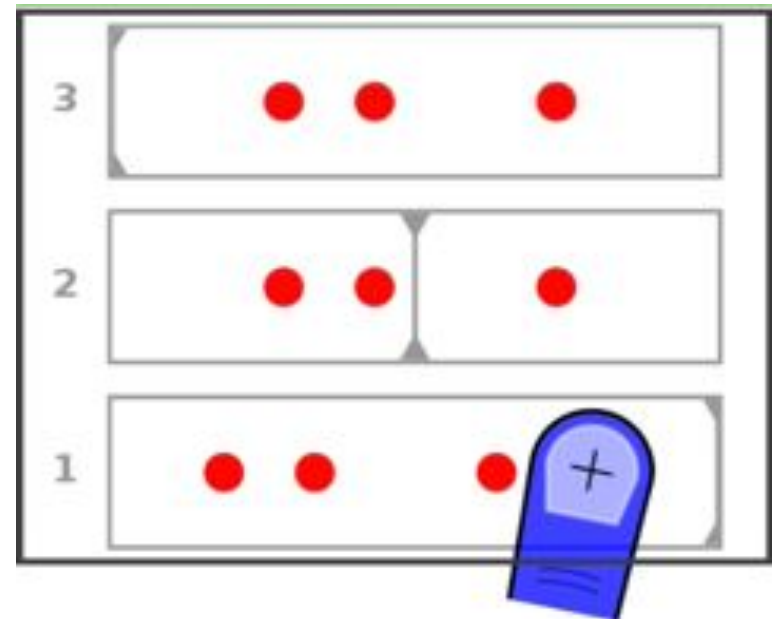


Short Experiments

3 – rate judgment

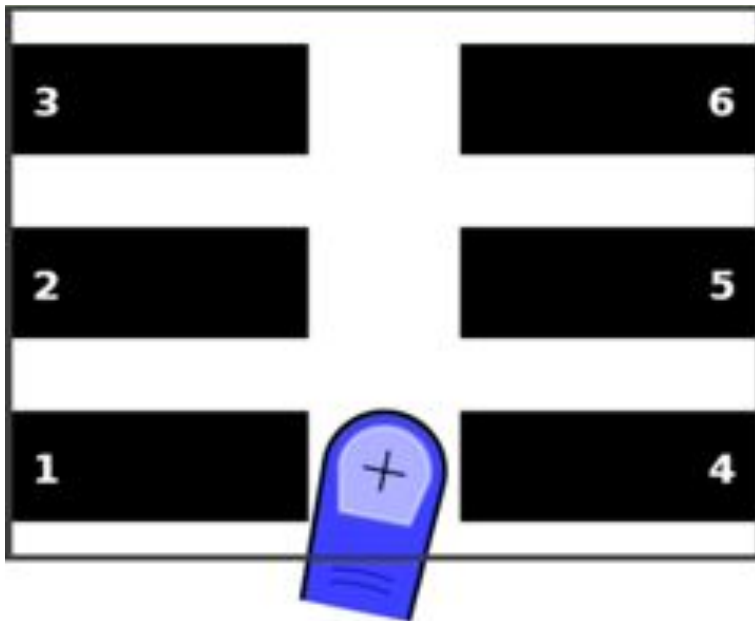


4 – feedback location



Short Experiments

5 – resistance



Design Guidelines

- 1 Use **few distinct detents** for precise or fast identification.
- 2 Expect **counting** to be **imprecise**.
- 3 Leverage **detent density** perception.
- 4 Trigger feedback at the screen's **center**; reinforce with visuals.
- 5 Augment rate controllers with **spring-like resistance**.

Conclusion

Seek collaborations!

Brainstorm, sketch, prototype!

Test what matters!

Give demonstrations!

For more information...



Short Talk – Monday 9:00

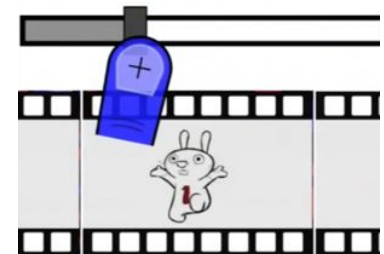
Adaptive Level of Detail in Dynamic, Refreshable Tactile Graphics
Vincent Levesque, Gregory Petit, Aude Dufresne, Vincent Hayward

Long Talk – Monday 9:35

Exploring the Design Space of Programmable Friction for Scrolling Interactions
Vincent Levesque, Louise Oram, Karon MacLean

Demonstration 32

Programmable Friction in Scrolling Interactions
Vincent Levesque, Louise Oram, Karon MacLean



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