# Ego/exo perspective motor learning

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# Chapter 1

# Abstract

- Overall aim of the Masters theses: provide insights to learning in vr, especially about the perspective on the avatar who is teaching (egocentric vs. exocentric perspective)
- thus: provide groundwork for motor learning in vr for future HCI related studies

# Chapter 2

# Introduction

## 2.1 Motivation

- Overall aim of the Masters theses: provide insights to learning in vr, especially about the perspective on the avatar who is teaching (egocentric vs. exocentric perspective)
- thus: provide groundwork for motor learning in vr for future HCI related studies

### Problem definition

- Motor learning tasks can be learn in MR (quellen)
- investigations in xyz but not in terms of perspective
- influence of perspective could lead to insights/ recommendations for learning in MR

## 2.2 Approach

How to address the Problem

- Design a Study, participants to perform movements
- three groups, ego/exo perspective
- investigate the performace of the groups

### Research questions and hypothesis

- RQ1: Does the perspective on a Virtual Avatar influence the learning performance (?better: outcome?)?
- RQ2: When the movement is only on a specific body part like upper body (UB), lower body (LB) or full body (FB), is there a relation between the egocentric or exocentric perspective on the avatar to the learning performance?
- H1: The perspective on the avatar has no influence on UB movements
- H2: The perspective on the avatar has no influence on LB movements
- H3: The perspective on the avatar has no influence on FB movements
- H4: The perspective on the avatar has no prefers no movement class, means the movement class has no influence on the learning performance

## 2.3 Outline

After this introduction, the scope of this thesis is given. The Motor Learning movements are described as well as the classification for the Mixed Reality. In the Therory section a classification of this work in relation to the Methodology and HCI Theory. The related work part will give an overview about other and MR learning systems and also work about perspectives on avatars. From this work the measures, dependent and independent variables and tasks are derived. Taking the related work into consideration a study design is proposed in the Study Setting section. Furthermore a outlook is given in the last section.

# Chapter 3

# Scope

## 3.1 Motor Learning

- discrete movements
- closed skills
- at least 2 different movement categories
- how to measure movements

### How do we learn movements

facts → adoption for study

## 3.2 Mixed Reality

- Milgram
- AR or VR

### other aspects

- synchron asynchron
- colocated/remote
- perspective
- hardware?

- feedback!
- real world, not abstract avatars
- only visuals - no audio or textual explanation
- 26: details following: how to measure movements for movements with a discrete target
- 3 types of measurements: measures of error for a single subject, measures of time and speed, measures of movement magnitude.
  - Constant Error: average Error $CE = \frac{\sum(x_i - T)}{n}$. i: all values, T: target value, n: number of values. interpretation: in average, the user missed the target by CE
  - Variable Error: inconcistency in movement error: $VE = \sqrt{\frac{\sum(x_i - M)^2}{n}}$. M: average movement, actual movement score - average movement score. interpretation: VE reflects the variability, or inconsistency in movements. moves consistently: VE small. user moves absolute consistently: VE is 0. VE does not depend on wether or not the subject was close to the target
  - total variability: the total variability around a target: $E = VE^2 + CE^2 = \sqrt{\frac{\sum(x_i - T)^2}{n}}$ interpretation: combination of VE and CE, total amount of spread about the target: overall measure how successful was the subject in achieving the target
  - absolute error: measure of overall accuracy in performance. $AE = \frac{\sum|x_i - T|}{n}$. interpretation: replace sqrt with abs
  - AE vs. E: **TODO**
  - Absolute Constant Error: $= |CE|$. if half pos and half neg could cancel each other out. when mean.
  - these measures can be applied to other movements. like pursuit motor: TOT, Mashburn task, stabilometer, two hand coordination task.
- measures of time and speed: basic to this idea: performer who can accomplish more in a given amount of time or who can accomplish a given amount of behavior is more skillfull. time measure:c $\frac{time}{unit}$. speed:$\frac{units}{time}$.

- reaction time (RT): can also be a performance measure. a measure of time from the arrival of a sudden and unanticipated signal to the beginning of the response. i will only describe it if i will use it
- movement time (MT): how long does the movement last. somtimes commbined with RT: response time= $RT + MT$
- 21 details following: discrete/closed skills
- for simplifying discussion introducing classification of movements and motor tasks.
- 2 important classification schemes:
  - based on particular movements made: discrete, continuous, serial
  - based on perceptual attributes of the task: open/closed skills
- discrete movements: movements with recognisable beginning and end. discrete tasks: kicking a ball, shifting gears. end of movement: the time on which a observer ceased examining. dm can be very rapid like blinking or longer like making the signing.
- continuous movements: dont have recognisable start and end, with behavior continuing till the movement arbitrarily stopped. Continuous tasks: swimming, running, steering a car. Continuous tasks tend to be longer than discrete tasks.
- serial movements: neither discrete nor continuous compromised of a series of individual movements tied together in time to make some "whole". center of continuum. can be rather long but are not stopped arbitrarily. serial tasks: starting a car, prepareing and lighting a wood fireplace. Serial tasks can be seen as many discrete tasks strung together and the order (and sometimes timing) is important.
- open skills: environment is constantly, unpredictably changing, so the performer cannot plan his activity effectively in advance. eg. penalty shot in ice hockey. own movement is dependet on the movement of the keeper. Driving on a freeway: depends on the other cars. Success in open skills largely determined by the extend to which a individual can adapt the planned motor behaviour to th echanging environment.
- closed skills: other end of continuum, predictable environment becaus it is stable. eg archery, bowling or signing. movement can be planned in advance. since open skills seems to require rapid adaptions to a

changing environment and closed skills require a very stable performances in a predictable environment questions are raised about the method of training, do different individuals perform better in in one of these skill classes.

- to overcome these question the focus of this seminar is on discrete movement tasks and closed skills. §-¿§ see stdudy

# Chapter 4

# Theory

## 4.1 Methodgy

sth like UX live cycle or participatory design

## 4.2 HCI Theory

sth like embodied cognition Groundwork for designing VR motor learning systems

# Chapter 5

# Related Work

wie haben die anderen diese variablen untersucht wie wurden die variablen untersucht → studiensetting

## 5.1 MR learning systems

## 5.2 Ego/exo perspective work - if exists

## 5.3 variables

- independent/dependent variables
- measures
- task: reuse or adapt existing task

### Task

- Onebody: artificial postures not from but like: tai chi, matial arts
- VR Dance Trainer: dance movements

### Measures

- onebody
- VR Dance trainer

## 5.4 Body parts included

- onebody
- vr dance trainer
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### Independent and Dependent Variables

#### Dependent Variables

- VR
- bilateral movements
- Movement types: synchronous / asynchronous

#### Independent Variables

- Body parts: upper body (UB), lower body (LB), full body (FB)
- Perspective: Ego, Exo, Ego/Exo combined
- Movement types: synchronous / asynchronous

write sth...

## 5.5 Conclusion

- task is xyz because of abc
- measures are xyz because of abc
- variables are...

# Chapter 6

# Study Setting/ concept

| | UB | LB | FB |
|---|---|---|---|
| Ego | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement |
| Exo | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement |
| Ego/Exo | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement | 1 synchronous and 1 asynchronous movement |

# Chapter 7

# Outlook

- timetable, what to do...