



GOTO Copenhagen 2018
Conference Nov. 19 - 21

Human-Computer Partnerships

Wendy E. Mackay

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Human-Computer Partnerships

Wendy E. Mackay

20 November 2018



Inria

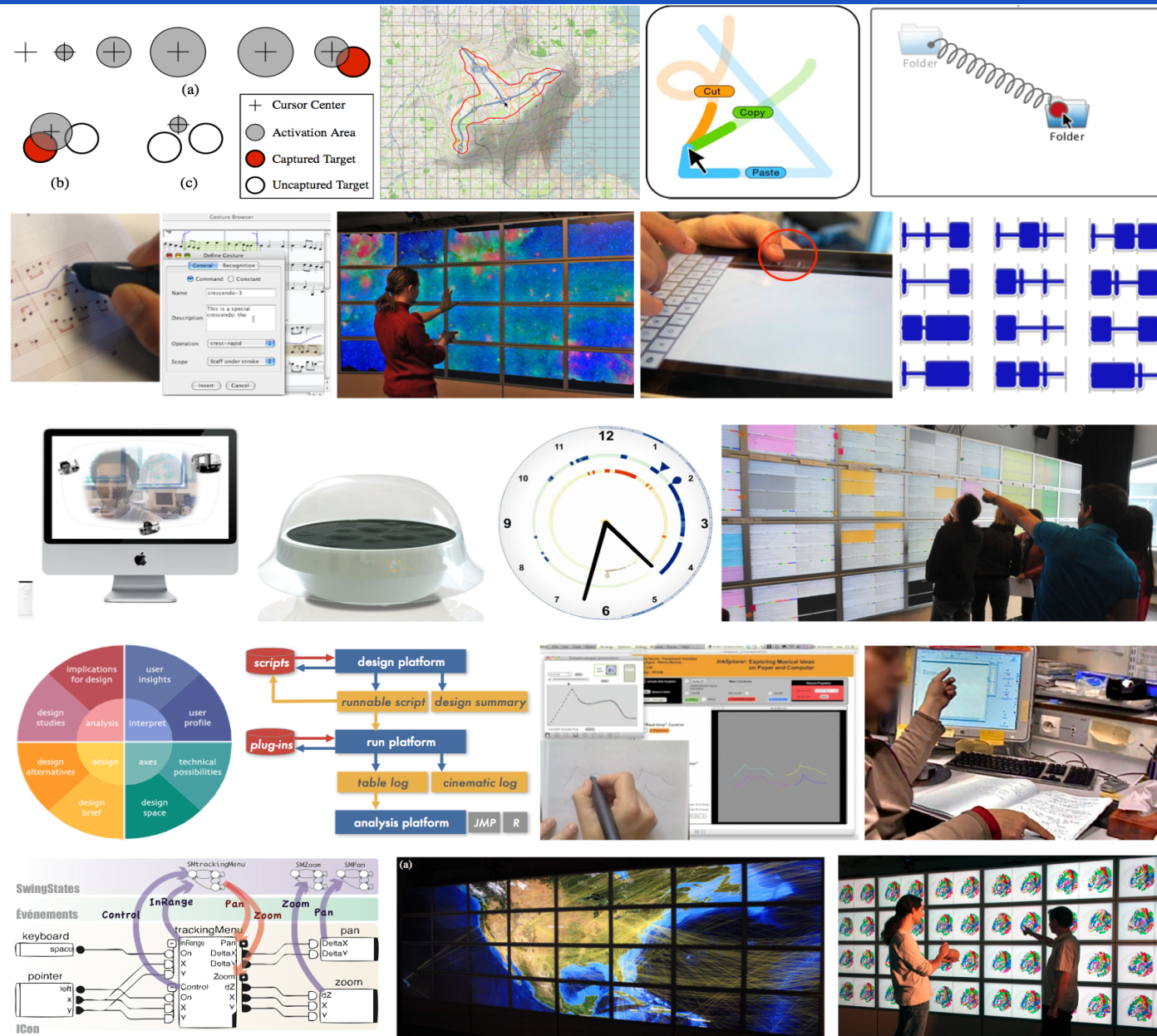
ex)situ

Interaction paradigms

Participatory design

Distributed communication

Engineering platforms



What is the role of
the human in the future?

This?



or this?



or this?



What kind of 'partnership' ?

Take a taxi

Driver in control



What kind of 'partnership' ?

Take a taxi

Driver in control

Drive a motorcycle

User in control



What kind of 'partnership' ?

Take a taxi

Driver in control

Drive a motorcycle

User in control

Ride a horse

Shared control



Who needs a
self-driving Ferrari ?



Relationships with computers

Computer as *tool*
Empower users



Human-
Computer
Interaction

Relationships with computers

Computer as *tool*
Empower users



Human-
Computer
Interaction

Computer as *servant*
Delegate tasks



Artificial
Intelligence

Relationships with computers

Computer as *tool*

Empower users

Computer as *servant*

Delegate tasks

Computer as *medium*

Communicate



Human-
Computer
Interaction

Artificial
Intelligence

Mediated
Communication

Competing perspectives

Machine learning perspective:

Human-in-the-loop

Human is input to the algorithm

What about this 'Human-in-the-loop' ?



Competing perspectives

Machine learning perspective:

Human-in-the-loop

Human is input to the algorithm

Human-Computer Interaction perspective:

Computer-in-the-loop

Algorithm is input to inform the user

Human-Computer Partnerships

Instead of only creating models of users
to inform the system

Shouldn't we create models of the system
that inform the user?

Human-Computer Partnerships

Combine:

- computer as a tool

- to **augment human capabilities**

and

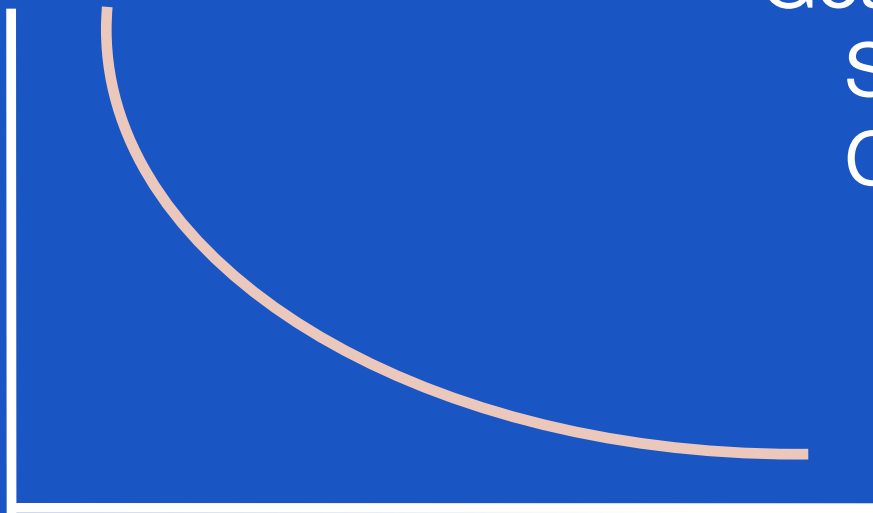
- computer as a servant

- to **take over undesirable tasks**

Keep the user in control

Fundamental design trade-off

power



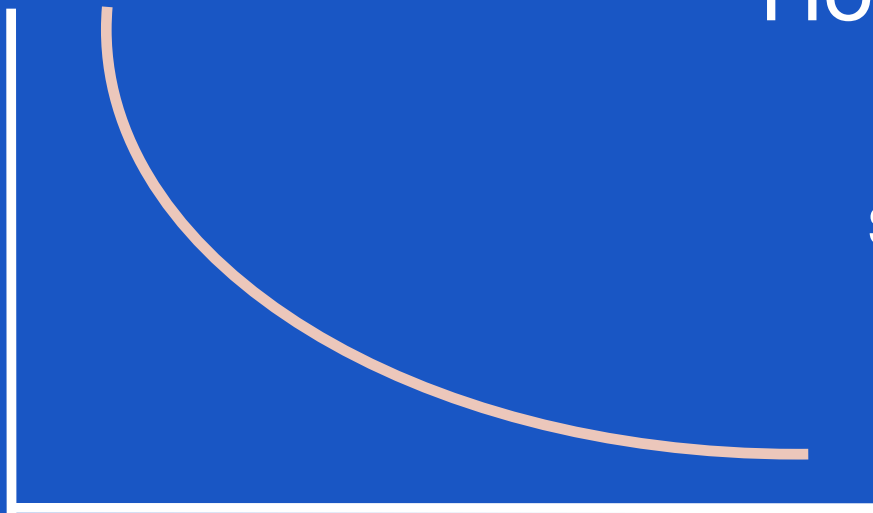
Goal:

Simple things are simple

Complex things are possible

Fundamental design trade-off

power



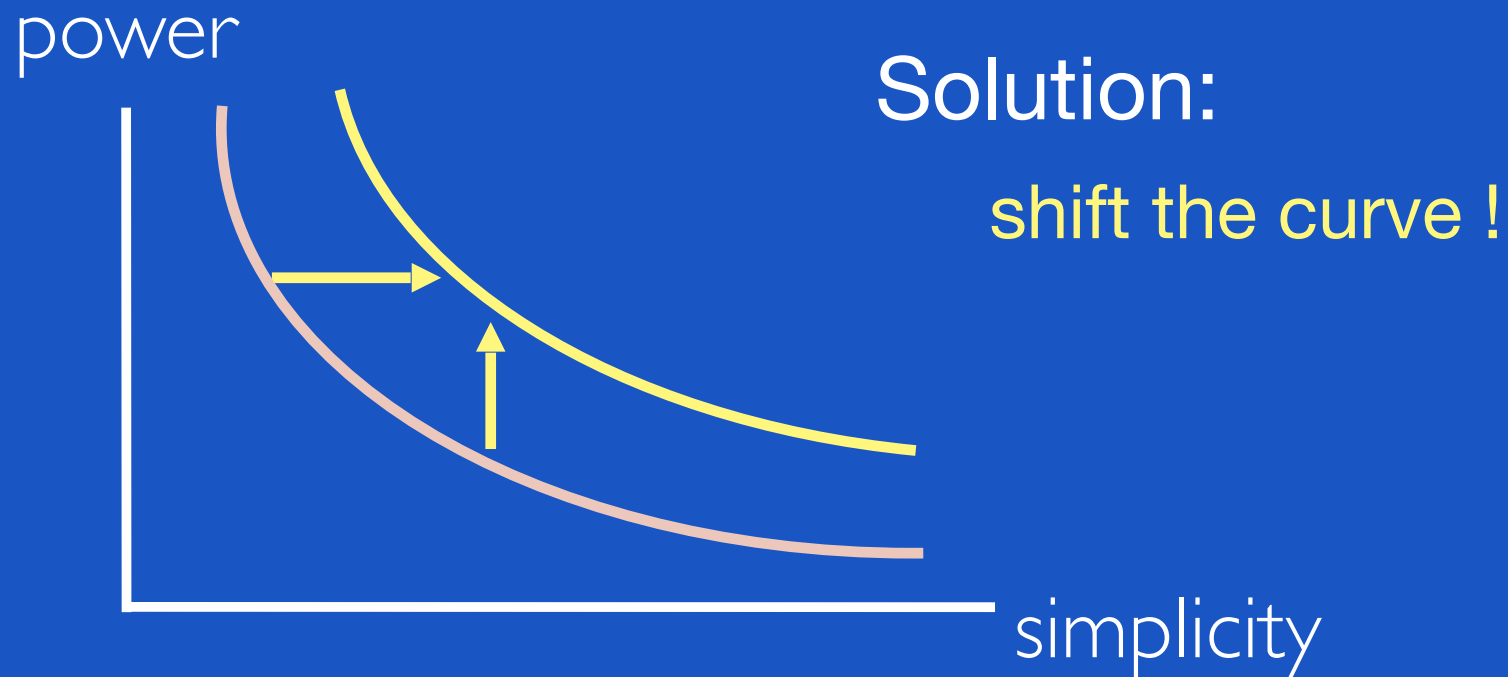
simplicity

How to balance:

power of expression

simplicity of execution ?

Solution: Shift the curve



Compare to physical tools

We use them as designed . . .



Compare to physical tools

or we can improvise ...

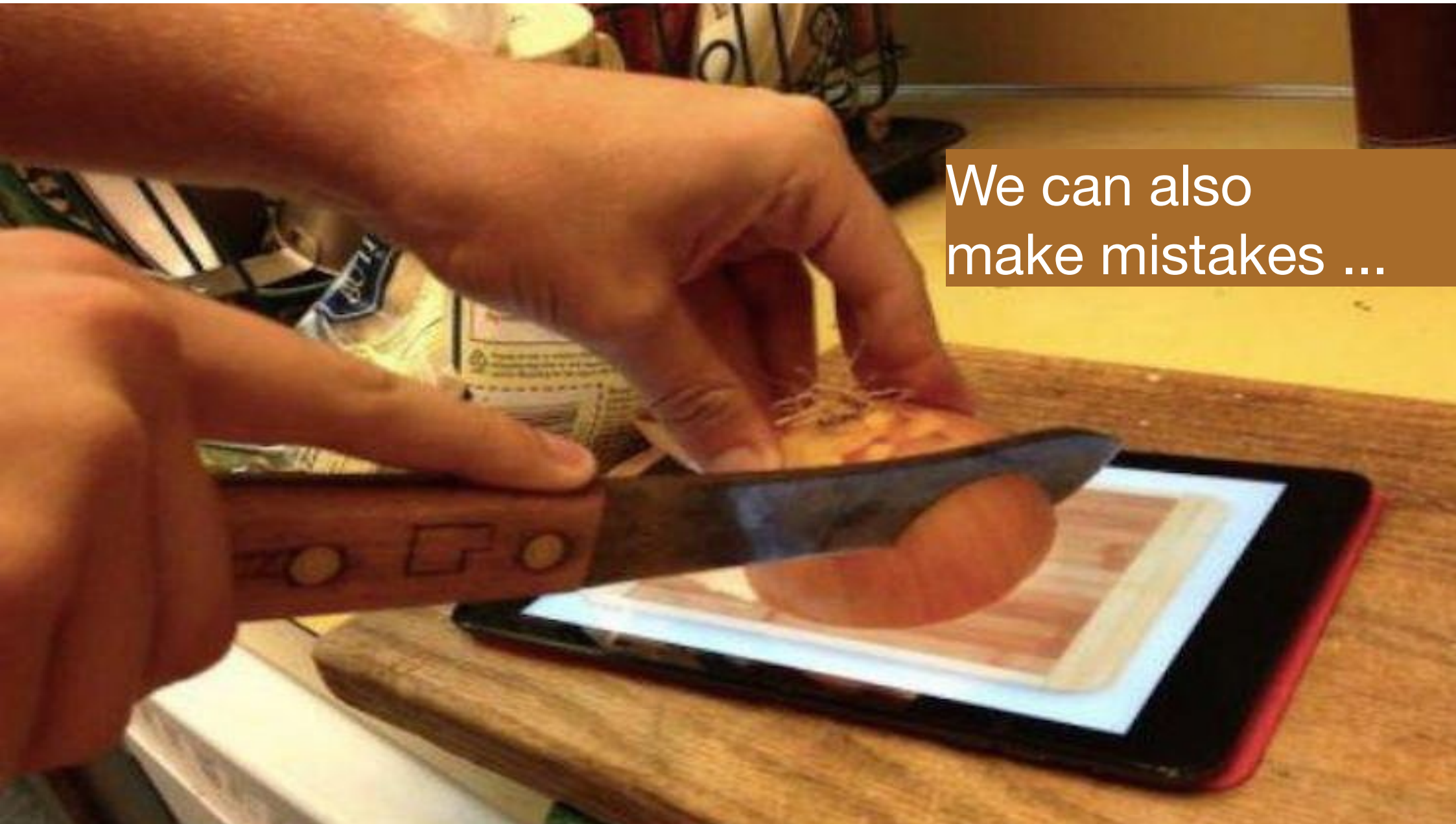


Compare to physical tools

or we can improvise ...



We can also
make mistakes ...

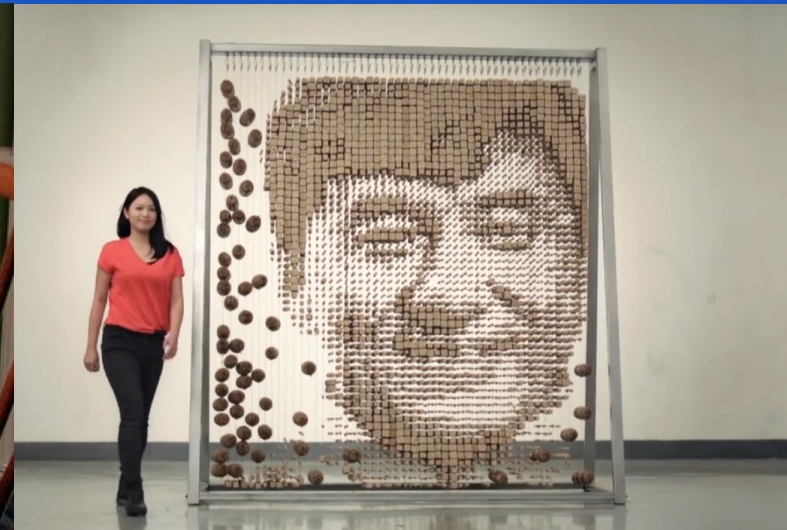


We appropriate physical tools



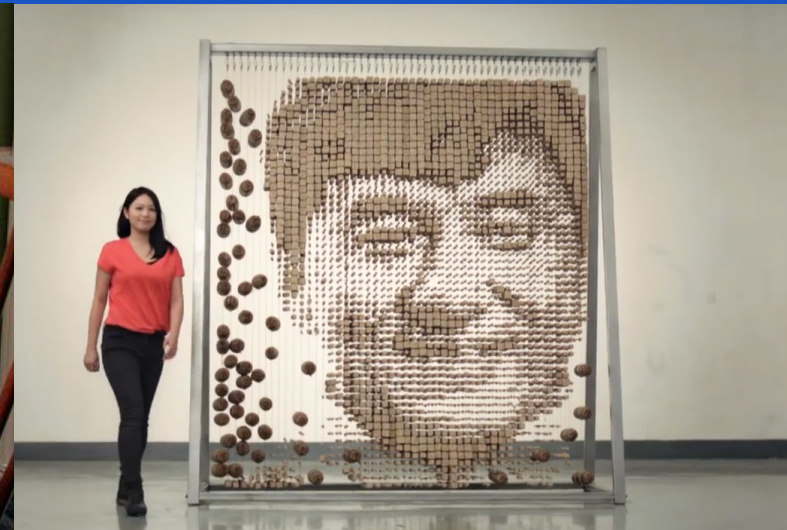
We appropriate physical tools

any object can become an instrument
any instrument can solve multiple problems



We appropriate physical tools

any object can become an instrument
any instrument can solve multiple problems
Why not software?



Today's software

Designed for secretaries
in the 1970s:

documents

files

folders

cut-and-paste

trash cans ...



Xerox Star in 1981

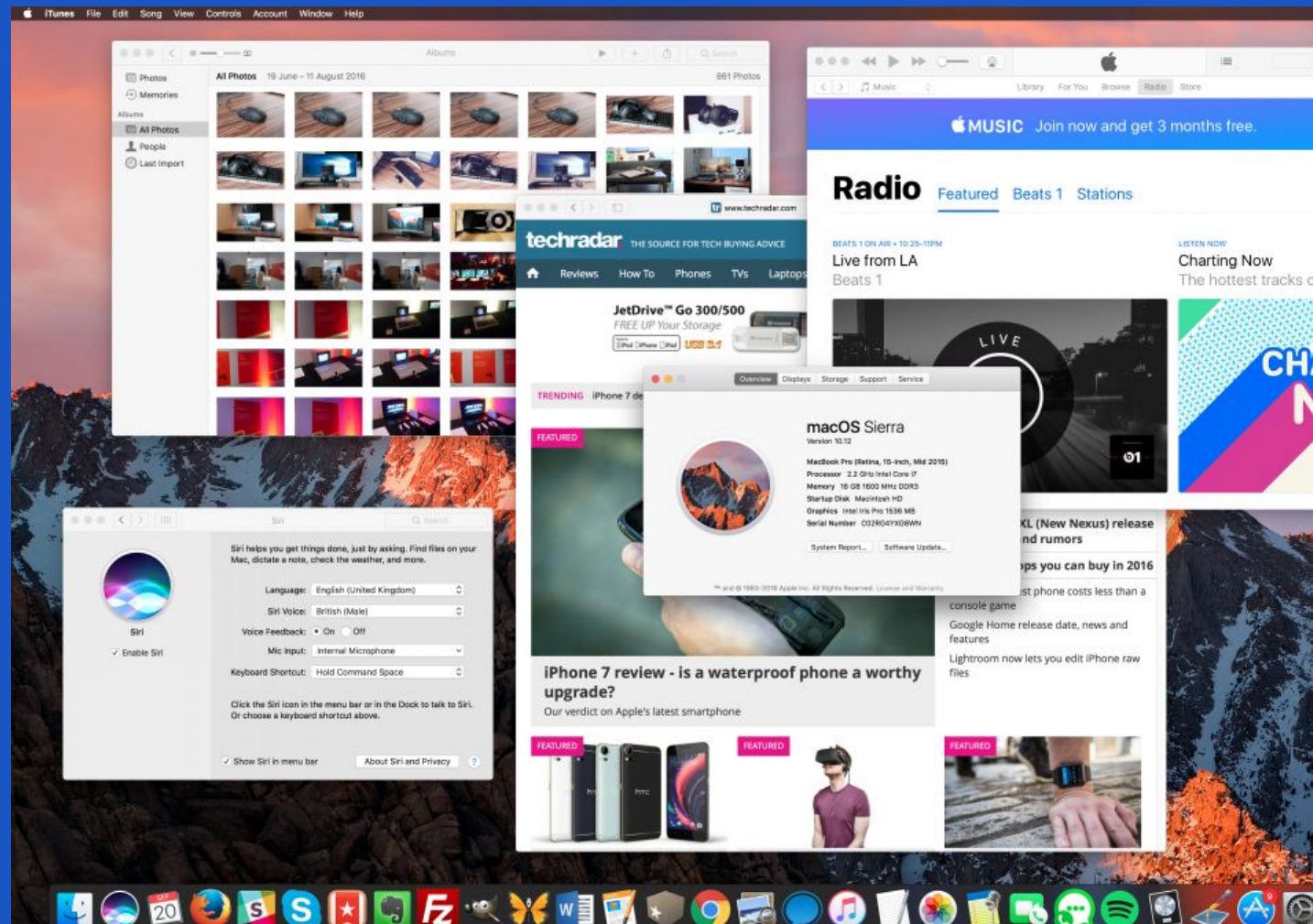
‘GUI’

Graphical
User
Interface

Focus on copying
not creating



40 years
later ...



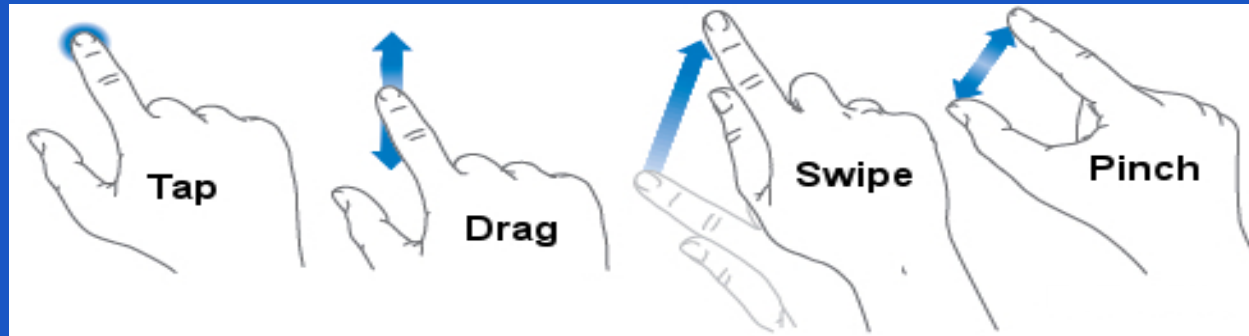
What about smart phones?

Can we create tools
that give us power ...

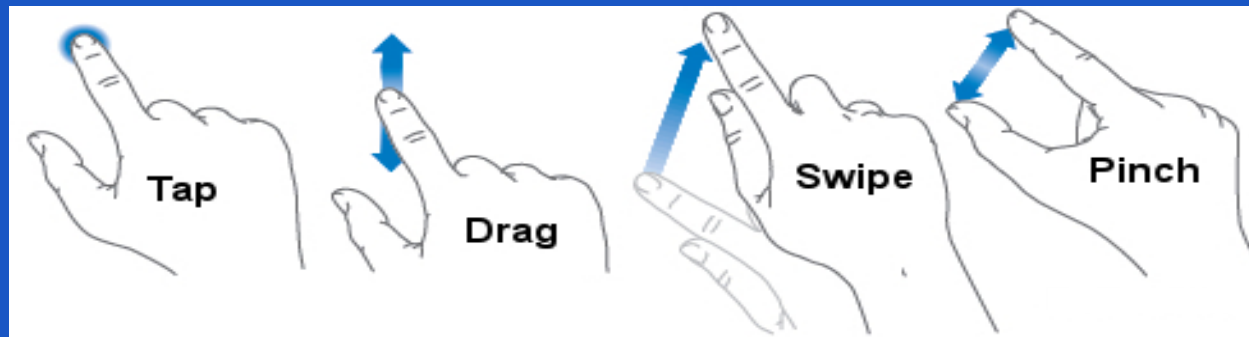
without losing simplicity?



Smart phones are easy to use



Smart phones are easy to use



... but interaction is limited



Can we learn to 'play' our phones?

Progress from novice to virtuoso ...

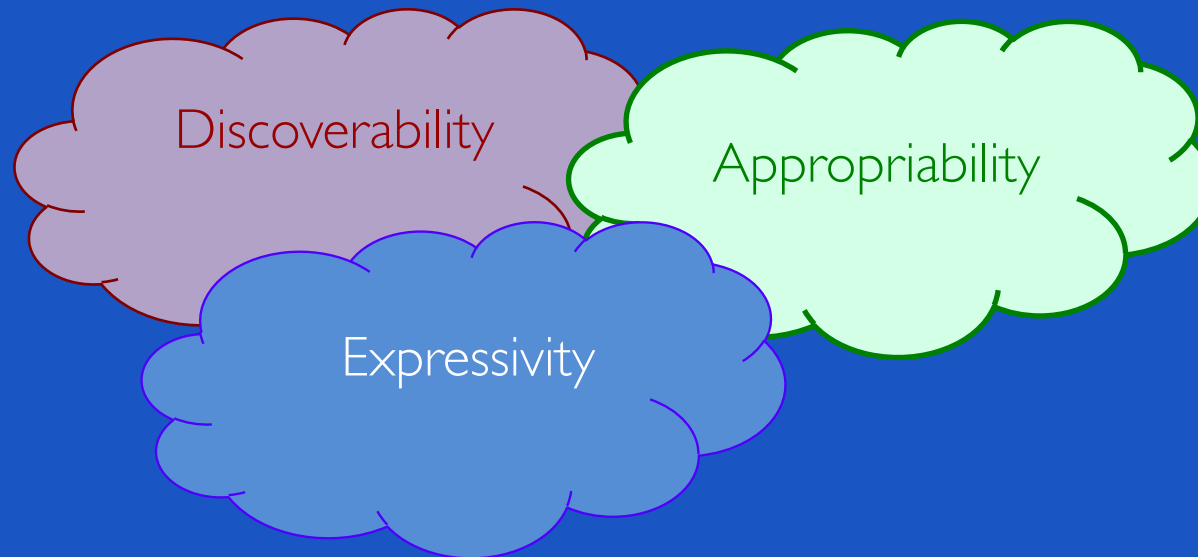


One solution:
Gesture-based commands



Human-computer partnerships

People *adapt to* technology = learn it
 adapt technology = appropriate it



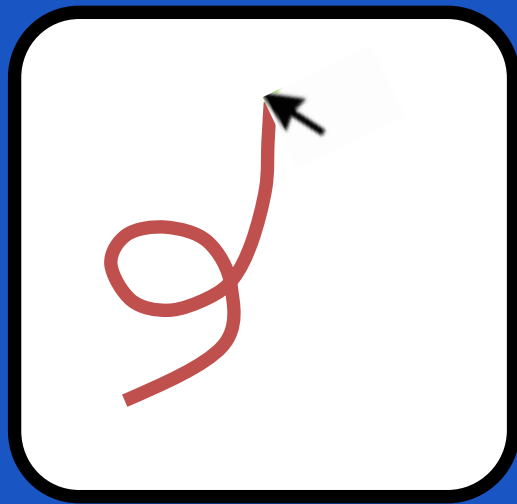


Discoverability

How to learn which gesture
executes which command?

Dynamic Guides

Experts just perform the gesture

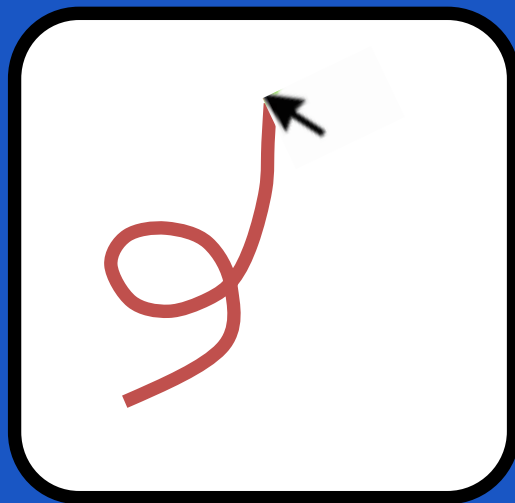
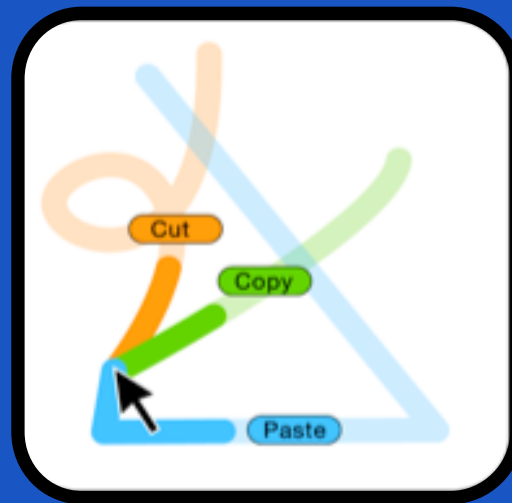
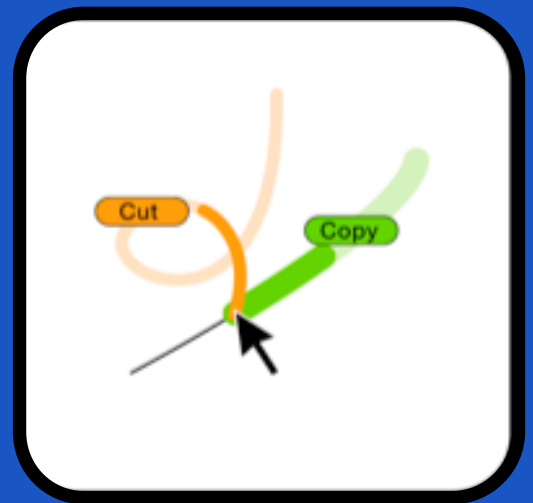


Bau & Mackay, UIST'09

Dynamic Guides

Experts just perform the gesture

Novices pause . . . a dynamic guide appears



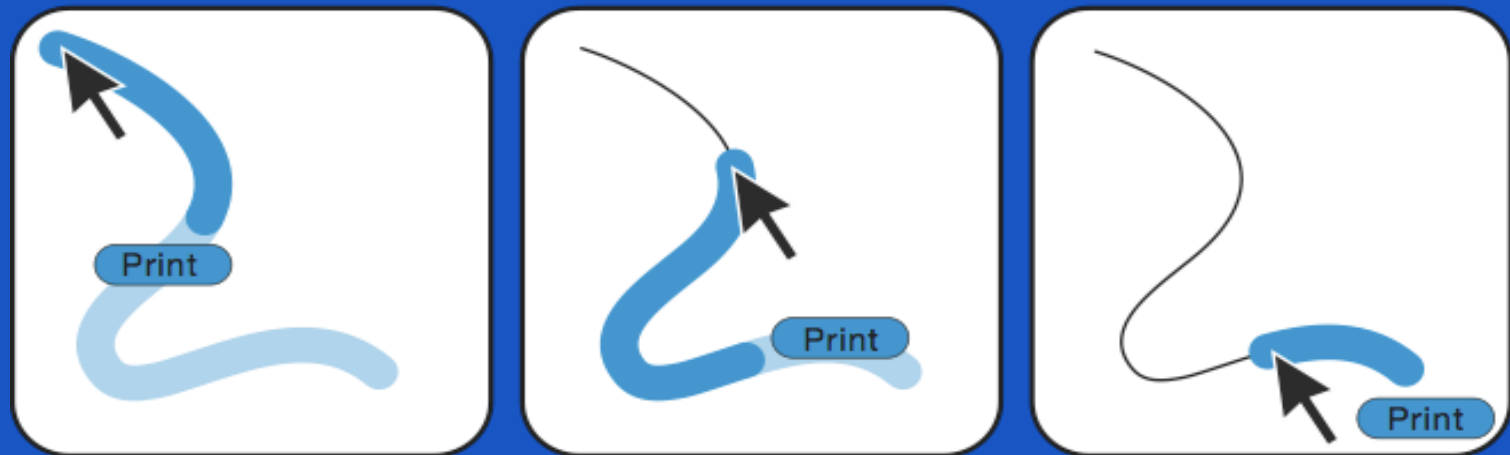
Dynamic Guides

Progressive feedforward

What gestures are available ?

Progressive feedback

What did the system recognize ?



Bau & Mackay, UIST'09

Inking the '*Help*' command



Appropriability

How to create personal
gesture commands?

Fieldward

Create your own gesture commands
easy for **user to remember**

Malloch, Griggio, McGrenere & Mackay CHI'17

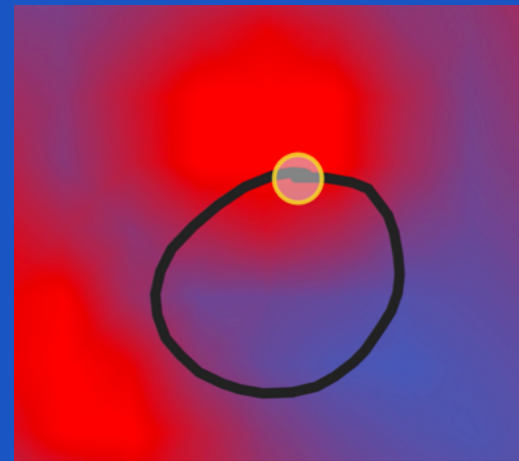
Fieldward

Create your own gesture commands
easy for user to remember
easy for the system to recognize

Fieldward

Draw a gesture for 'set timer'

If it ends in a **red zone**
the gesture already exists

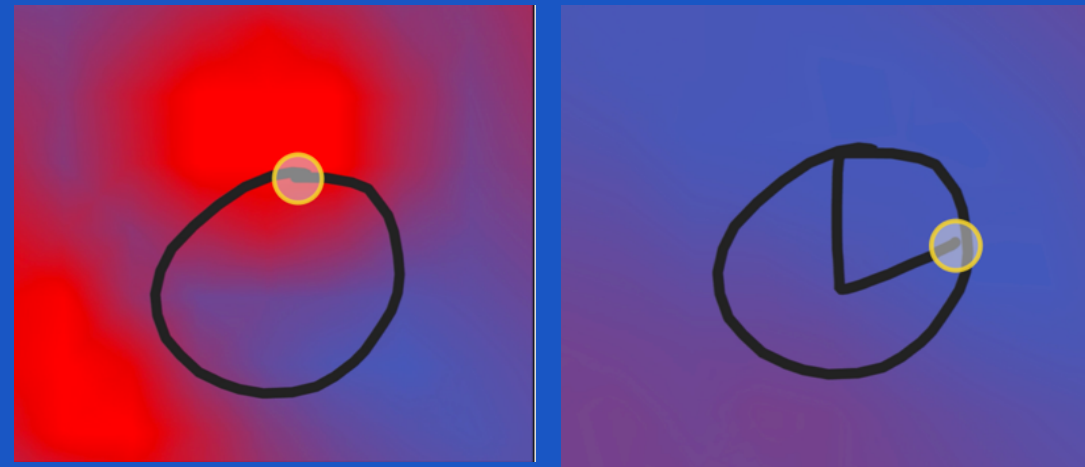


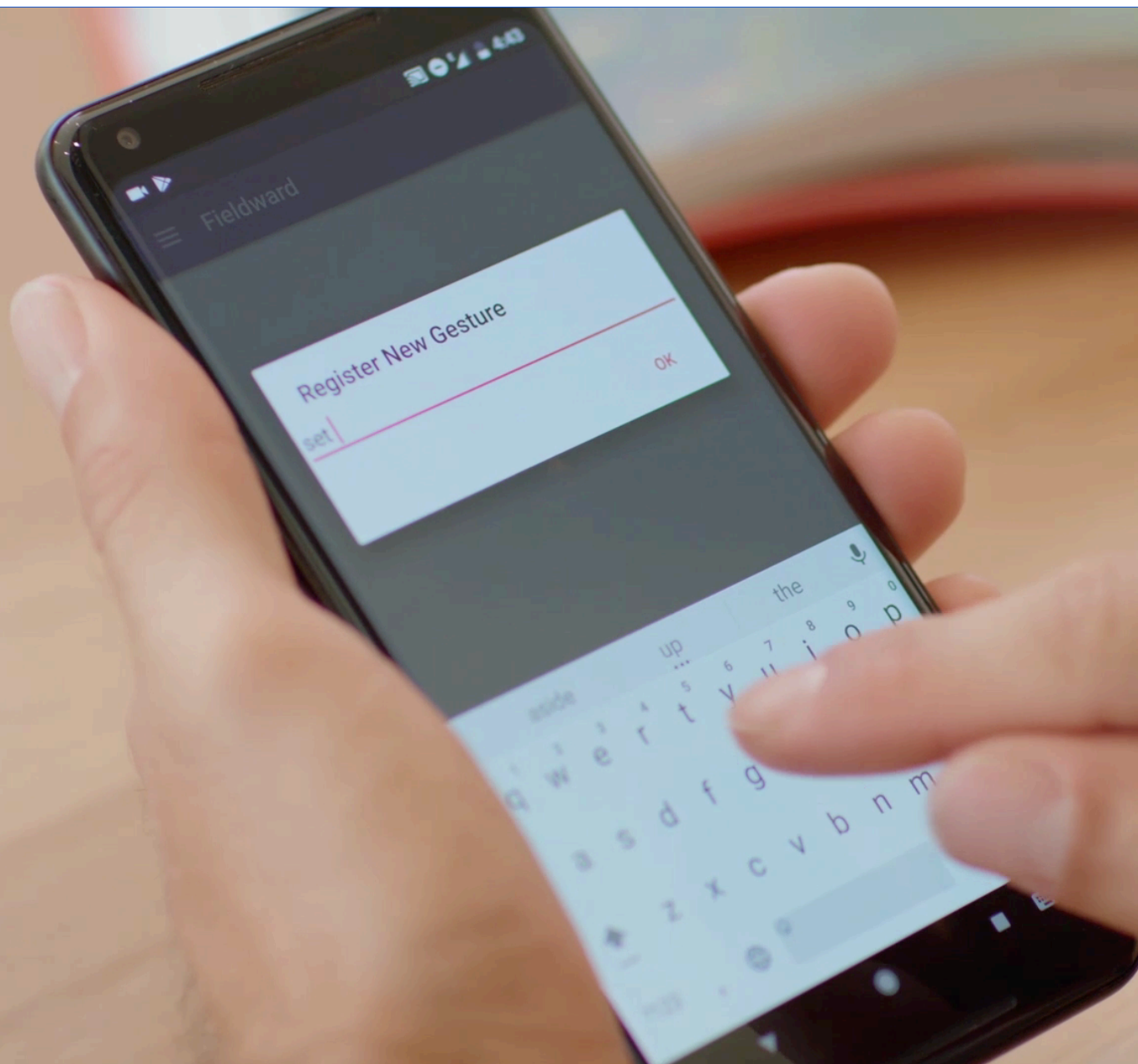
Fieldward

Draw a gesture for 'set timer'

If it ends in a red zone
the gesture already exists

If it ends in a **blue zone**
the gesture can be
recognized







Discoverability



Appropriability

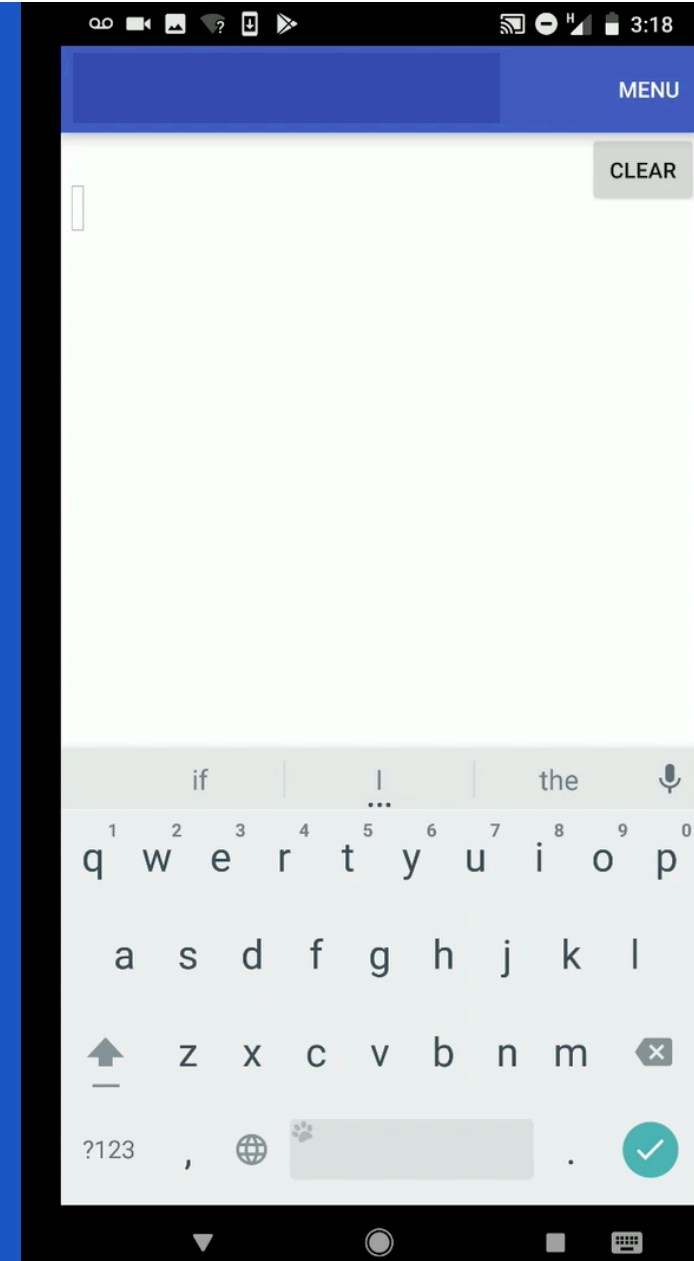
How to achieve
power of expression
... simply ?

CommandBoard

Transform the space
above a soft keyboard
into a command input space

Offers the power of a
command-line interface
on a mobile phone

Alvina, Griggio, Bi & Mackay UIST'17



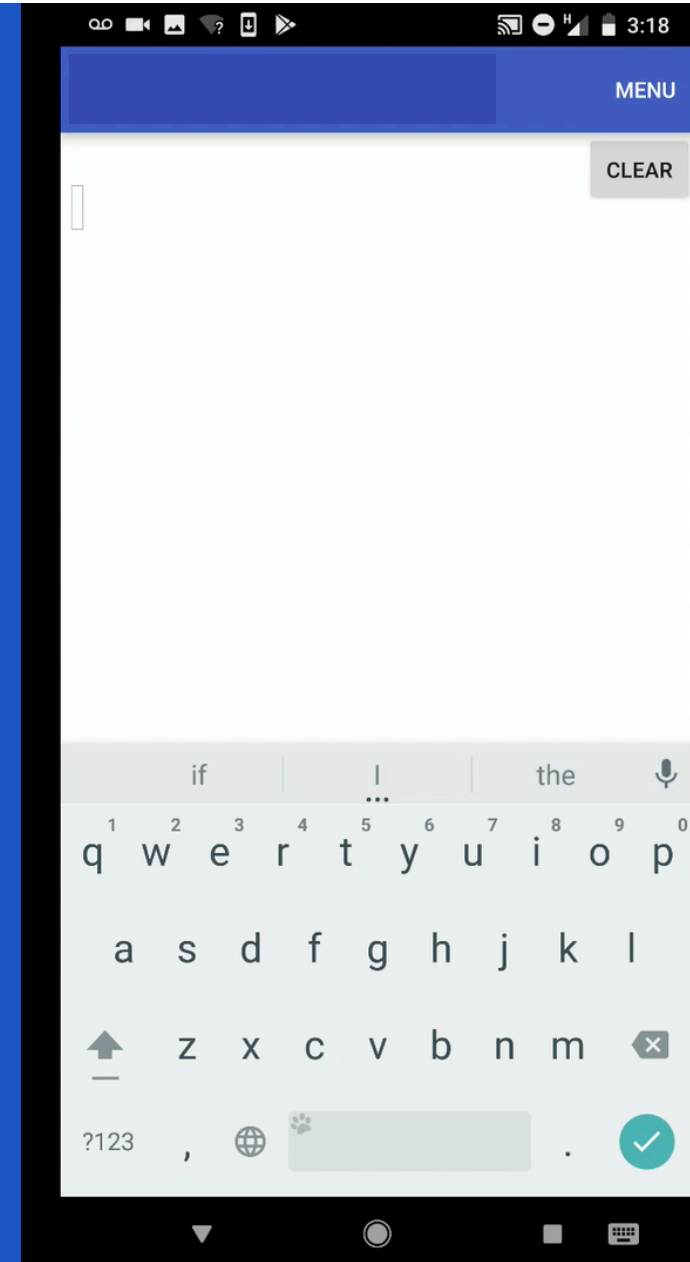
CommandBoard

Type 'doodle'

then 'execute' gesture ^

Launches 'doodle'

Alvina, Griggio, Bi & Mackay UIST'17

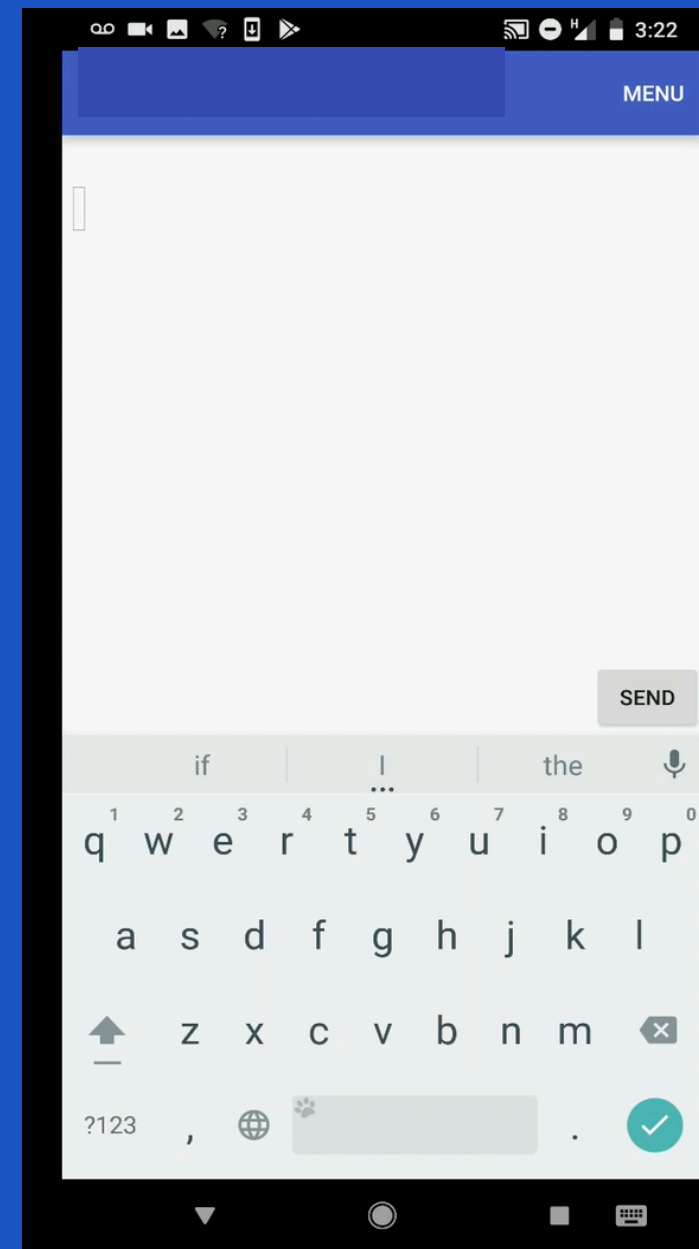


CommandBoard

Type 'doodle'
then 'execute' gesture ^
Launches 'doodle'

Type 'color'
then select a color

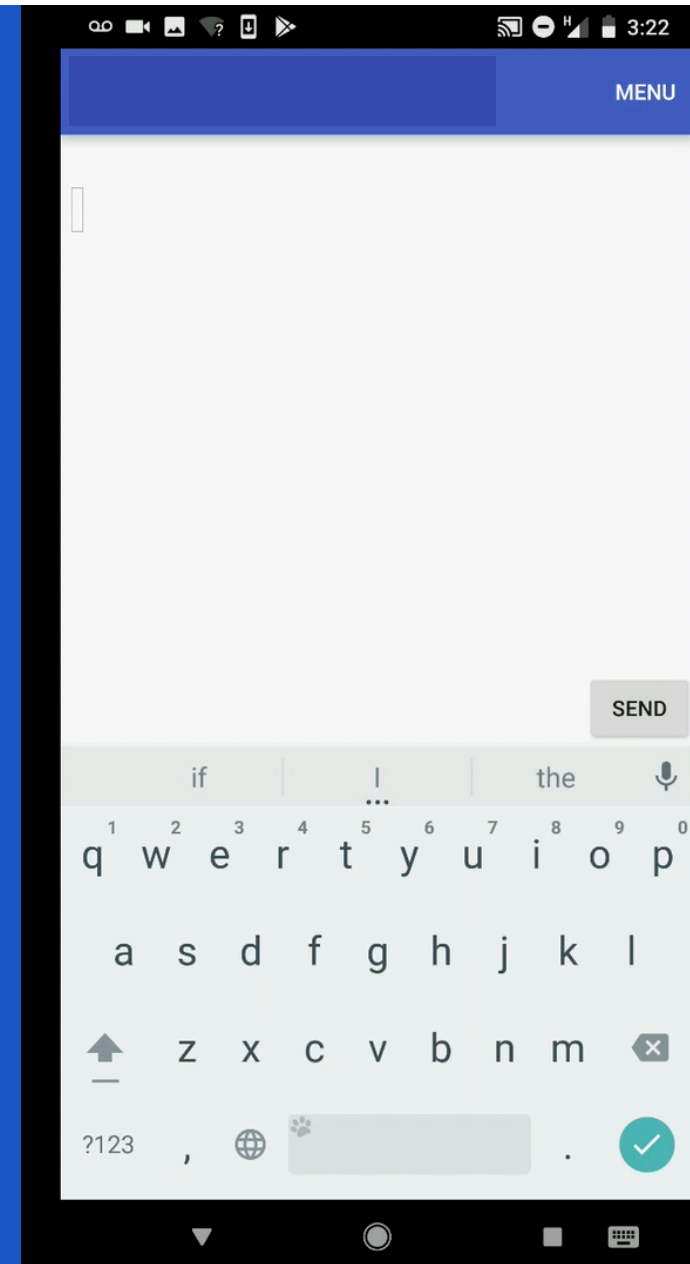
Alvina, Griggio, Bi & Mackay UIST'17



Commandboard

Use progressive feedforward to
discover strike-through command

Alvina, Griggio, Bi & Mackay UIST'17



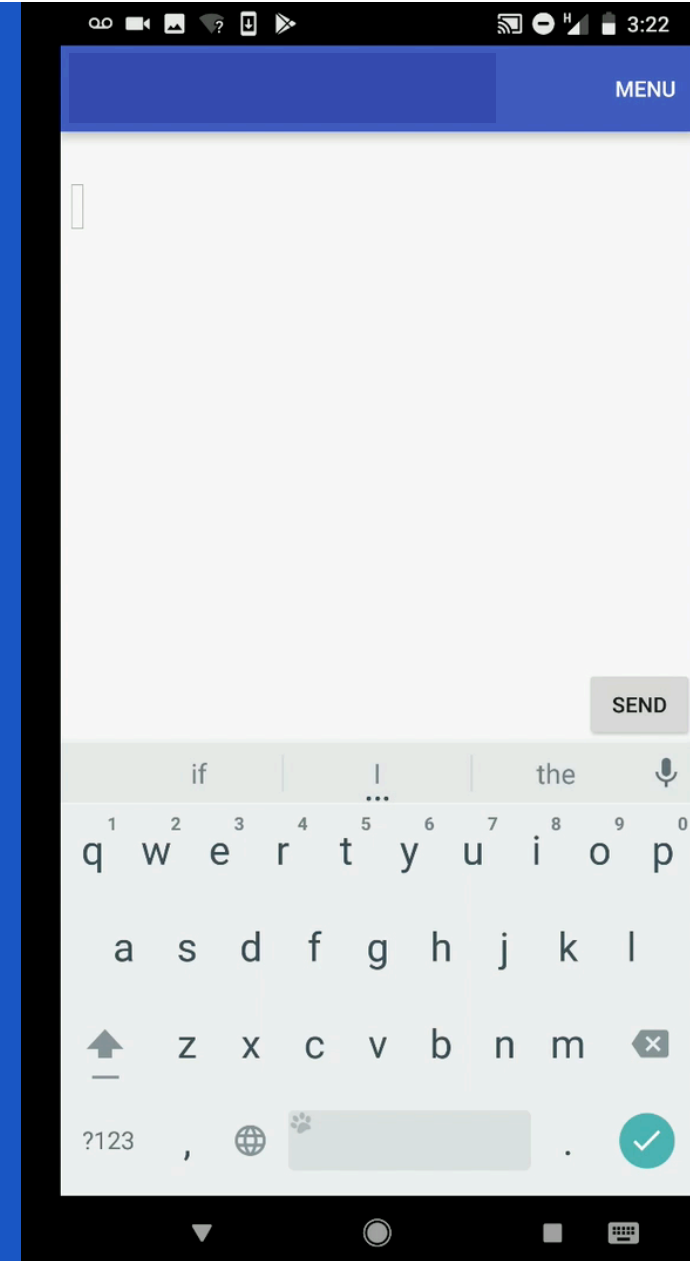
Commandboard

Use progressive feedforward to
discover strike-through command

When you know the gesture
you just draw it

~~I slept through~~ loved the lecture

Alvina, Griggio, Bi & Mackay UIST'17





Expressivity

How to generate
expressive output?

Human expression vs. Machine classification

Machine learning algorithms:

Goal is to **classify** the correct word

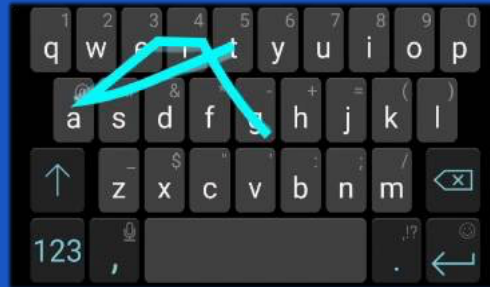
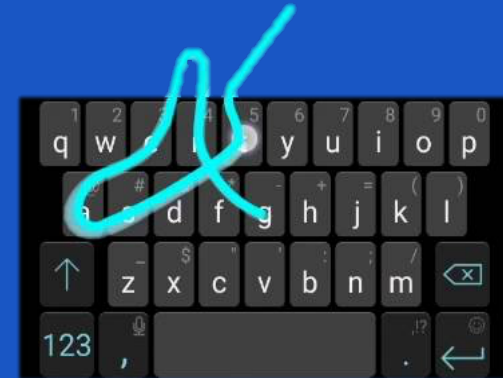
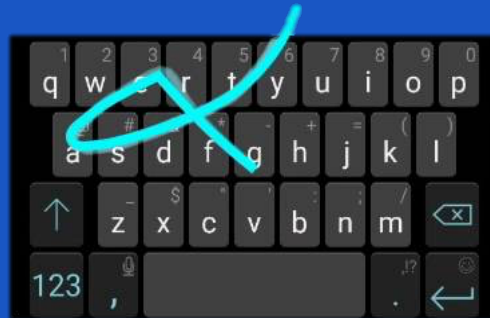
Human variation is treated as **noise**



Gesture typing algorithms are great . . .

Four ways to input
the word “great”

All produce the
identical result:
great



Expressive Keyboard

Machine learning approach

Classify the correct word

Remove human variation



Expressive Keyboard

Machine learning approach

Classify the correct word

Remove human variation

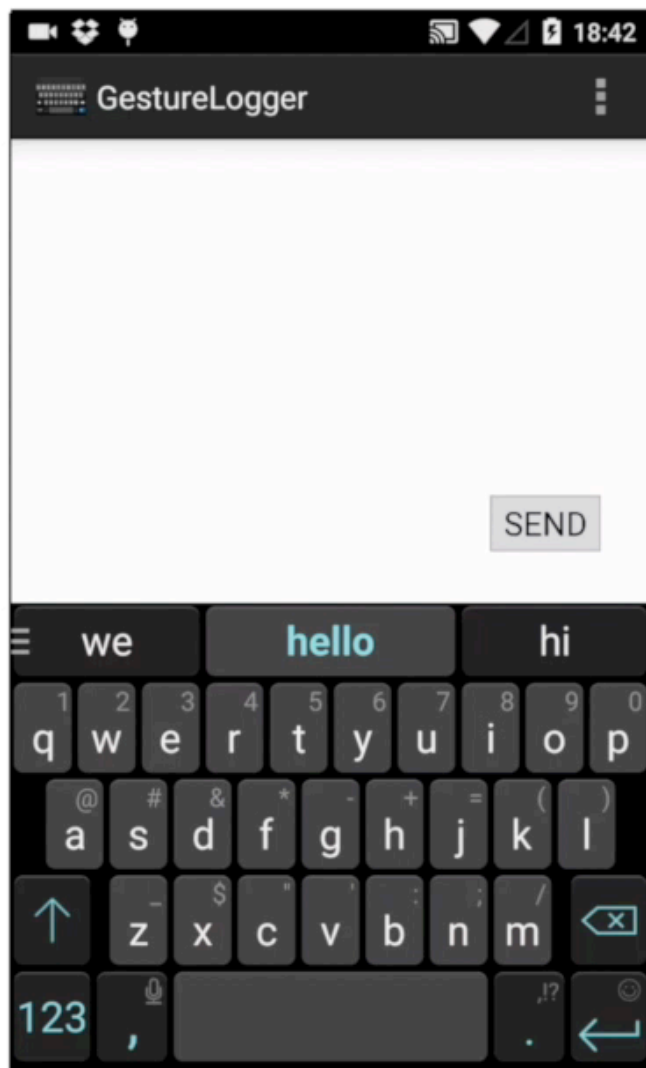
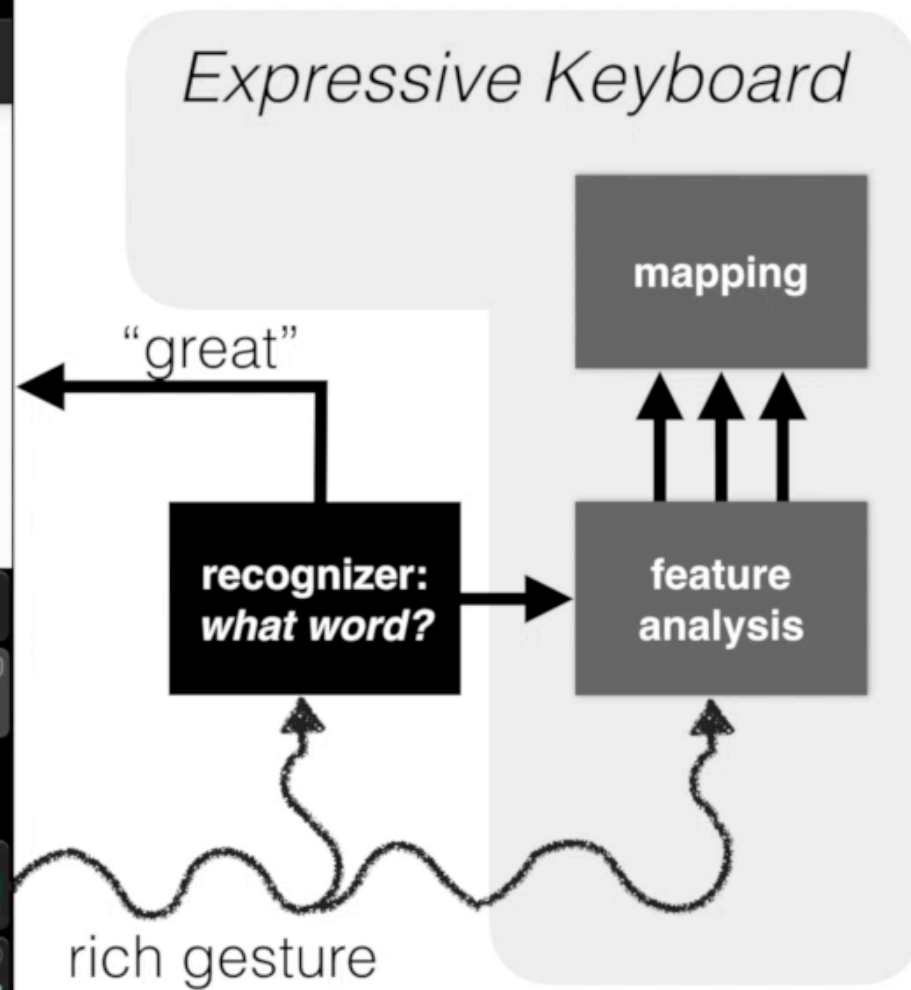


Expressive Keyboard approach

Transform human variation into expressive output
color, emojis, typography ...

Alvina, Malloch & Mackay CHI'16





Expressive Typography

Vary fonts for different
audiences, goals and contexts

Dynamic typography plain style

Dynamic **typography** plain style

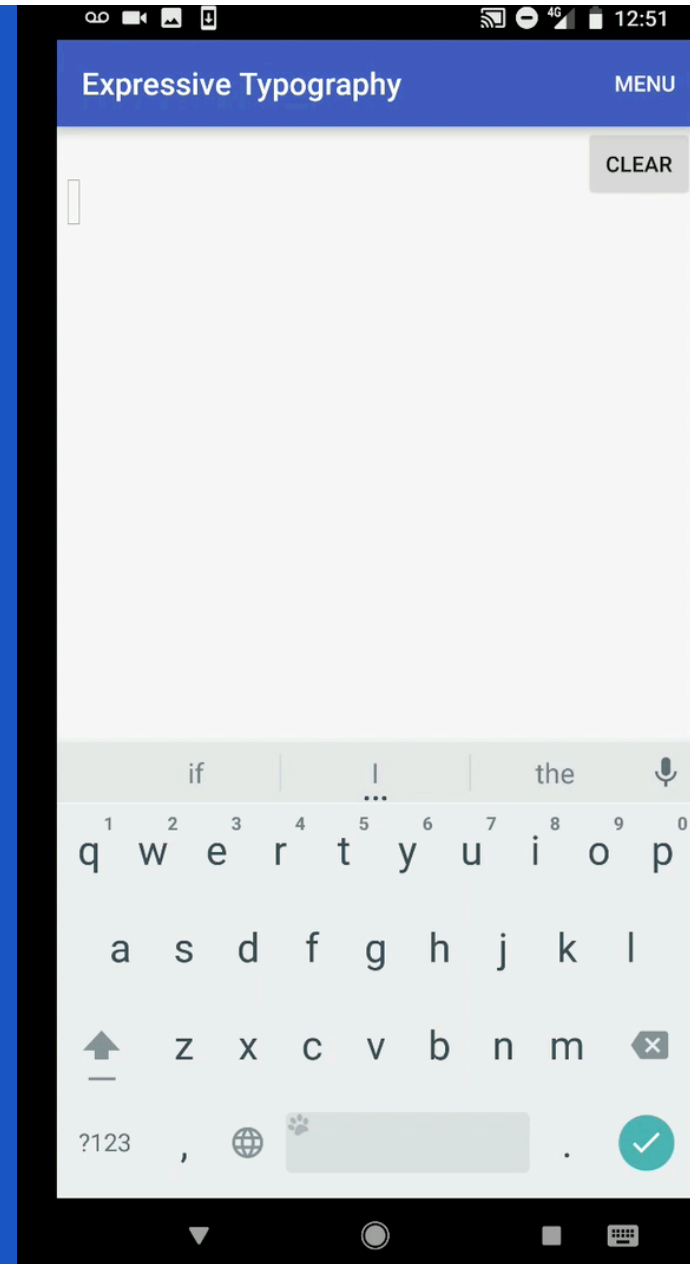
Dynamic *typography* informal style

Dynamic *typography* kids style

Dynamic *typography* spread style

Dynamic *typography* elegant style

Dynamic *typography* scripte style



Human-computer partnerships like these?

Discover



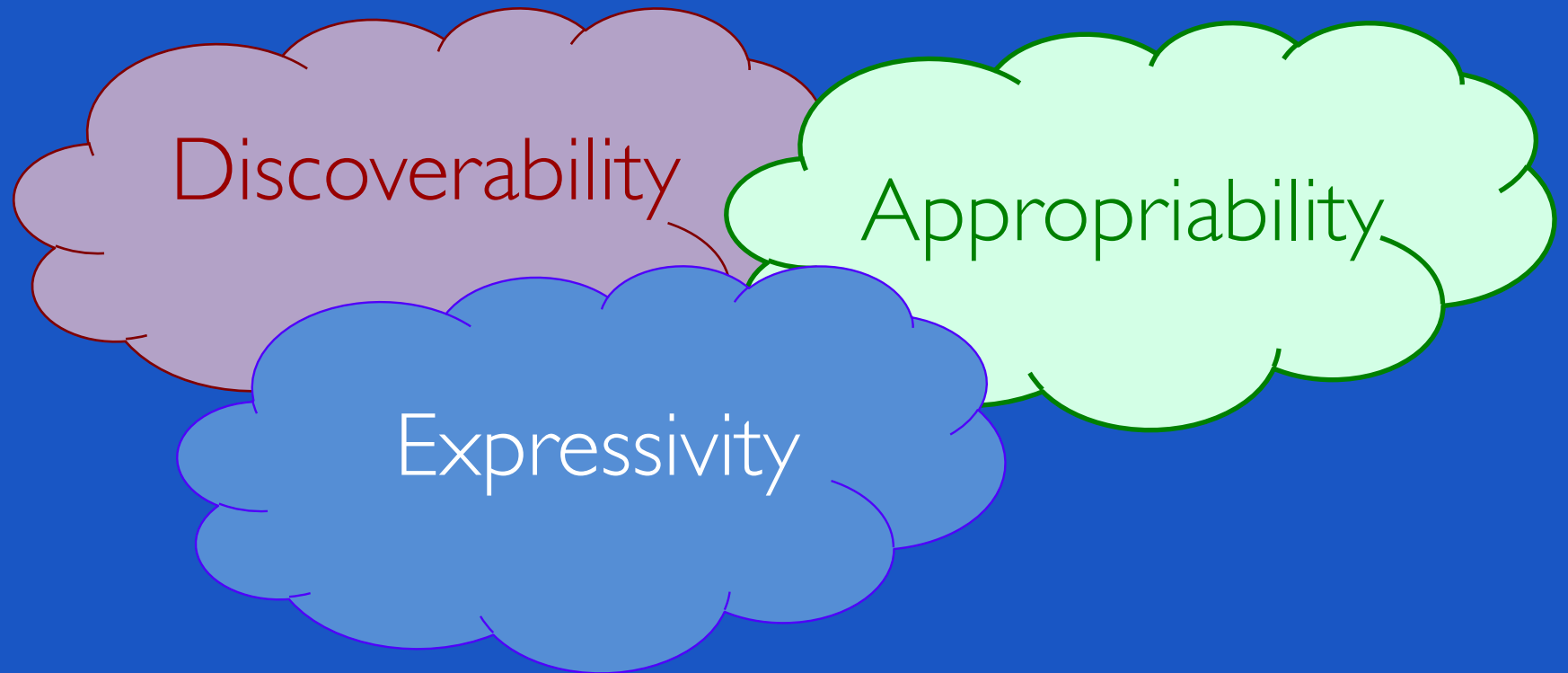
Appropriate



Express



Human-Computer Partnerships



Interactive Paper

Mixing the physical and the digital

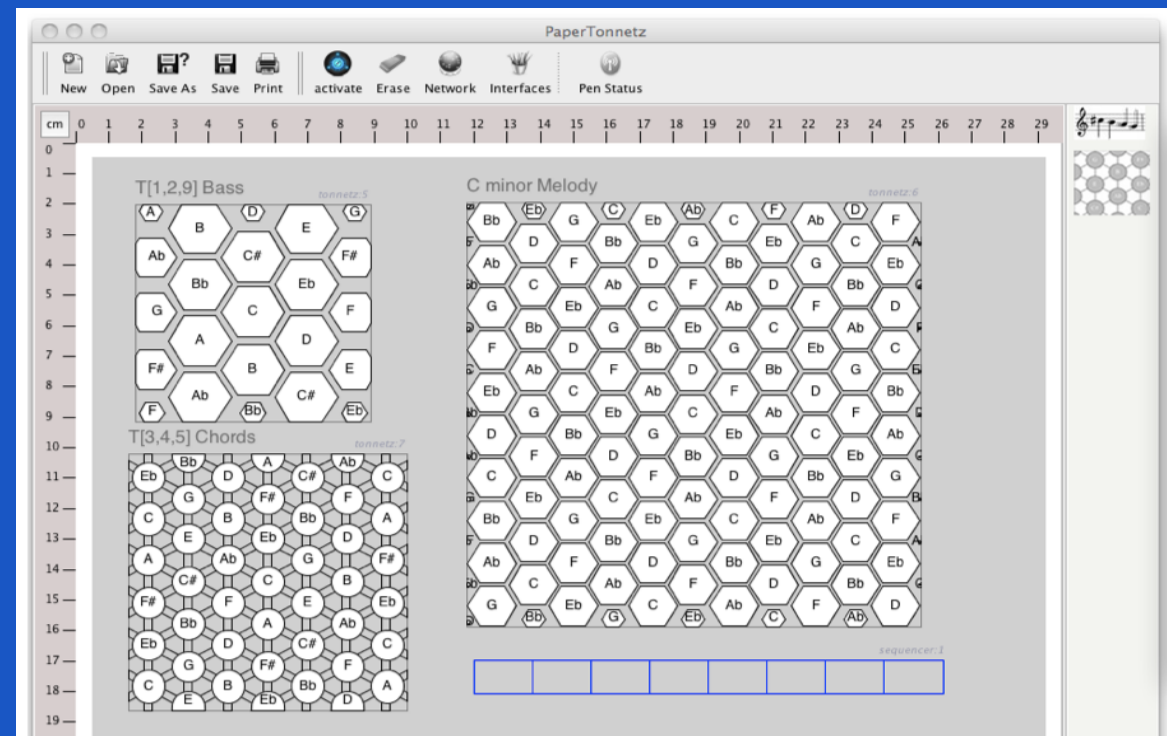


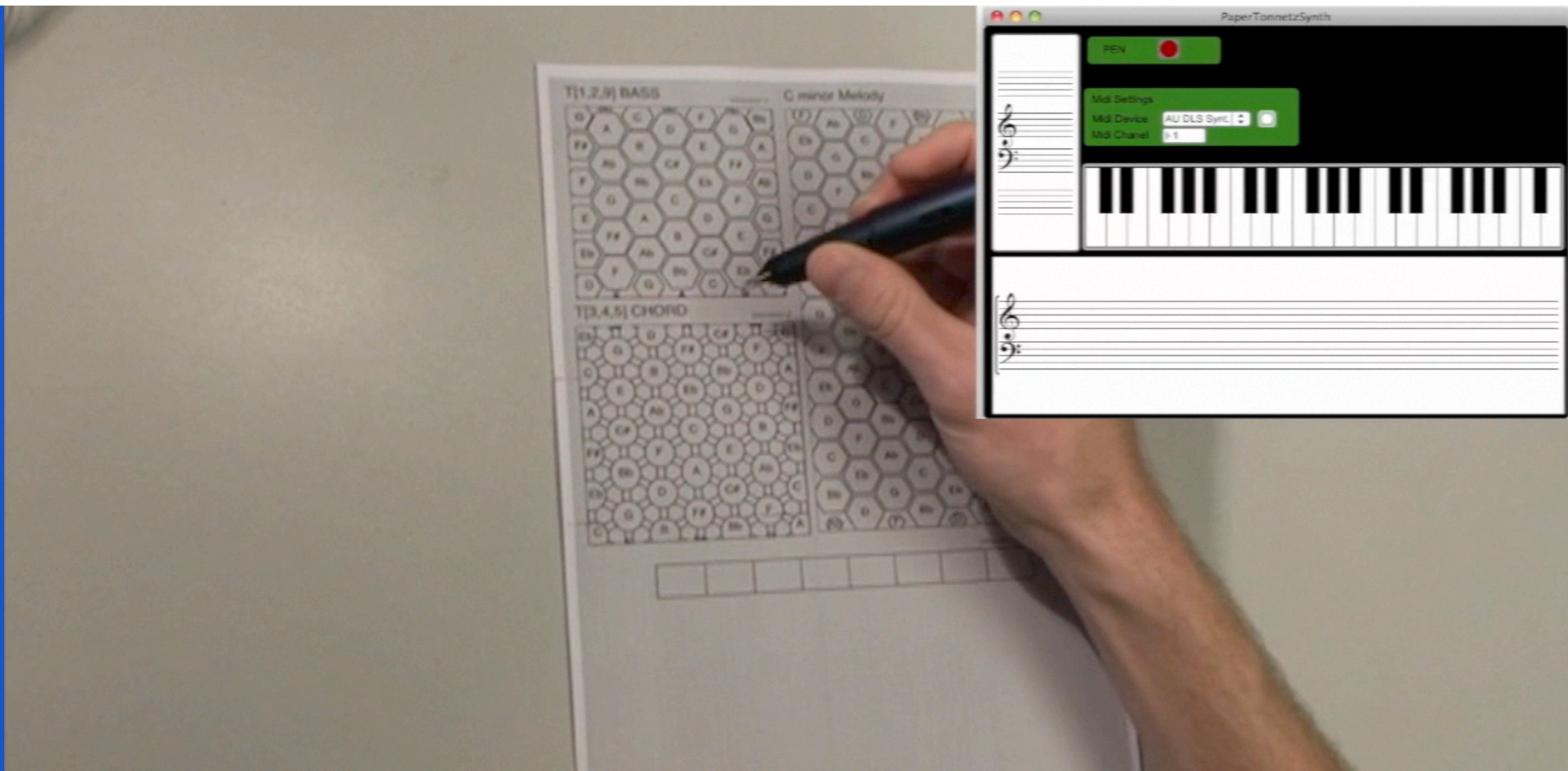


Discoverability

How to learn which gesture
executes which command?

Garcia, Tsandilas & Mackay SMC'12





The composer starts with the bass part



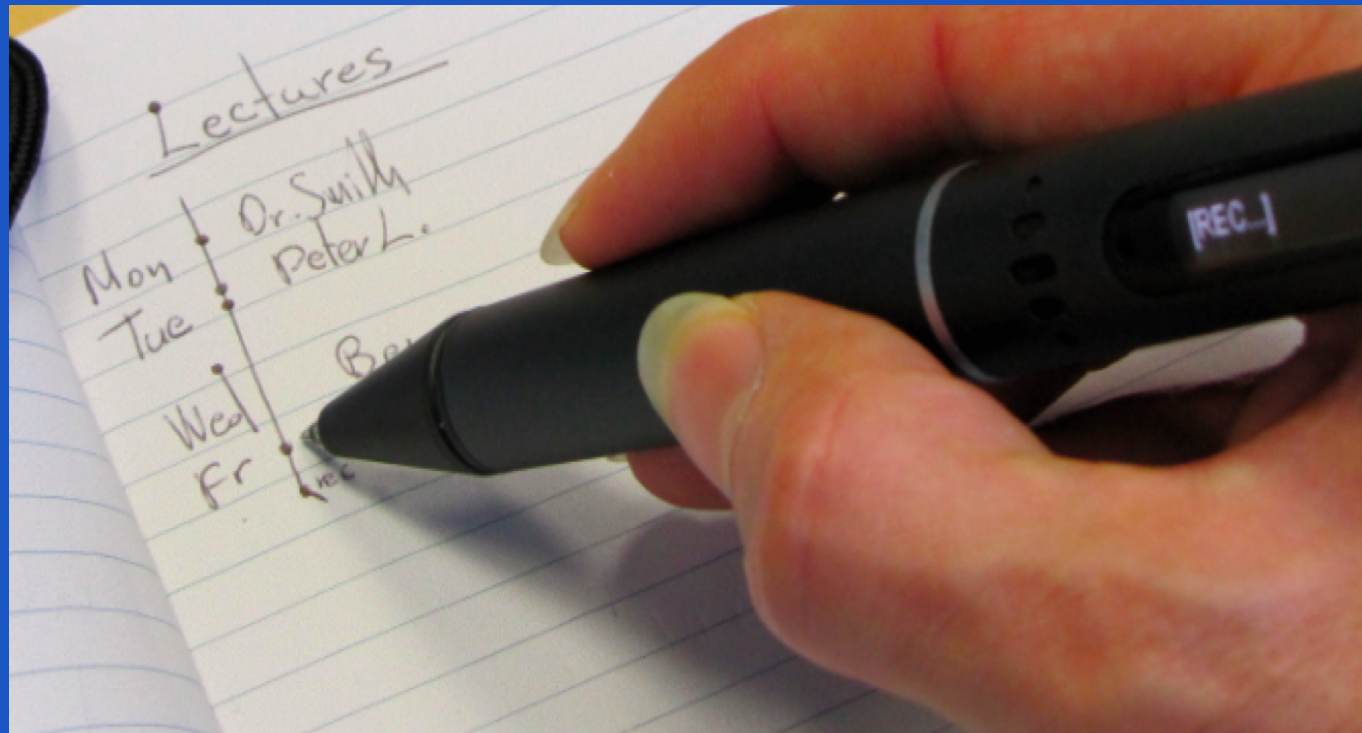
Appropriability

How to create personal
gesture commands?

Knotty Gestures:

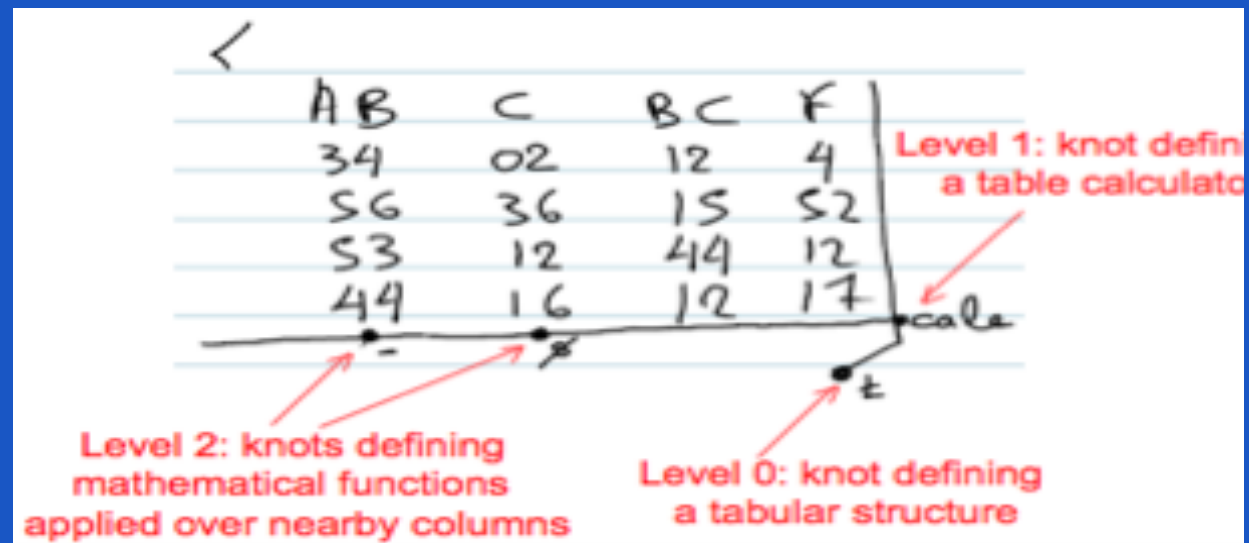
Draw a knot to define a command

Interact now or later



Knotty Gestures

Knots can define
mathematical or
other relationships



Knotty Gestures

Draw a line with a knot

Choose “recording” to define the type of line



Knotty Gestures

Add another knot to define
the start of the recording



Knotty Gestures

Add a third knot to define
the end of the recording

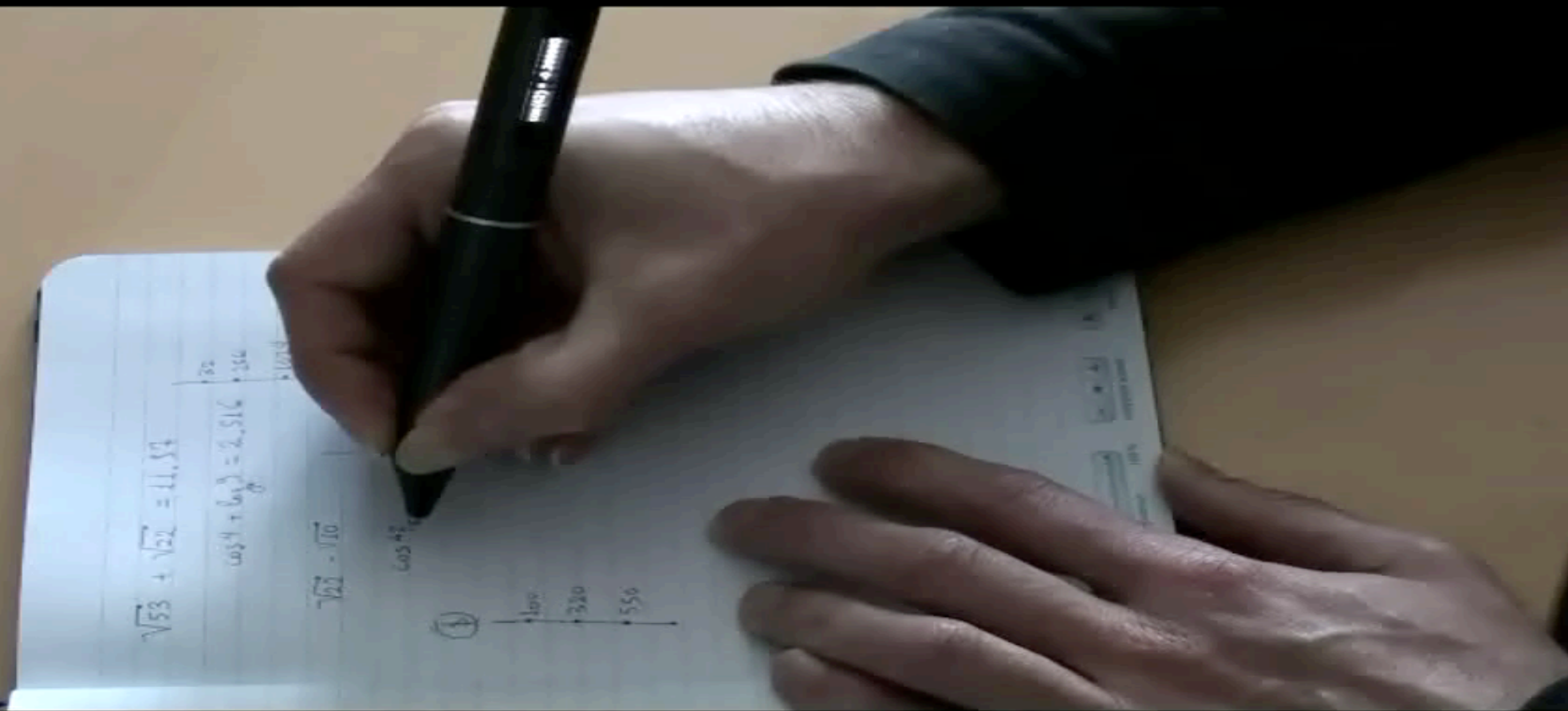


Knotty Gestures

Slide the pen back and forth
to play the recording



Knotty Gestures





Expressivity

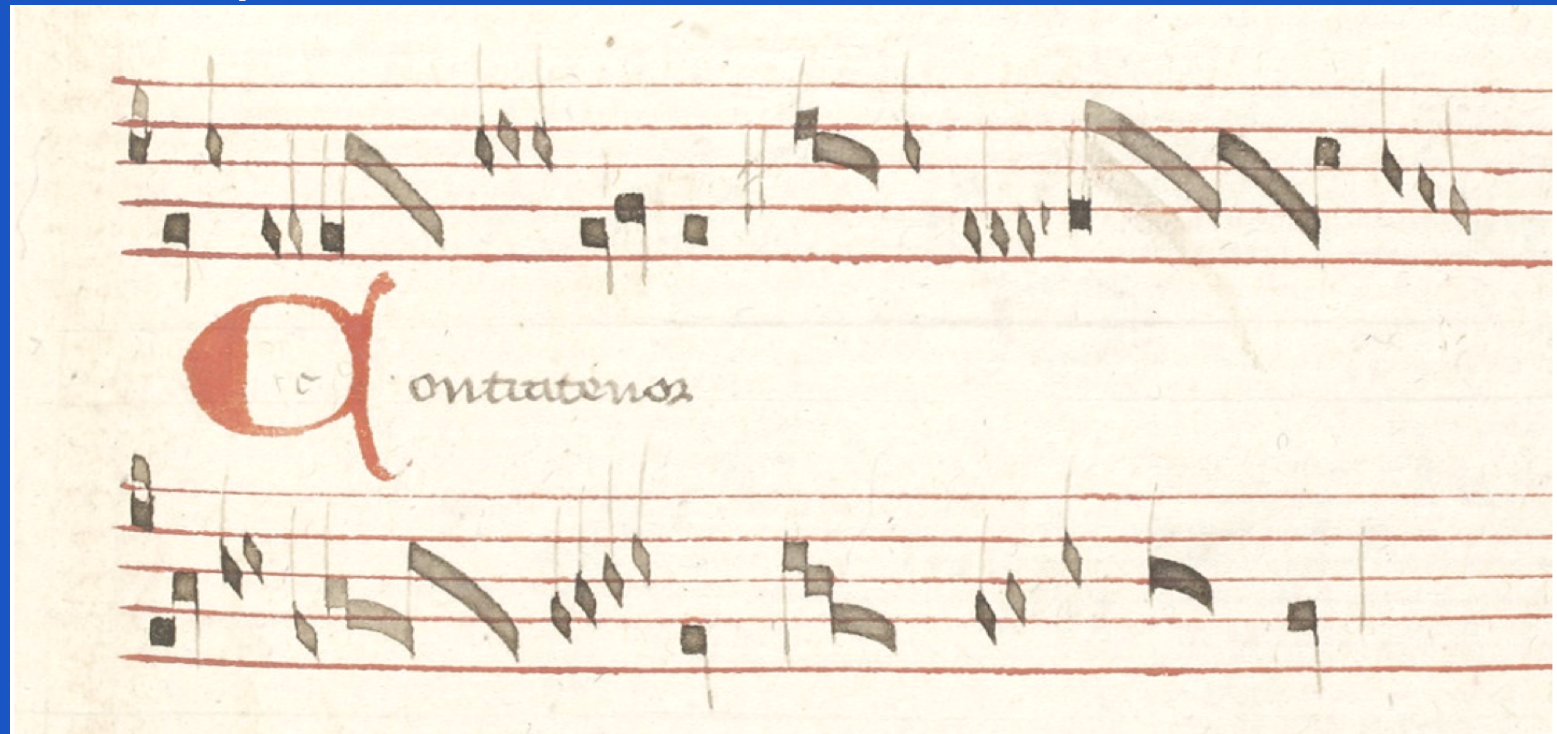
How to generate
expressive output?

Quid Sit Musicus

World Premier 2014

13th century musical scores

Each note indicates expression



Pillippe Leroux

Paper Composer

IHM'14

Associate gesture characteristics
with sounds and features

compose
& perform



Garcia & Mackay, IHM '14

Quid Sit Musicus?

QUID SIT MUSICUS?
BY PHILIPPE LEROUX

Tomorrow:
true human-
computer
partnerships

empower
rather than
frustrate
(or replace)
people

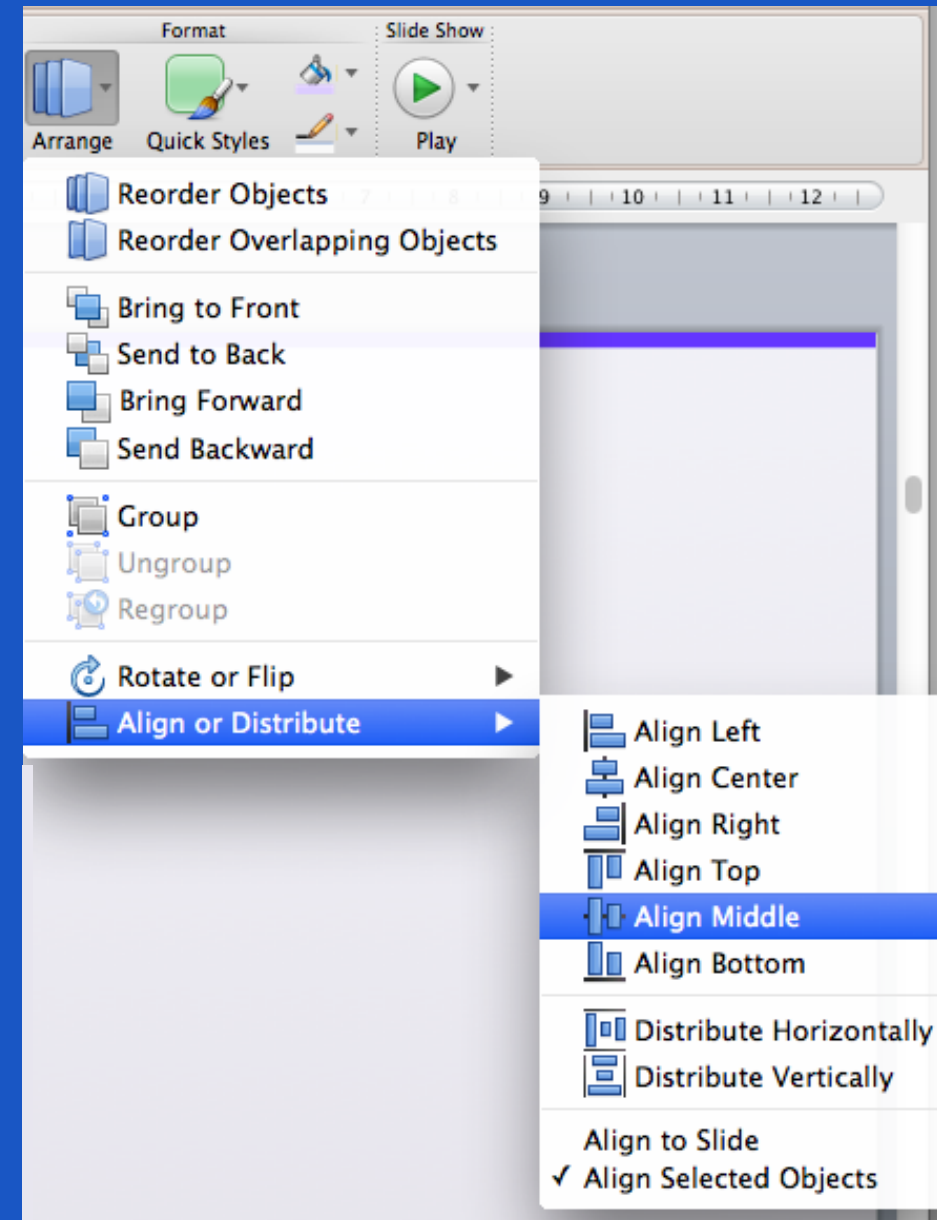


Software tools

Example: Powerpoint
Alignment and distribution

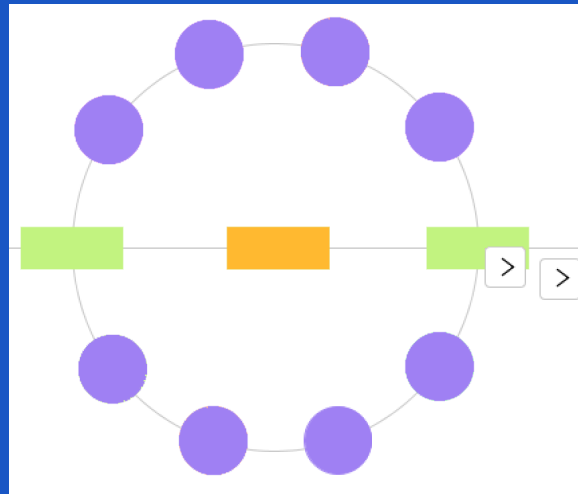
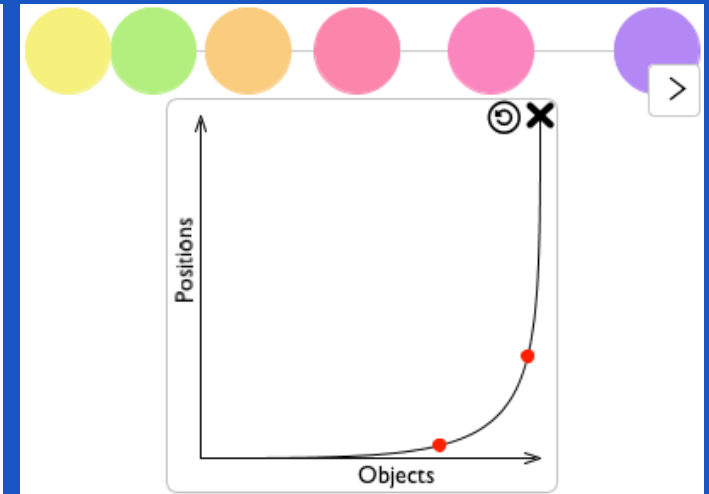
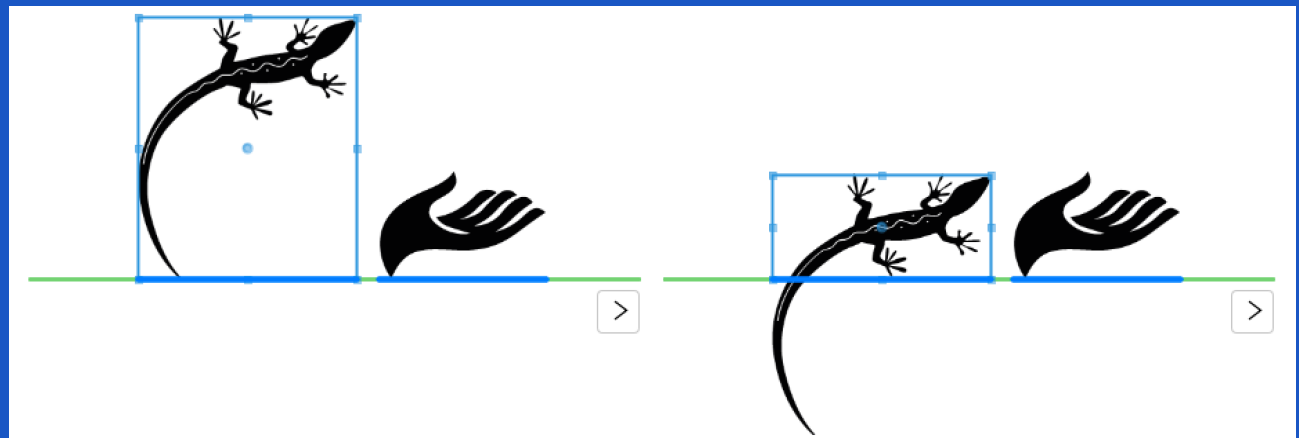
=

Cumbersome buttons
and pull-down menus

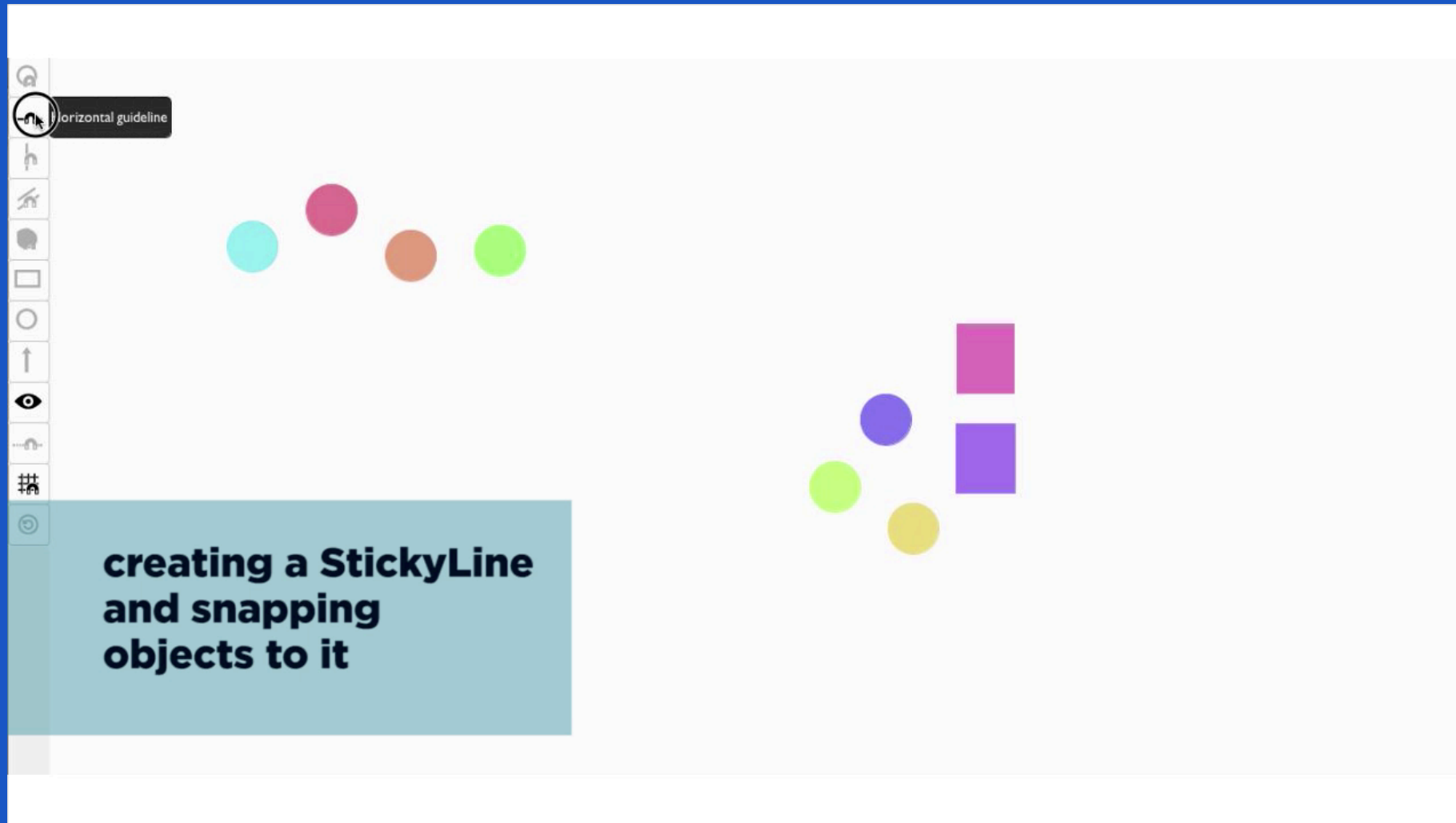


StickyLines

Reify
alignment
distribution
'tweaks'



StickyLines





Thank you!

Wendy Mackay
mackay@lri.fr

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