Creating Human-Computer Partnerships

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HAMAC - 8 July 2018

Inria · Université Paris Sud · ex)situ · université Paris-Saclay · erc

How do we interact with computers ?

Computer as ***tool***
Empower users

Human-Computer Interaction

Computer as ***servant***
Delegate tasks

Artificial Intelligence

Computer as ***medium***
Communicate

Mediated Communication

How do we interact with computers ?

Machine learning perspective:

Human-in-the-loop

Use human input to ***improve the algorithm***

How do we interact with computers ?

Machine learning perspective:

Human-in-the-loop

Use human input to *improve the algorithm*

User types
Google suggests
User chooses


But ‘human-in-the-loop’ is
not always best for the user

How do we interact with computers ?

If *Human*-in-the-loop

uses human input to ***improve the algorithm***

How do we interact with computers ?

If *Human*-in-the-loop
uses human input to ***improve the algorithm***

Shouldn't we also have
'*Computer*-in-the-loop' to ***empower the user?***

Human-Computer Partnerships

We already create models of *users*
to inform the *system*

Shouldn't we also create models of the *system*
to inform the *user?*

We need to create effective
human-computer partnerships

What do we mean by 'partnership' ?

Take a taxi

Driver in control

What do we mean by 'partnership' ?

Take a taxi

Driver in control

Drive a motorcycle

User in control

What do we mean by 'partnership' ?

Take a taxi

Driver in control

Drive a motorcycle

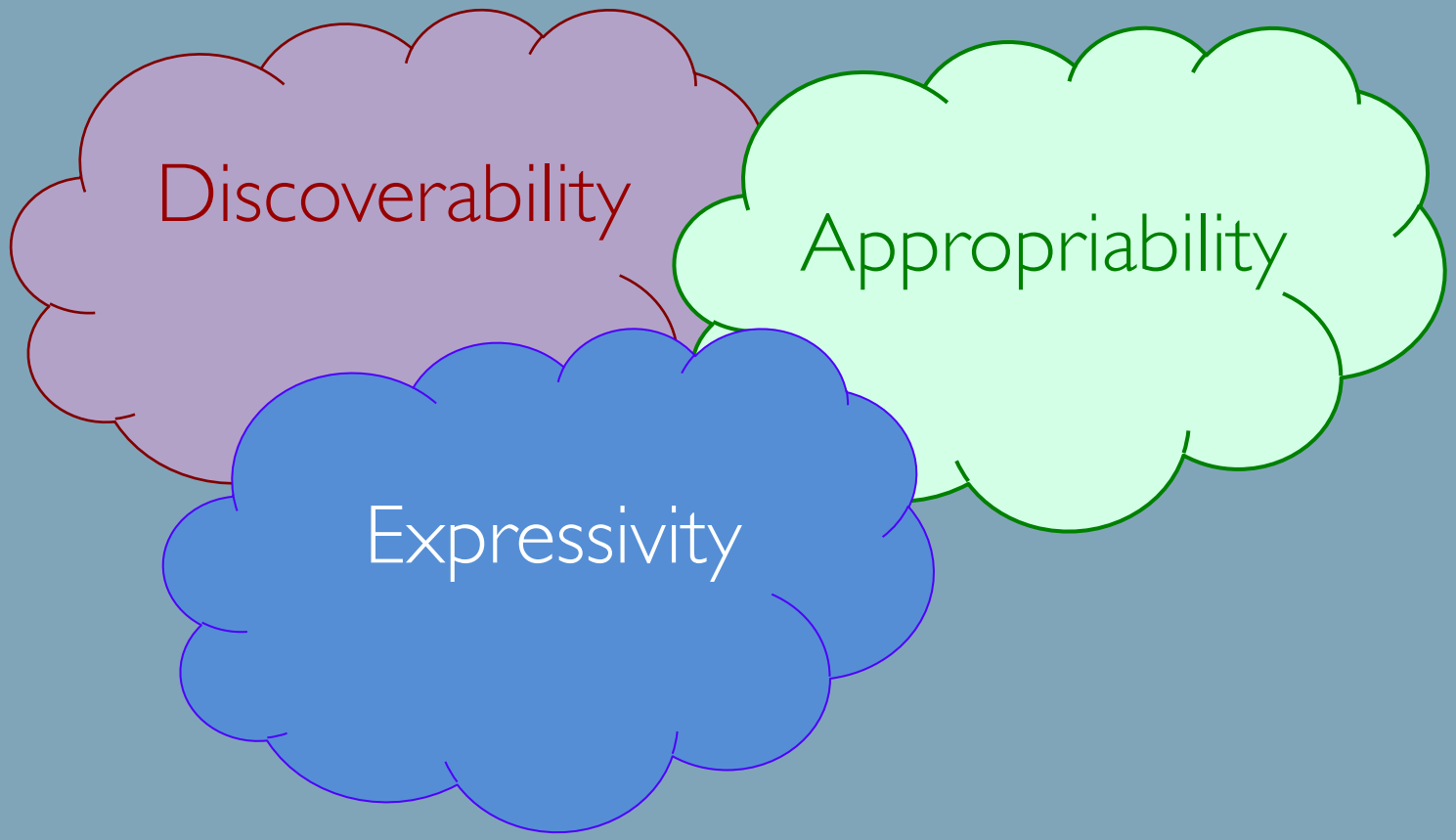
User in control

Ride a horse

Shared control

Human-Computer Partnerships

To share control, users need:



What can we learn from physical tools ?

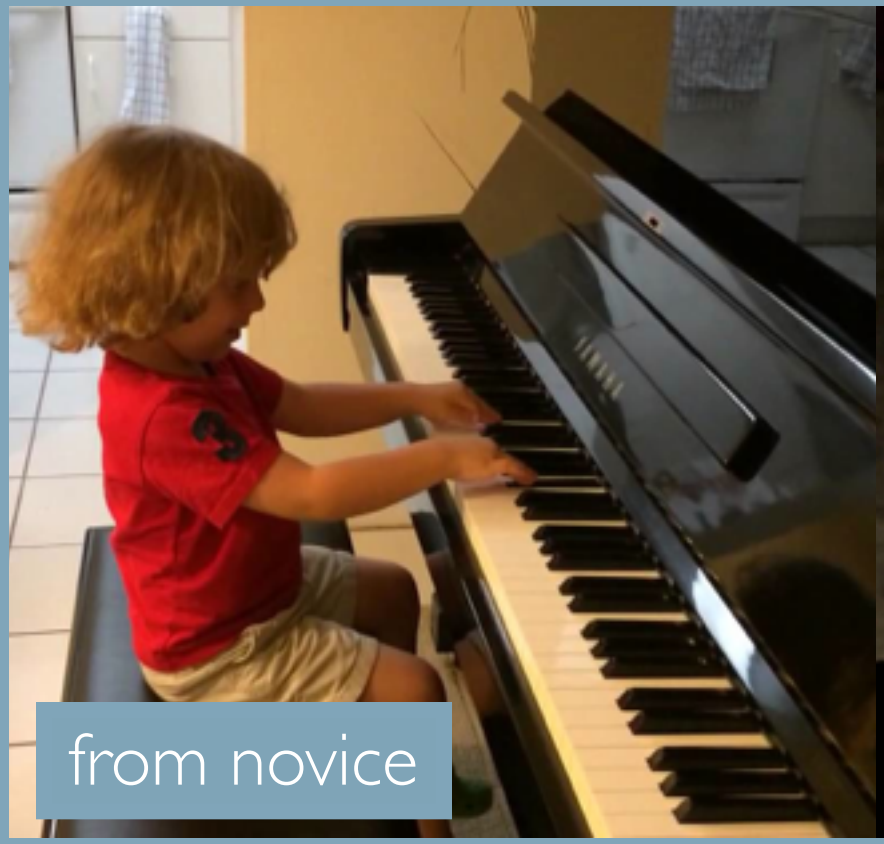
We can use physical tools as designed…

What can we learn from physical tools ?

But we can also improvise !

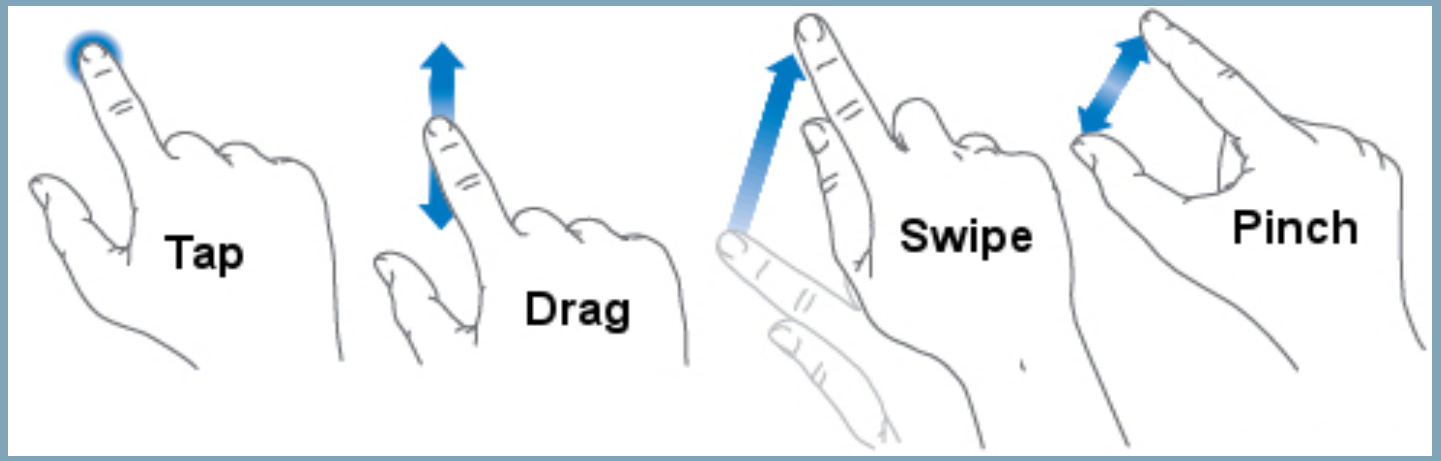

Some of us become
virtuoso users

Why can't we learn to 'play' software tools ?
without relearning the interface
with every software upgrade ?

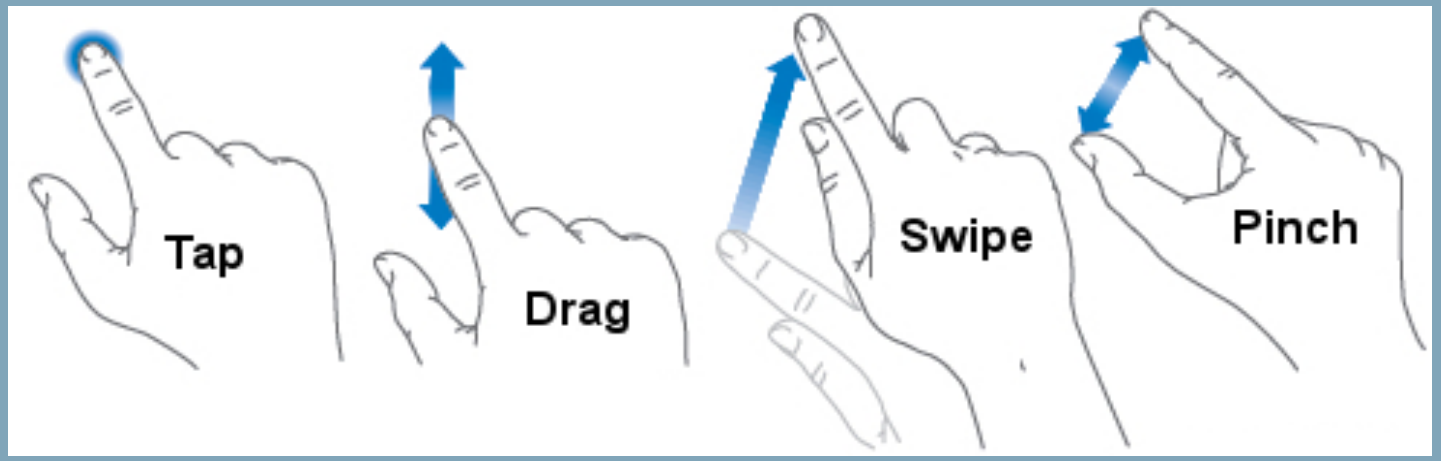


Take a smartphone ...

Smartphone interfaces are simple

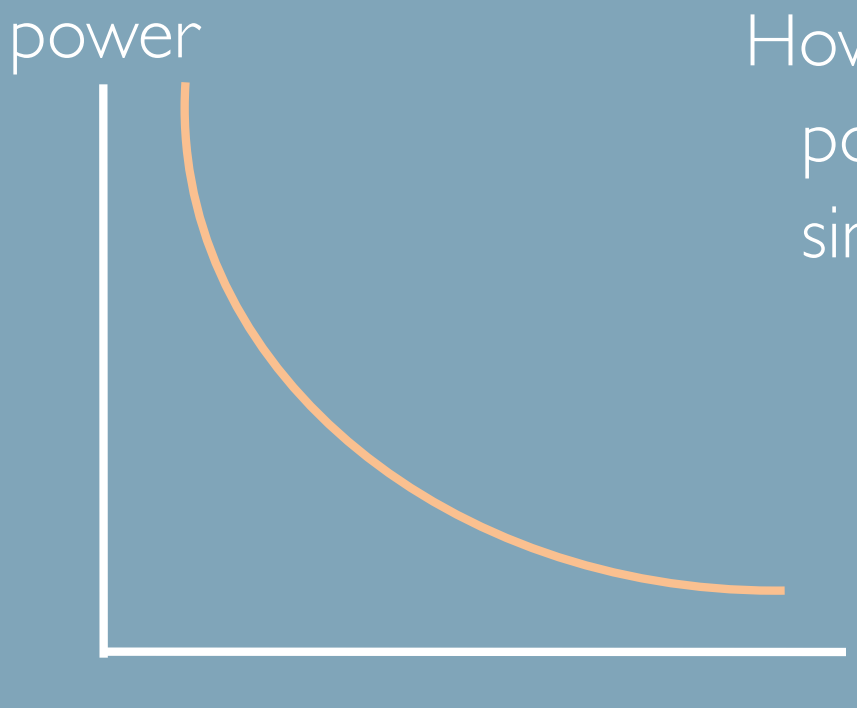


Smartphone interfaces are simple



Why not powerful, expressive *and* simple ?

Major design trade-off

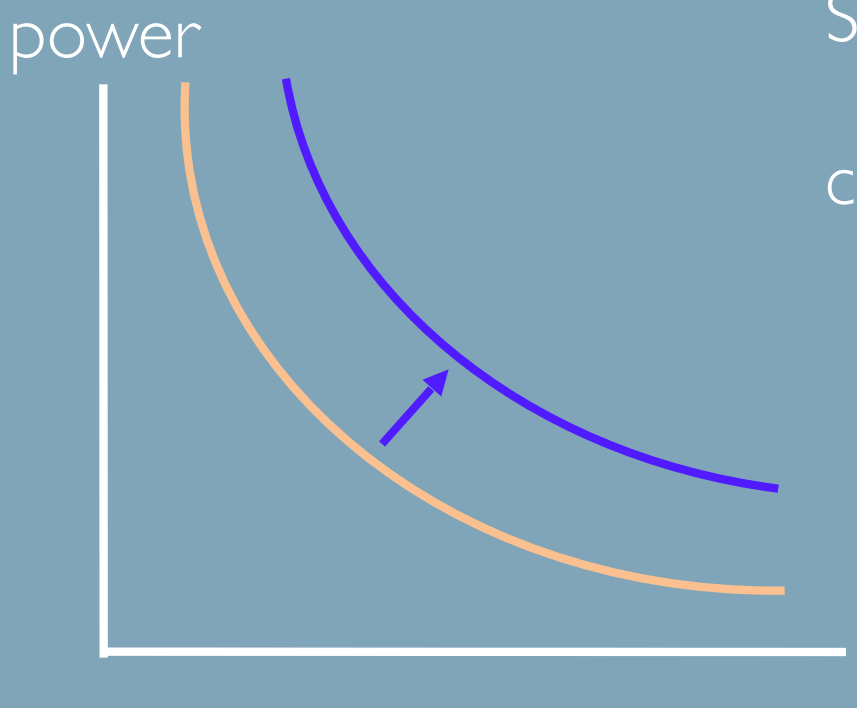


How to balance:

power of expression

simplicity of execution?

Solution: Shift the curve

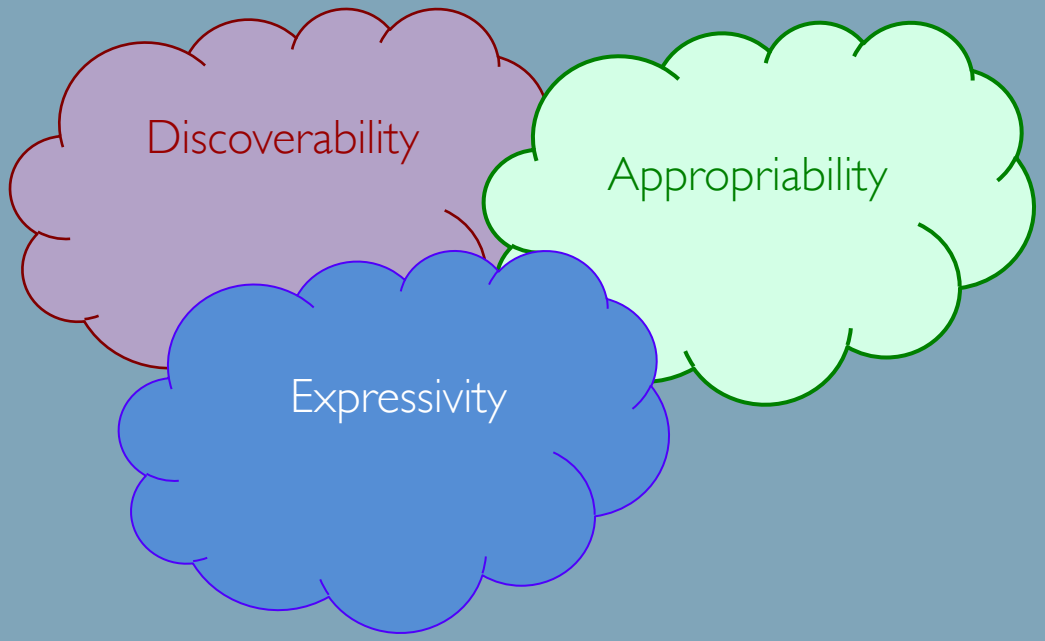


Simple things
should be simple,
complex things
should be possible

Human-computer partnerships

People can

adapt to technology	they learn it
adapt the technology	they appropriate it



Human-computer partnerships

People can

adapt to technology	they learn it
adapt the technology	they appropriate it

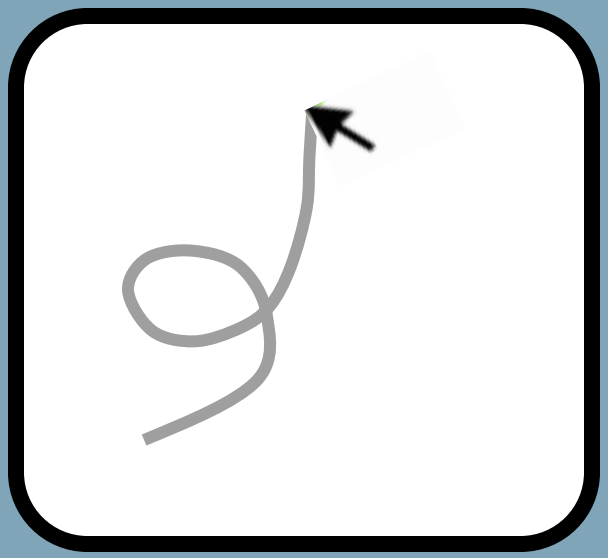
Computers can

adapt to people	they learn (AI)
adapt people's behavior	they teach (CAI)

How can I learn
which gesture
executes which command?

Octopocus

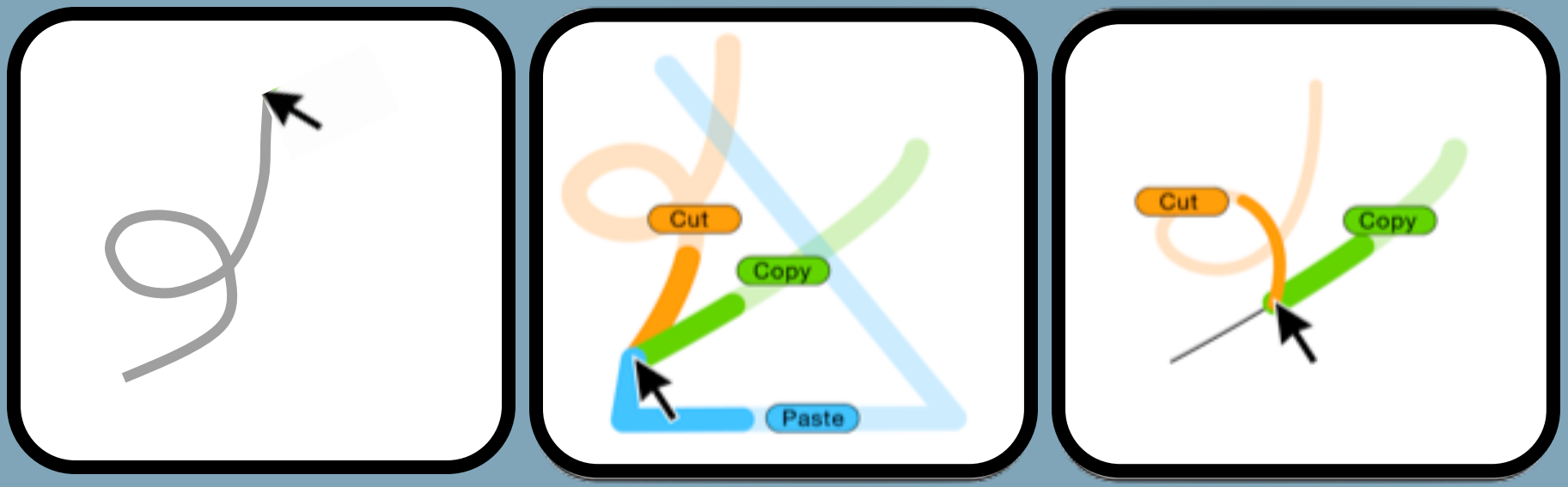
Experts just perform the gesture



Bau & Mackay, UIST'09

Octopocus

Experts just perform the gesture
Novices pause . . .
and the Octopocus guide appears



Bau & Mackay, UIST'09

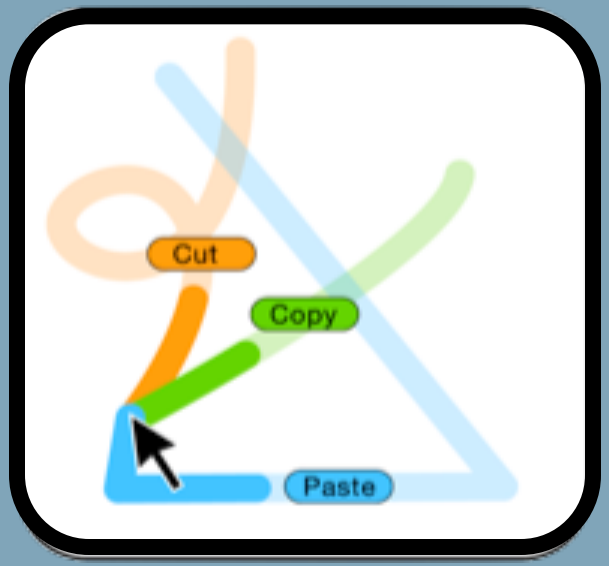
Octopocus

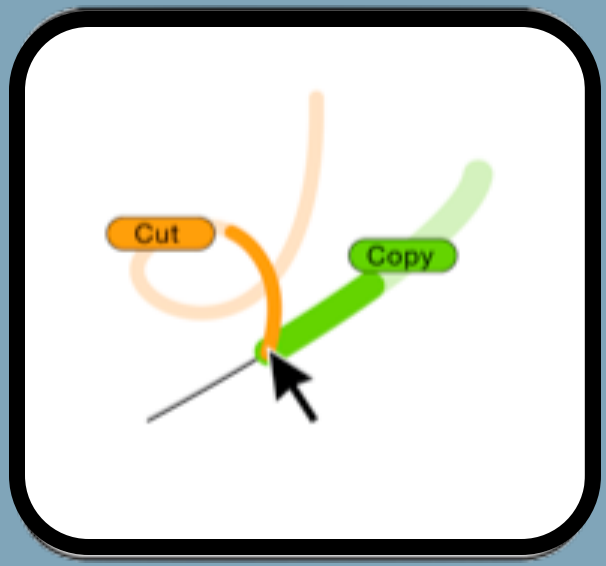
Progressive feedforward

What gestures are available ?

Progressive feedback

What did the system recognize ?





Bau & Mackay, UIST'09

Inking the '*Help*' command

How can I learn
new gestures
that execute commands ?

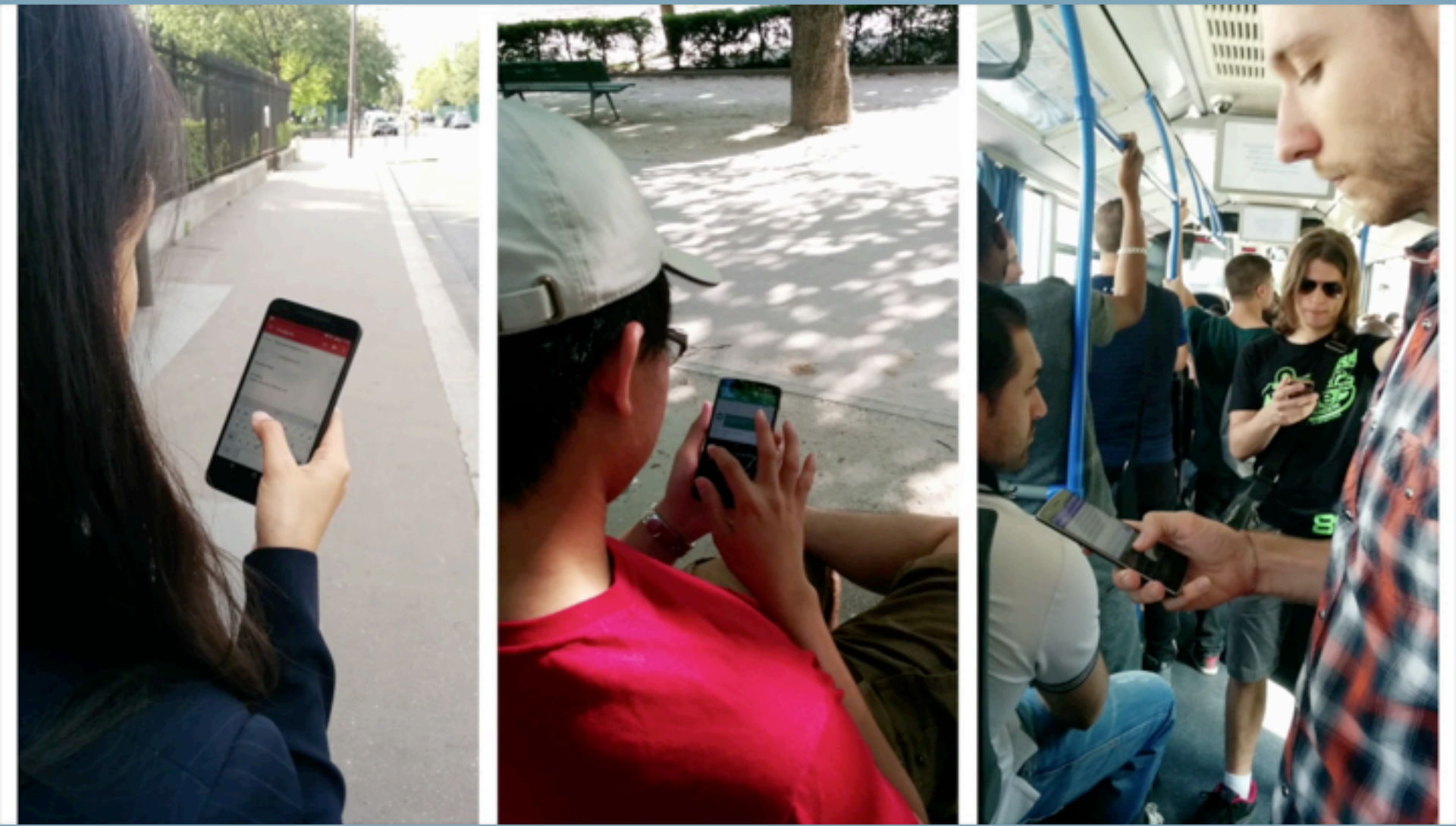
Gesture typing: Typing with gestures

Instead of tapping. . .

draw through
each letter
to type a word

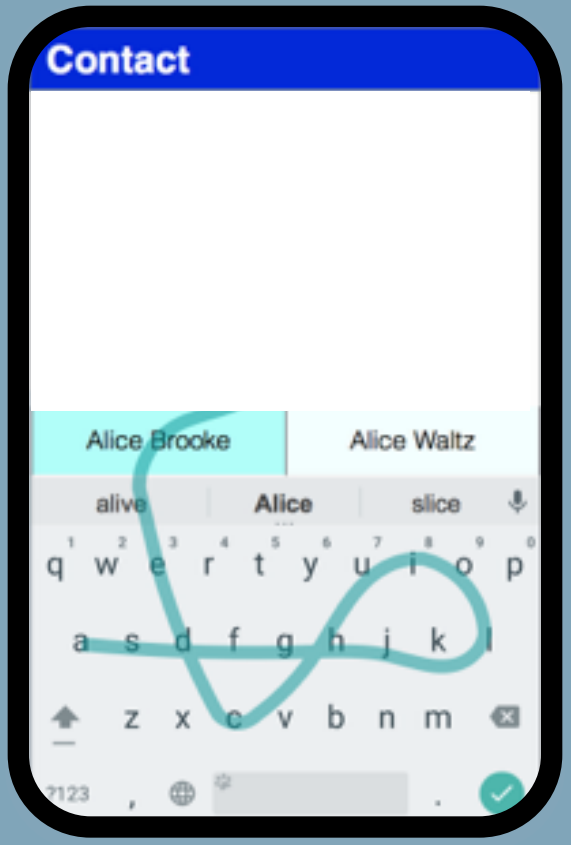
Zhai, S. & Kristensson, P.-O. CHI'03

Gesture typing



CommandBoard

Transform gestures into commands ...

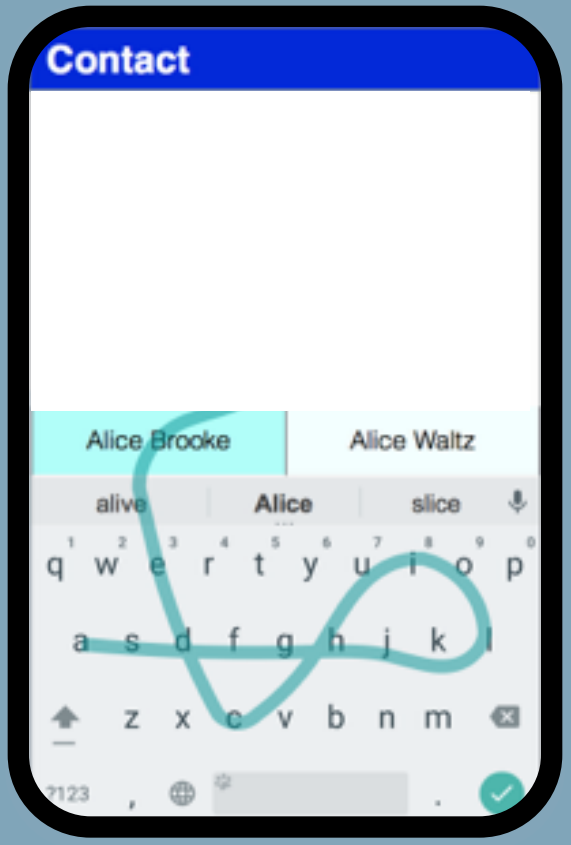


draw:
alice

Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

Transform gestures into commands ...



draw:

alice

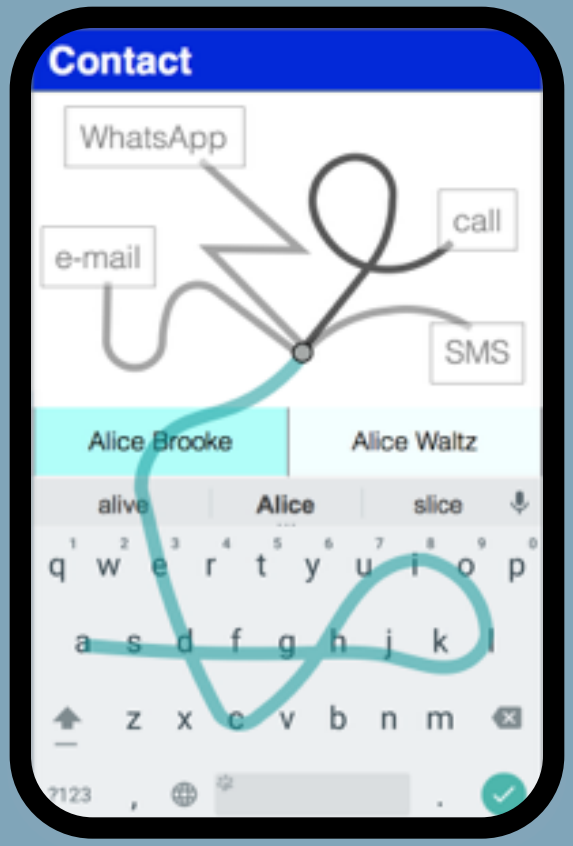
choose contact:

Alice Brooke

Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

Transform gestures into commands ...



write:

alice

choose contact:

Alice Brooke

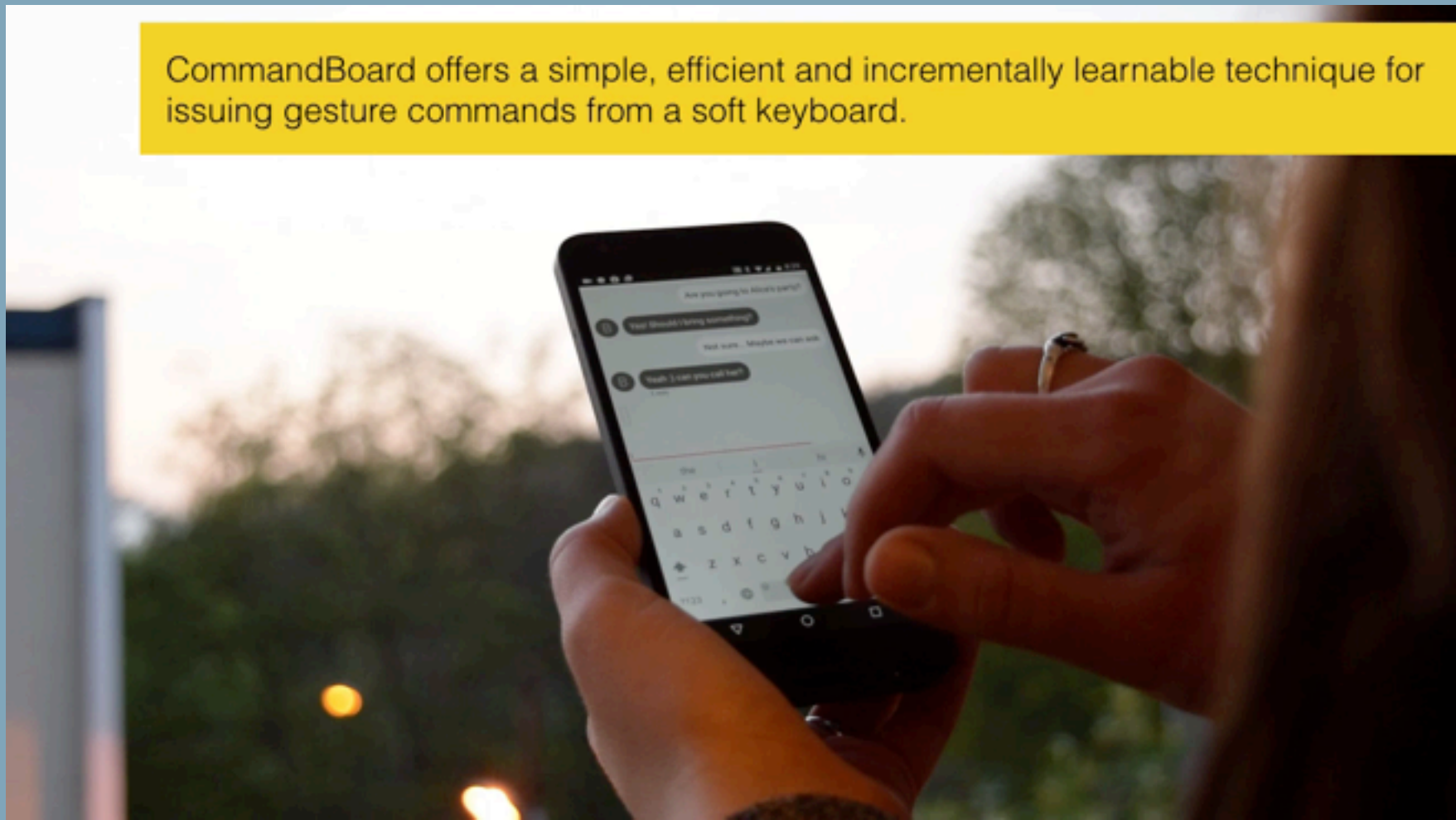
choose comm app:

Alice Brooke

Alvina, Griggio, Bi & Mackay UIST'17

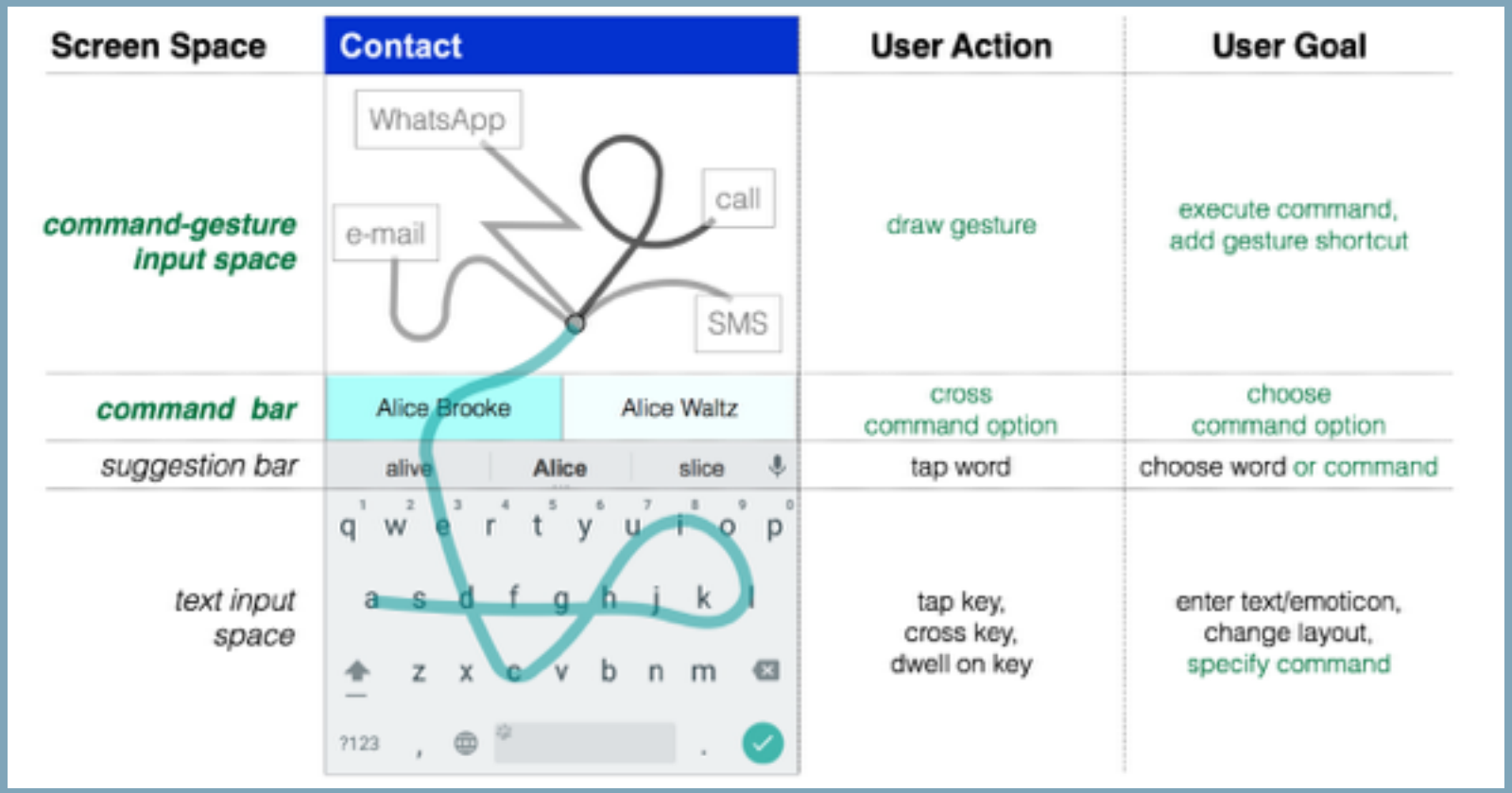
CommandBoard

Command-line interaction from a soft keyboard



CommandBoard

Execute any command from a gesture keyboard



Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

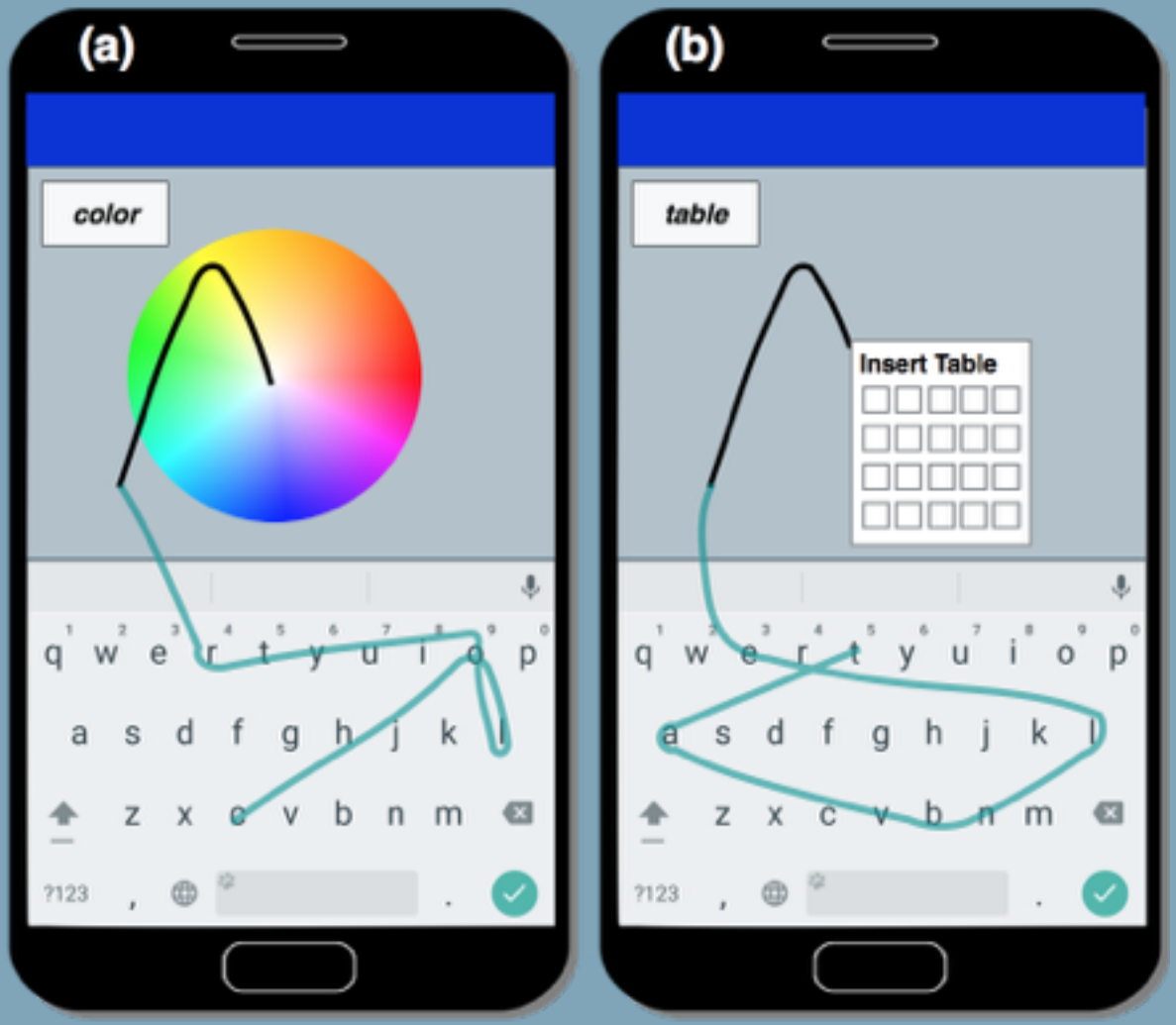
Execute any command from a gesture keyboard

Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

Draw *color*,
then pick from
a color wheel

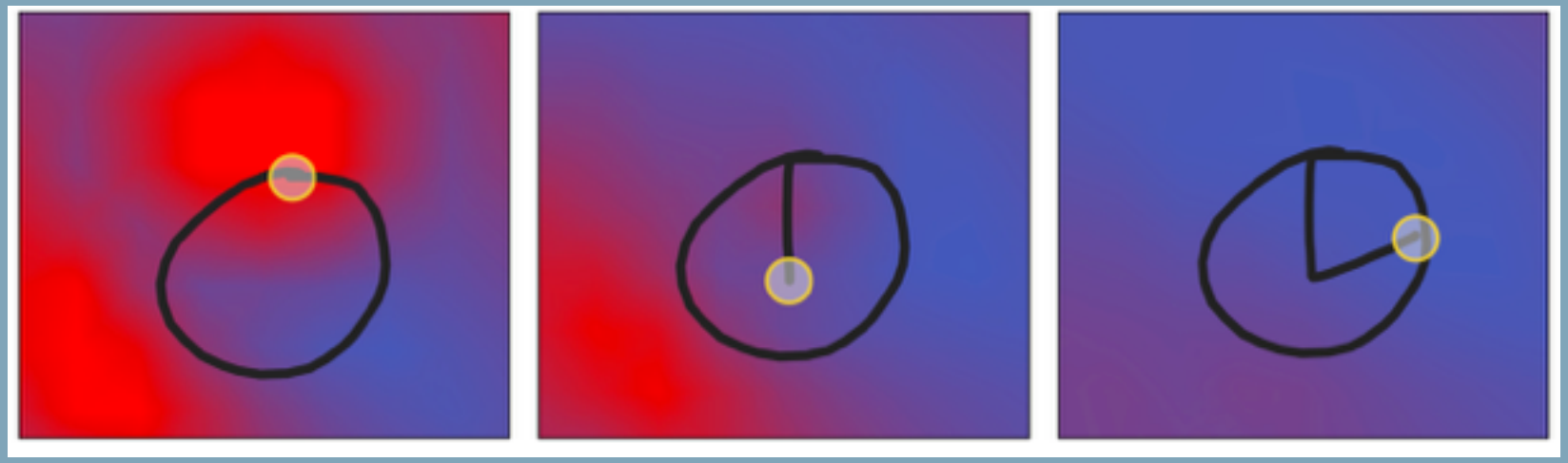
Draw table,
then insert
a table



How can I
create my own
gesture commands?

Fieldward

Create your own gesture commands
Must be:
easy for you to remember

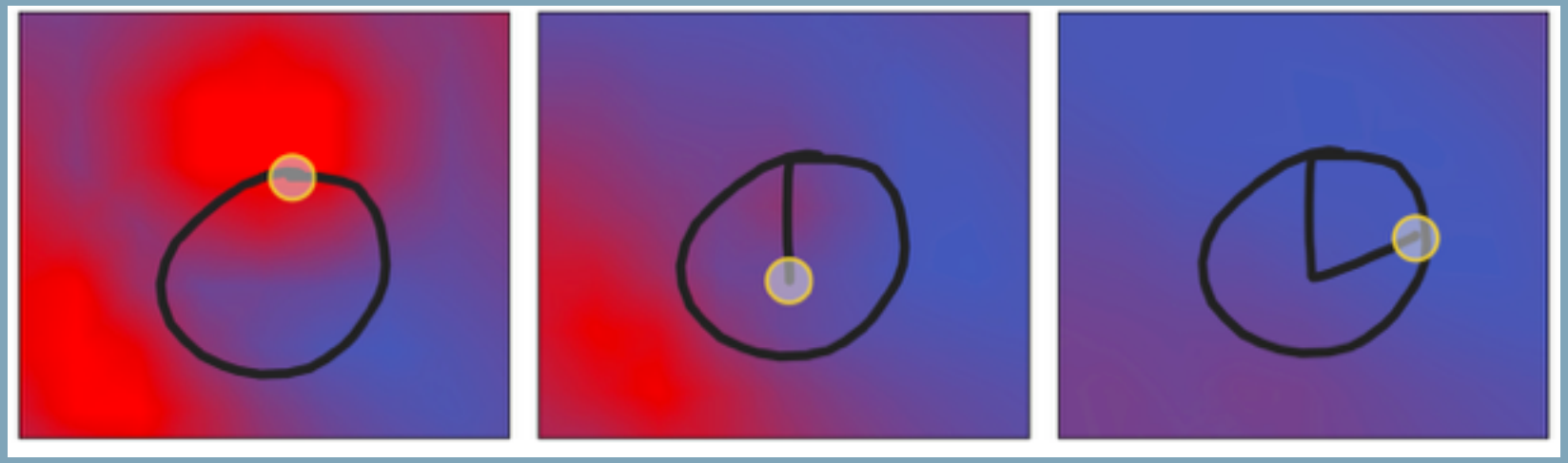


Fieldward

Create your own gesture commands

Must be:

- easy for you to remember
- easy for the system to recognize

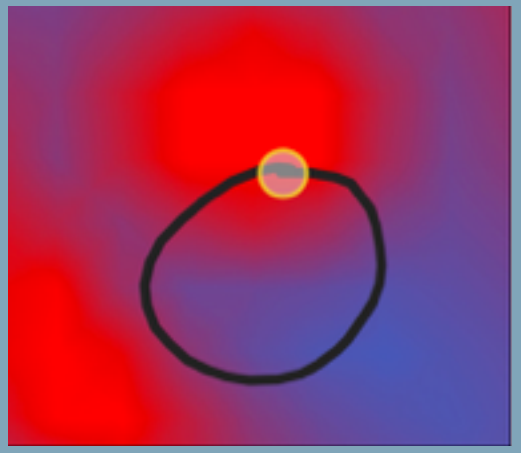


Fieldward

Draw a gesture

If it ends in a red zone
the gesture is ambiguous

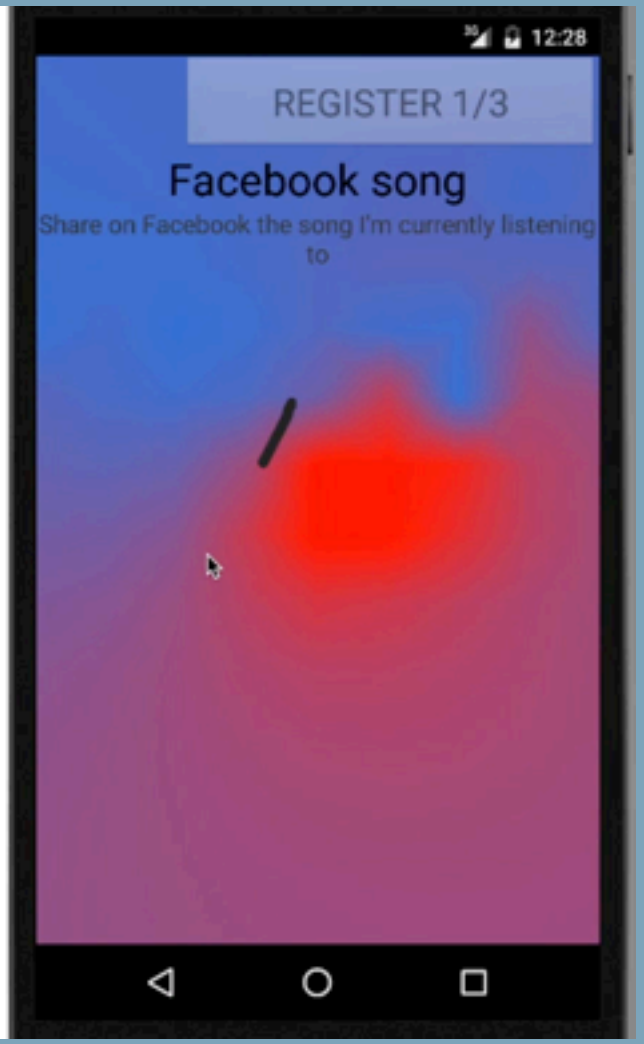
If it ends in a blue zone
you have a new gesture !



Fieldward:

Fieldward

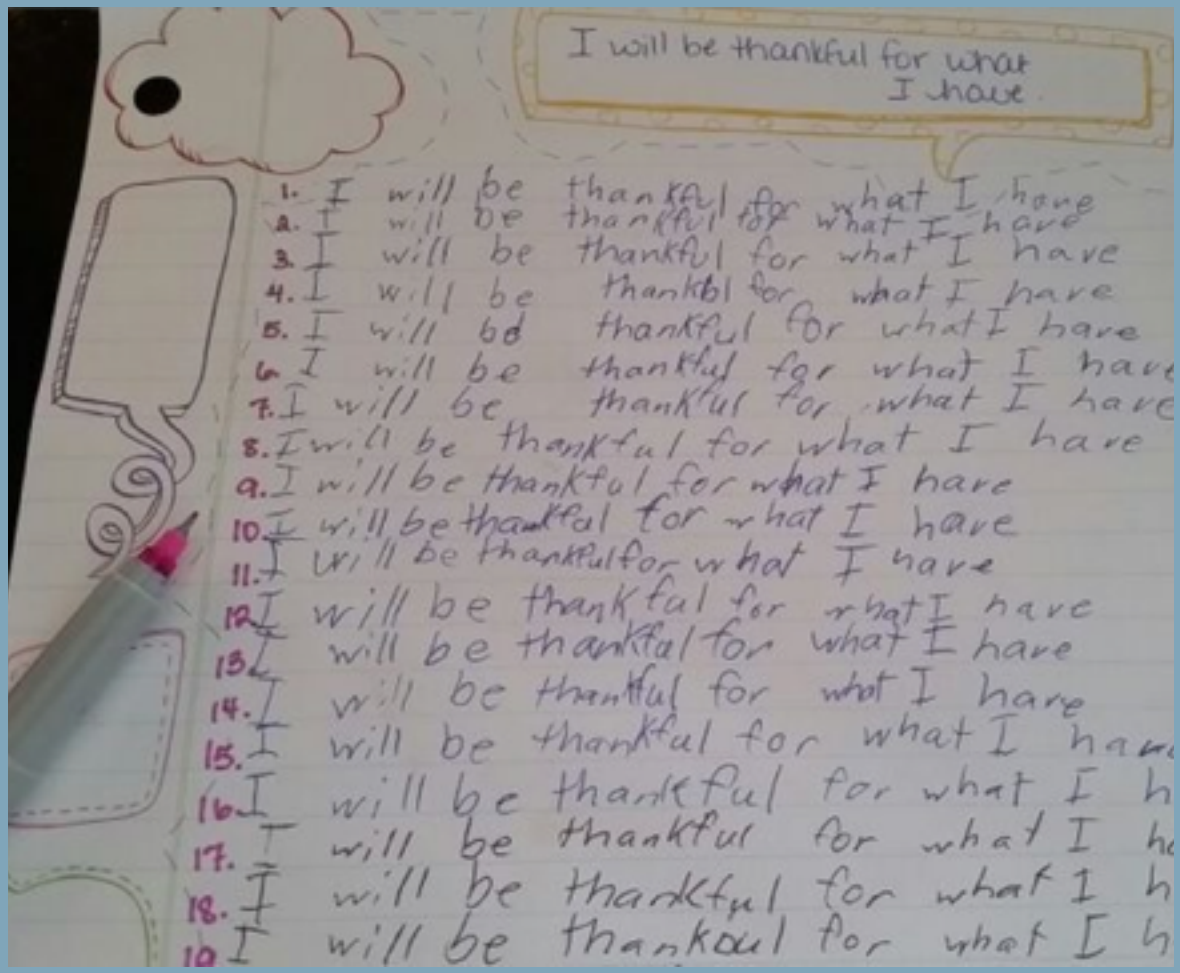
Shows a color gradient
indicating optimal directions
to make a recognizable gesture



How can I
generate
expressive text?

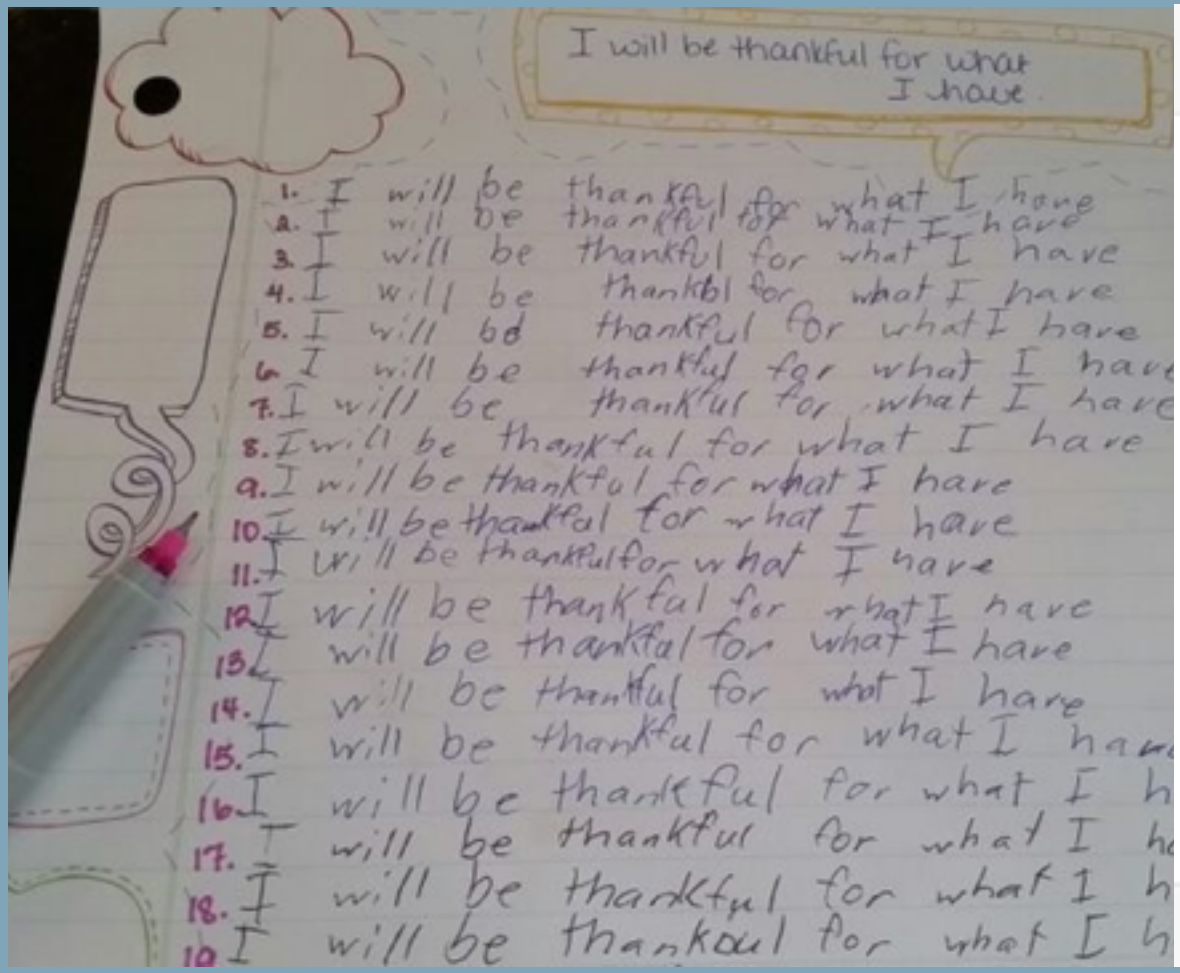
Human expression

Handwriting is expressive



Human expression

Handwriting is expressive ... SMS messages -- not so much



Human expression vs. Machine classification

- Machine learning algorithms:
  - Goal is to classify the correct word
  - Human variation is treated as noise

Gesture typing algorithms are great . . .

Human expression vs. Machine classification

Four ways to input the word "great"

All produce the identical result: great

Expressive Keyboard vs. Machine classification

- Machine learning
  - Guess the correct word (classify)
  - Throw away human variation

- Human-centered approach
  - Create expressive output
  - Transform human variation

Alvina, Malloch & Mackay CHI'16

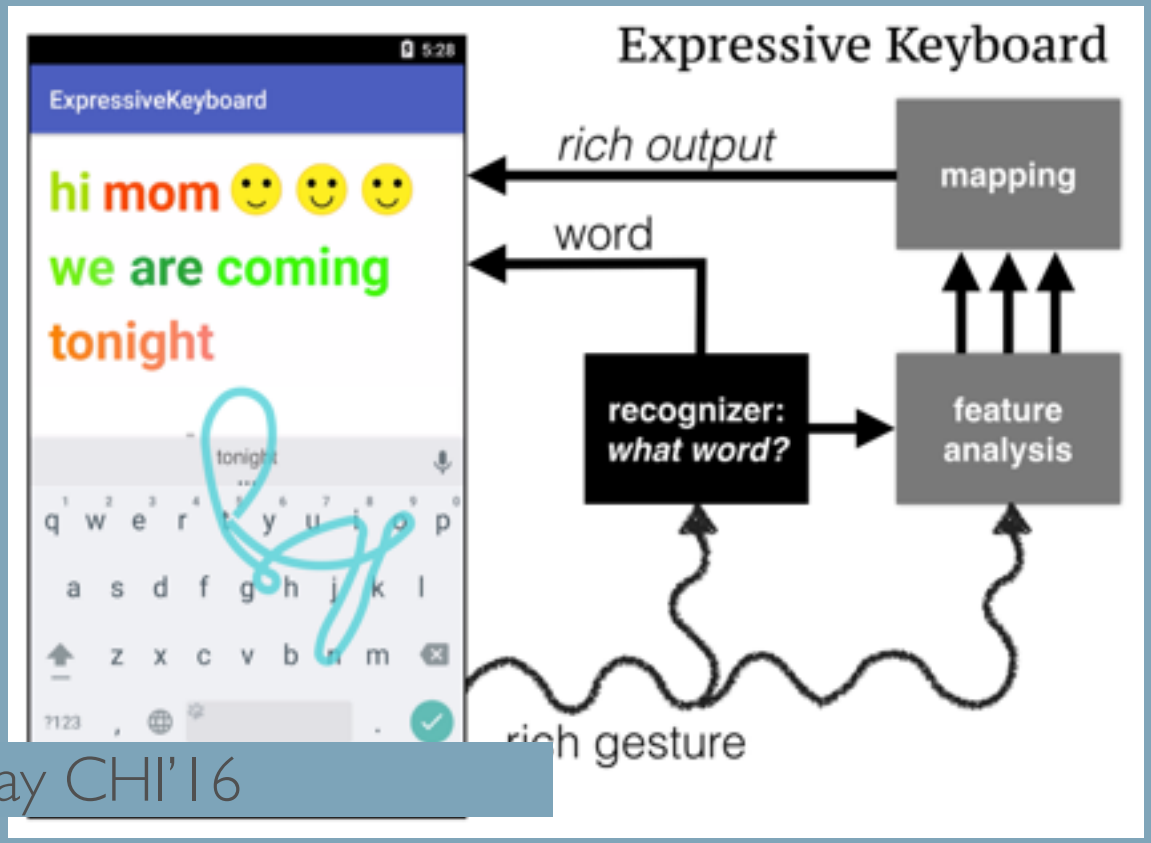
Expressive Keyboard

Expressive Keyboards produce accurate words, but let users control the output properties

Expressive Keyboard

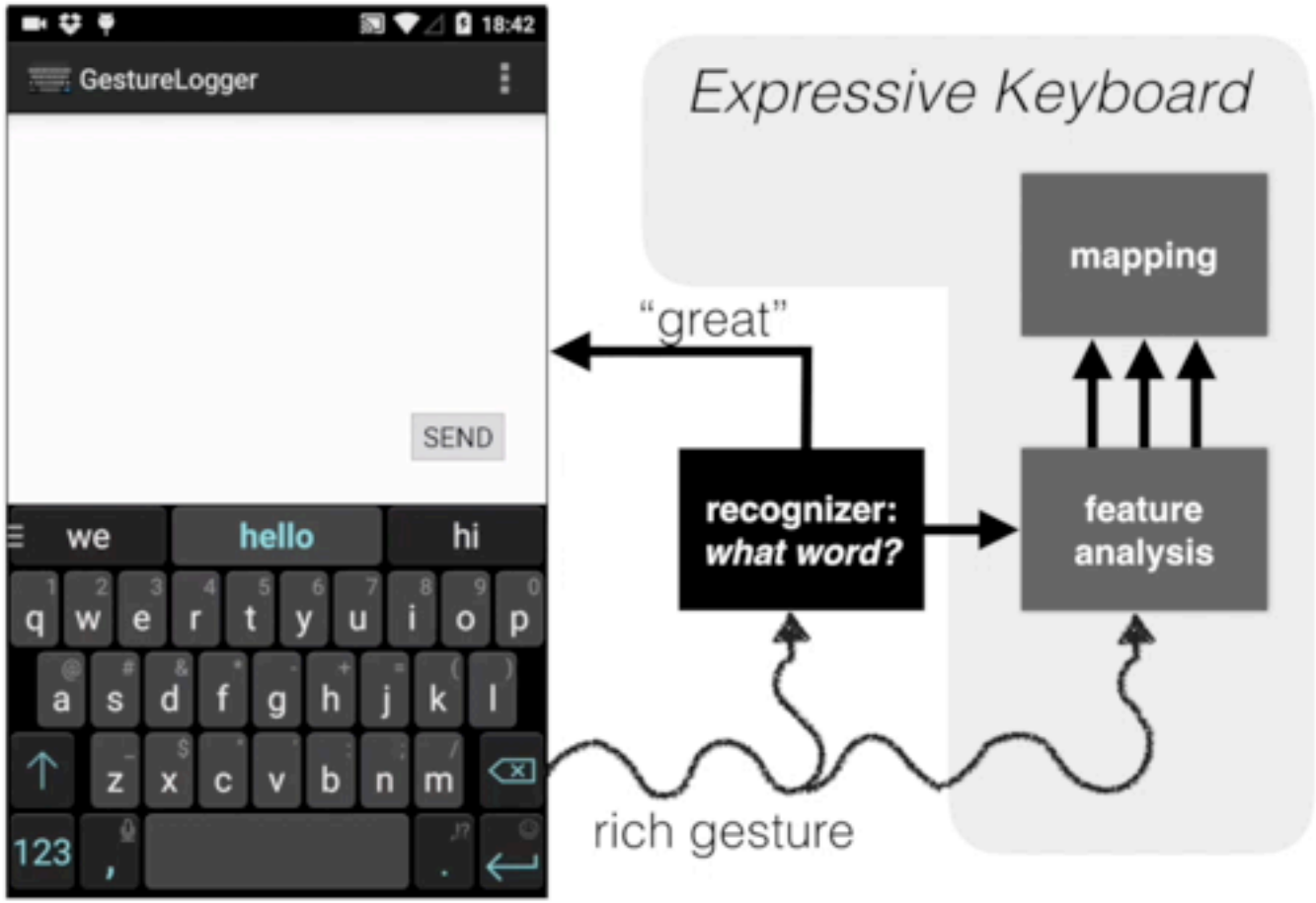
Map gesture variation to output properties

Users control:
- text color
- font style
- emojis



Alvina, Malloch & Mackay CHI'16

Expressive Keyboard – measure variation



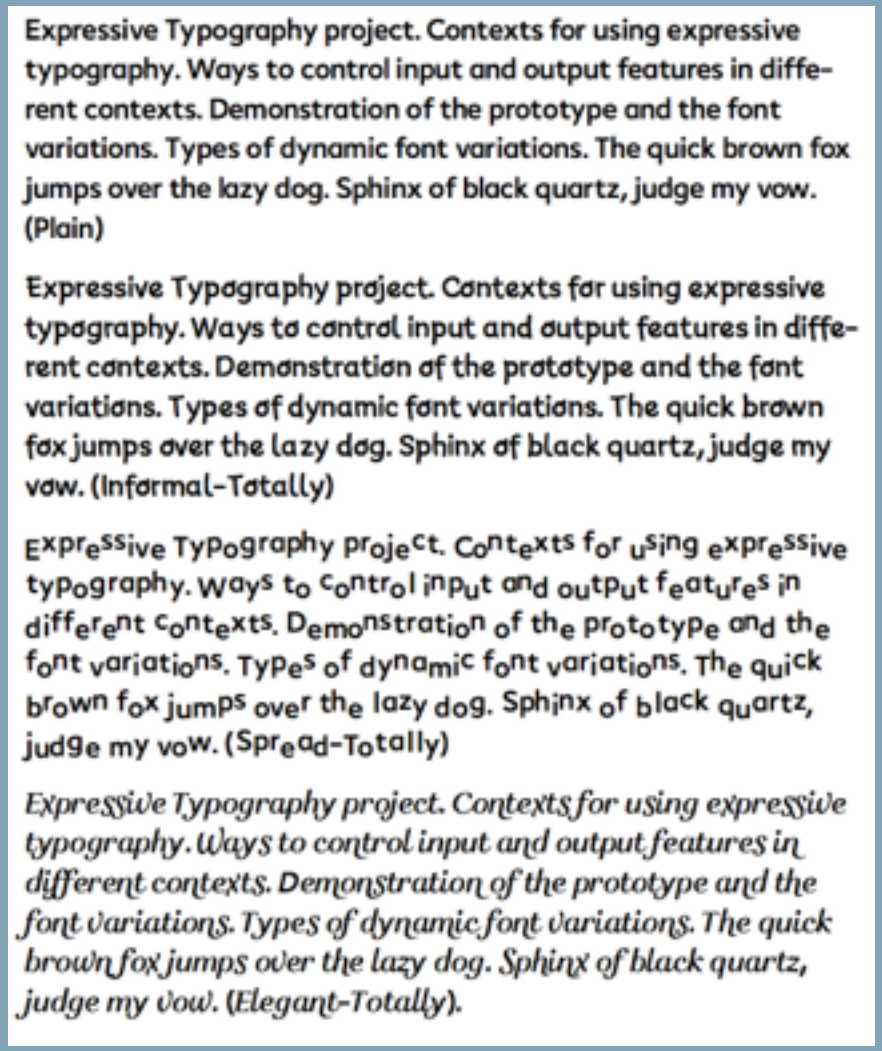
Expressive Keyboard – Expressive emojis

What else can we do with
Expressive Keyboards?

Next: Expressive Typography

Current project:

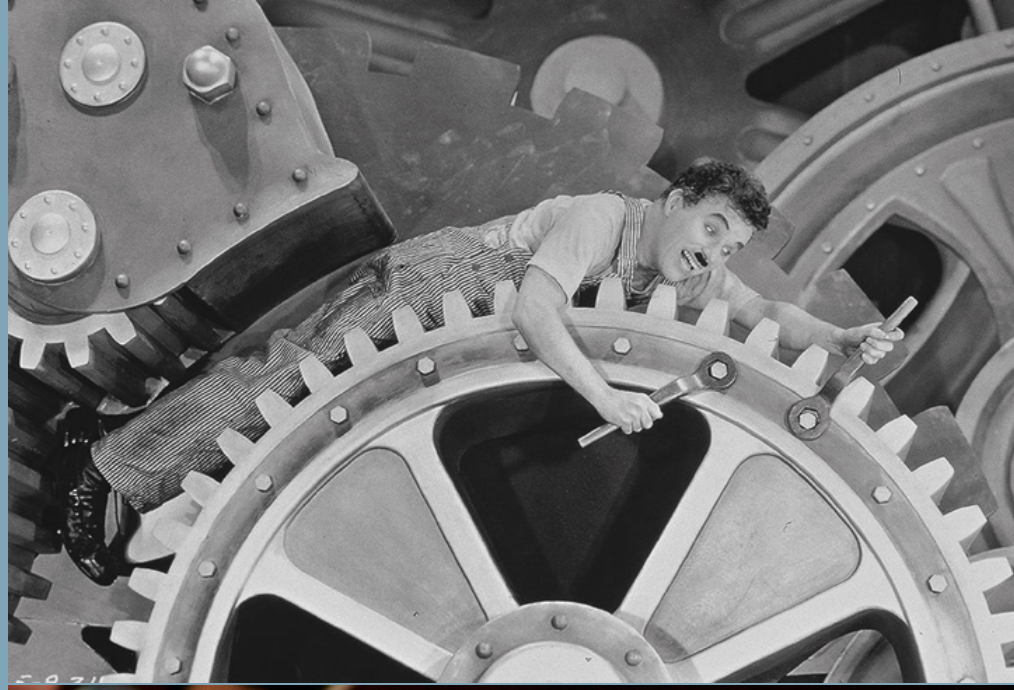
Express how the text appears ... by modifying your gesture typing



Tomorrow:

true human-computer partnerships

that empower rather than frustrate (or replace) people



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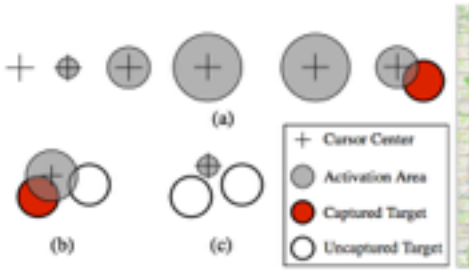
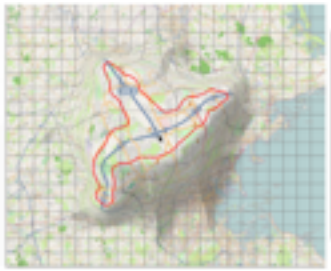

(a)
(b)
(c)
Cursor Center
Activation Area
Captured Target
Uncaptured Target




Cut
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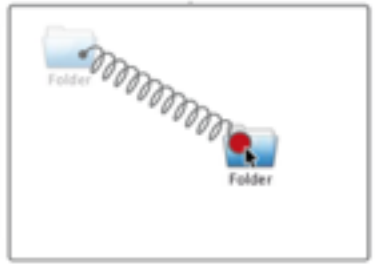
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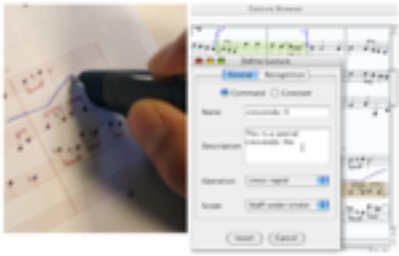

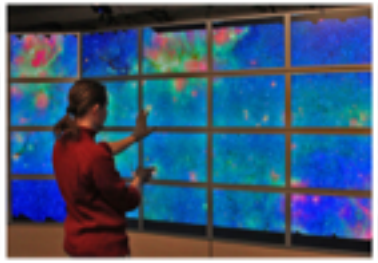

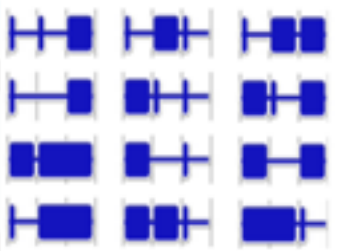


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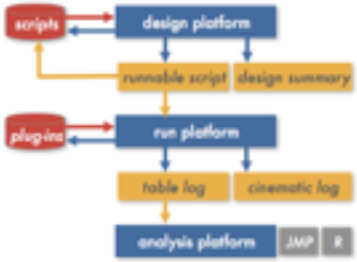
implications for design
user insights
design studies
analysis
interpret
user profile
design alternatives
design
axes
technical possibilities
design brief
design space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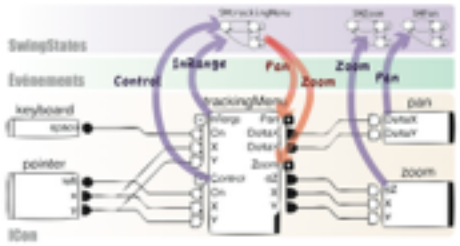
runnable script
design summary
plug-ins
run platform
table log
cinematic log
analysis platform
JMP
R


SwingStates
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keyboard
pointer
trackingMenu
pan
zoom


(a)