Mensch-Maschine-Interaktion 2

Interactive Environments

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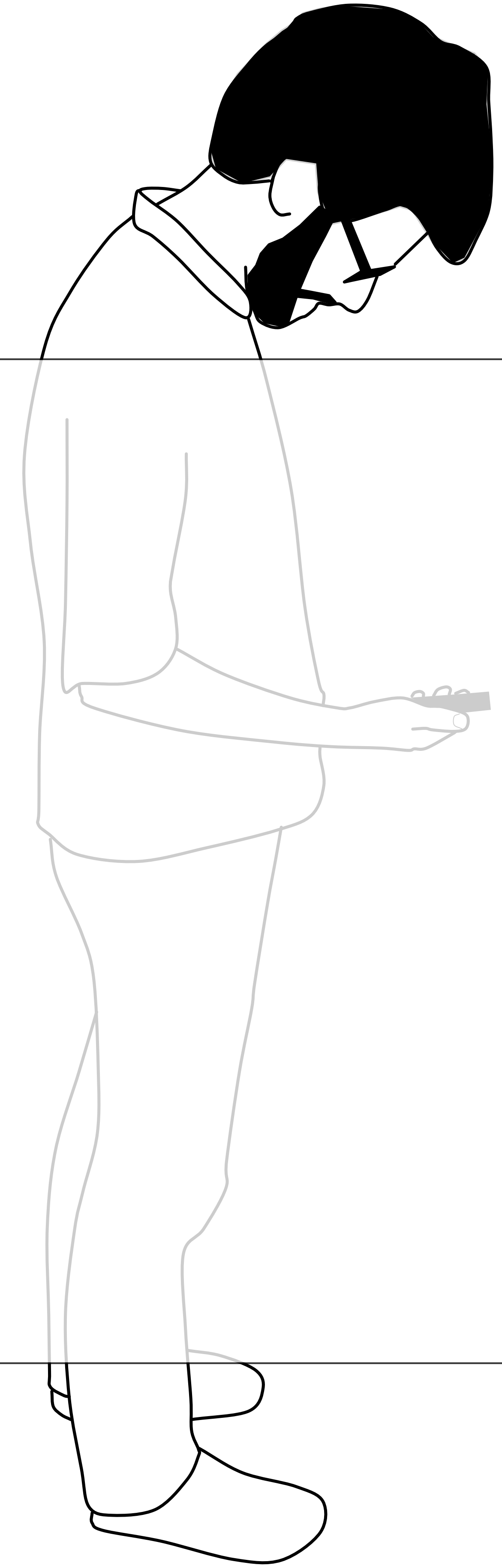
Interactive Environments



context and task

challenges

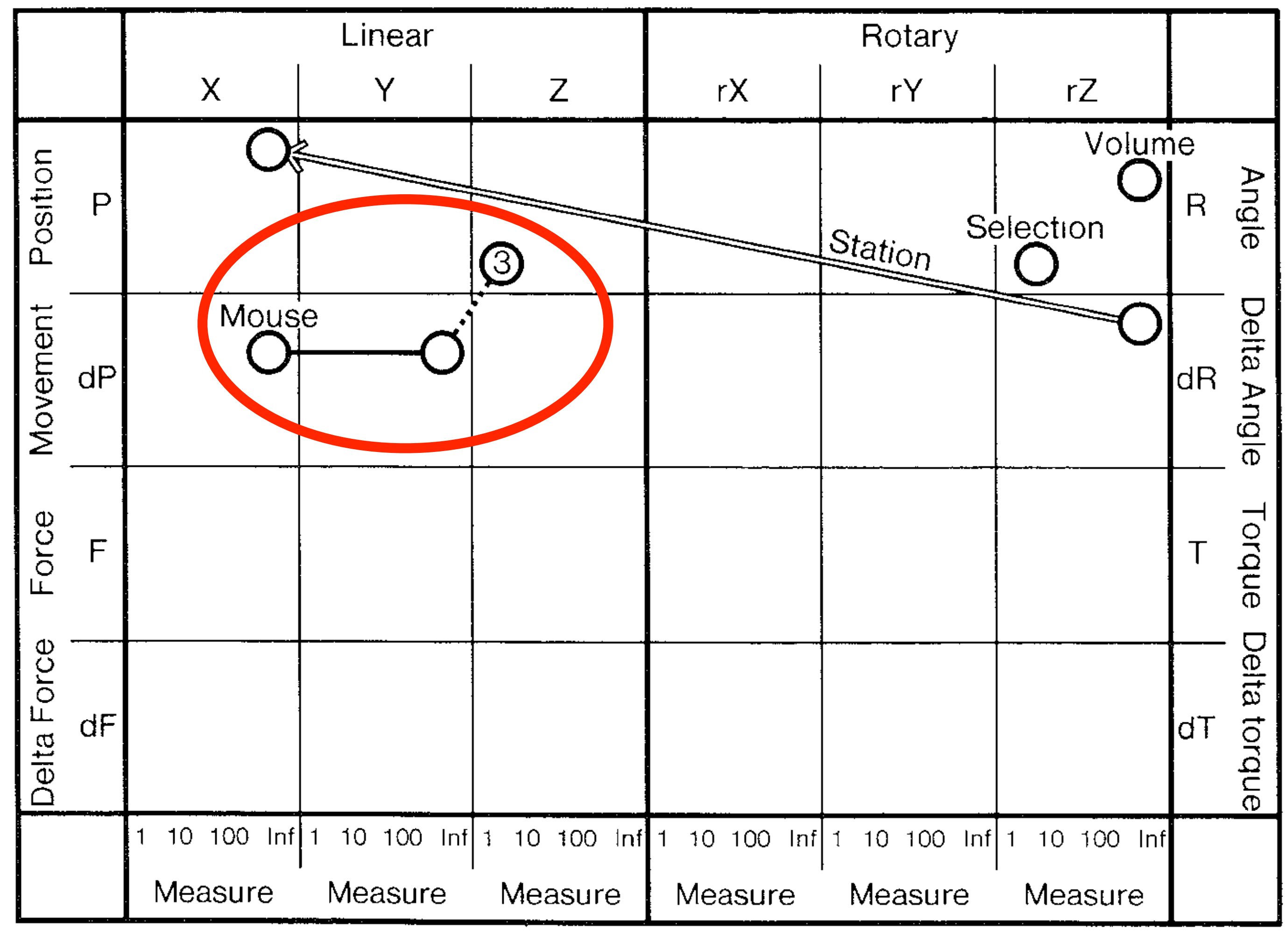
input technologies

challenges in interaction design

output technologies

Card’s Design Space

Descriptive Power



Card's Design Space

Predictive Power

Mental preparation	1.20 s
Hand from keyboard to mouse or vice versa	0.40 s
Point the mouse to on-screen object	1.10 s
Button press or release (mouse)	0.10 s
Select on-screen object with the mouse after typing text on the keyboard:	2.80 s

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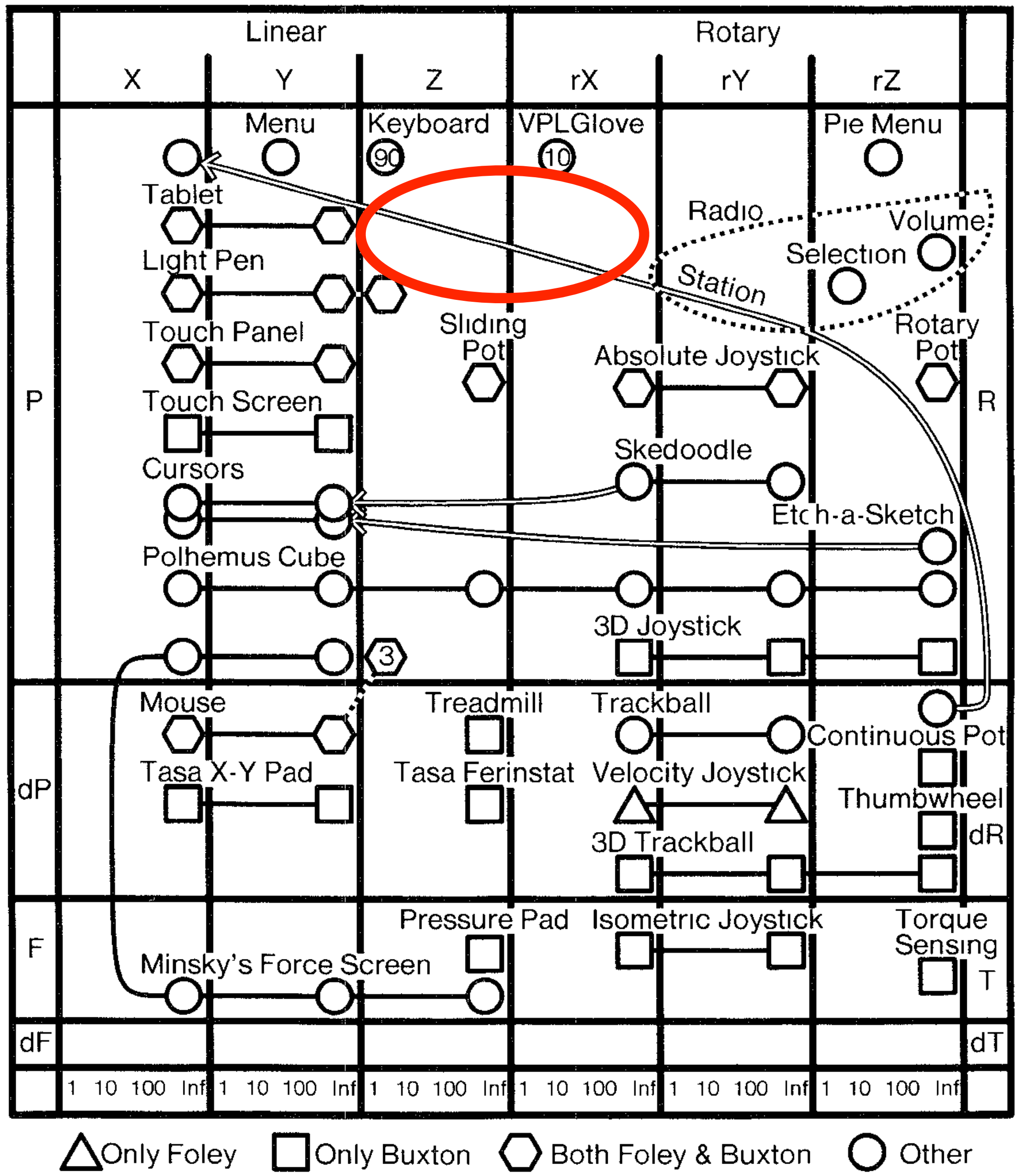
Card's Design Space

Generative Power



Challenge: body involvement

- BodyScape
- Involvement of body parts
- Relationship between the body and the interactive environment

Environment

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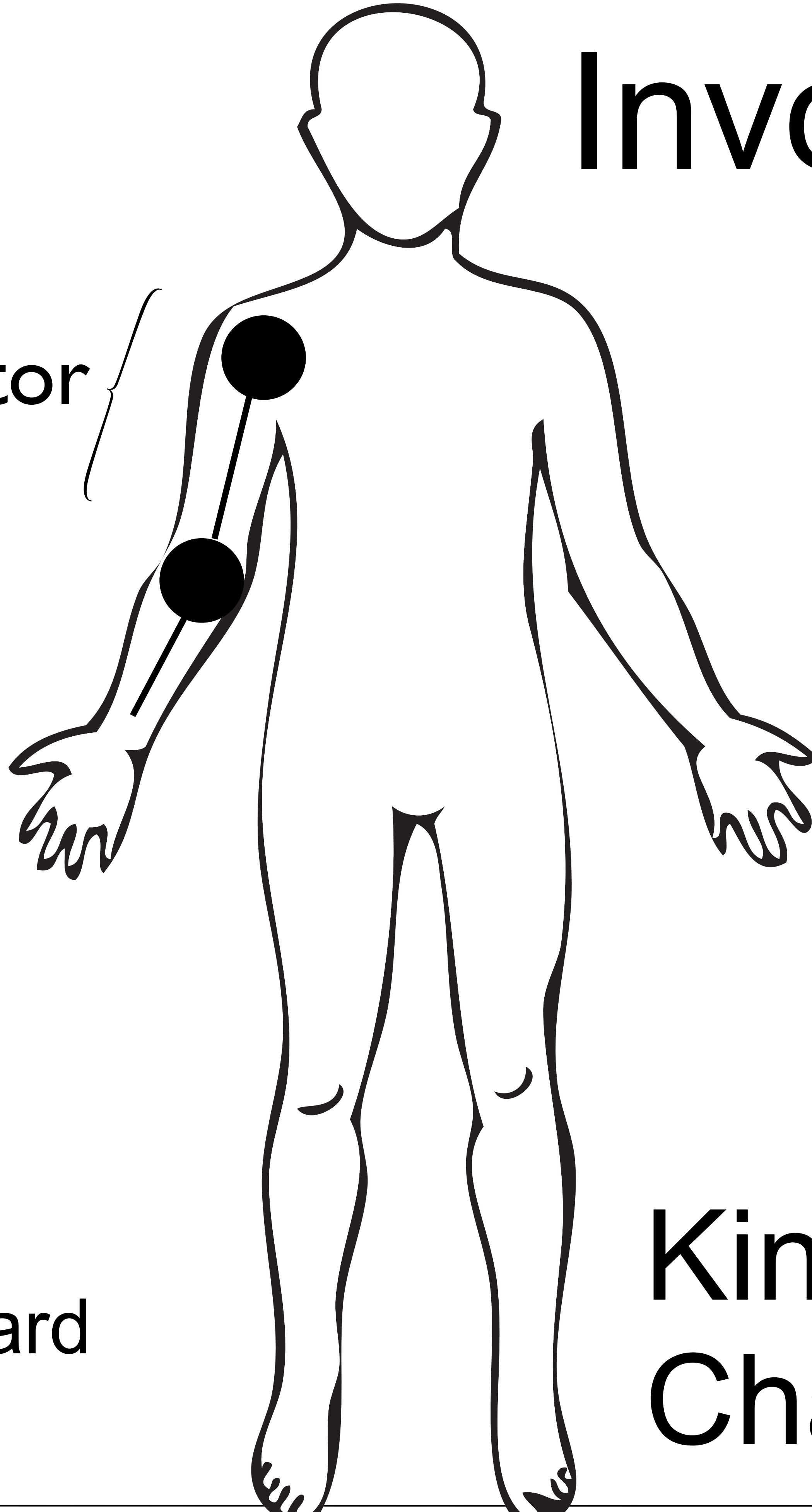
Involvement of Body Parts



motor = body part that contributes to the overall performance of a movement

Y.Guiard

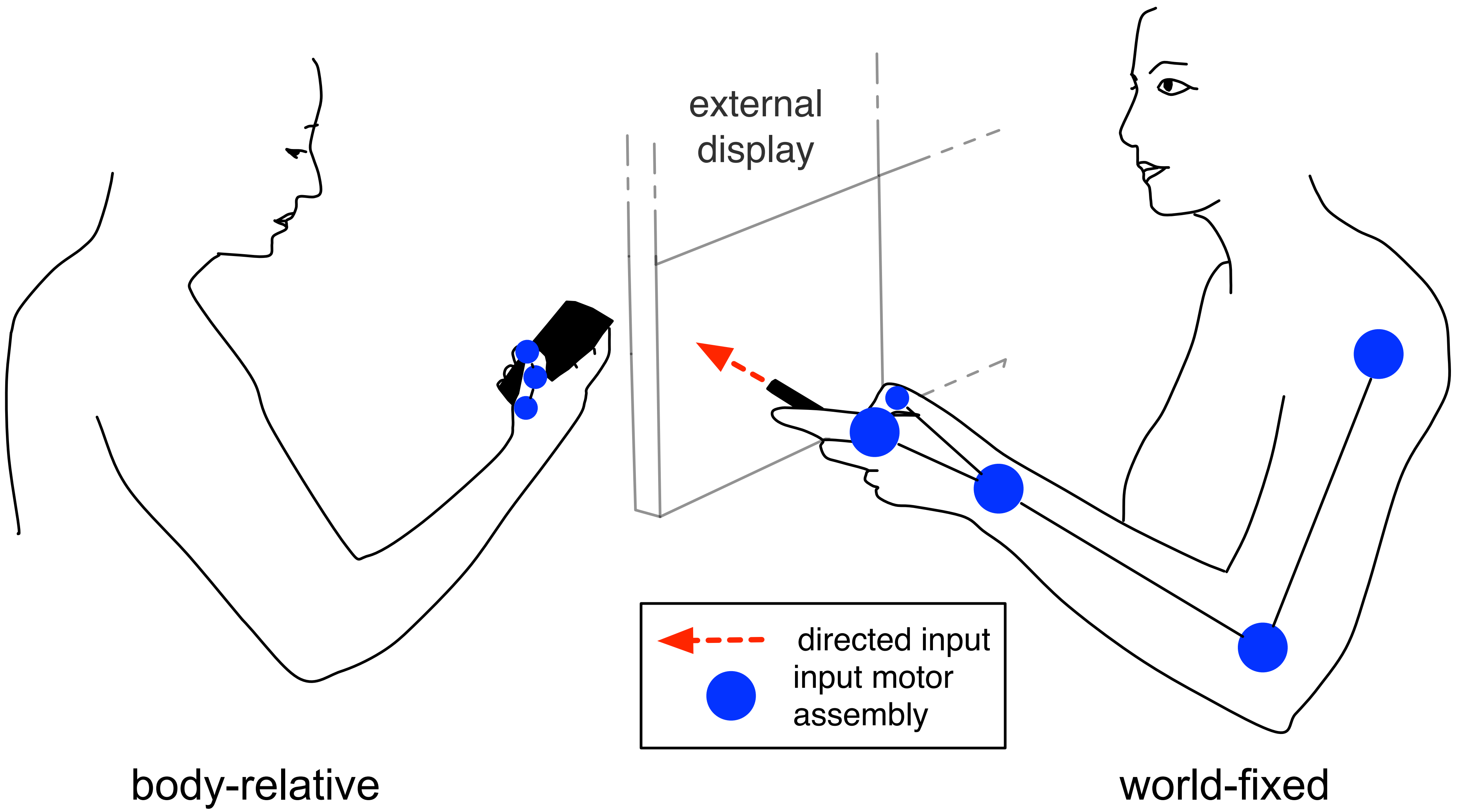
Kinematic Chain

Involvement of Body Parts

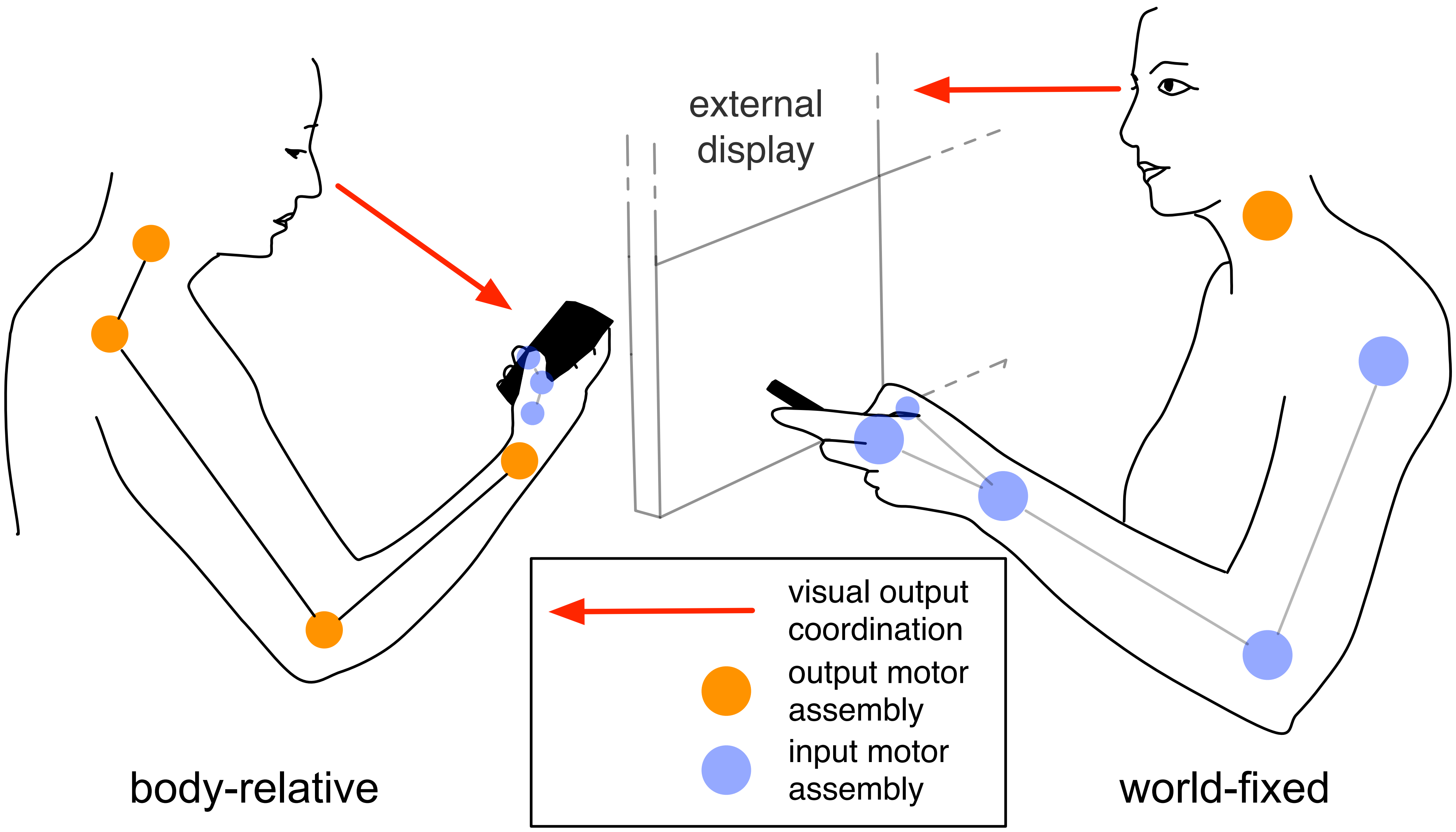
- **Input** motor assembly: a group of motors that handle a specific interaction task.
- **Output** motor assembly: a group of motors that is responsible for bringing the eyes into an appropriate position to enable visual perception of output.

Body-environment Relationship

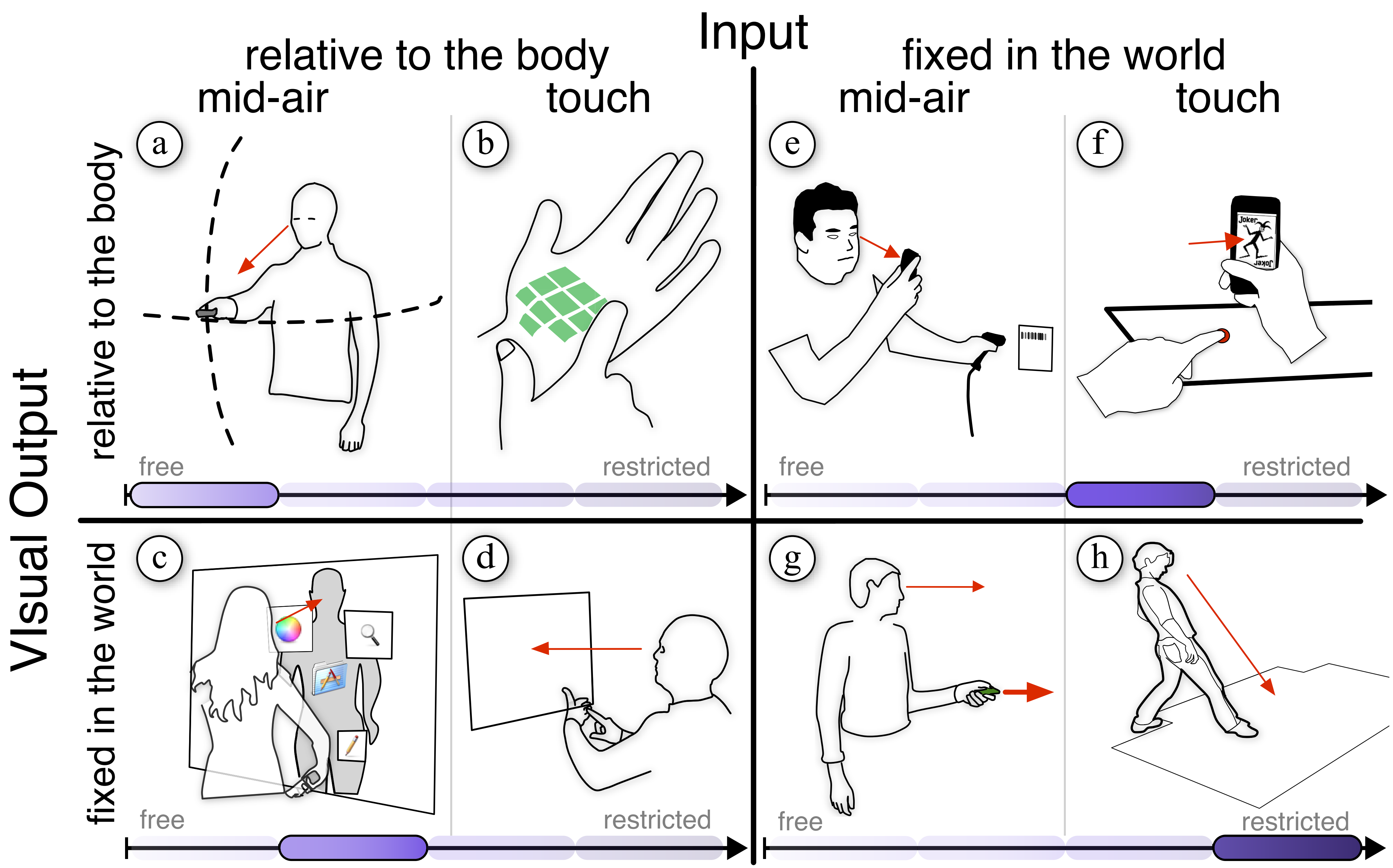
Input Motor Assembly



Body-environment Relationship
Output Motor Assembly



Classifying Interaction Techniques



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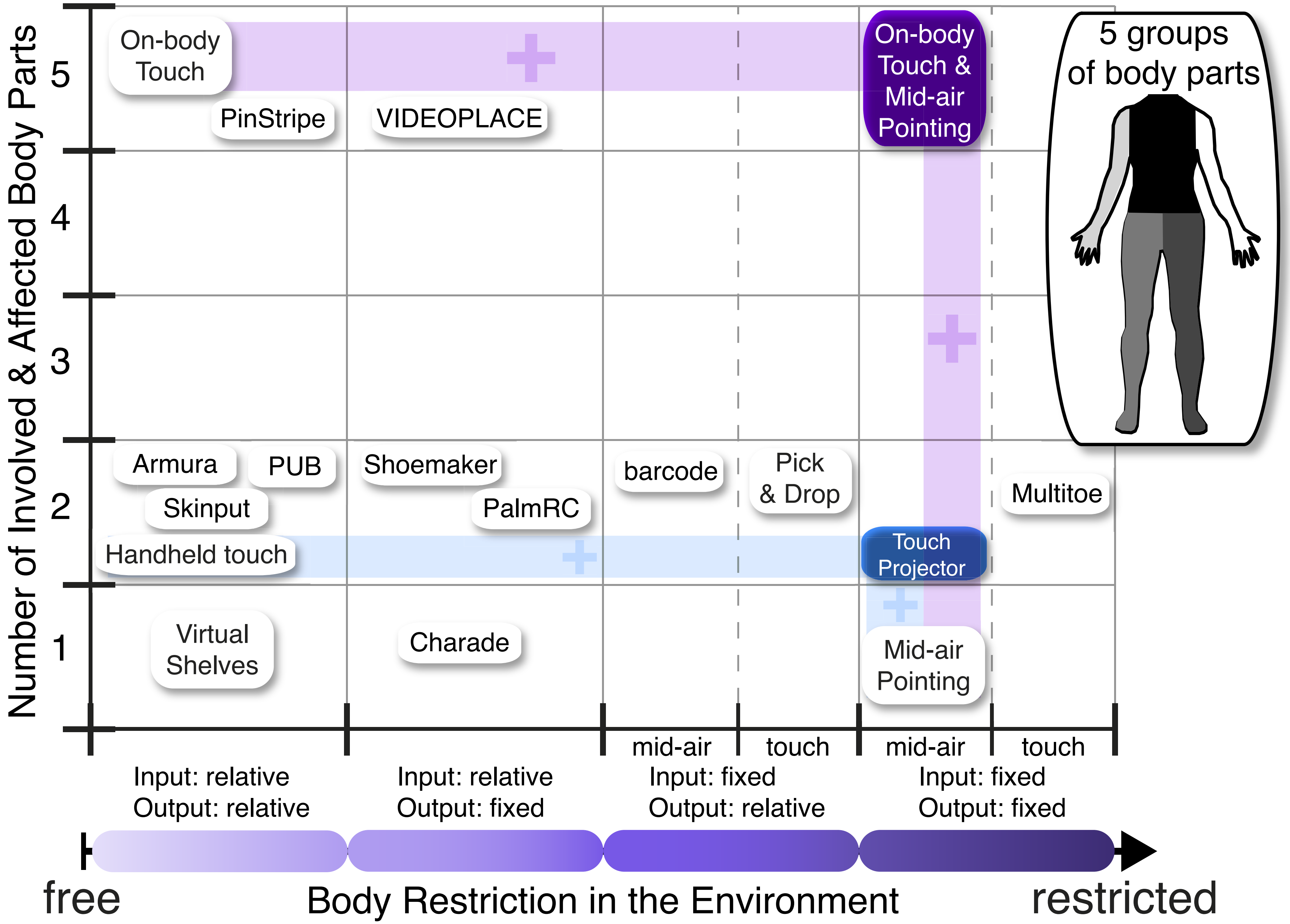
Generating Power of the Design Space



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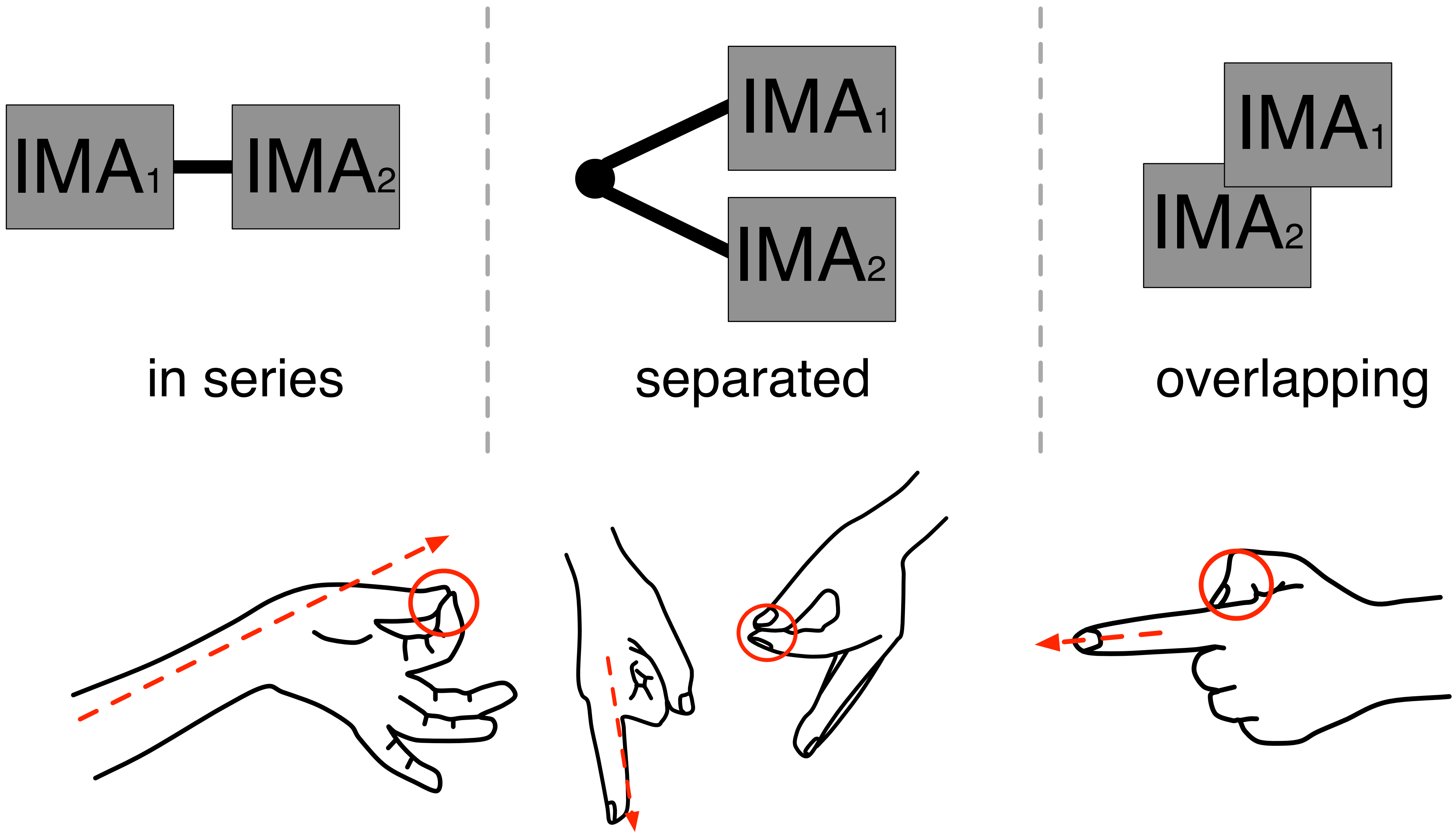
Composing Motor Assemblies



IMA = Input Motor Assembly   = pointing   = select

BodyScape

- Body’s involvement
- Relationship between the body and the interactive environment
- Categorize related work
- Generate and analyze new compositions

Challenge: limited attention resources

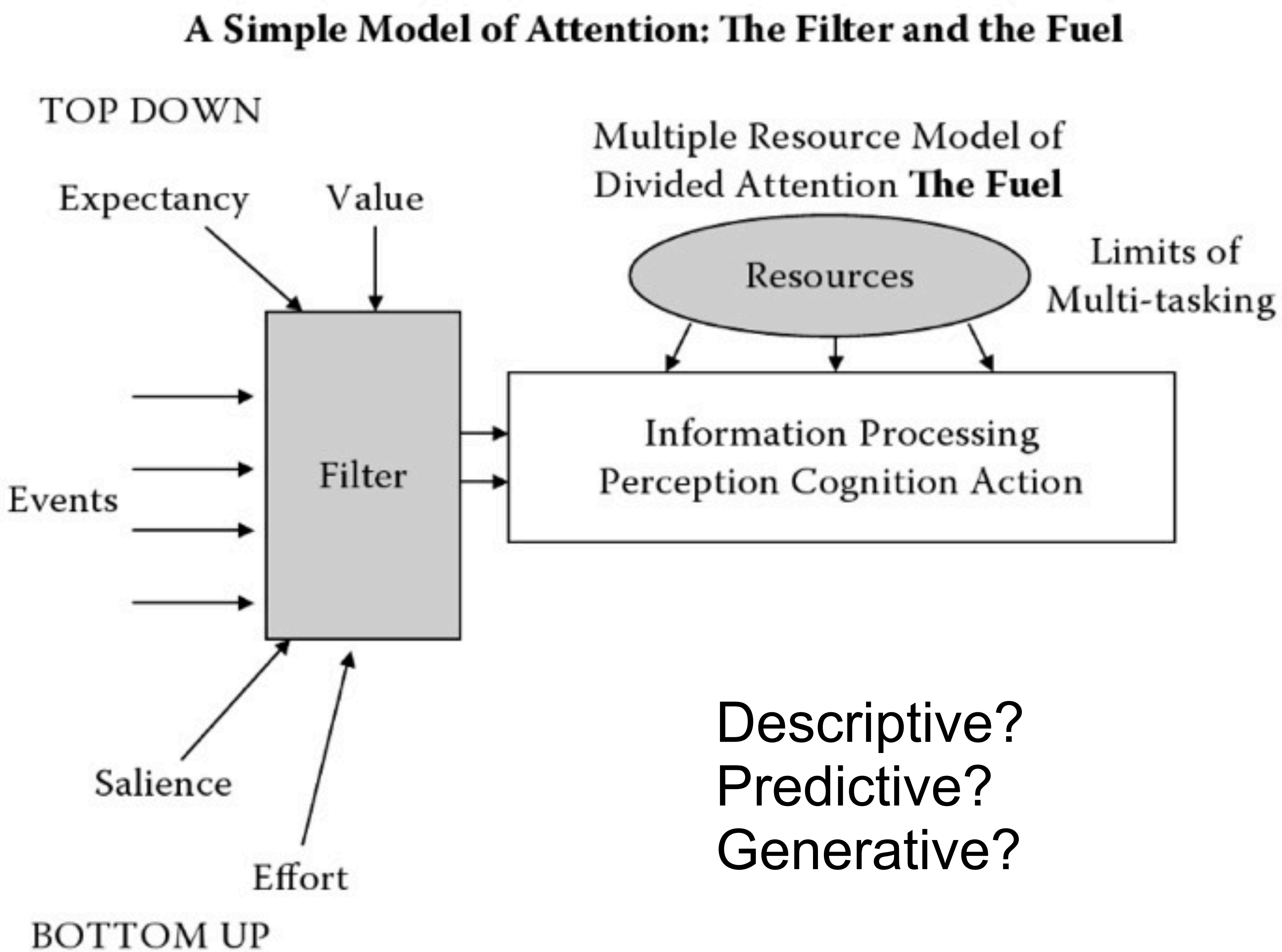
- We have seen change blindness as an example
  - limited visual attention
  - reasons physiological and cognitive
- Attention is generally a limited resource
  - various parts of the environment may compete for our attention
  - how does the mind decide what to pay attention to?
- Visual stimuli might be out of sight
- Acoustic stimuli might drown each other out
  - cocktail party effect may help us

Negative Example (from Minority report)

http://www.youtube.com/watch?v=7bXJ_obaiYQ

A Model of Human Attention

- Christopher D. Wickens, Jason S. McCarley: Applied Attention Theory, CRC Press, May 7, 2012
- http://books.google.de/books?id=dIagIraXHPUC



Descriptive?
Predictive?
Generative?

SEEV model of influencing factors

- http://www.prometei.de/fileadmin/prometei.de/veranstaltungen/2008-05-28-Wickens_AppliedAttentionTheory.pdf

S: Salience: The bottom-up attention capturing properties of **events**, bright flashes, sounds, etc. The salient runway line in the Singapore Airlines crash

Ef: Effort: Inhibits the movement of attention across longer distances: bigger scans, head movements. Failure of drivers to "check the blind spot" before lane changing.

Ex: Expectancy: The likelihood of seeing an event at a particular location: a top-down cognitive factor that is calibrated to the **bandwidth** (frequency of occurrence) of events that occur at that location.

V: Value: The importance (value) of tasks served by the attended event, as well as the *relevance* of the event to a valued task. Also top-down

Probability of attending $P(A) = s{*}S - ef{*}EF + \left| \begin{array}{c} ex{*}EX + vV \\ (ex{*}EX * vV) \end{array} \right| \leftarrow$ Which one?

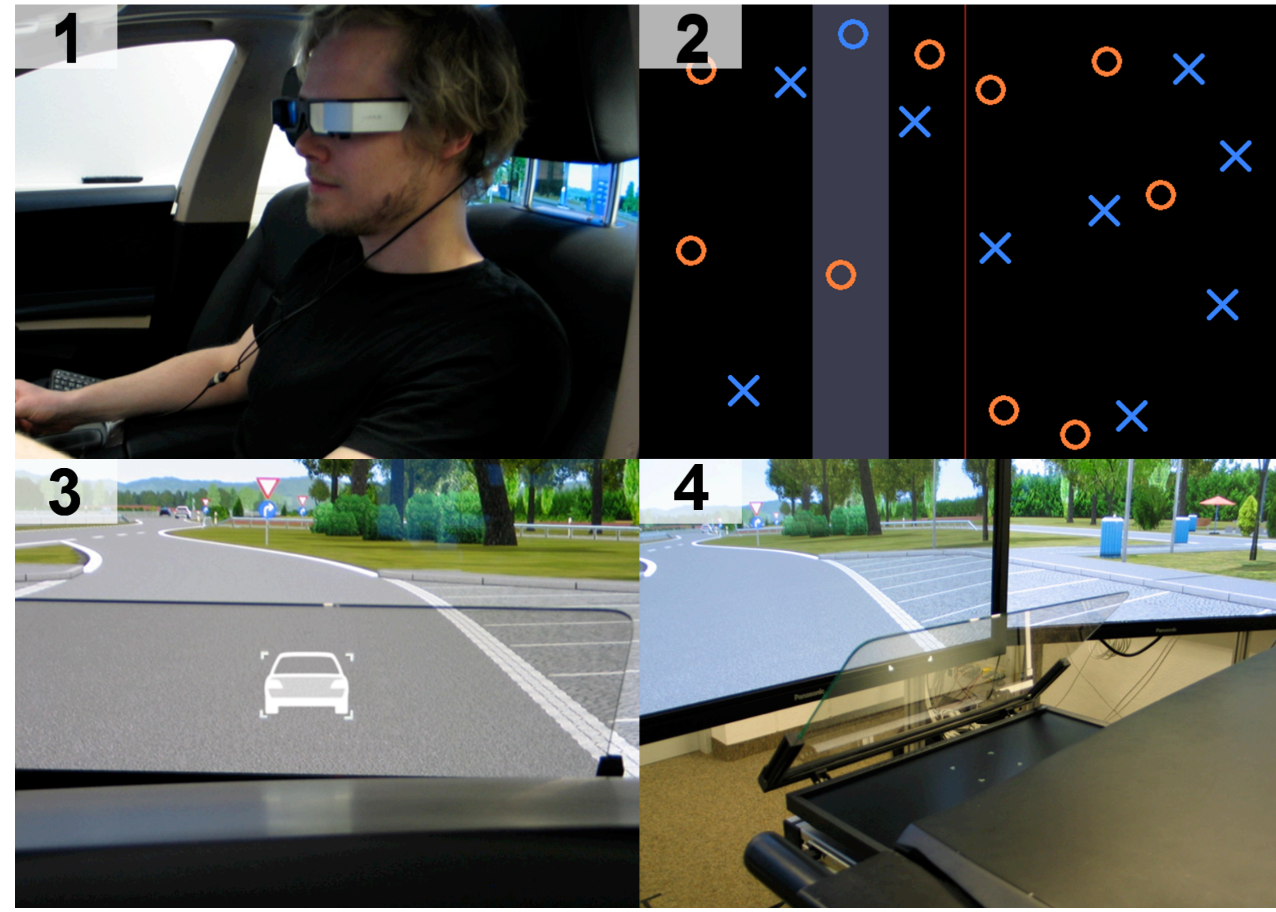
Mini-discussion on SEEV:

- remember: change blindness examples (flicker)
- remember the moonwalking bear?
  - (a.k.a Simon‘s gorilla: http://www.theinvisiblegorilla.com)
- other effects you‘ve come across?

$$\text{Probability of attending } P(A) = s*S - ef*EF + \left| \begin{matrix} \underline{ex*EX + vV} \\ \underline{(ex*EX * vV)} \end{matrix} \right| \longleftarrow \left| \begin{matrix} \text{Which one?} \\ . \end{matrix} \right.$$

Example: unexpected warnings

- F. Lauber, A. Butz: In-Your-Face, Yet Unseen? Improving Head-Stabilized Warnings to Reduce Reaction Time, CHI 2014
- driving scenario with a secondary visually demanding task
- warnings in HUD and HMD
- Warnings in the main field of view (HMD) were not faster than in the constant location (HUD)
- After introducing a visual maker for the place where warnings would appear (expectancy), they were faster!



Example: notification in ambient soundscapes

- known effect: we recognize known sounds
  - even when they are played in the background
  - crosses the border from subconscious to conscious

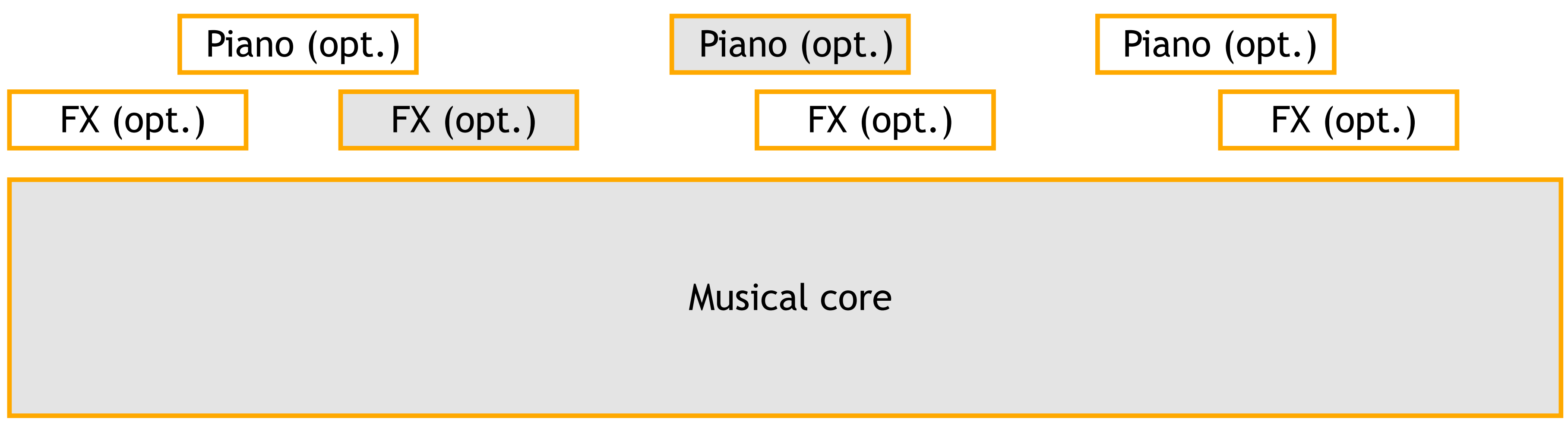
- idea: use this to notify people of events
  - play an ambient piece of music
  - to notify, mix in a motif known to that person
  - ...or a specific instrument

- effect: remains unnoticed to other people

Notification in Ambient Soundscapes
[Butz, Jung, IUI 2005]

Notification in Ambient Soundscapes
[Butz, Jung, IUI 2005]

- Core music always present
- Notification in a musically fitting way
  - Learned by target person
- Crosses the border to conscious perception by the target person
- Ignored by other people
- Quantitative user study
  - Audio Workshop at Pervasive 2005



Challenge: Social interaction & awareness

- Instrumented environments are no longer single user
  - users might collaborate locally
  - users might compete for resources locally
  - users might collaborate remotely

- Users need to be aware of technology
  - discoverability: How do I see what I can do?

- Technology aware of users
  - Example: proxemic interactions
  - Example: group mirrors

http://www.smart-future.net/13.html

A spatial model for social interactions: F-formations

- Conducting Interaction: Patterns of Behavior in Focused Encounters, Adam Kendon, Cambridge University Press 1990, http://books.google.de/books?id=7-8zAAAAIAAJ
- Images taken from Nicolai Marquardt's PhD thesis:

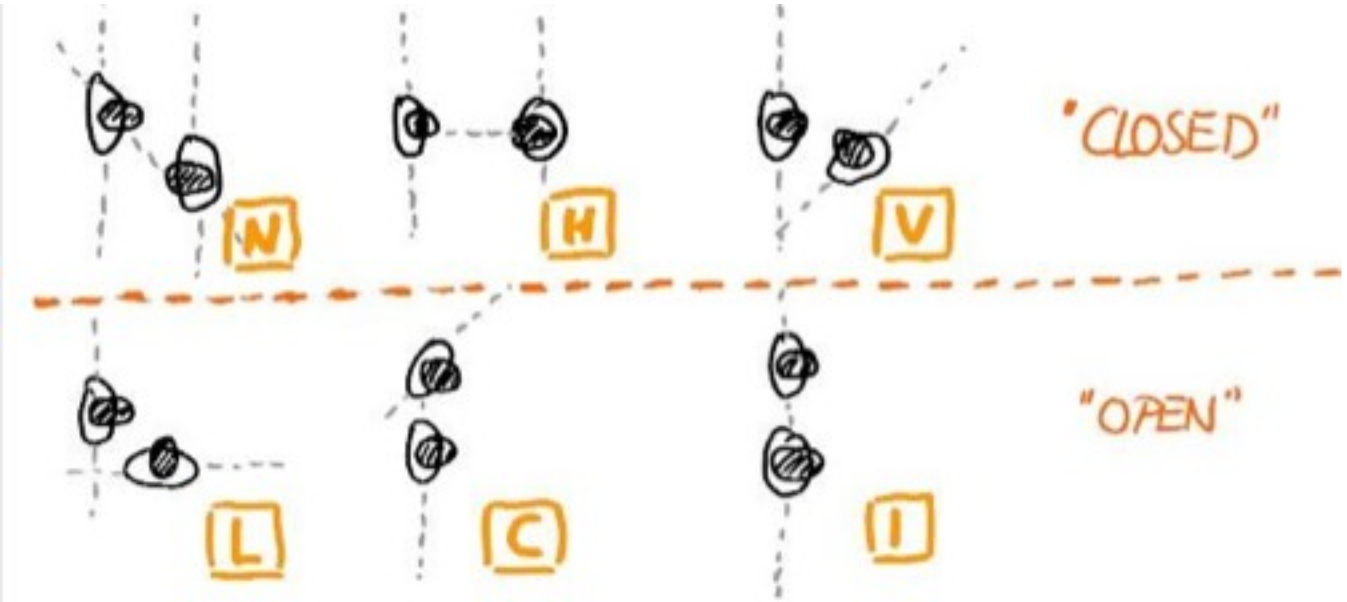
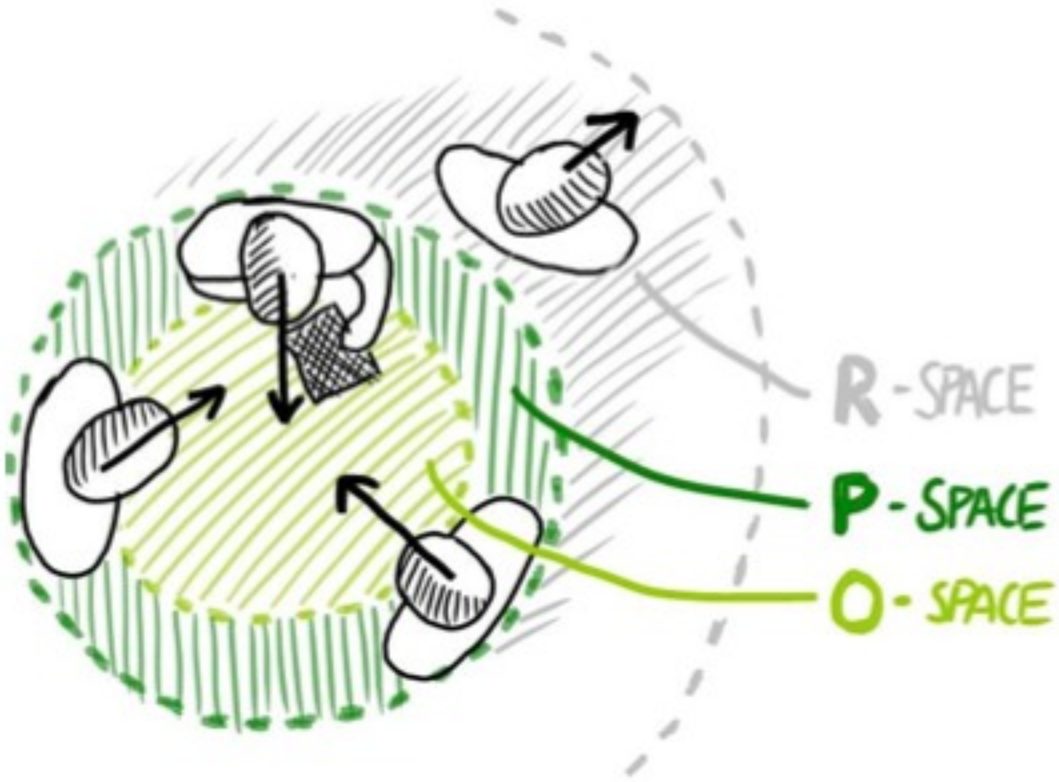
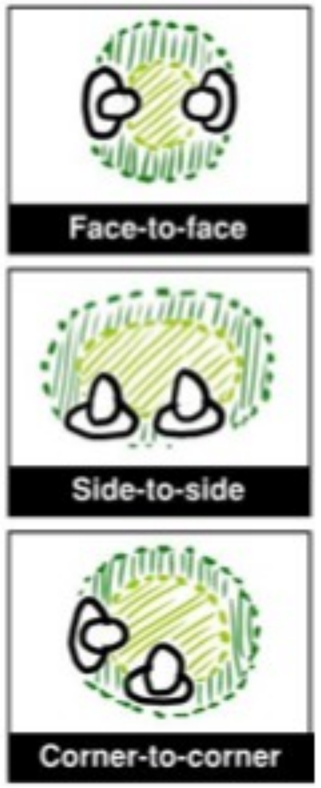


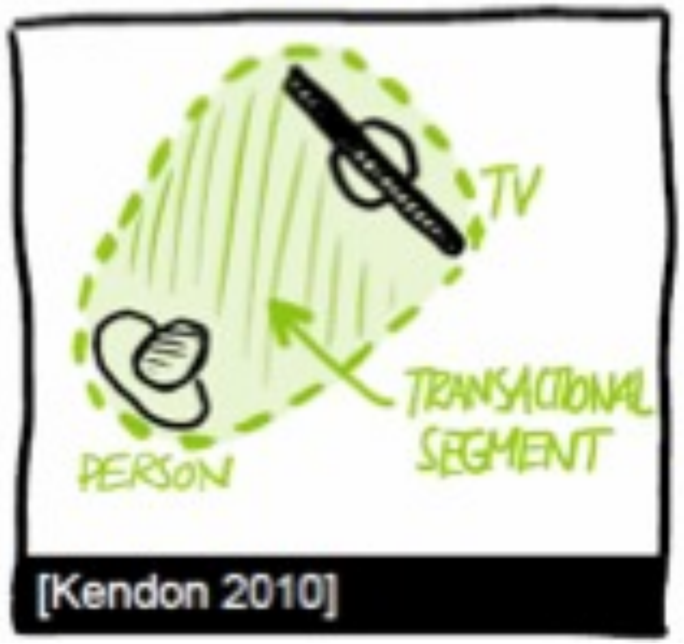
Figure 3.3 F-formations: (left) circular, (center) corner-to-corner, (right) face-to-face[20].

Proxemic interactions based on F-formations

- extend spatial relationship concept to machines
  - F-formations between humans and Displays
- remember proxemic media player shown earlier...







Take-away Message

- Instrumented environments involve us (plural! ;-) with our entire body and all senses.
- This poses new research challenges, e.g.
  - describing whole body involvement
  - models for limited cognitive resources
  - describing (and creating) social collaboration
- Interaction with these environments brings back some of the richness of the physical world

Lecture Evaluation: Discussion

- Thanks for graceful judgements ;-) Main points:

- Selection of topics interesting
- Level of detail and difficulty OK

- Too much workload in exercises
  - have you at least learned something useful?
- More structure and crossreferences!
- Too many videos
- Language mix is disturbing
- Filming is problematic
  - light disturbing, video of us not really needed ;-)