

Creating Human-Computer Partnerships

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21 September 2018

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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



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

Human-Computer Partnerships

Human-in-the-loop

A 'simple' human-computer partnership

User types – Google suggests – User chooses

The image shows a screenshot of a Google search results page for the query "google". The search bar at the top contains the word "google". Below the search bar, there are several search filters: "Everything", "Images", "Videos", "News", "Shopping", "Realtime", and "More". The location is set to "San Francisco, CA" and the time filter is set to "Any time". The search results list several items: "google", "google maps", "google translate", "google earth", and "google images". Each item has a small icon and a link to the respective service. The "google images" result is highlighted, showing a description: "Google Images. The most comprehensive image search on the web." Below this, there are links to "Google Maps" and "News for google". The "News for google" result shows a headline: "Google Goes Gaming With Search Puzzles" and a sub-headline: "This week, Google is happy to oblige, introducing a new puzzle called 'a Google a Day' that asks users to — what else? — use the search engine to solve the ...".



Human-Computer Partnerships

Human-in-the-loop

Machine learning perspective:

Human helps ***improve the algorithm***

Human-Computer Partnerships

Human-in-the-loop

Machine learning perspective:

Human helps ***improve the algorithm***

Computer-in-the-loop



How can we
empower people?

Human-Computer Partnerships

Human-in-the-loop

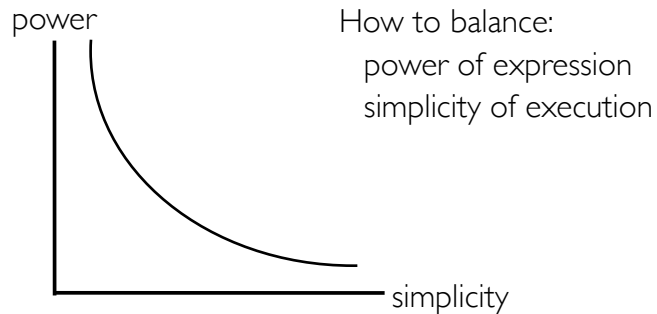
Human helps ***improve the algorithm***

Computer-in-the-loop

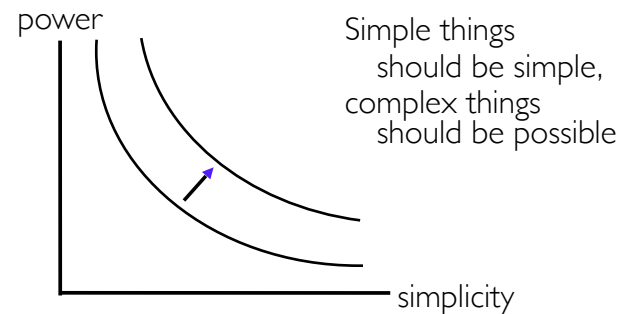
Human-computer interaction perspective:

Computers ***empower the human user***

We face a major design trade-off



Solution: Shift the curve



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
Human: How to interact with it ?
Co-adaptive Systems
Human-computer partnerships

Human-computer partnerships

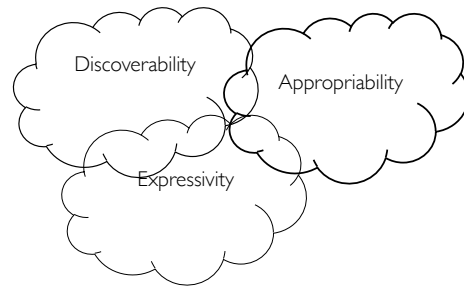
People can

adapt to technology

they learn it

adapt the technology

they appropriate it



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



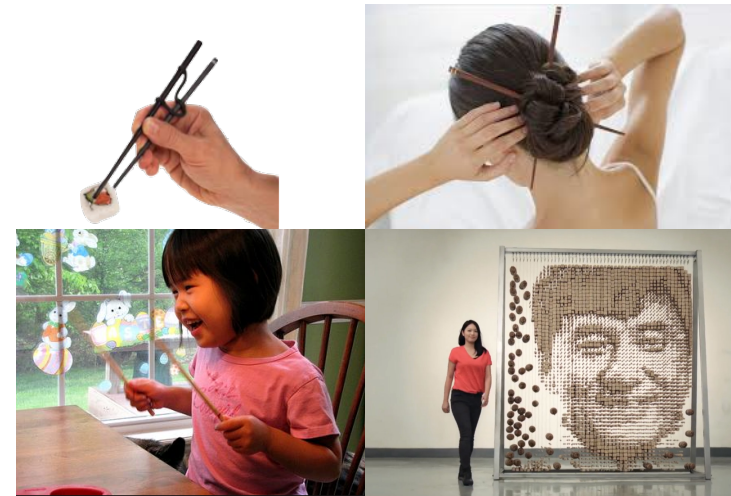
We can appropriate physical tools



We can appropriate physical tools



We can appropriate physical tools
... why not software ?



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



Ways of interacting with computers

Computer as **tool**
Empower users



Human-
Computer
Interaction

Computer as **servant**
Delegate tasks



Artificial
Intelligence

Computer as **medium**
Communicate



Mediated
Communication

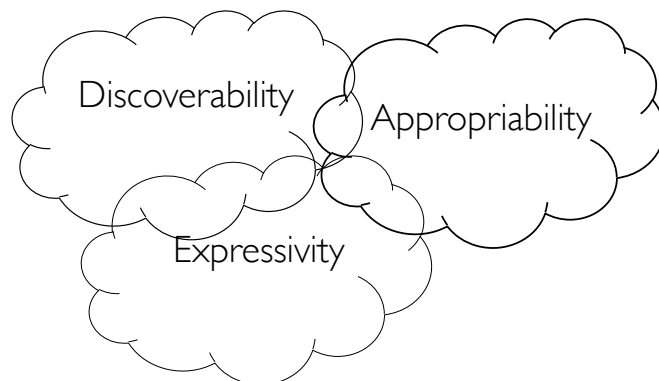
Human-computer partnerships

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

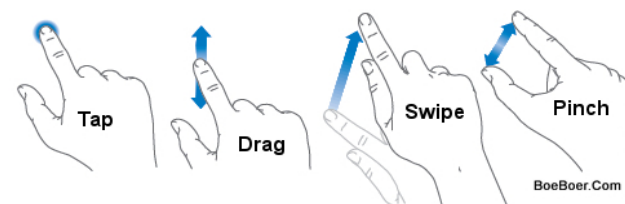
Computers can
adapt to people they learn (AI)
adapt people's behavior they teach

Human-Computer Partnerships

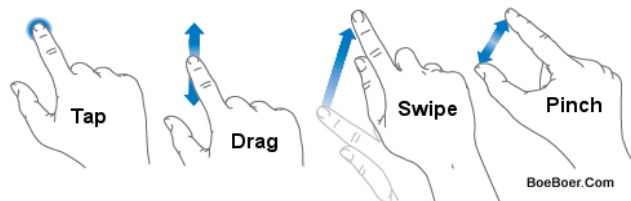
People want:



Smartphone interfaces are simple



Smartphone interfaces are simple



How to make them powerful, expressive *and* simple ?



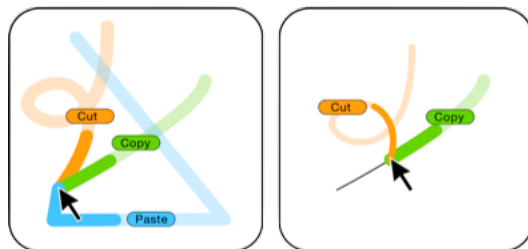
Discoverability

How can I learn
new gestures
and commands ?

Octopocus

UIST '09

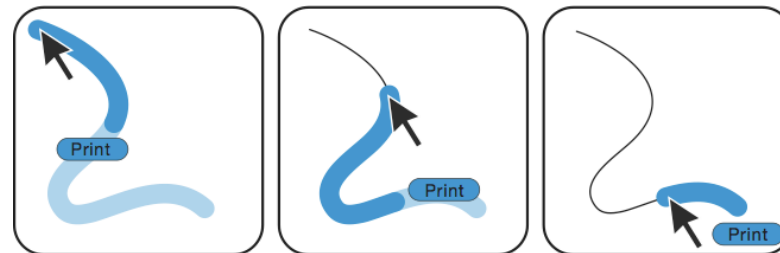
Learn gestures that issue commands
Progressive feedforward
What gestures are available ?
Progressive feedback
What did the system recognize ?



Olivier Bau

Dynamic partnership

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



Inking the *'Help'* command

Appropriability

How can I define
my own gestures ?

Fieldward

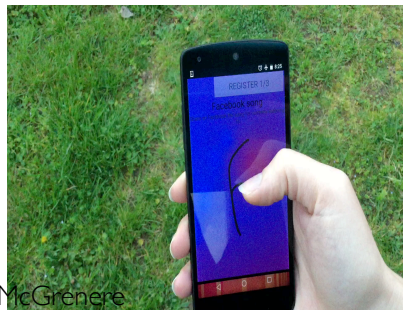
CHI '17

Create personal gesture commands

Choose easy-to-remember gestures

Progressive feedforward reveals whether

- command exists
- it is recognizable

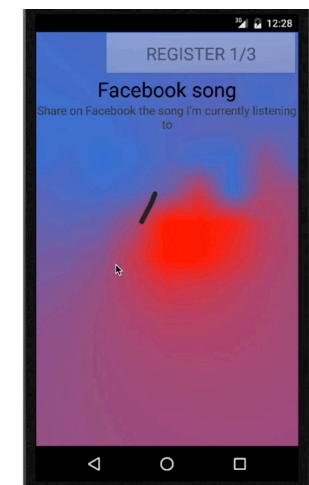


Joe Malloch, Carla Griggio & Joanna McGrenere

Fieldward: create personal gesture commands

Fieldward

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





Expressivity

How can I
express myself?

Expressive Keyboard

CHI'16

Redefining gesture-typing keyboards
to support user expression

Four ways to type the word "great"
all produce the same result

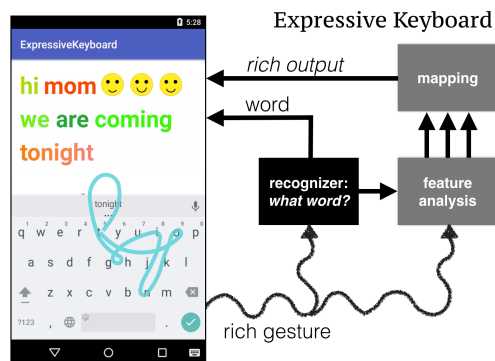


Jessalyn Alvina, Joe Malloch

Expressive Keyboard

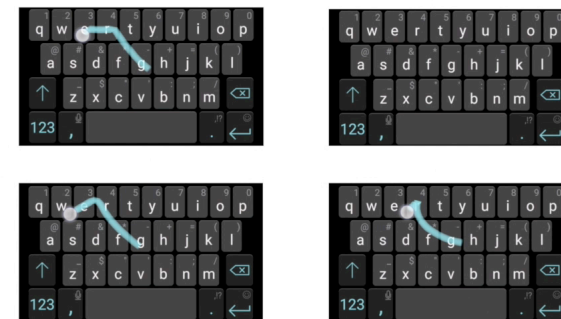
Machine learning guesses the correct word
Gesture variations creates expressive text

Users control
text color
font style
and emojis



Expressive Keyboard

The recognition algorithm is highly tolerant
of input variation ... these are all "great"!



Expressive typography

Dynamic typography plain style

Dynamic typography plain style

Dynamic typography informal style

Dynamic *typography* kids style

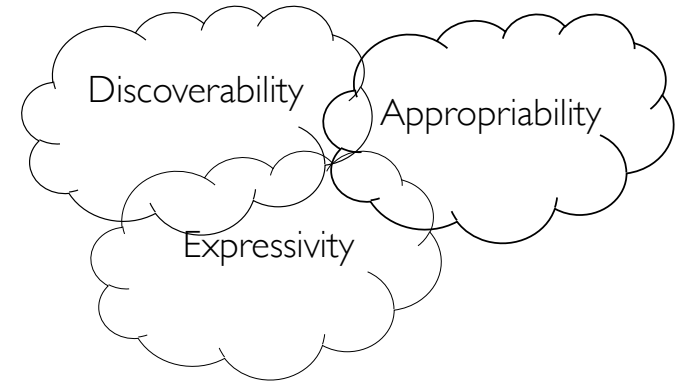
Dynamic *typography* spread style

Dynamic *typography* elegant style

Dynamic *typography* scripte style

Human-Computer Partnerships

Interactive paper for musicians

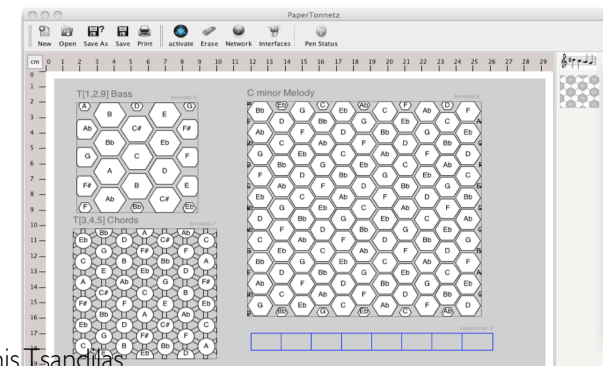


How can I learn
musical relationships ?

PaperTonnetz

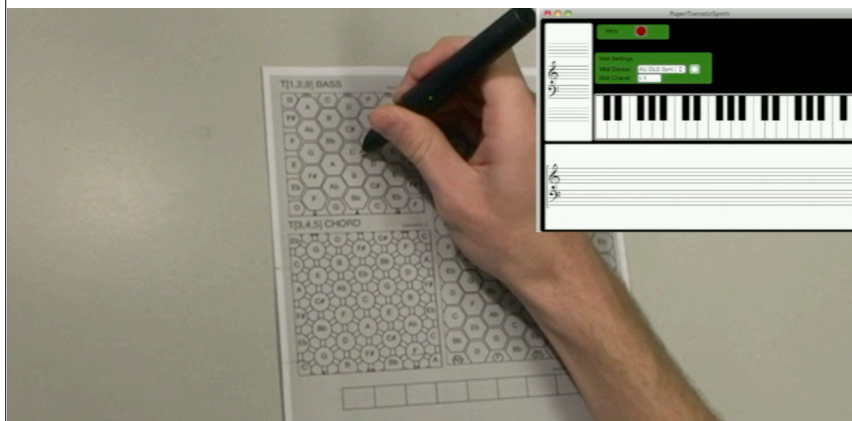
SMC'12

Musical relationships create a 'paper substrate'
Draw music with gestures



Jérémie Garcia, Fanis Tsandilas

Paper Tonnetz



The composer starts with the bass part



How can I define my own commands?

Knotty Gestures:

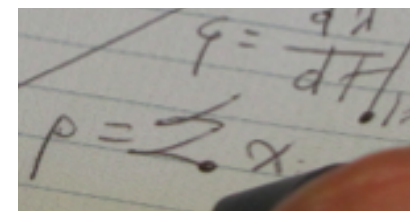
AVI'10

Draw a knot to define a command
Interact now or later



Fanis Tsandilas

Knots can define mathematical or other relationships



AB	C	BC	F
34	02	12	4
56	36	15	52
53	12	44	12
44	16	12	17

Level 1: knot defining a table calculator

Level 2: knots defining mathematical functions applied over nearby columns

Level 0: knot defining a tabular structure

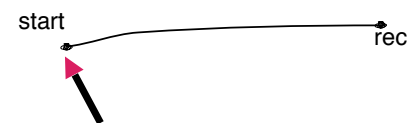
Knotty Gestures

Draw a line with a knot
Choose "recording" to define the type of line



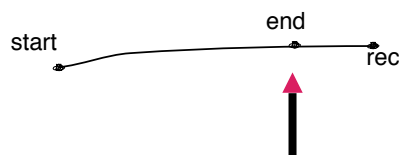
Knotty Gestures

Add another knot to define
the start of the recording



Knotty Gestures

Add a third knot to define
the end of the recording

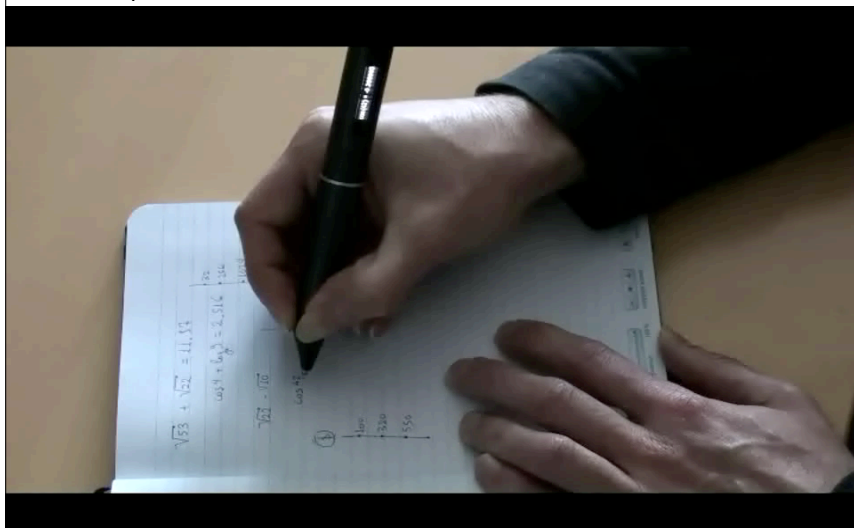


Knotty Gestures

Slide the pen back and forth
to play the recording



Knotty Gestures



Expressivity

How can I
express myself ?

Quid Sit Musicus

World Premier 2014

13th century musical scores
Each note indicates expression



Philippe Leroux, Jérémie Garcia

Paper Composer

IHM'14

Associate gesture characteristics
with sounds and features

compose
& perform



Jérémie Garcia

Quid Sit Musicus?

QUID SIT MUSICUS?
BY PHILIPPE LEROUX

Goal:
true human-computer
partnerships

that empower
rather than frustrate
(or replace) people

