This evening:
Welcome to LMU Students!
Schedule

- About eGym
- Lecture
- Machine Demo
- Refreshments
eGym’s journey over the past 6 years

2010

2 Employees

- Philipp Rösch-Schlanderer
  CEO/Founder

- Florian Sauter
  CTO/Founder

First Prototype

2016

~ 270 Employees

- 4 Business Units
- 5 Products

~ 1000 Gyms across DACH region

12+ Countries
eGym observed that the fitness industry hadn’t caught on to the digitization trend

Initial Vision: Build the world’s best fitness machines
eGym’s smart fitness machines took the industry by storm

- Automatic machine settings
- Tailored towards fitness goals
- Optimal training weights
- Guided training
With time and experience, eGym’s vision and product portfolio grew.
New products lead to new customers

Gym operators

Trainers

End customers
Fast growth is a constant challenge for our company’s culture
eGym’s success story has yet to end

Markets
Gyms → Physiotherapy → ?

Internationalisation
Germany → Europe → ?

Hardware
Prototype → Machine circuit → Standalone → ?

Software
Fitness App → Trainer App → Wearables → ?

Reshaping the fitness industry
Lecture
About me

Gino Gravanis, B.Sc.
gino.gravanis@egym.de

- Degree in Media Informatics @ LMU
- Bachelor thesis with Florian Alt in 2014
- Joined eGym 09/2014
- Software Engineer
- Working on INSEIL
INSEIL

- Research project with public funding

- TUM

- Goal: Develop novel fitness machine that can
  - support learning of exercises
  - continuously correct and improve exercise form
  - make working out more fun
INSEIL

- Research project with public funding

- Goal: Develop novel fitness machine that can
  - support learning of exercises
  - continuously correct and improve exercise form
  - make working out more fun
  - “The self-driving fitness machine”
INSEIL: Key Challenges

- (Partial) Pose tracking
  - Depth camera, Smart clothing, Wearables, Instrumented fitness equipment
- Exercise recognition
  - Neural network, SVM
- Formal specification for exercises (explicit or implicit)
  - Domain-specific language, neural network
- Intuitive user interface
INSEIL: Key Challenges

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Motor Learning
Motor Learning Basics

Motor Skill

- Capability to produce a purposeful movement
- Certainty of goal achievement
- Energy requirement
- Movement time (Fitts’ Law)
- Performance consistency
- Relative
Motor Learning Basics

Motor Performance

- Execution of a skill at a specific time and situation
- Temporary
- Susceptible to fluctuations
Motor Learning Basics

Motor Performance

- Execution of a skill at a specific time and situation
- Temporary
- Susceptible to fluctuations

Motor Learning

- Changes internal processes
- Permanent
- Can’t be measured directly
Motor Learning Basics

Abilities

- Stable individual differences
- Hard to change
- Don’t respond to practice
- Influence the performance of multiple skills
- There are few
Measuring Learning

• Changes in performance
  • Improvement
  • Consistency
  • Transferability
  • Retention
Measuring Learning

- Changes in performance
  - Improvement
  - Consistency
  - Transferability
  - Retention

Problems
- Plateau, Ceiling and Floor Effects
- Within-Subject Variability
- Between-Subject Variability
# Learning stages

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Fitts and Posner (1967)
Fitts and Posner (1967)

Cognitive stage
trial and error (Schmidt & Wrisberg)

- high mental activity
- attention demanding
- rapid and gross change
- frequent & large errors
Fitts and Posner (1967)

**Cognitive stage**
trial and error

- high mental activity
- attention demanding
- rapid and gross change
- frequent & large errors

**Associative stage**

homing in

- movement refined
- patterns less variable
- fewer & less gross errors
- error detection
## Fitts and Posner (1967)

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- **Cognitive stage**
  - high mental activity
  - attention demanding
  - rapid and gross change
  - frequent & large errors

- **Associative stage**
  - movement refined
  - patterns less variable
  - fewer & less gross errors
  - error detection

- **Autonomous stage**
  - little attention required
  - few errors
  - error detection & correction
Learning stages

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Utility of extrinsic feedback

Ability to process extrinsic feedback
Feedback Design
Feedback functions
Feedback functions

- Increase **motivation**
  - Tell the user that he/she is doing well
  - Balance positive and negative feedback
Feedback functions

• Increase **motivation**
  • Tell the user that he/she is doing well
  • Balance positive and negative feedback
• **Inform** of movement errors and how to correct them
  • Right type, amount and modality at the right time
Feedback functions

• Increase motivation
  • Tell the user that he/she is doing well
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• Inform of movement errors and how to correct them
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• Focus attention ⇒ Reduce task complexity
  • External focus > Internal focus
  • Box jump, chair squat
Feedback functions

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• **Dependency-producing** (Guidance hypothesis)
Feedback types
Feedback types

Source

- Intrinsic vs Extrinsic
Feedback types

Source
- Intrinsic vs Extrinsic

Modality
- Unimodal vs Multimodal
- Auditory vs Visual vs Haptic
Feedback types

Source
• Intrinsic vs Extrinsic

Modality
• Unimodal vs Multimodal
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Content
• Positive vs Negative
• Descriptive vs Prescriptive
• Knowledge of Results vs Knowledge of Performance
Feedback types

Source
- Intrinsic vs Extrinsic

Modality
- Unimodal vs Multimodal
- Auditory vs Visual vs Haptic

Content
- Positive vs Negative
- Descriptive vs Prescriptive
- Knowledge of Results vs Knowledge of Performance

Timing
- Concurrent vs Terminal
- Fading feedback vs Bandwidth feedback vs Self-controlled feedback
Guidance hypothesis
Guidance hypothesis

• Too much feedback during skill acquisition leads to dependency
• Better performance with feedback
• Poor performance without feedback
Guidance hypothesis

- Too much feedback during skill acquisition leads to dependency
- Better performance with feedback
- Poor performance without feedback

Implications

- Poor motor learning
- Feedback must be adapted to motor skill and task difficulty
- Feedback should decrease over time
Specificity of learning hypothesis
Specificity of learning hypothesis

- Learning involves integration of relevant feedback sources
- Especially true for complex tasks
Specificity of learning hypothesis

• Learning involves integration of relevant feedback sources
• Especially true for complex tasks

Implications
• Removing a source of feedback after practice decreases performance
• Adding a source of feedback after practice decreases performance
• Extrinsic feedback can change the task
Action effect hypothesis
Action effect hypothesis

- Motions are best controlled by their intended effects
- Common coding theory
  - Perceptions and actions are linked
  - Playing piano vs listening to piano music
- Feedback for stability exercise
Zumba Fitness

- https://youtu.be/ZthJWnH0HOw?t=72
Zumba Fitness

- [https://youtu.be/ZthJWnH0HOw?t=72](https://youtu.be/ZthJWnH0HOw?t=72)
- Motivation through positive reinforcement
- Separate tutorial for early learning phase
- Concurrent and terminal feedback
- Animation of correct execution
- Color coding to convey Knowledge of Results
- Red markers on specific body parts to convey Knowledge of Performance
- No fading, bandwidth or self-controlled feedback
Your Shape Fitness Evolved

- https://www.youtube.com/watch?v=zEH5ek3j7N8&t=44
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- External focus
- Perception of depth
Pixformance
Bitte halte deine Karte an den Kartenleser
Pixformance
Pixformance

Ausgangsposition:
- Zwei Hände nebeneinander
- Beine schulterbreit gestellt
- Knie leicht beugen
- Oberkörper waagrecht 45° vor beugen
- Hände vorn auf Kniehöhe halten
Pixformance
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Thank you!

Next: Machine Demo and Refreshments!
Extraordinary Success is driven by Extraordinary People!

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