



Designing for Physical-Virtual Activities

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Background

- Computers (e.g. desktop PCs, laptop PCs, PDAs, cellular phones) play an increasingly important role in human activity.
 - everyday human activity takes place in a physical-virtual space
 - humans perform physical-virtual activities
 - activities that involve "world switching"
 - and manual bridging of the physical-virtual environment gap
- We (environment designers) should help users bridge the physical-virtual gap!

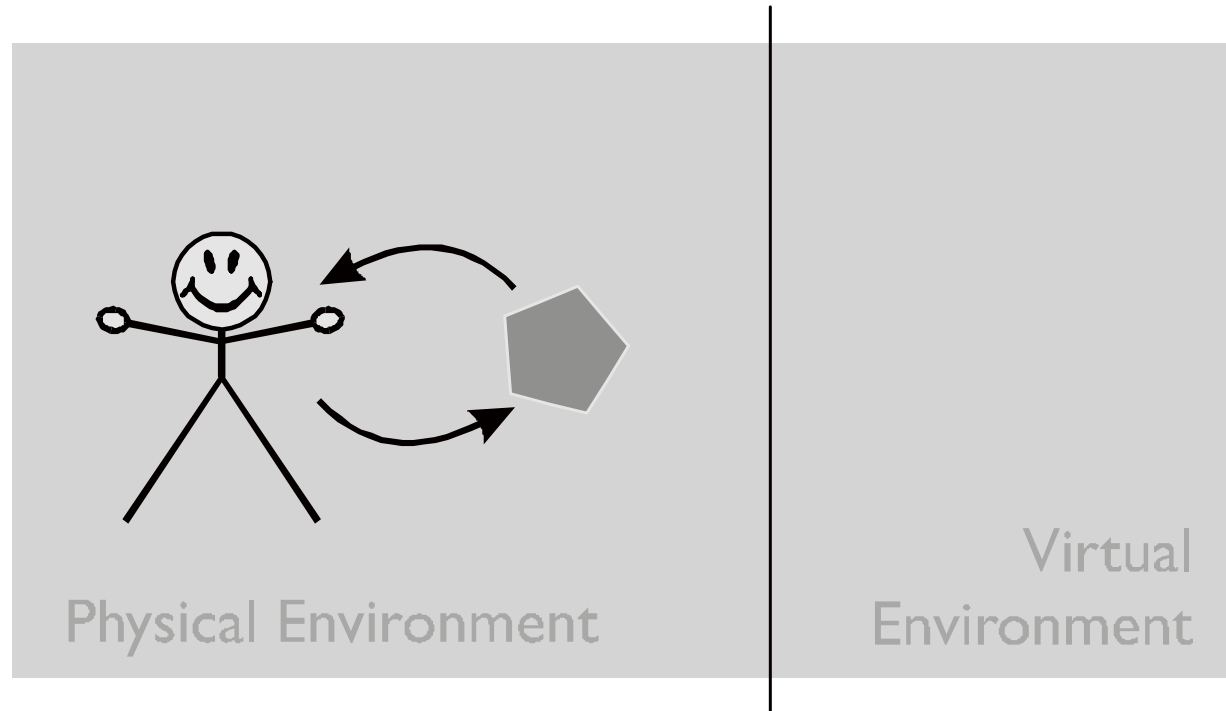


Research goal

- To develop a design framework that helps designers create environments that are better suited for physical-virtual activities
- Approach
 - to model the physical and the virtual worlds using the same terminology
- Underlying assumption
 - by viewing the physical and the virtual worlds as one, we can make them one,
 - i.e. an environment with less physical-virtual ”friction”

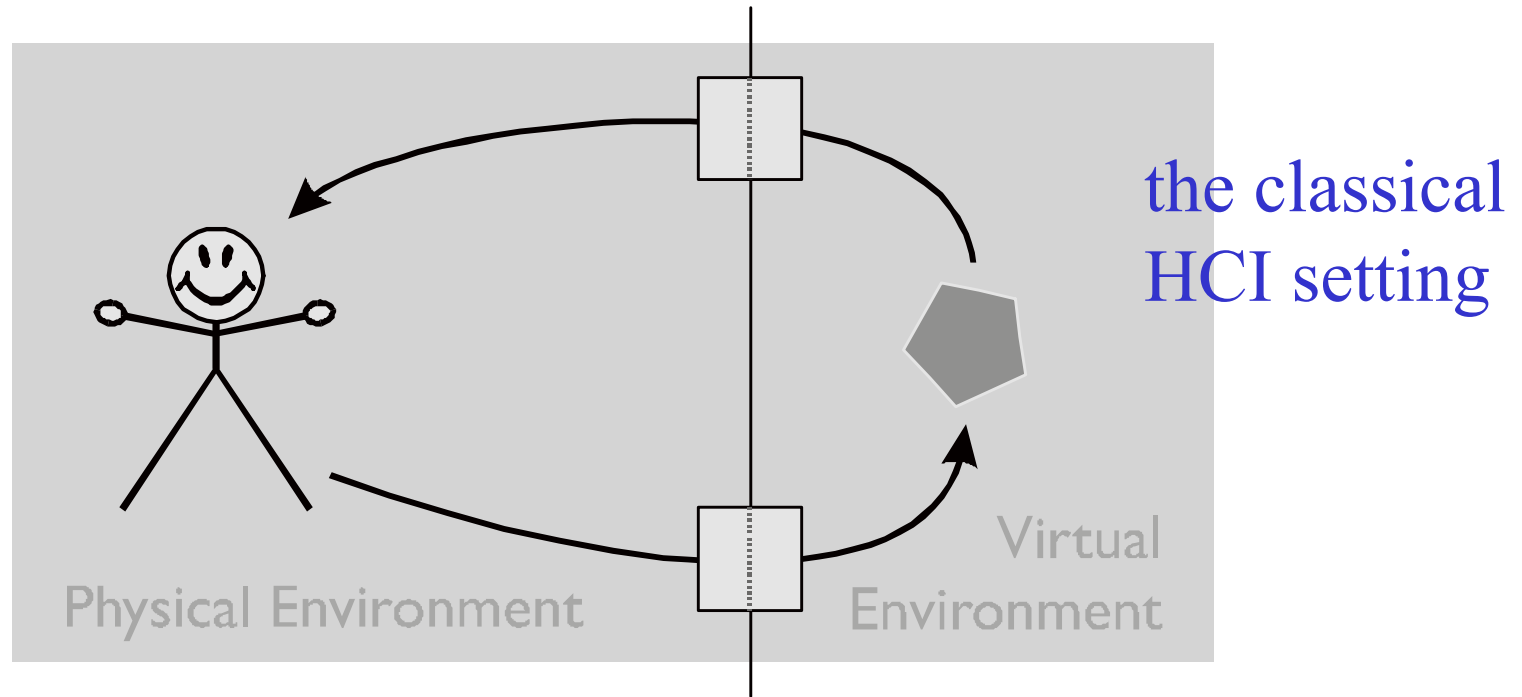


Physical action



- to kick a football at a goal on a football field
- to write down a shopping list on a piece of paper

Virtual action



- inserting a character while writing a paragraph in word processor; to dial a phone number on a phone that displays the numbers as you dial

Physical-virtual action pair

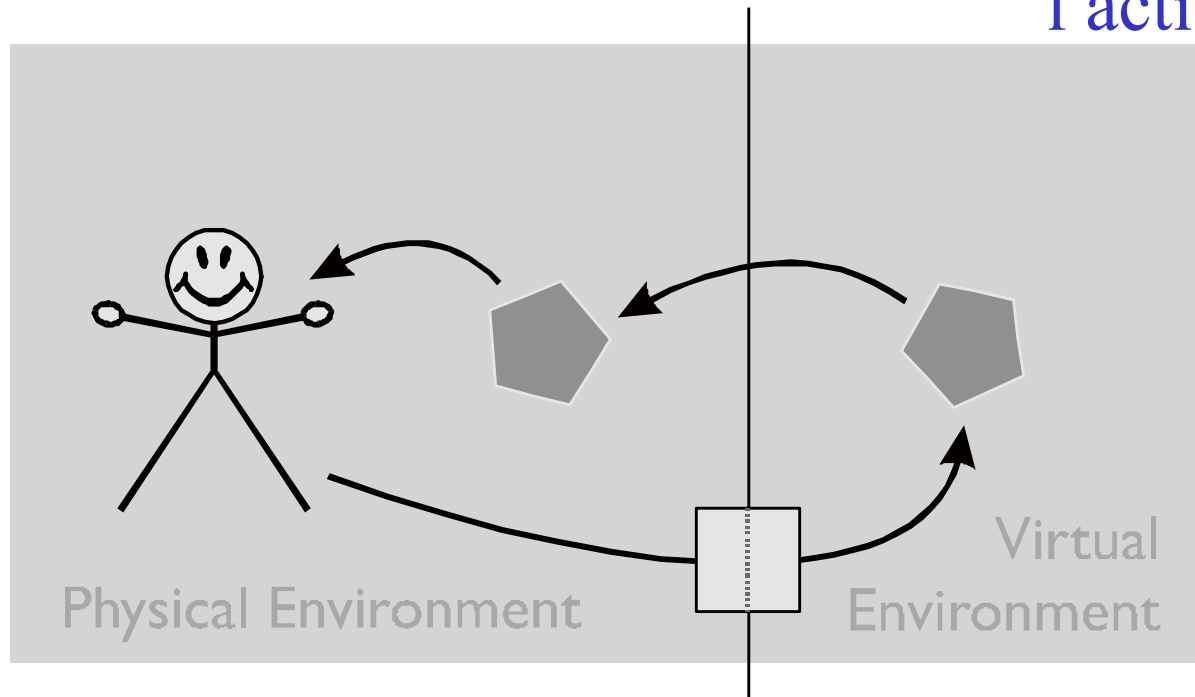
- pv action pair: two actions belonging to the same activity where the first action is performed in the physical world and the second action is performed in the virtual world, or vice versa.
 - appears for instance within the activity of “writing a text document”:
 - adjusting paragraphs in a document using a word processor
 - proof-reading it on paper

Core concept: Physical-Virtual Artefact

- objects that have manifestations in both worlds
- often manipulated in both actions belonging to a physical-virtual action pair
 - example:
 - activity: to read a long web page
 - PV action pair: a) to locate the web page and initiate the printing, b) to read the paper manifestation of the web page

Physical-virtual actions based on synchronised PVAs

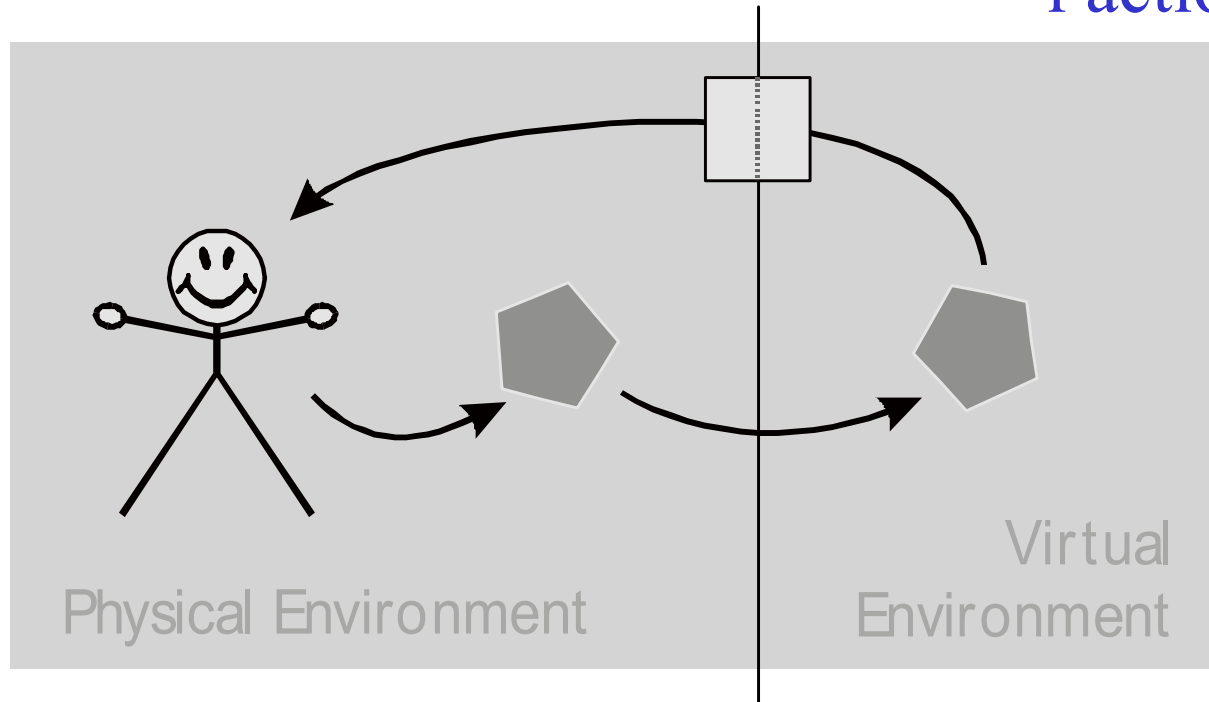
virtual → physical action



- example: ejecting a CD from a computer-mounted CD player by manipulating the virtual manifestation of the CD player

Physical-virtual actions based on synchronised PVAs

physical → virtual
action



- example: the mediaBlock video player (Ullmer, Ishii & Glas, 1998)



Physical-virtual activities

A *physical-virtual activity* is an activity consisting of an ordered sequence of actions containing

- a) at least one physical-virtual action pair or
- b) at least one physical-virtual action



The physical-virtual design framework and activity-centric design [1/5]

- ws organisers' reflection:
 - lack of support for activities spanning
 - multiple software applications
 - multiple IT devices
 - also, sometimes the same activity is performed using different set of software applications and IT devices, based on available resources *in situ*
- ws organisers' proposal: activity as first-class object (instead of single file and applications only)



The physical-virtual design framework and activity-centric design [2/5]

- from the ws call:
 - “... by lacking a first class notion of user tasks, current systems fail to support **easy shifting between tasks.**”
- rephrased from a physical-virtual design perspective:
 - “by lacking a first class notion of **PVAs**, current systems fail to support **easy shifting between physical and virtual manipulation of a PVAs**“
 - With "first class notion" I mean that the system is able to unambiguously link the two manifestations to each other.



The physical-virtual design framework and activity-centric design [3/5]

- example situation from the ws call:
 - “...for the medical staff at a hospital, it is impractical to shift their attention from the focus of their task – a patient – in order to locate a device, login, and locate the relevant application/file to show to a colleague.”



The physical-virtual design framework and activity-centric design [4/5]

- example situation from the ws call:
 - “...for the medical staff at a hospital, it is impractical to shift their attention from the focus of their task – a patient – in order to locate a device, login, and locate the relevant application/file to show to a colleague.”
- in the eyes of the physical-virtual framework:
 - the task can be categorised as a physical-virtual activity (it includes a physical-virtual action pair)
 - the patient and her/his corresponding virtual medical documents are modelled as a PVA

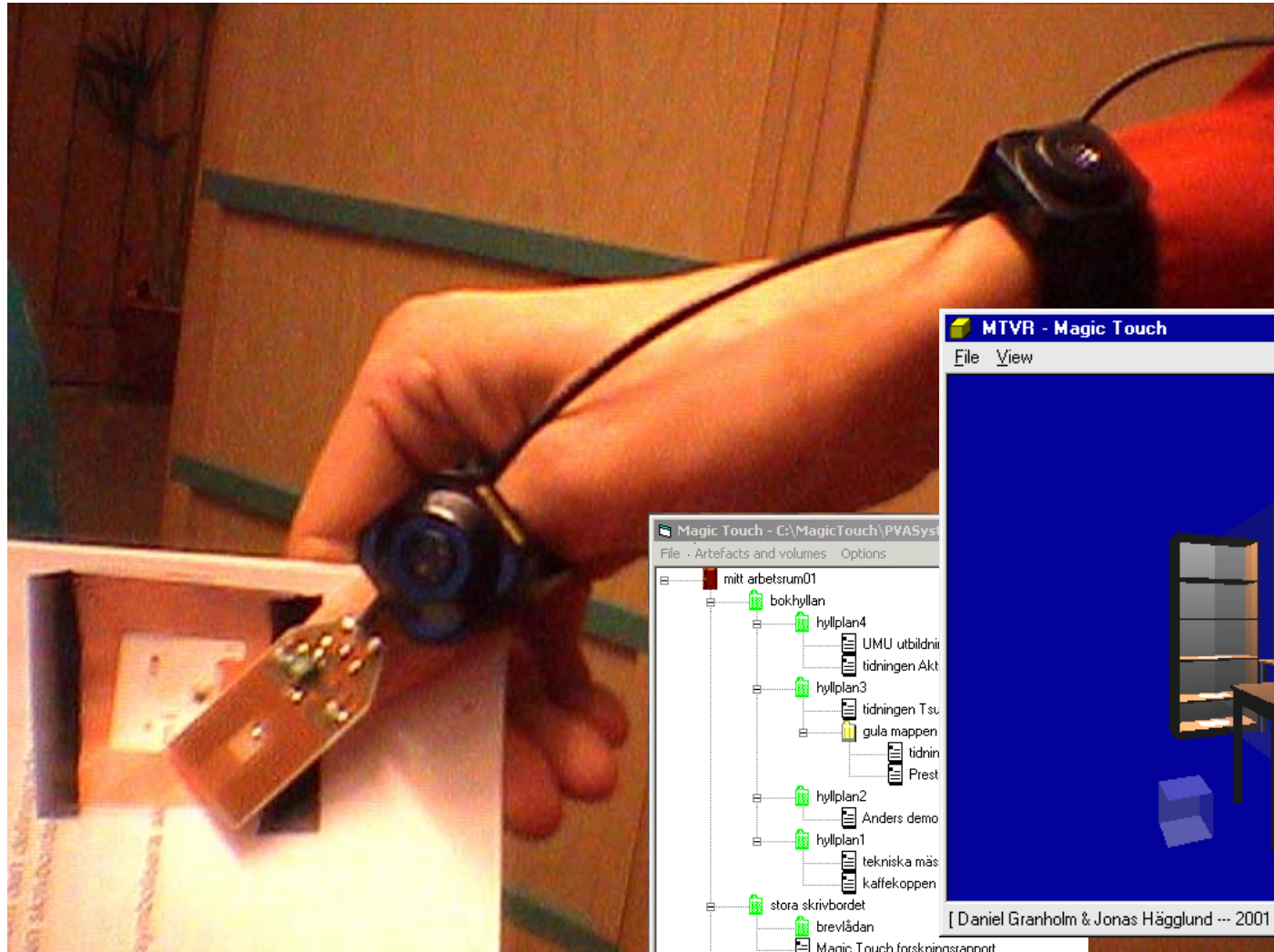


The physical-virtual design framework and activity-centric design [5/5]

- in the eyes of the physical-virtual framework:
 - the task can be categorised as a physical-virtual activity (it includes a physical-virtual action pair)
 - the patient and her/his corresponding virtual medical documents are modelled as a PVA
- infrastructure is introduced to maintain the relationship between the PVA manifestations
 - e.g. by "tagging" the patient and to show all relevant medical virtual documents on a wearable computer as soon as the medical doctor reads the tag with a wearable tag reader. If the doctor's inspection equipment is connected to the wearable computer, the heart beat rate, blood values, etc. can be automatically entered into the journal, having the doctor only to confirm the measurements.

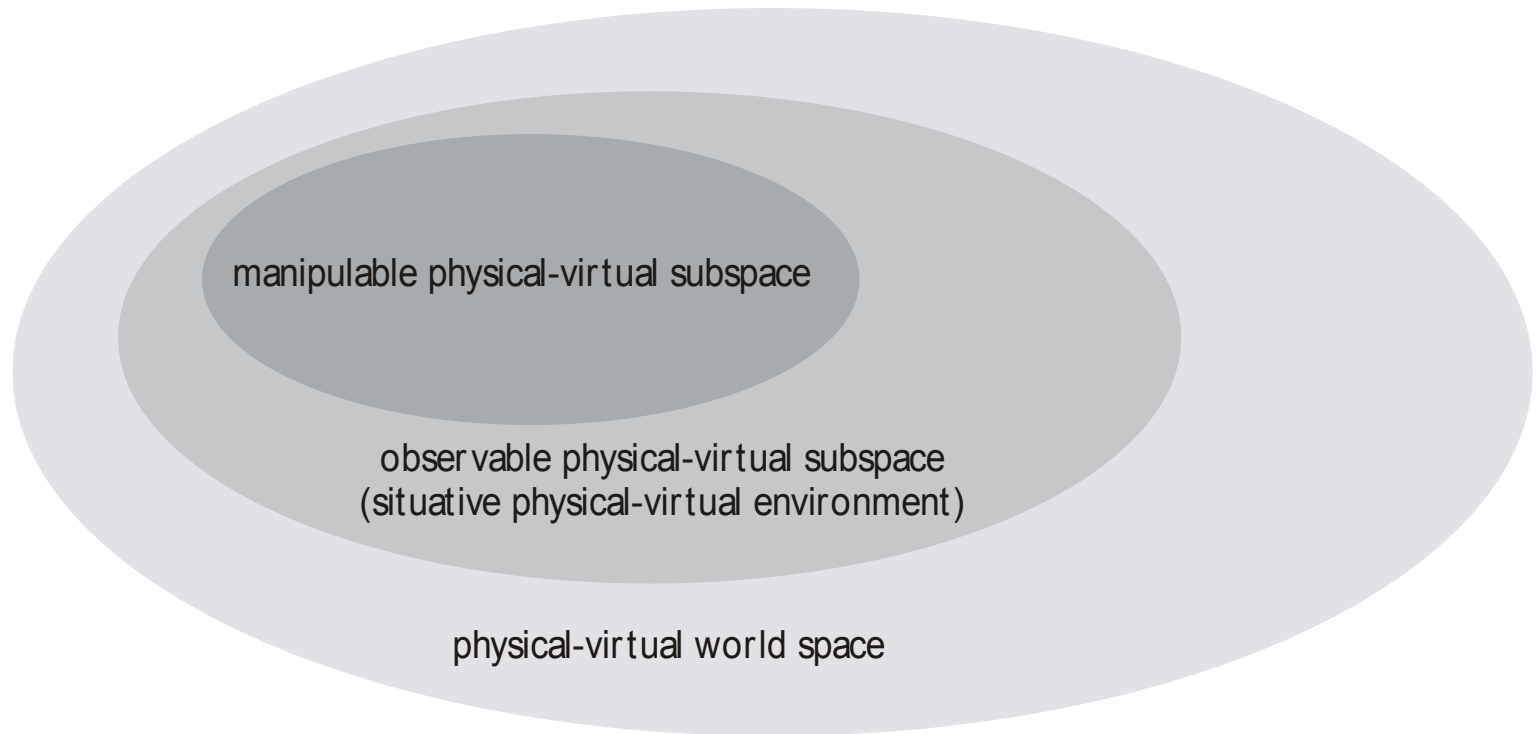


Magic Touch – system delivering (limited) support for synchronised PVAs



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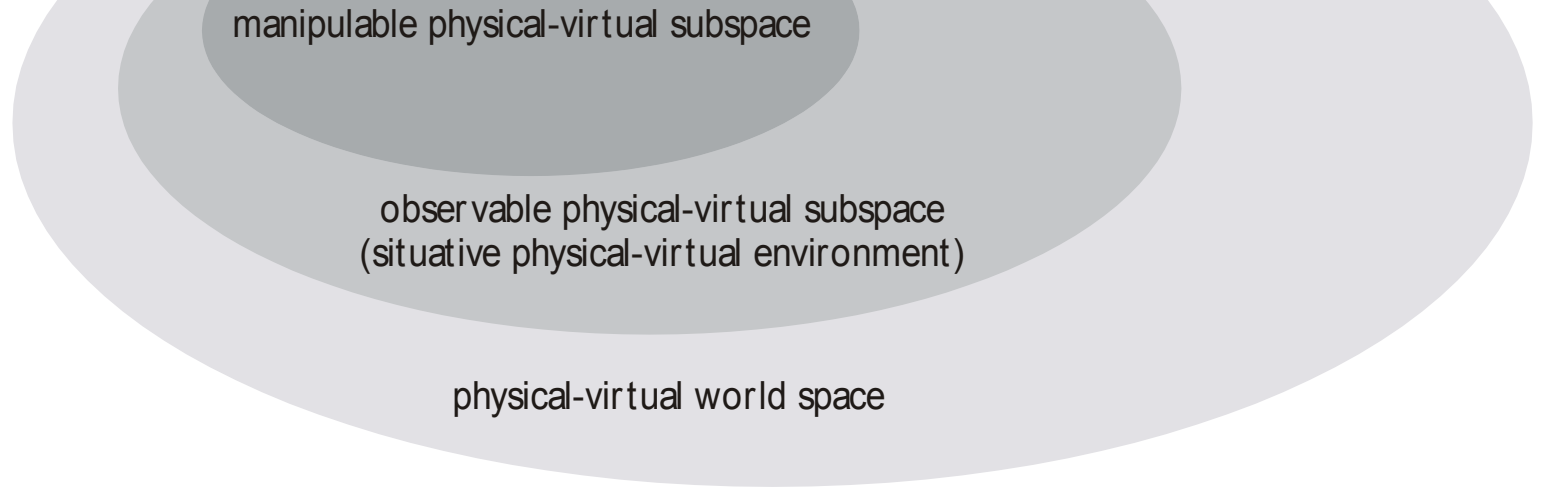
A situative physical-virtual space model



describing the basic dynamics of (p & v) object logistics during the course of human activity



A situative physical-virtual space model



- can help to formally motivate intuitive design decisions (e.g. why the doctor's computer should be wearable)
- reformulates our goal as environment designers:
 - to make sure that all necessary objects for a particular task or subtask are (easily made) present in the manipulable p-v subspace at all times during the course of the activity



Summary, conclusion, and position

- I have presented selected concepts from the design framework proposed in my PhD thesis, defended 4 months ago
 - faculty opponent: Bill Buxton, Univ. of Toronto)
- I believe that models of human activity should be world-neutral by modelling physical and virtual objects/actions in a uniform fashion
 - c.f. “context awareness”, “location tracking”
- I believe that the best environments are those that not only simplify *task-switching* but also *physical-virtual world switching* within tasks