Creating Human-Computer Partnerships

Wendy E. Mackay
Inria, Université Paris-Saclay

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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

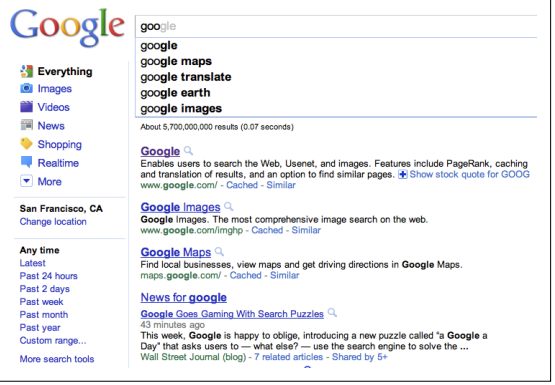
Mediated Communication

Human-Computer Partnerships

Human-in-the-loop

A 'simple' human-computer partnership

User types – Google suggests – User chooses



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

Human-Computer Partnerships

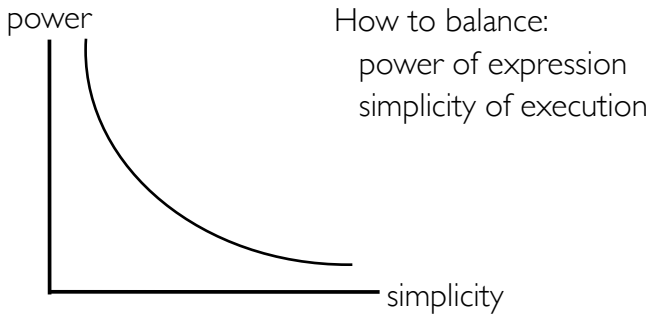
Human-in-the-loop

Human helps ***improve the algorithm***

Computer-in-the-loop

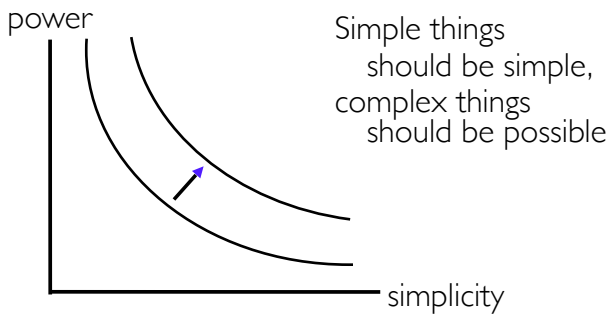
Human-computer interaction perspective:
Computers ***empower the human user***

We face a major design trade-off



How to balance:
power of expression
simplicity of execution

Solution: Shift the curve



Simple things
should be simple,
complex things
should be possible

Unified principles of interaction

Two complementary perspectives:
System: How to build it ?
Instrumental Interaction
and Substrates

with Michel Beaudouin-Lafon

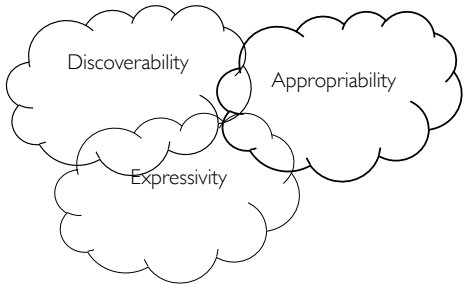
Unified principles of interaction

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

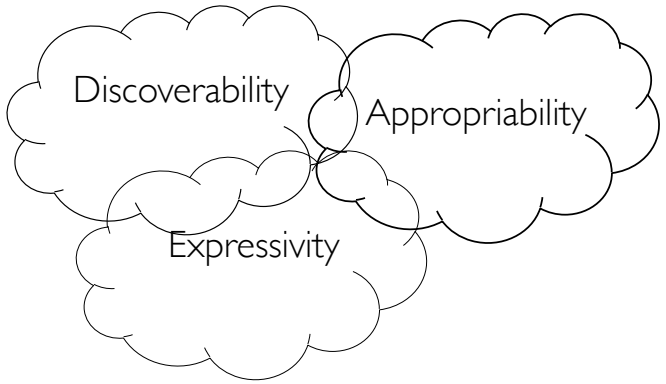
adapt to technology	they learn it
adapt the technology	they appropriate it

Computers can

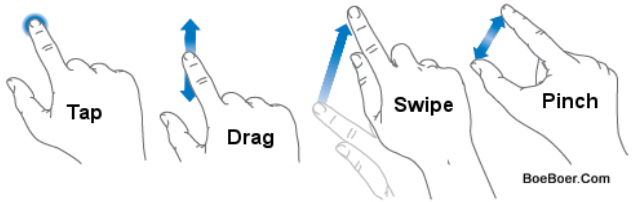
adapt to people	they learn (AI)
adapt people's behavior	they teach

Human-Computer Partnerships

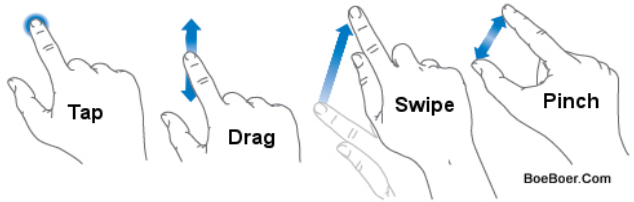
People want:



Smartphone interfaces are simple



Smartphone interfaces are simple



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



How can I learn
new gestures
and commands ?

Octopocus

UIST '09

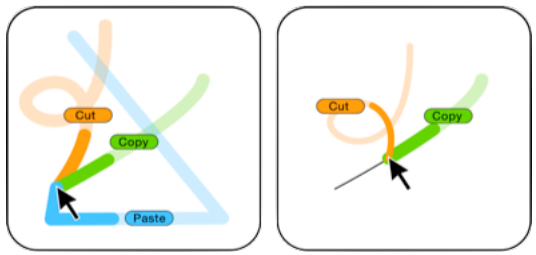
Learn gestures that issue commands

Progressive feedforward

What gestures are available ?

Progressive feedback

What did the system recognize ?

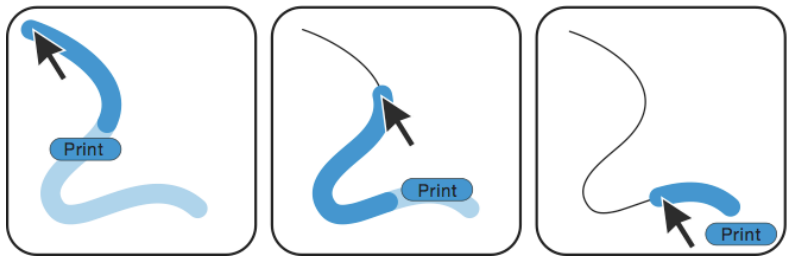


Olivier Bau

Dynamic partnership

Experts just perform the gesture

Novices pause ... the guide appears



Inking the '*Help*' command

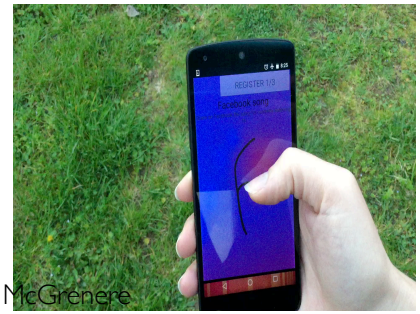
Appropriability

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

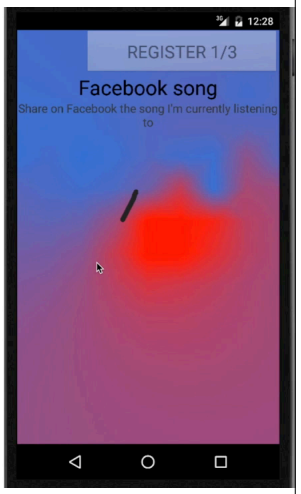


Joe Malloch, Carla Griggio & Joanna McGrenere

Fieldward: create personal gesture commands

Fieldward

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



Expressivity

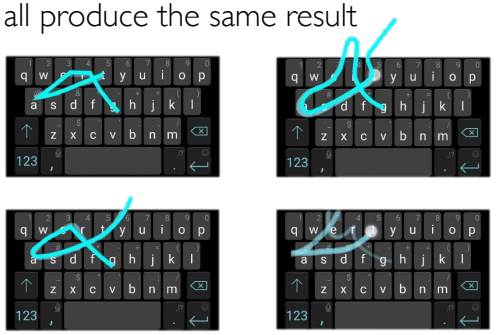
How can I
express myself ?

Expressive Keyboard

CHI'16

Redefining gesture-typing keyboards
to support user expression

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

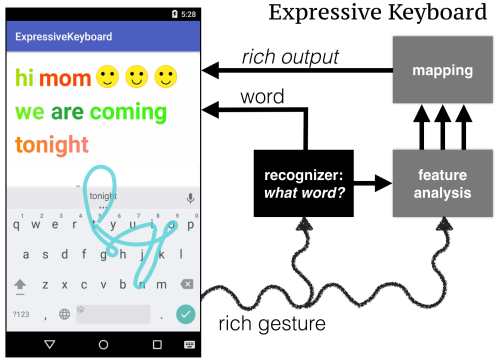


Jessalyn Alvina, Joe Malloch

Expressive Keyboard

Machine learning guesses the correct word
Gesture variations creates expressive text

Users control
text color
font style
and emojis



Expressive Keyboard

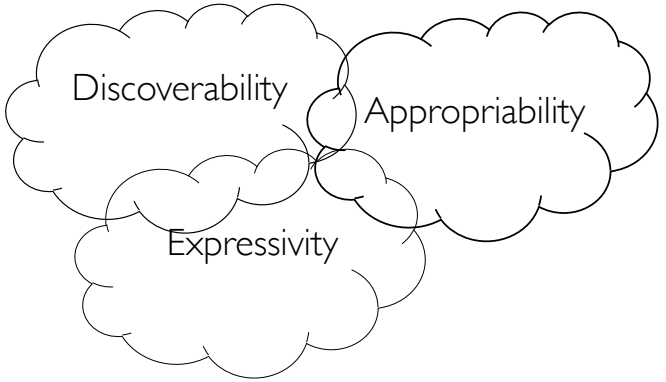
The recognition algorithm is highly tolerant
of input variation … these are all "great"!

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

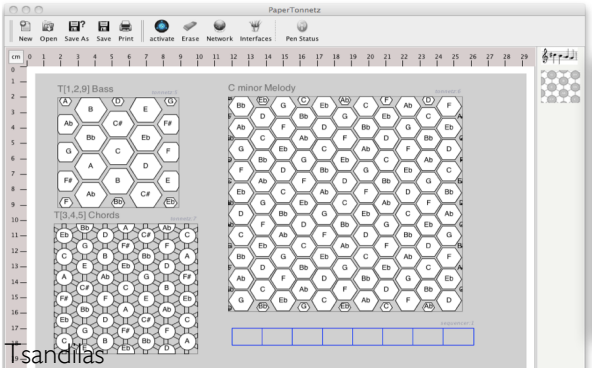


How can I learn
musical relationships ?

Paper Tonnetz

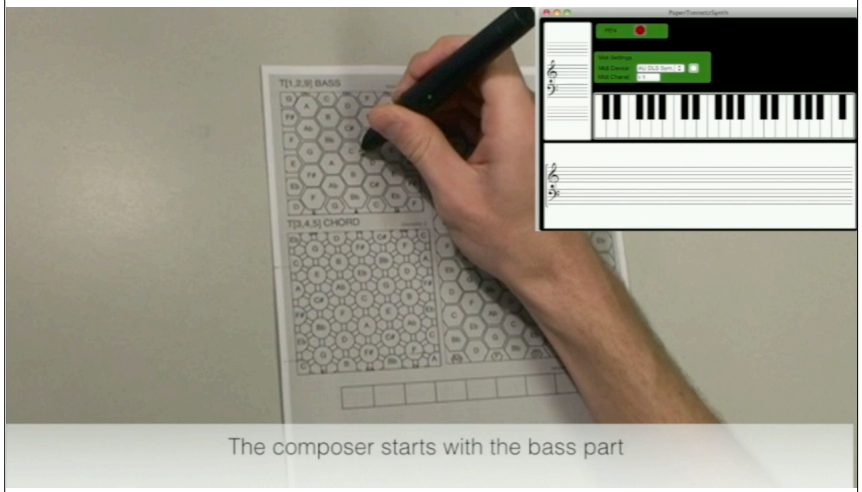
SMC'12

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



Jérémie Garcia, Fanis Tsandilas

Paper Tonnetz



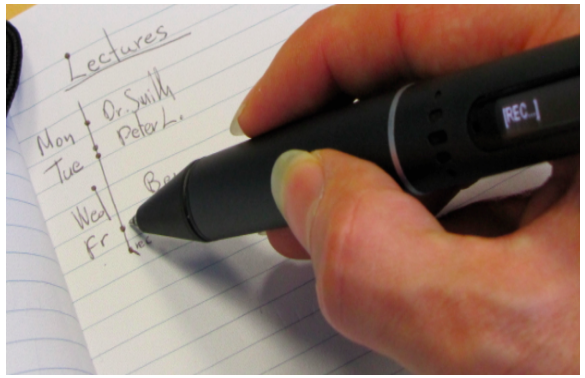
Appropriability

How can I define
my own commands ?

Knotty Gestures:

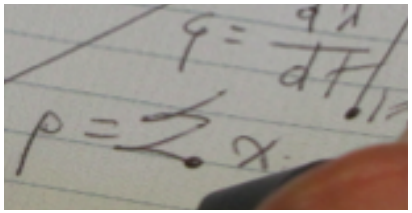
AVI'10

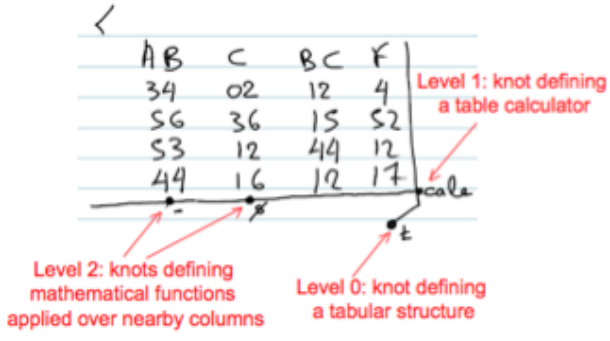
Draw a knot to define a command
Interact now or later



Fanis Tsandilas

Knots can define
mathematical or
other relationships





Knotty Gestures

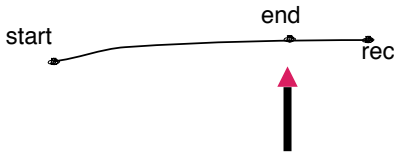
Draw a line with a knot
Choose "recording" to define the type of line

Knotty Gestures

Add another knot to define
the start of the recording

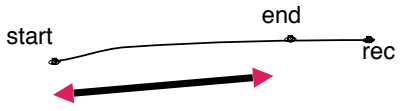
Knotty Gestures

Add a third knot to define
the end of the recording

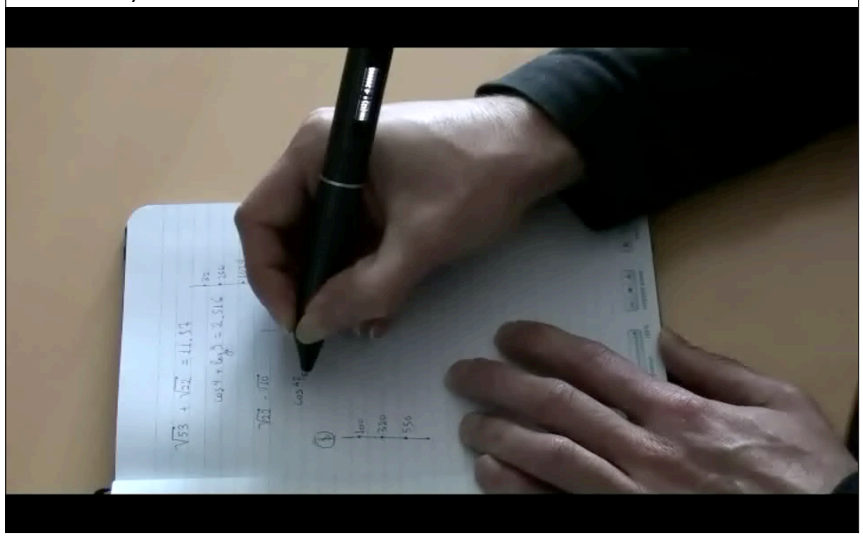


Knotty Gestures

Slide the pen back and forth
to play the recording



Knotty Gestures

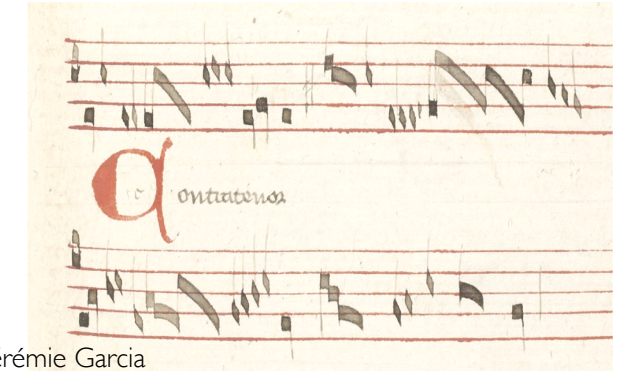


How can I
express myself ?

Quid Sit Musicus

World Premier 2014

13th century musical scores
Each note indicates expression



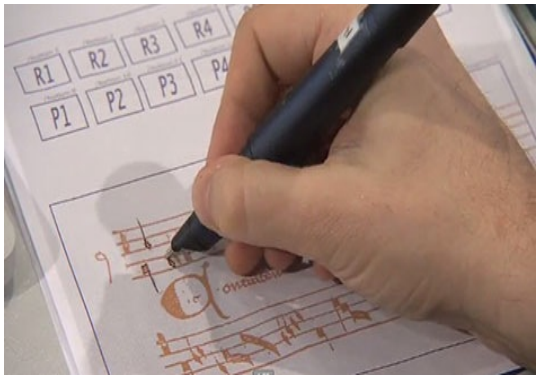
Philippe Leroux, Jérémie Garcia

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