Human-in-the-loop? or Human-Computer Partnerships?

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Unified principles of interaction

Two complementary perspectives:

System: How to build it ?

Instrumental Interaction and Substrates

with Michel Beaudouin-Lafon

Unified principles of interaction

Two complementary perspectives:

System: How to build it ?

Instrumental Interaction

and Substrates

User: How to interact with it?

Co-adaptive Systems

Human-computer partnerships

Our relationship to a computer

Computer as ***tool***
Empower users

Human-Computer Interaction

Computer as ***servant***
Delegate tasks

Artificial Intelligence

Computer as ***medium***
Communicate

Mediated Communication

Different perspectives:

Machine learning:

Human-in-the-loop

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

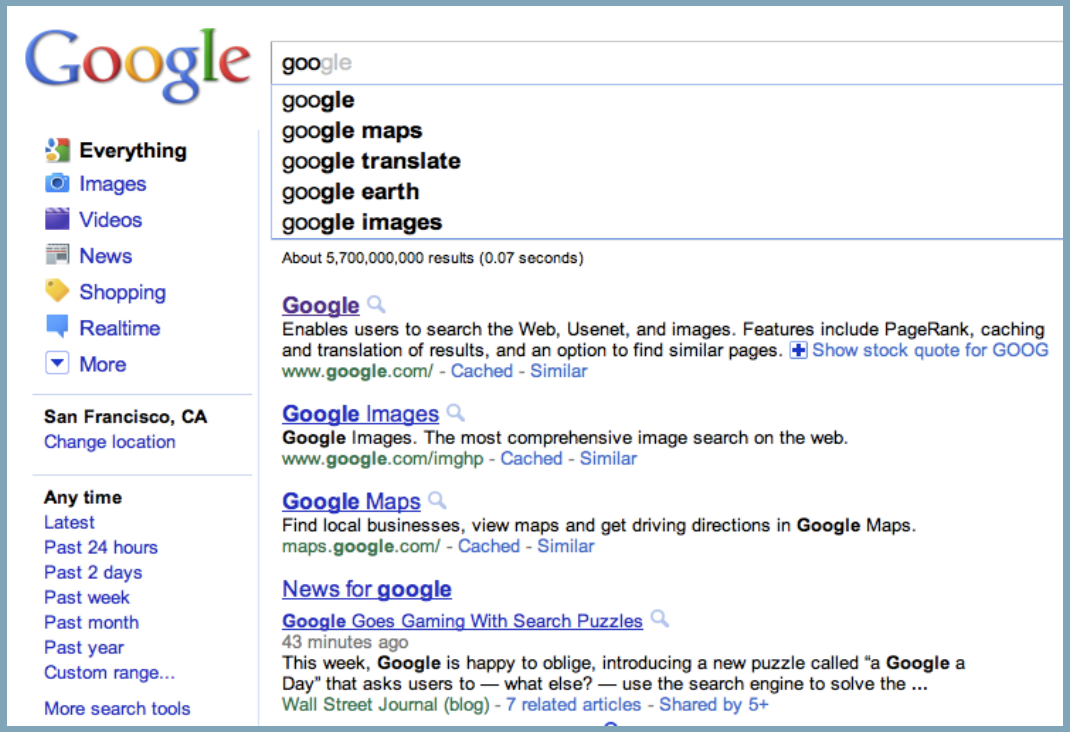
Different perspectives:

Machine learning:

Human-in-the-loop

Use human input to *improve the algorithm*

User types
Google suggests
User chooses




Too often, this is the
‘human-in-the-loop’ !

Different perspective

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

Instead of just creating models of ***users***
to inform the ***system***

We should create models of the ***system***
to inform the ***user?***

Together, they 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

Multiple ways to interact

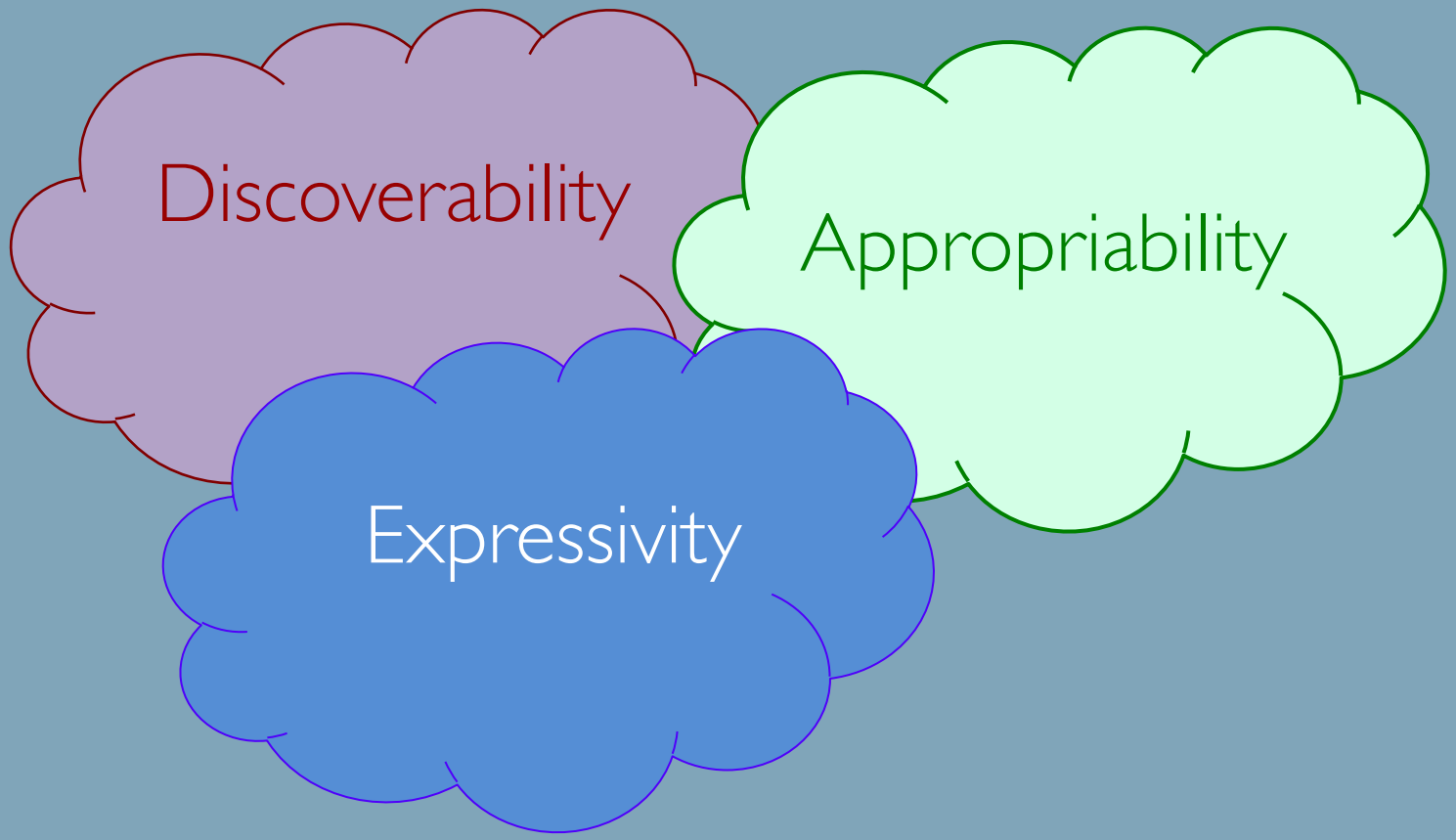
Discover

Appropriate

Express

Human-Computer Partnerships

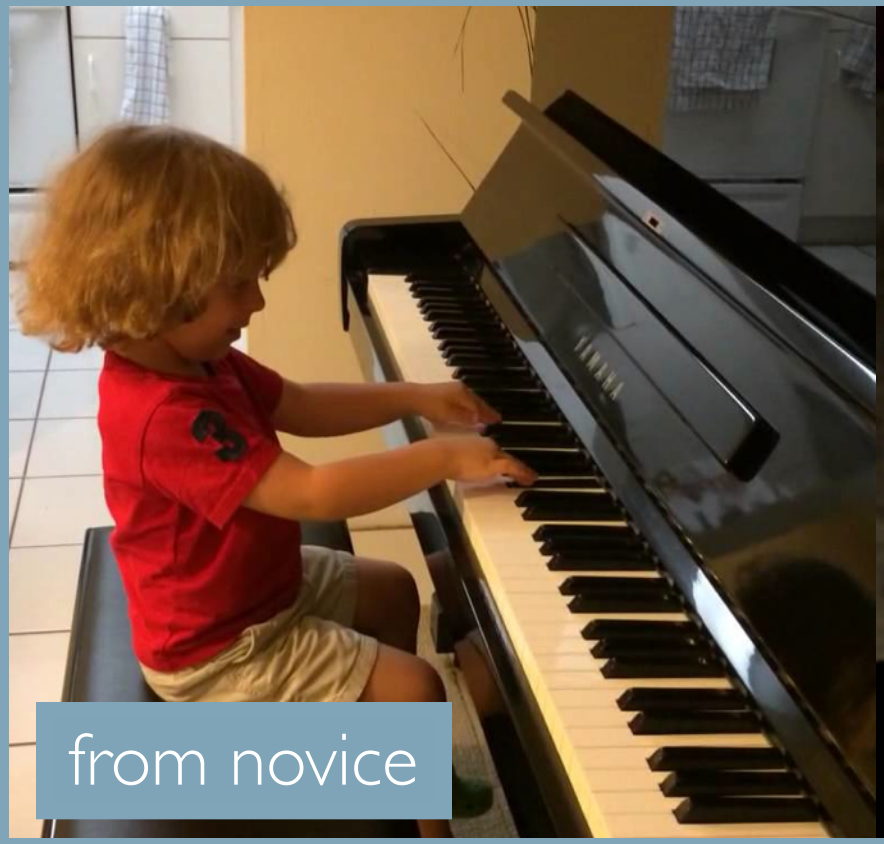
To share control, users need:



Why can't we learn to 'play' software tools ?

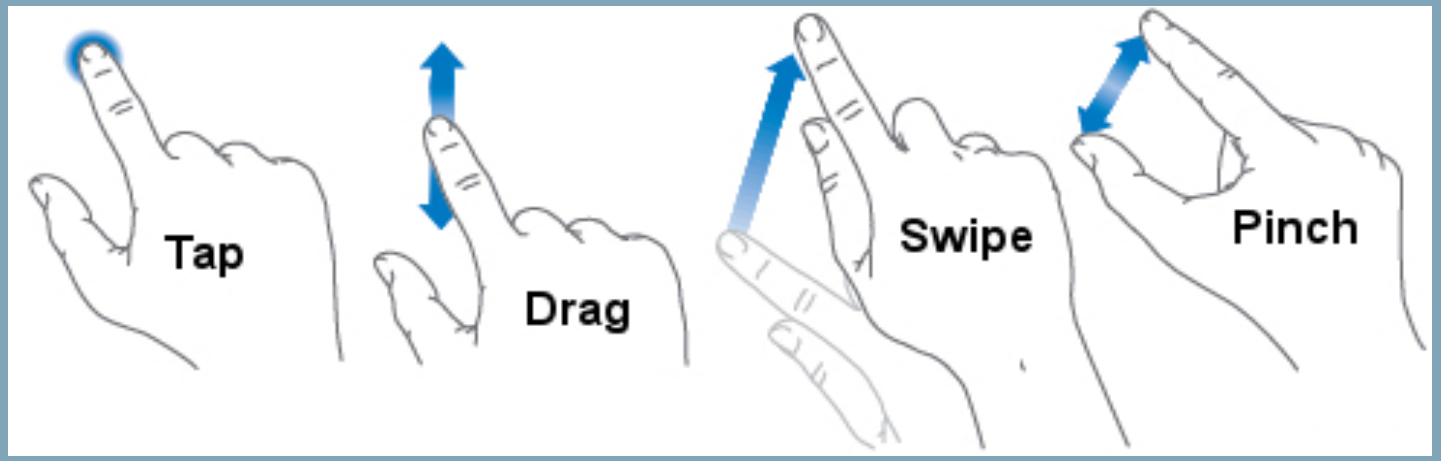
without relearning the interface

after every software upgrade ?

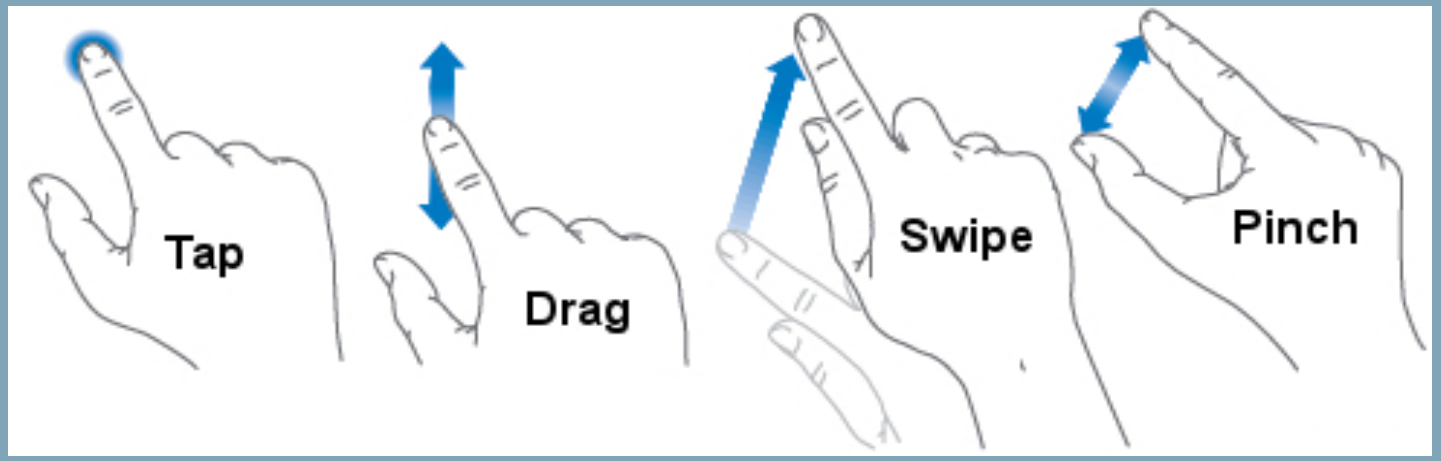


Take a smartphone ...

Smartphone interfaces are simple

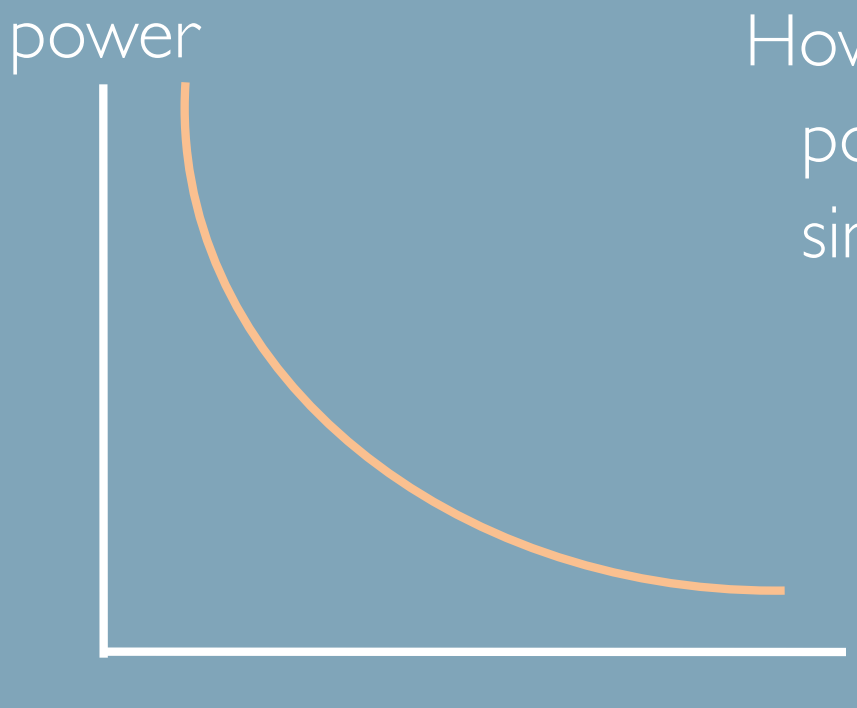


Smartphone interfaces are simple



Why not powerful, expressive *and* simple ?

Major design trade-off

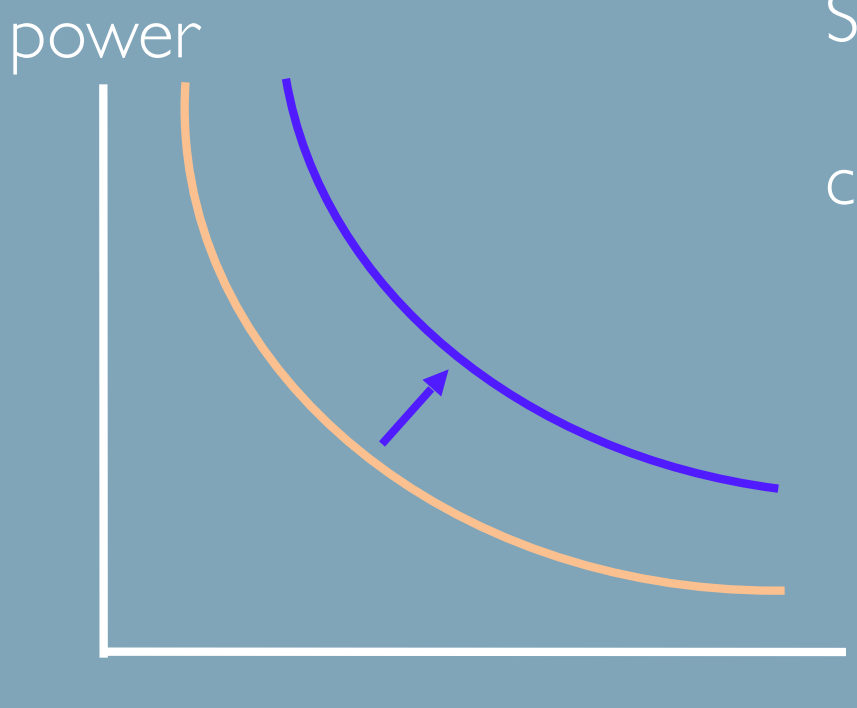


How to balance:

power of expression

simplicity of execution?

Solution: Shift the curve

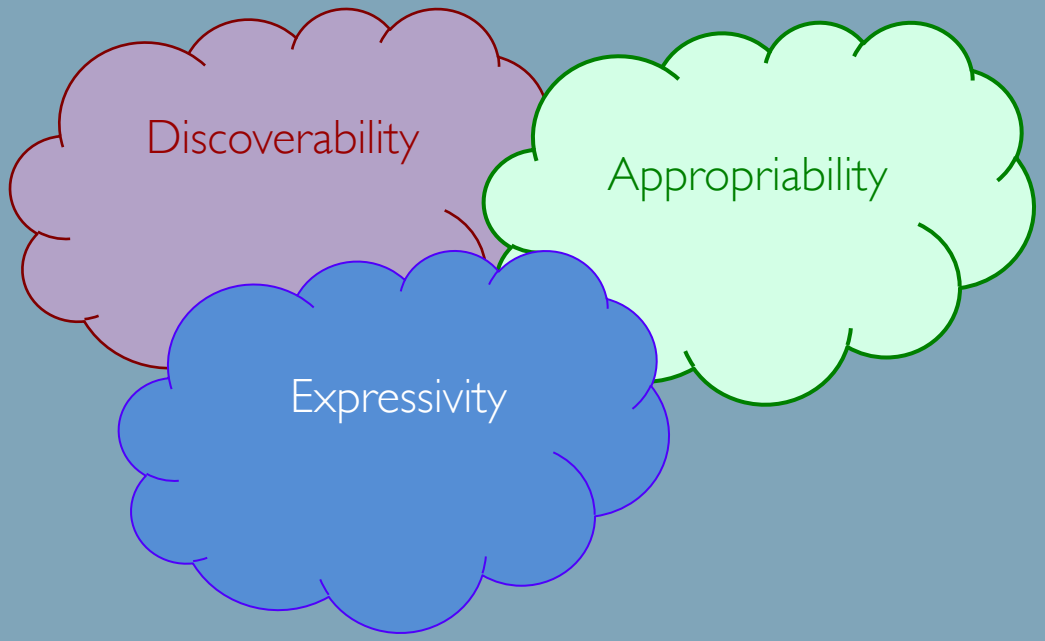


Simple things
should be simple,
complex things
should be possible

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

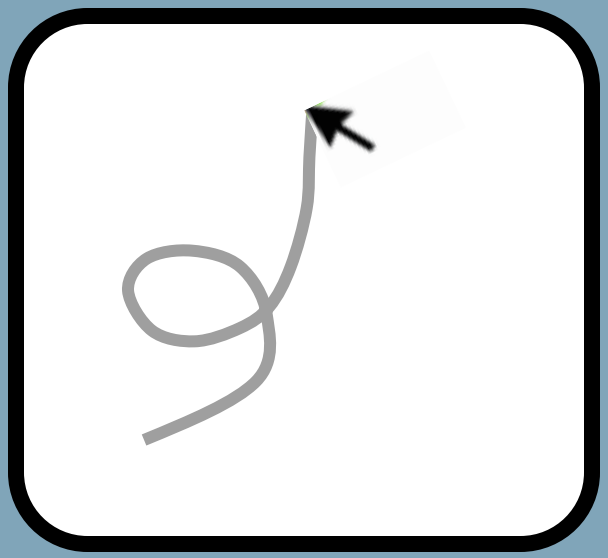
adapt to people	they learn (AI)
adapt people's behavior	they teach (CAI)

Reciprocal co-adaptation

How can I learn
which gesture
executes which command?

Octopocus

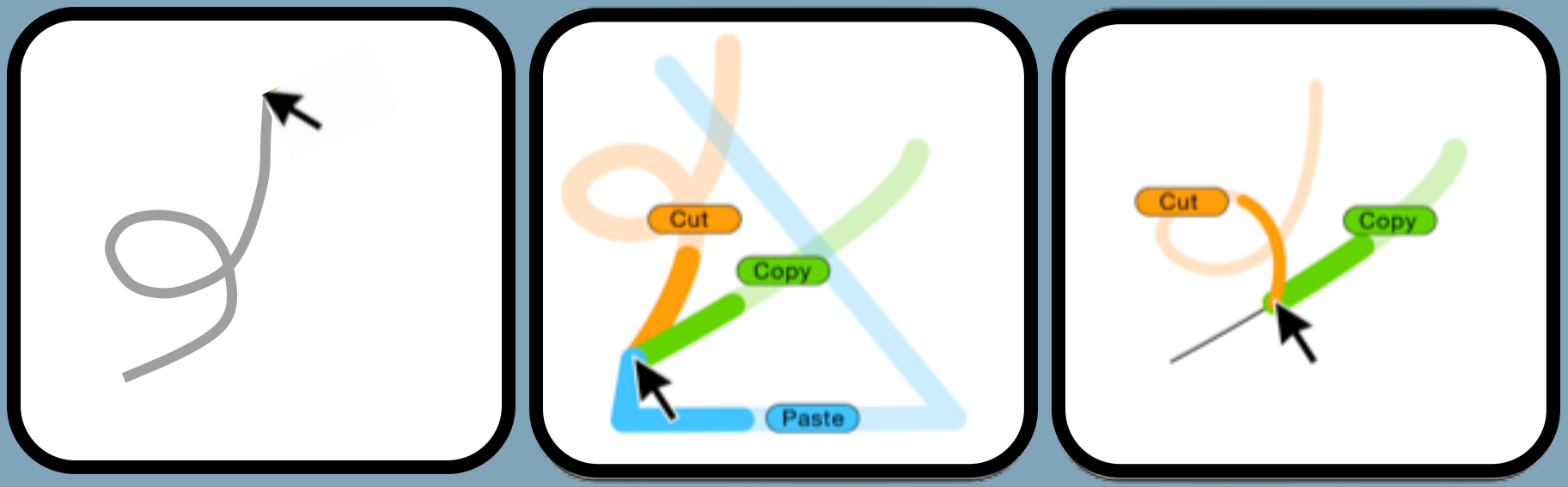
Experts just perform the gesture



Bau & Mackay, UIST'09

Octopocus

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



Bau & Mackay, UIST'09

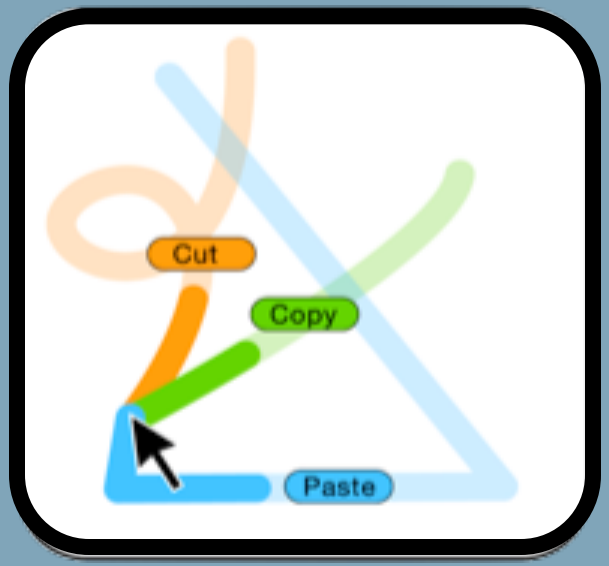
Octopocus

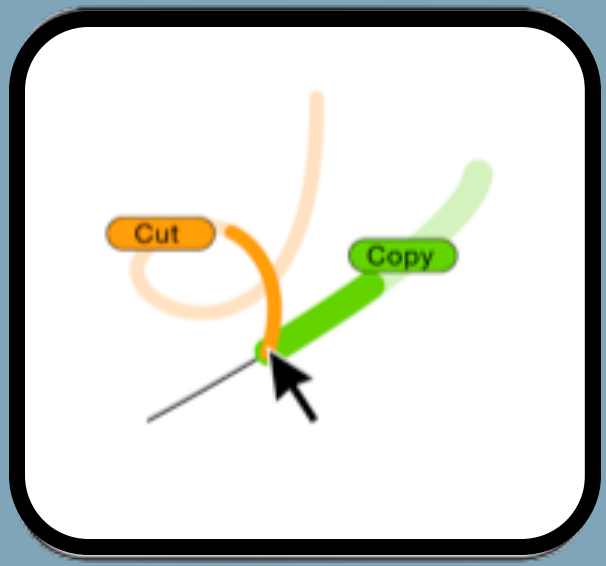
Progressive feedforward

What gestures are available ?

Progressive feedback

What did the system recognize ?





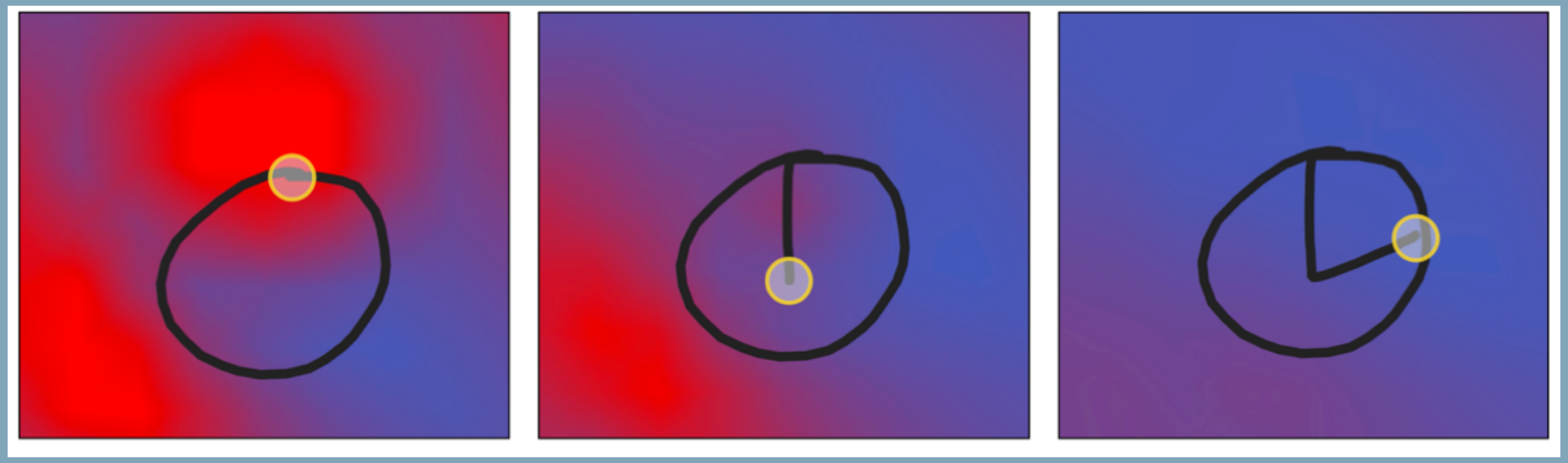
Bau & Mackay, UIST'09

Inking the '*Help*' command

How can I
create my own
gesture commands?

Fieldward

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

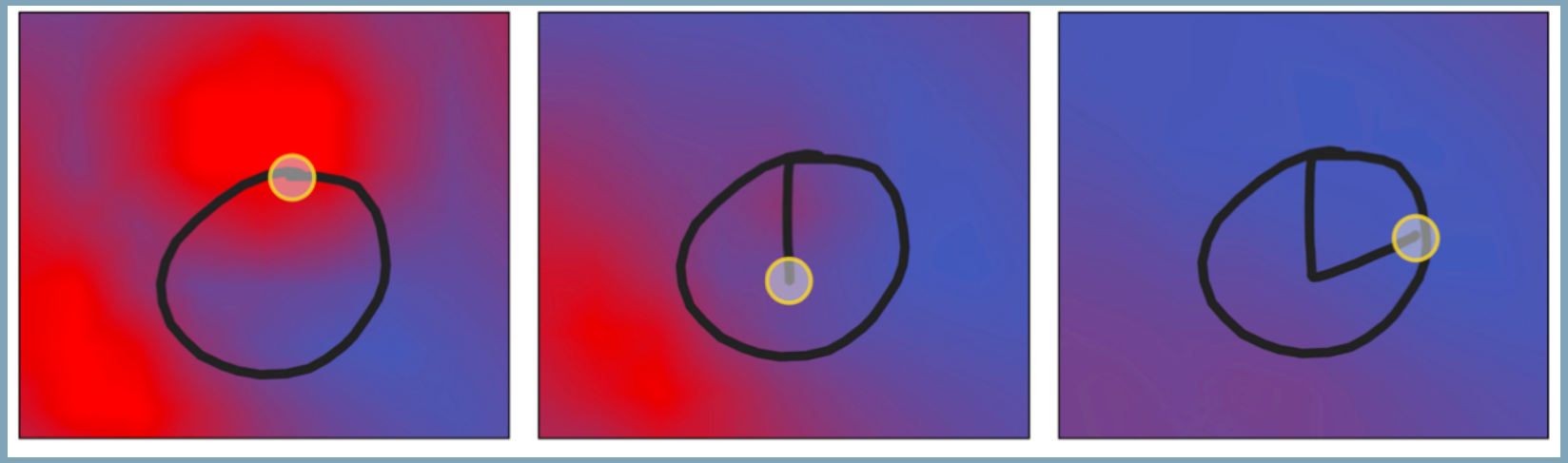


Fieldward

Create your own gesture commands

Must be:

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

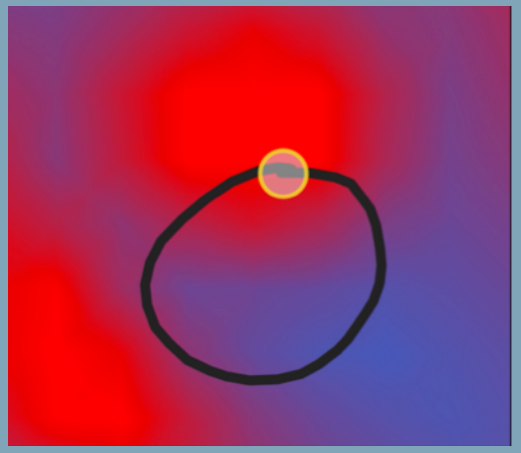


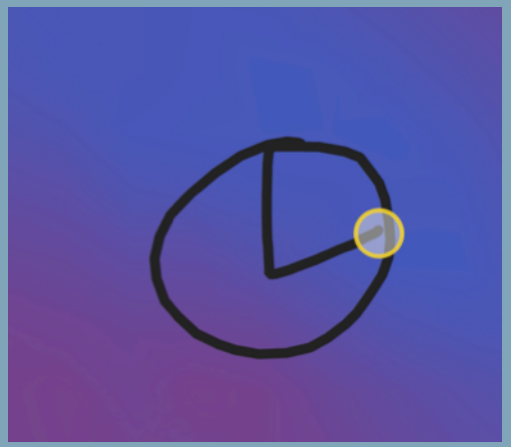
Fieldward

Draw a gesture

If it ends in a red zone
the gesture already exists

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

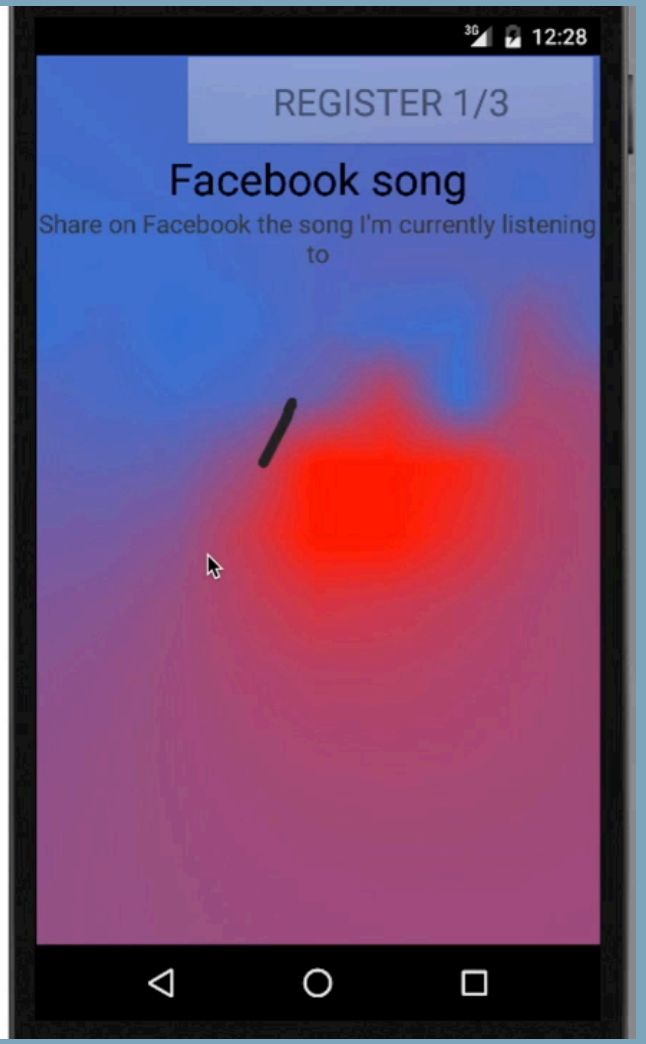




Fieldward:

Fieldward

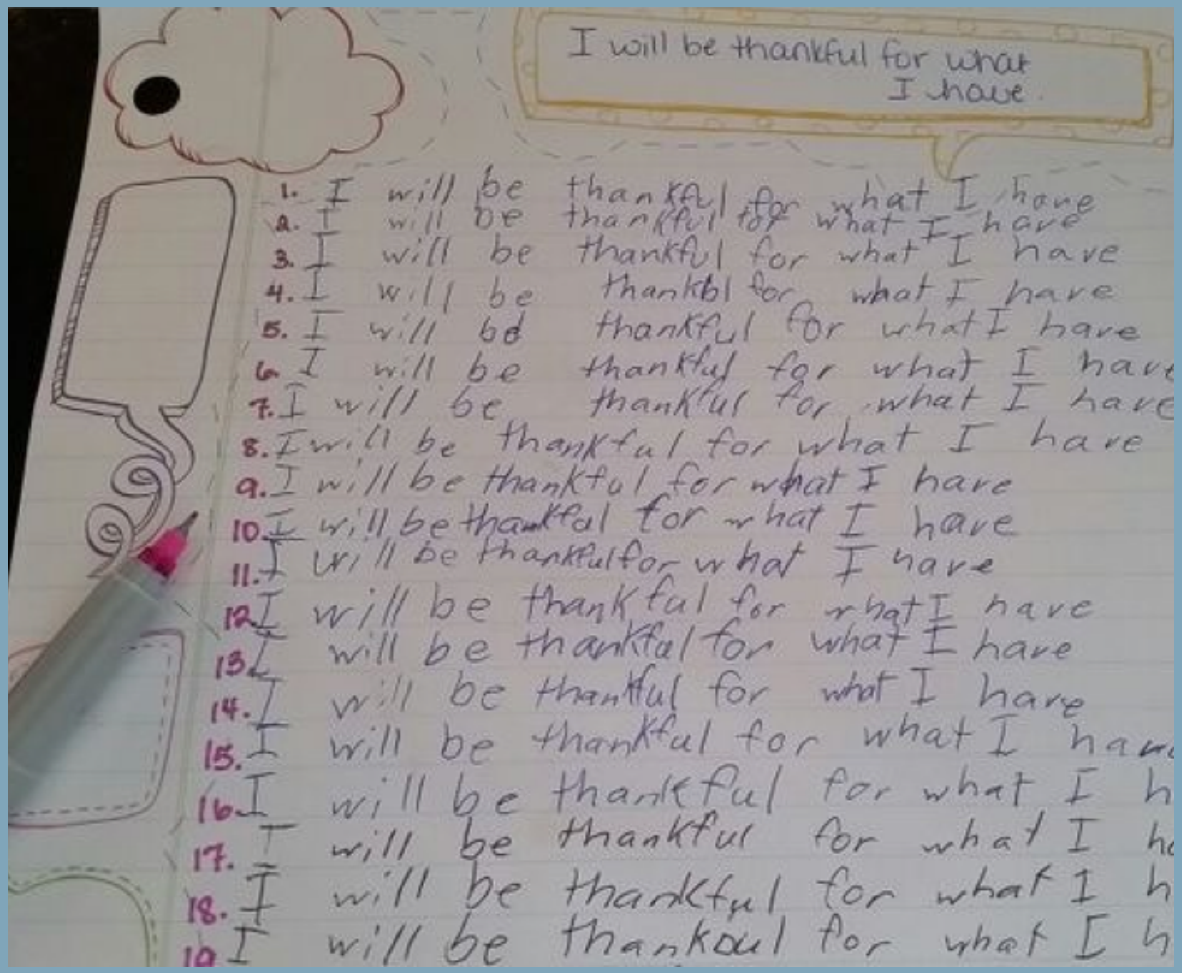
Shows a color gradient
indicating optimal directions
to make a recognizable gesture



How can I
generate
expressive text?

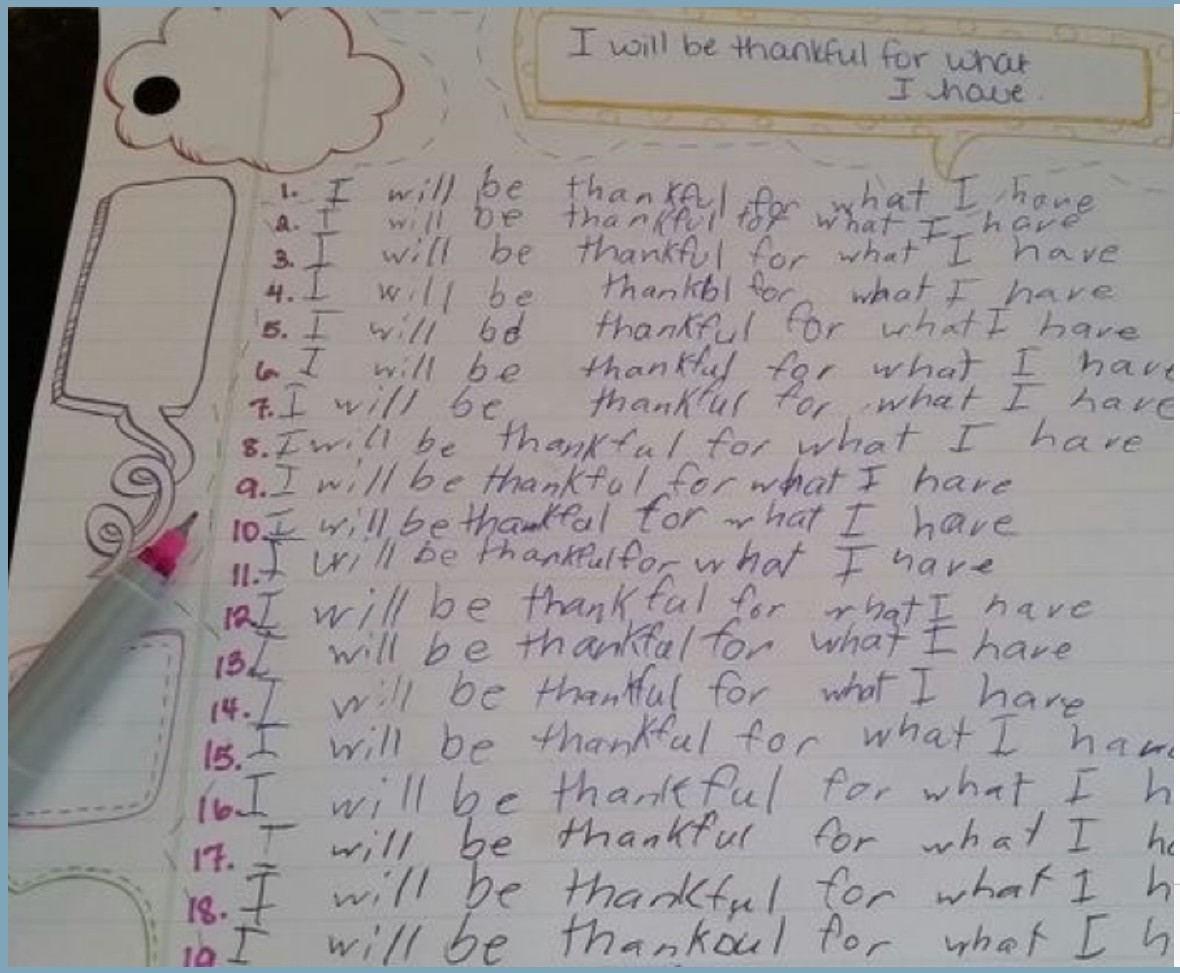
Human expression

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

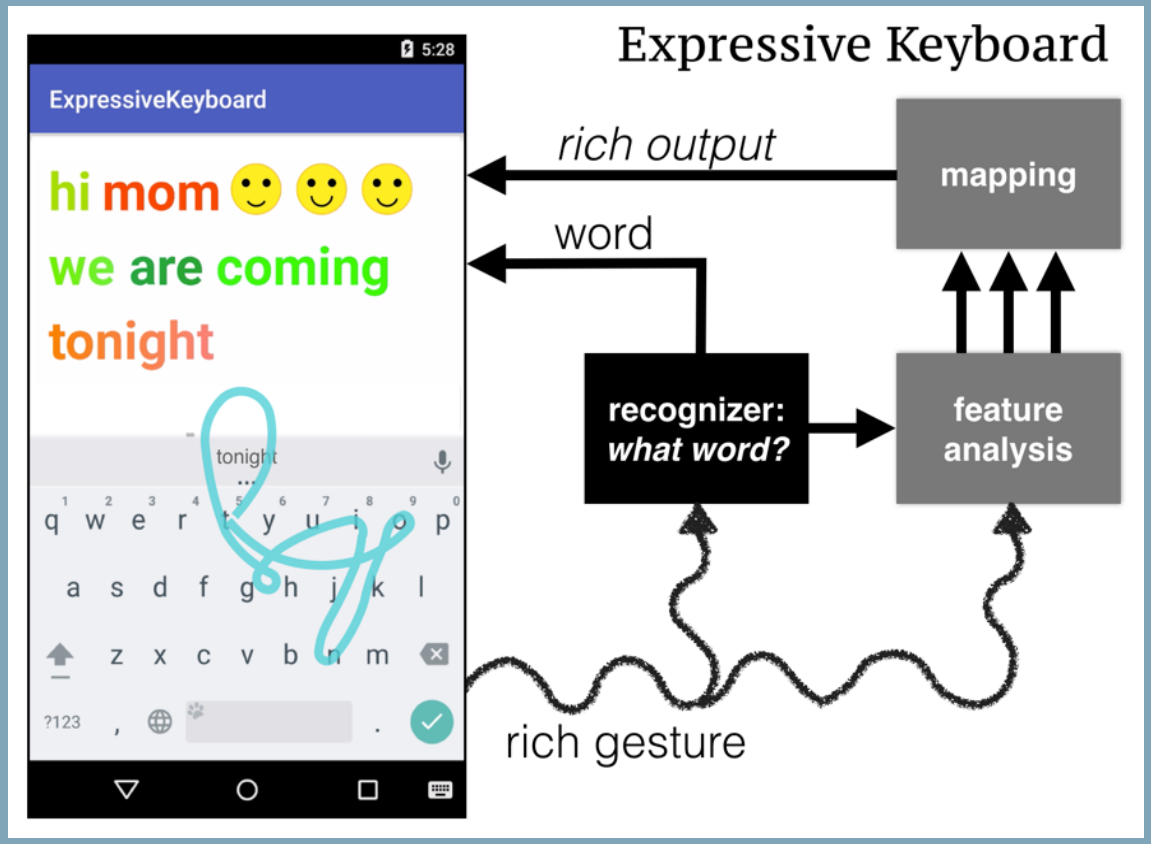
Expressive Keyboard

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



Expressive Keyboard

Machine learning guesses the correct word ...

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

Expressive Keyboard – measure variation

Can users control their gestures deliberately
to produce rich output, such as colored text?

Expressive Keyboard – Expressive emojis

What else can we do with
Expressive Keyboards?

Generative power: Three design principles

Reification

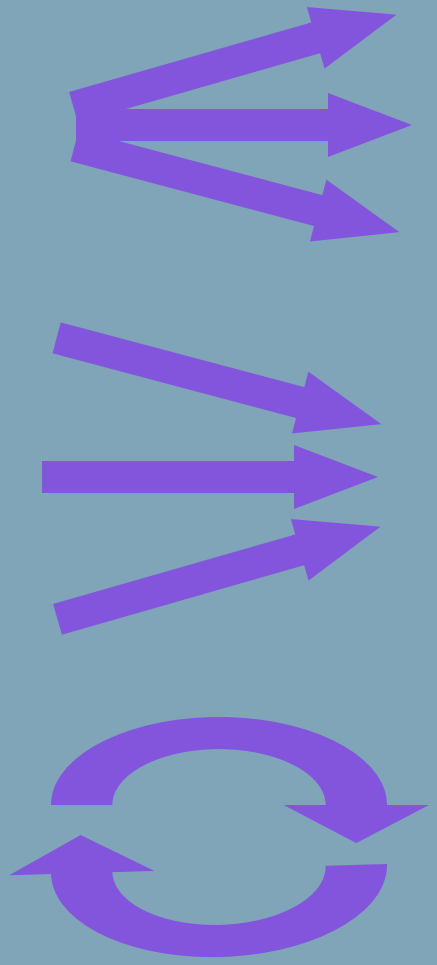
extends the notion of
what constitutes an object

Polymorphism

extends the power of commands
with respect to these objects

Reuse

provides a way of capturing and
reusing interaction patterns



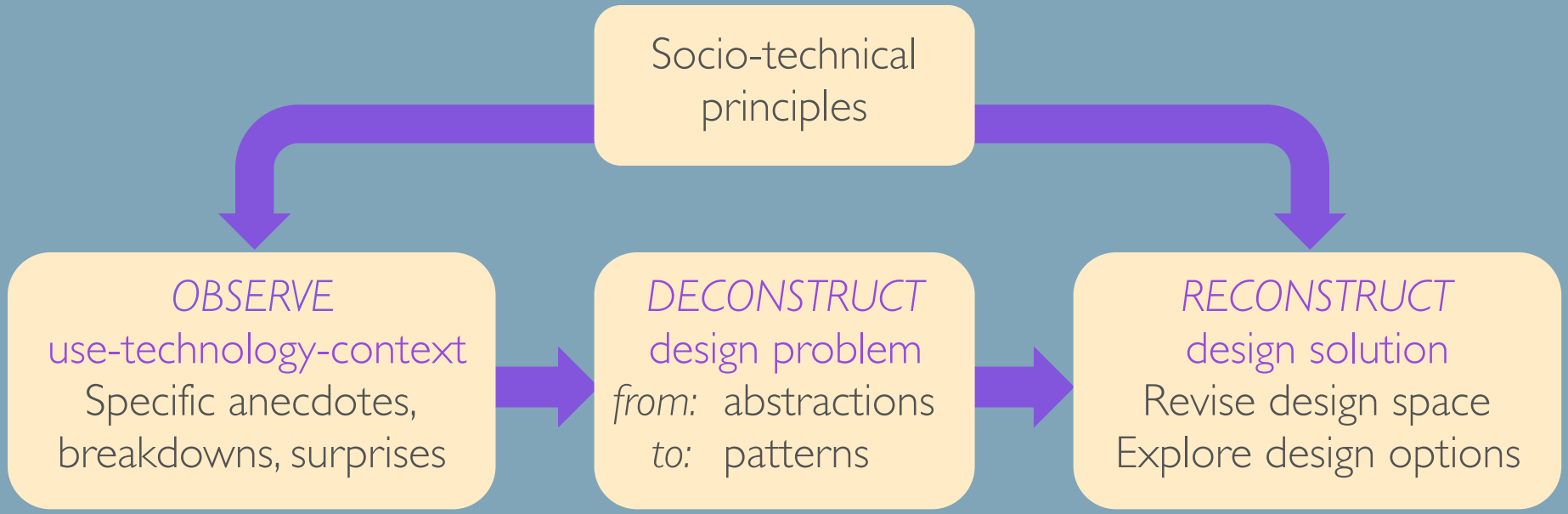
What about socio-technical principles ?

Social scientists conduct extensive field studies
and provide deep insights in the form of
socio-technical principles
about how people interact with technology in context

But
it is difficult to translate these principles
into specific designs

Generative Deconstruction

Apply socio-technical principles systematically
to generate grounded designs



Examples of Socio-technical Principles

Situated Action *beyond planning*	Go beyond planned activities; Users decide how to act in unforeseen circumstances
Rhythms & routines *identify use patterns*	Build upon routine activities and spatial patterns; Users integrate systems into their daily lives
Peripheral awareness *design the periphery*	Design for both focus and periphery; Users vary degree of engagement
Co-adaptation *re-interpret use*	Expect users to re-interpret and customize; Enable capture and sharing of customizations
Distributed cognition *"outside the head"*	Let objects and people reduce cognitive load for memory or communication tasks

So …

How do we incorporate
socio-technical principles
into the design process?

Generative Deconstruction & Reconstruction

Observe users either:

- to understand what to design or
- to evaluate what has been designed

First deconstruct what is going on:

- Who is the user?
- What is the technology?
- What is the user's context?
- What is the interaction like?

Then reconstruct the design

- to design a new technology or
- to fix an existing one

Generative Walkthroughs: Creative redesign

Structured walkthroughs

Systematic critique of design artifacts, such as scenarios & storyboards

Generative Walkthroughs: Creative redesign

Structured walkthroughs

Systematic critique of design artifacts,
such as scenarios & storyboards

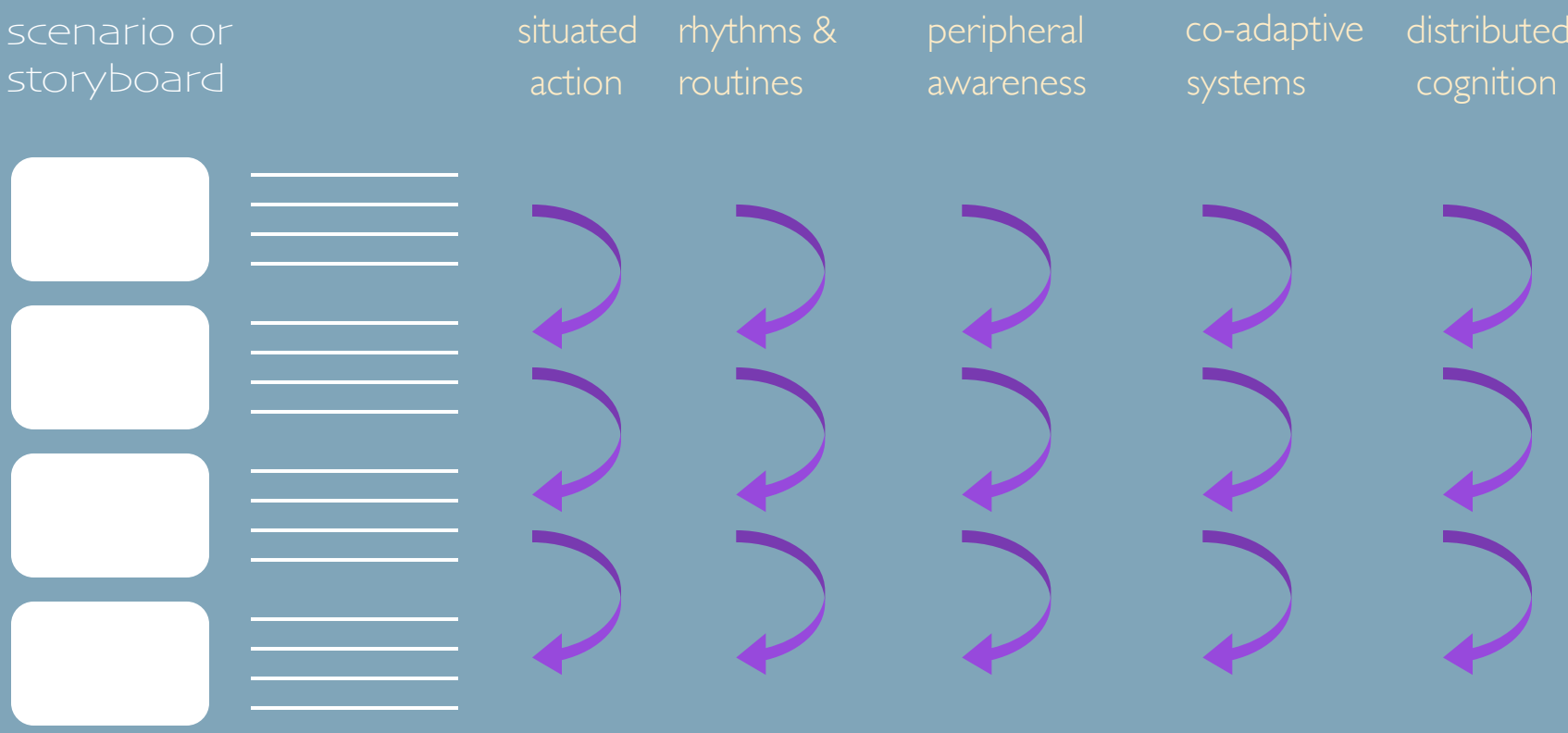
plus

Focused brainstorming

Generation of novel ideas,
based on socio-technical principles

Exercise: Generative Walkthroughs

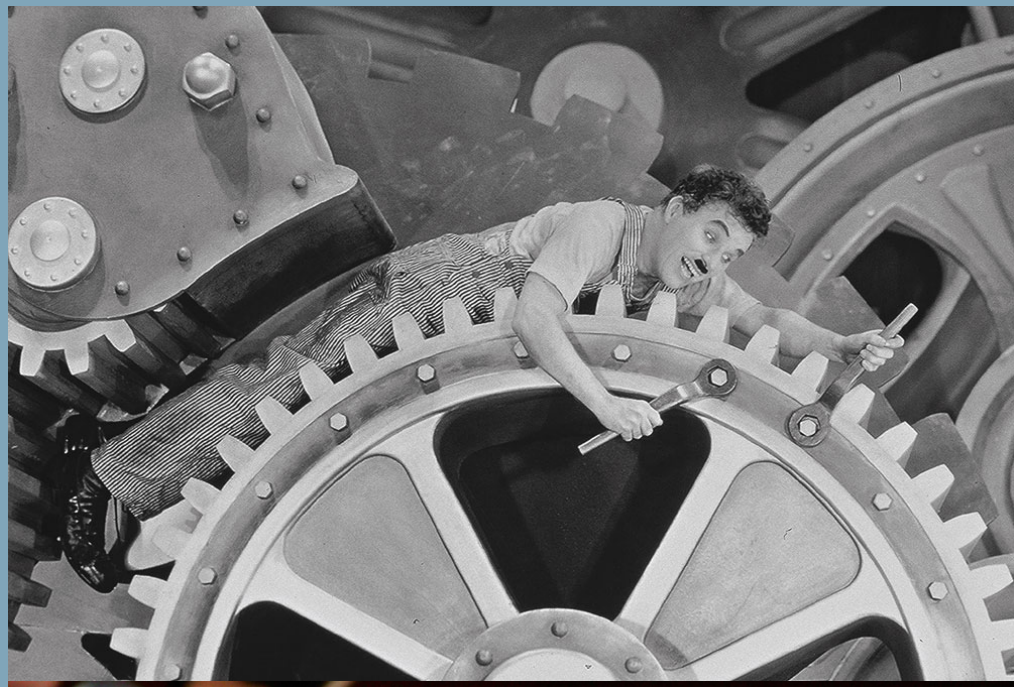
Step-by-step: deconstruct and reconstruct a scenario
in light of socio-technical principles



How do we

- deconstruct today's interactive systems

- reconstruct to generate new forms of interaction?



How can I learn
new gestures
that execute commands ?

Gesture typing: Typing with gestures

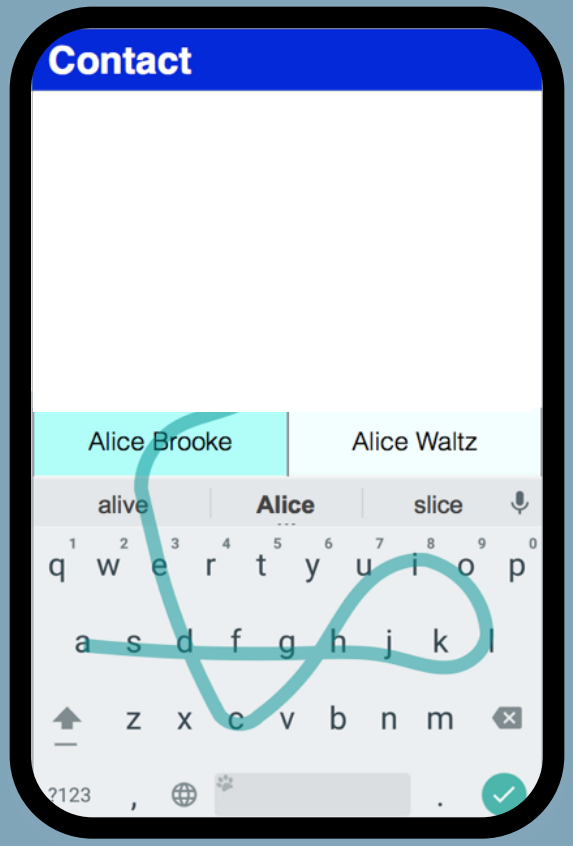
Instead of tapping. . .

draw through
each letter
to type a word

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

CommandBoard

Transform gestures into commands ...

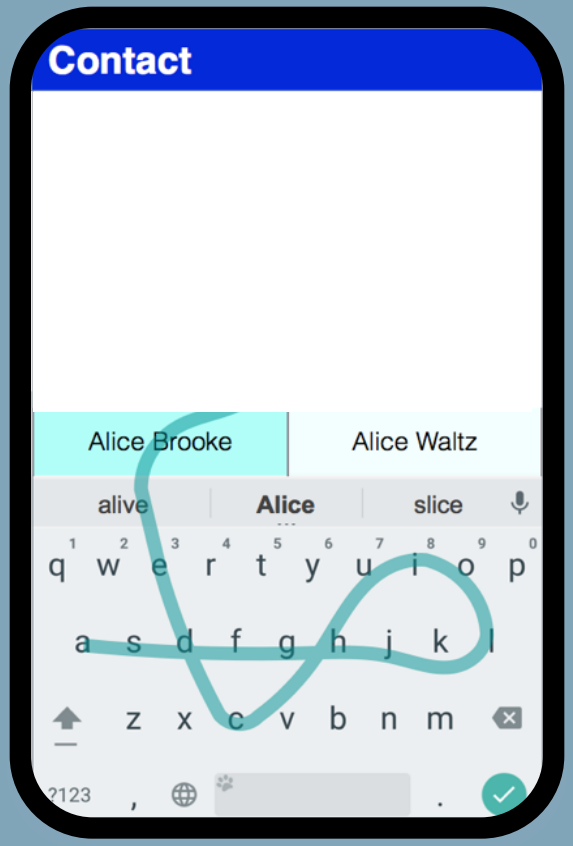


draw:
alice

Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

Transform gestures into commands ...



draw:

alice

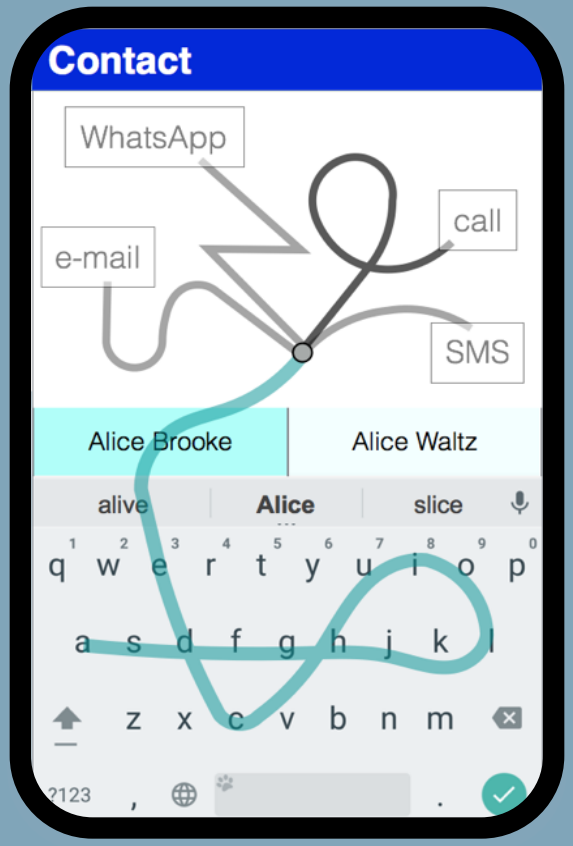
choose contact:

Alice Brooke

Alvina, Griggio, Bi & Mackay UIST'17

CommandBoard

Transform gestures into commands ...



write:

alice

choose contact:

Alice Brooke

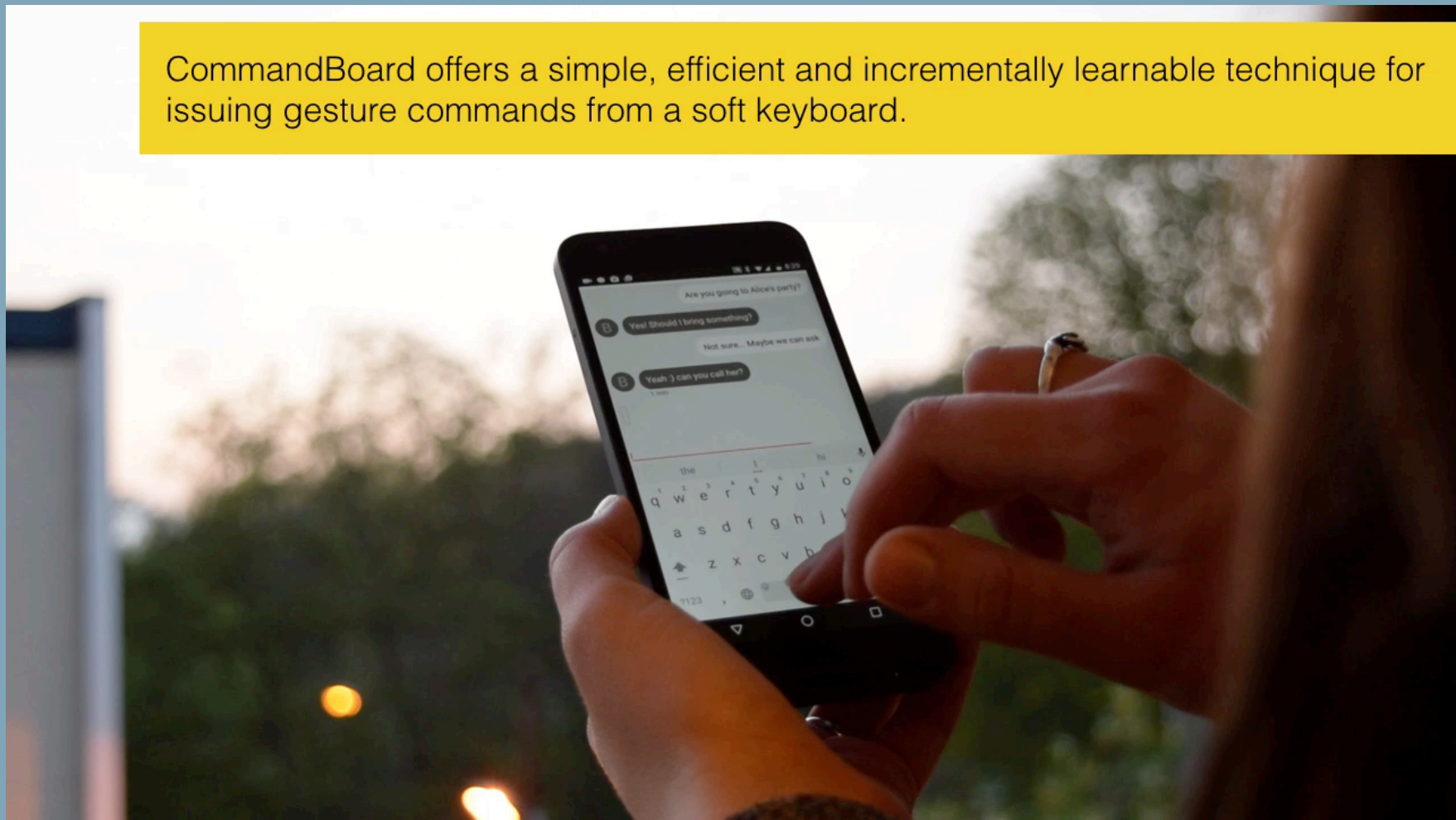
choose comm app:

Alice Brooke

Alvina, Griggio, Bi & Mackay UIST'17

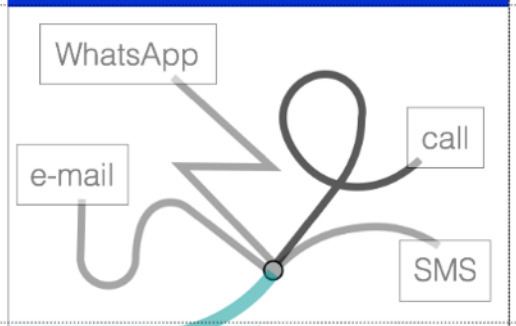
CommandBoard

Command-line interaction from a soft keyboard



CommandBoard

Execute any command from a gesture keyboard

Screen Space	Contact	User Action	User Goal
command-gesture input space		draw gesture	execute command, add gesture shortcut
command bar	Alice Brooke | Alice Waltz	cross command option	choose command option
suggestion bar	alive | **Alice** | slice	tap word	choose word or command
text input space		tap key, cross key, dwell on key	enter text/emoticon, change layout, specify command

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