Wearables as Context for Guiard-abiding Bimanual Touch

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multi-touch: large displays

multiple users
distinguish users
distinguish hands
bimanual interaction design
multi-touch: 
large displays

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bimanual interaction design
large, collaborative displays
digital whiteboards and tabletops
laptops, tablets, phones
wearables
smartwatches and fitness bands
contextualize personal interactions

society of devices
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large, collaborative displays
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contextualize
personal interactions
augment touch with wearables

personally-identifiable touch
augment touch with wearables

personally-identifiable touch

phrasing together input
augment touch with wearables

personally-identifiable touch

phrasing together input

assign asymmetric roles to the hands
multi-touch bimanual interaction design

ambiguities with input
multi-touch bimanual interaction design

ambiguities with input

interchangeable roles
multi-touch bimanual interaction design

ambiguities with input
interchangeable roles

mechanical intermediaries
multi-touch bimanual interaction design

ambiguities with standard input
interchangeable roles
mechanical intermediaries

applying principles from guiard
principles of bimanual-asymmetric action
[Guiard 1987]

bimanual activity
based upon roles of hands
principles of bimanual-asymmetric action
[guiard 1987]

bimanual activity
based upon roles of hands

lateral preference
hand role assignment
asymmetric
principles of bimanual-asymmetric action
[guiard 1987]

bimanual activity
based upon roles of hands

lateral preference
hand role assignment
asymmetric

right-to-left
spatial reference

left-hand precedence
right-to-left spatial reference

left frames interaction relative to right
right-to-left spatial reference

left frames interaction relative to right

left defines steady states
right-to-left
spatial reference

left frames interaction
relative to right
left defines steady states
right creates changes
left-hand precedence

left leads right

need steady state
to initiate manipulation
symmetric vs asymmetric

guiard focuses on asymmetry
symmetric vs asymmetric

Guiard focuses on asymmetry

Symmetric mappings use interchangeable hand roles
symmetric vs asymmetric

guiard focuses on asymmetry

symmetric mappings use interchangeable hand roles

mask inability to differentiate the hands
Ideally, we want a one-to-one mapping between concepts and gestures. User interfaces should be designed with a clear objective of the mental model we are trying to establish. Phrasing can reinforce the chunks or structure of the model.

Phrasing
[buxton 1986]

muscular tension to tie together a series of inputs
closure returns to neutral state
phrasing guiard-abiding touch

left hand establishes the phrase and frame of reference
phrasing guiard-abiding touch

left hand establishes the phrase and frame of reference

right hand then acts on reference frame
phrasing guiard-abiding touch

left hand establishes the phrase and frame of reference

right hand then acts on reference frame

left hand closes phrase
Affinity

affinity diagram authoring

instrument one hand

microsoft band
Affinity

affinity diagram authoring

instrument one hand

microsoft band
Affinity diagram authoring

instrument one hand

microsoft band
Affinity

instrument one hand
microsoft band

_guiard-abiding touch_
initiate bimanual actions with left
tool sheet provides frame
sensing with wearables

accelerometer spikes

size and width

100ms window
Mood Board

instrument both hands

photo by Kava Gorna
Mood Board

instrumenting both hands

mood board authoring

photo by Kava Gorna
Mood Board

instrument both hands
mood board authoring
suite of interaction techniques

photo by Kava Gorna
two wearables

ring

band on left (non-preferred)

user 1
two wearables

band on left
(non-preferred)

ring on right
(preferred)
two wearables

band on left (non-preferred)
ring on right (preferred)

distinguish both hands
leverage additional sensing capabilities of wearables

normal, side, and back
ChopZ

layering overlapping content
chop gesture
animate to side view
straightedge tool

phrase: two finger left hand
constrain right hand input
different functionality for pen and touch
straightedge tool
straightedge tool
group sheets

explicitly defining groups
group sheets

phrasing: three finger right-angle gesture with left hand
right hand actions adds elements to sheet

Group Sheets: Explicitly Defini
group sheets
ink styling
Single Finger Translation
unimanual
preliminary evaluation

8 participants (4 female)
walkthrough each technique
mood board authoring
preliminary evaluation

8 participants (4 female)
walkthrough each technique
mood board authoring

ChopZ
easy, selection, fatigue
preliminary evaluation

8 participants (4 female)
walkthrough each technique
mood board authoring
ChopZ
easy, selection, fatigue

Straightedge Tool
modalities
preliminary evaluation

8 participants (4 female)
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modalities

Unimanual
confusion
conclusions

wearables as context
conclusions

wearables as context

self-revelation
conclusions

wearables as context
self-revelation

asymmetric vs. symmetric
conclusions

wearables as context

self-revelation

asymmetric vs. symmetric

flexible assignments
questions, comments, & suggestions?
user activity tracking
visual clipboard