“ExerLink - Enabling Pervasive Social Exergames with Heterogeneous Exercise Devices”†

PRESENTED BY SALIKH BAGAVEYEV

† Park, T., Hwang, I., Lee, U., Lee, S., Yoo, C., Lee, Y., Jang, H., Choe, S., Park, S., and Song, J. Exerlink: enabling pervasive social exergames with heterogeneous exercise devices. In Proceedings of the ACM MobiSys, ACM (2012), 15-28.

Introduction

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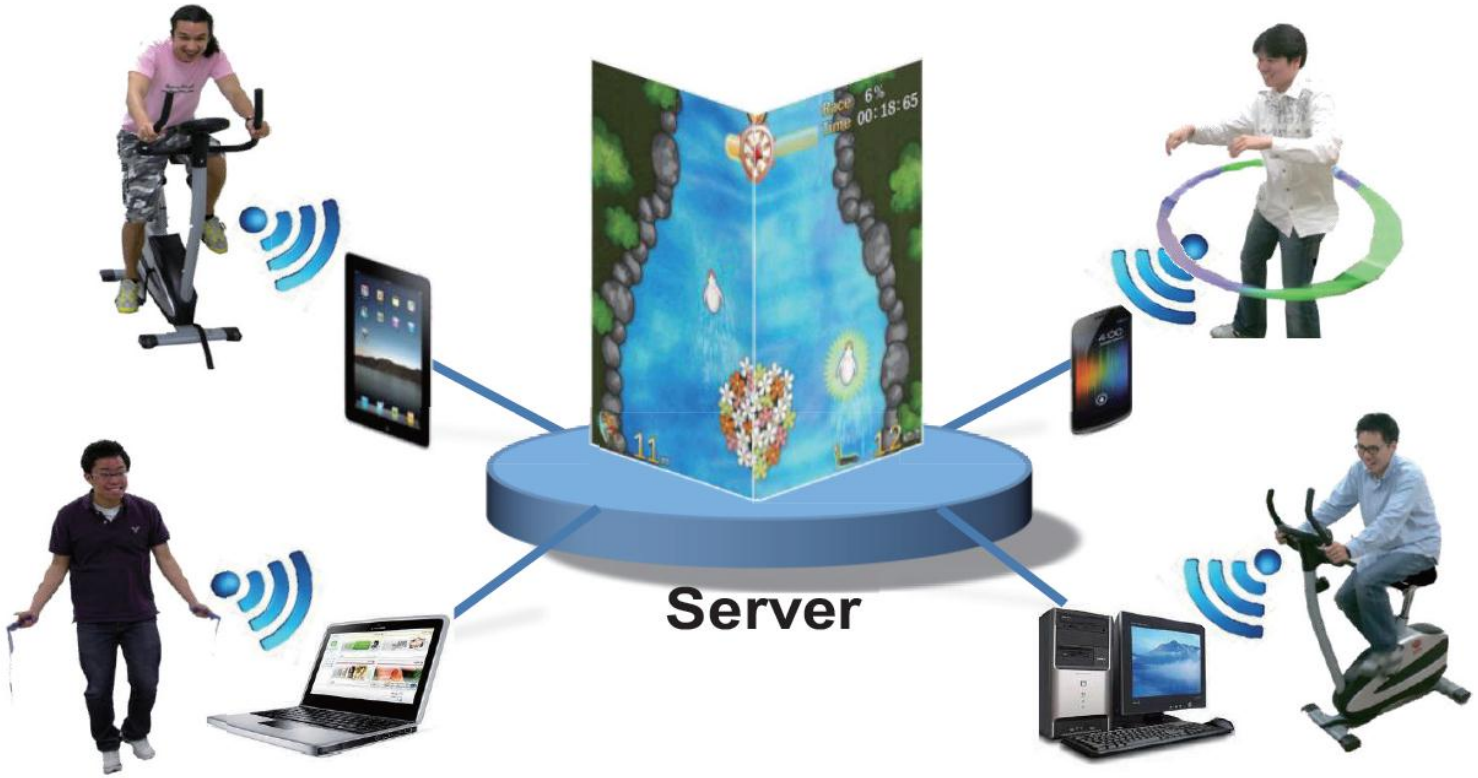
Introduction

- Diverse pervasive devices as game interfaces. Exergames.
- Social exergames provide ubiquitous social interactions
- Focus on Repetetive-Individual-Aerobic exercises

Motivation

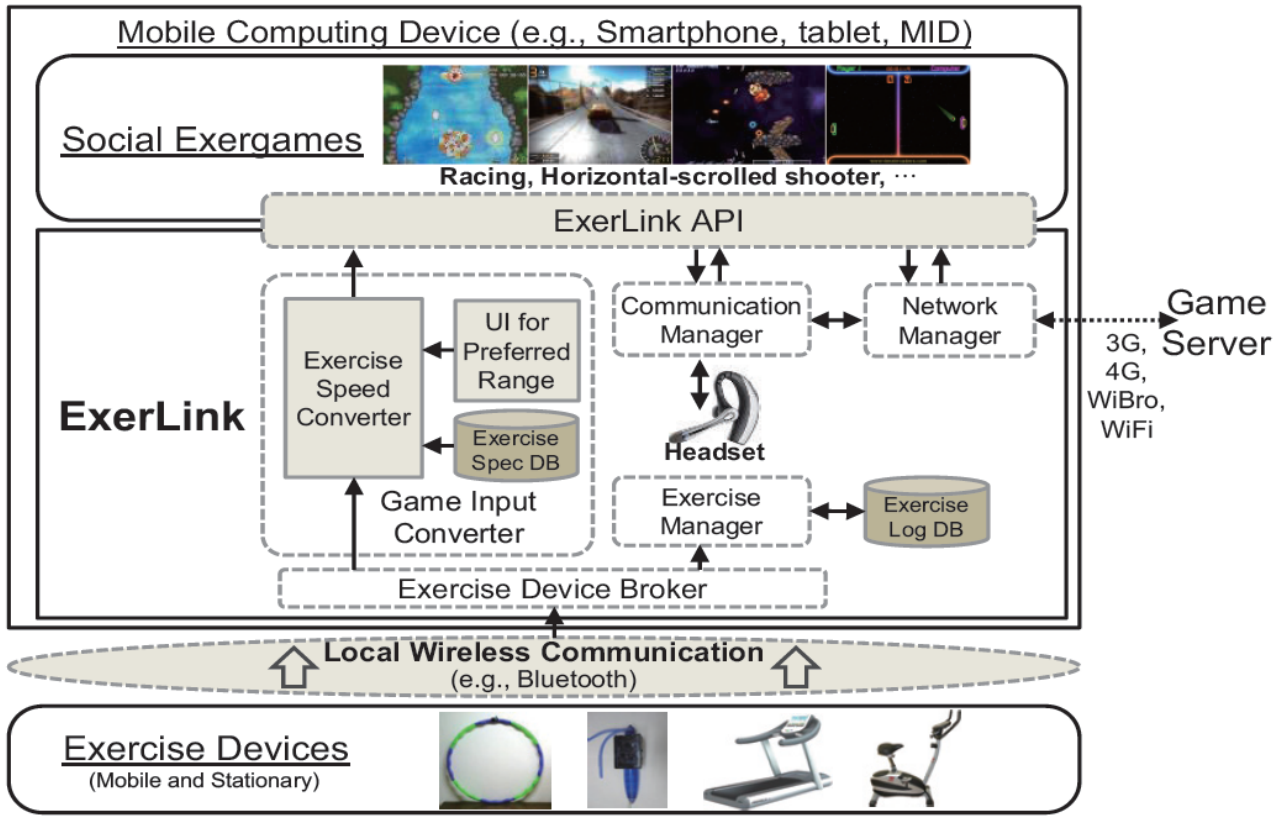
- Complement existing persuasive techniques relying on peer pressure and social recognition
- Existing approaches cannot be fully extended to pervasive social exergame scenarios
- Motivating Scenario: three friends prefer various exercises and cannot meet regularly
- Repetetive-Individual-Aerobic exercise benefits:
  - Popularity
  - Ease of access
  - Monotony
  - Long-lasting
  - Measurability
- Target Social Exergames

Exerlink Platform



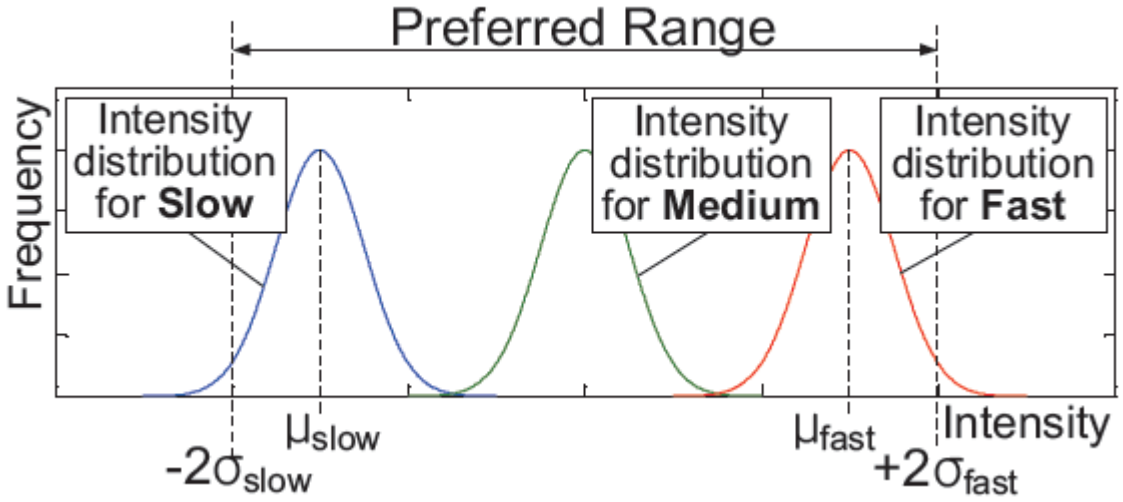
Exerlink Platform

- Game Input Controller
- Voice Channel Manager
- Network Manager
- Exercise Information Manager



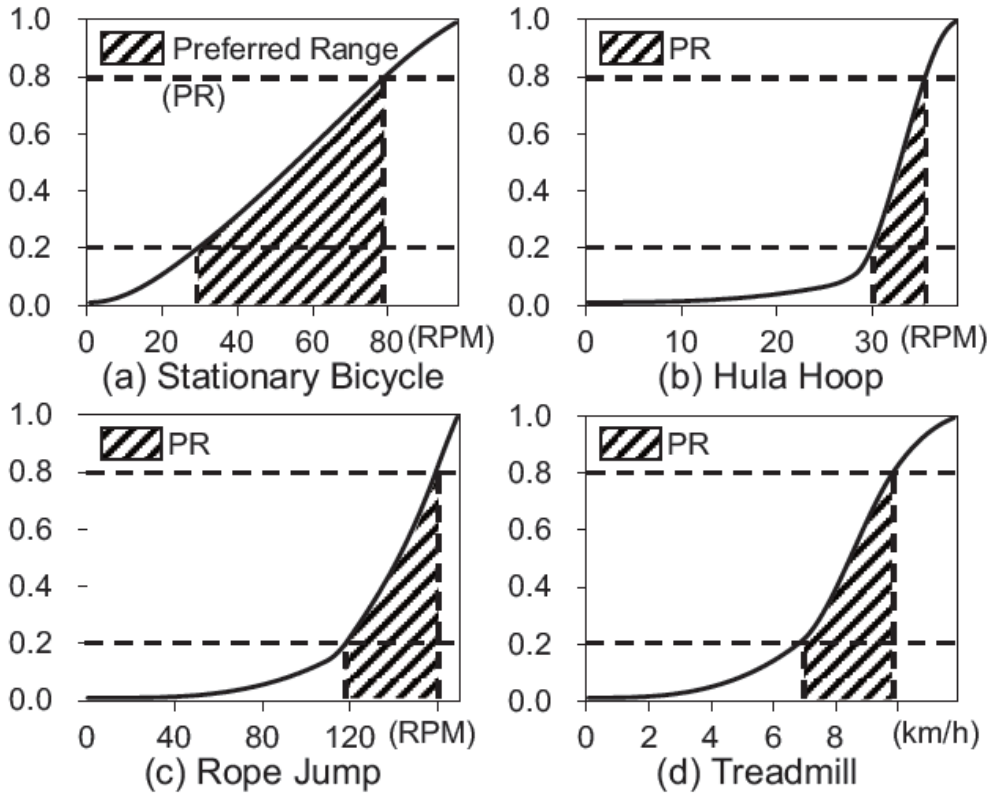
Providing Fair Gameplay:
converting intensity into game input

Personalized Mapping



Providing Fair Gameplay:
converting intensity into game input

Mapping functions



Providing Fair Gameplay:
balancing heterogeneity

- Preferred range for balancing heterogeneity
- Create target rate for acceleration and deceleration
- Adjust acceleration and deceleration to target rate

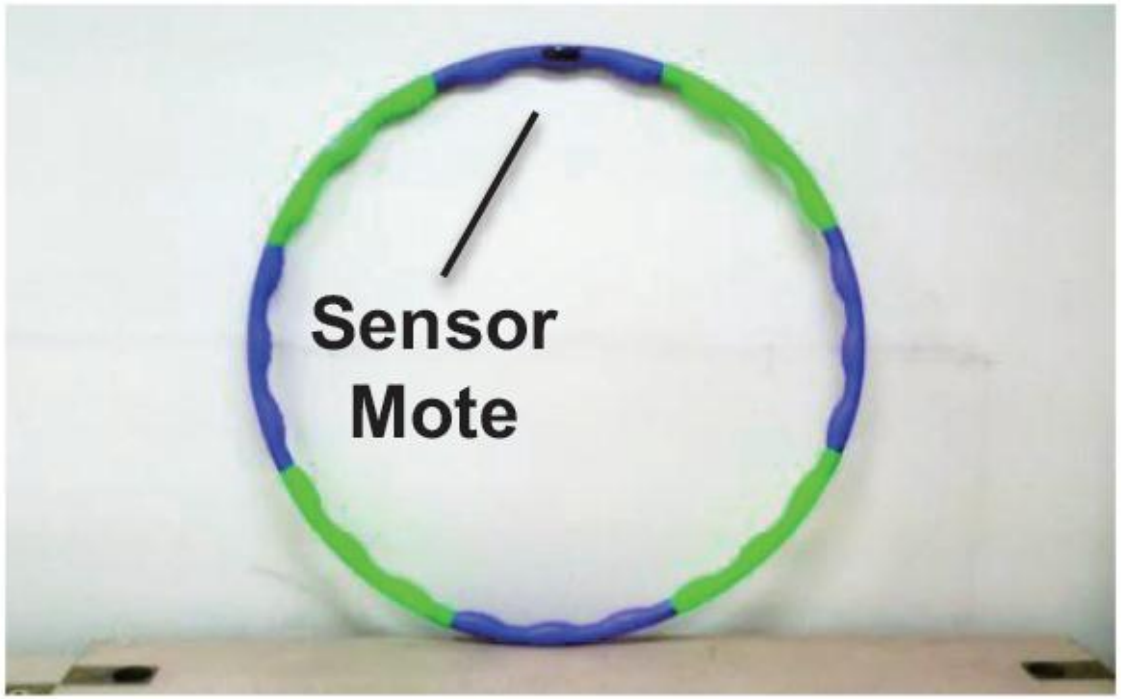
Function : *AccelerationBalancing*
Input : *Vin is the original game input, t is current time, β is the target rate*
Output : *Vout is the converted game input*

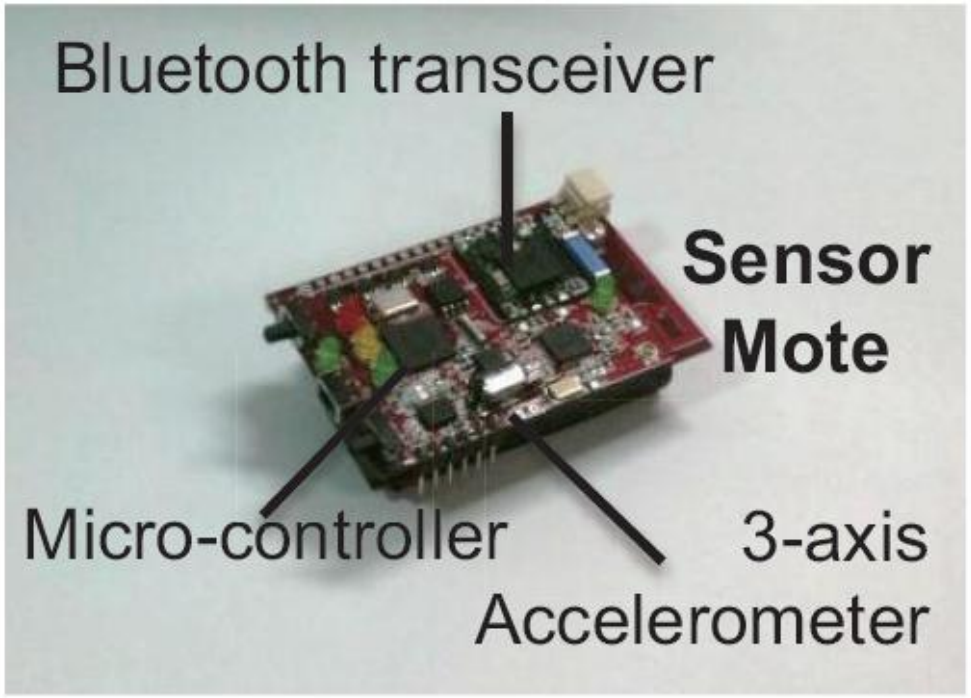
```
1.  // detect acceleration
2.  if ((Vin − Vin_old) / (t − t_old) > acceleration_threshold)
3.      if (current_state != ACCELERATING)
4.          current_state ← ACCELERATING
5.          t_accel_begin ← t_old
6.          Vin_accel_begin ← Vin_old
7.      // convert acceleration rate from the beginning of the current acceleration
8.      current_accel ← (Vin − Vin_accel_begin) / (t − t_accel_begin)
9.      converted_accel ← β · current_accel
10. else
11.     if (current_state == ACCELERATING)
12.         current_state ← ACCEL_END_WAIT
13. if (current_state == ACCELERATING || current_state == ACCEL_END_WAIT)
14.     Vout ← Vout_old + converted_accel × (t − t_old)
15. Vin_old ← Vin
16. Vout_old ← Vout
17. t_old ← t
```

Providing Fair Gameplay:
balancing delay variation

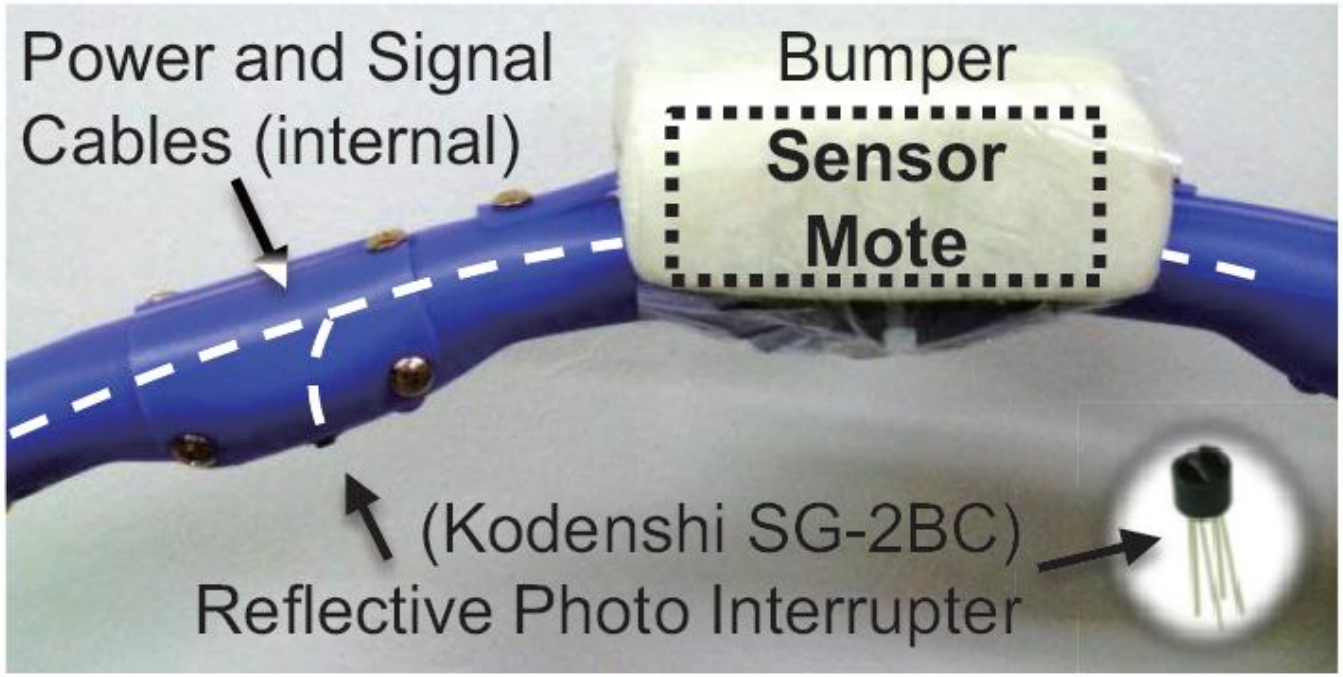
- Dead reckoning to predict the state of another player
- Fair-ordering service: at the server side action messages should be properly ordered based on players' reaction times

Controller prototype:
hula hoop

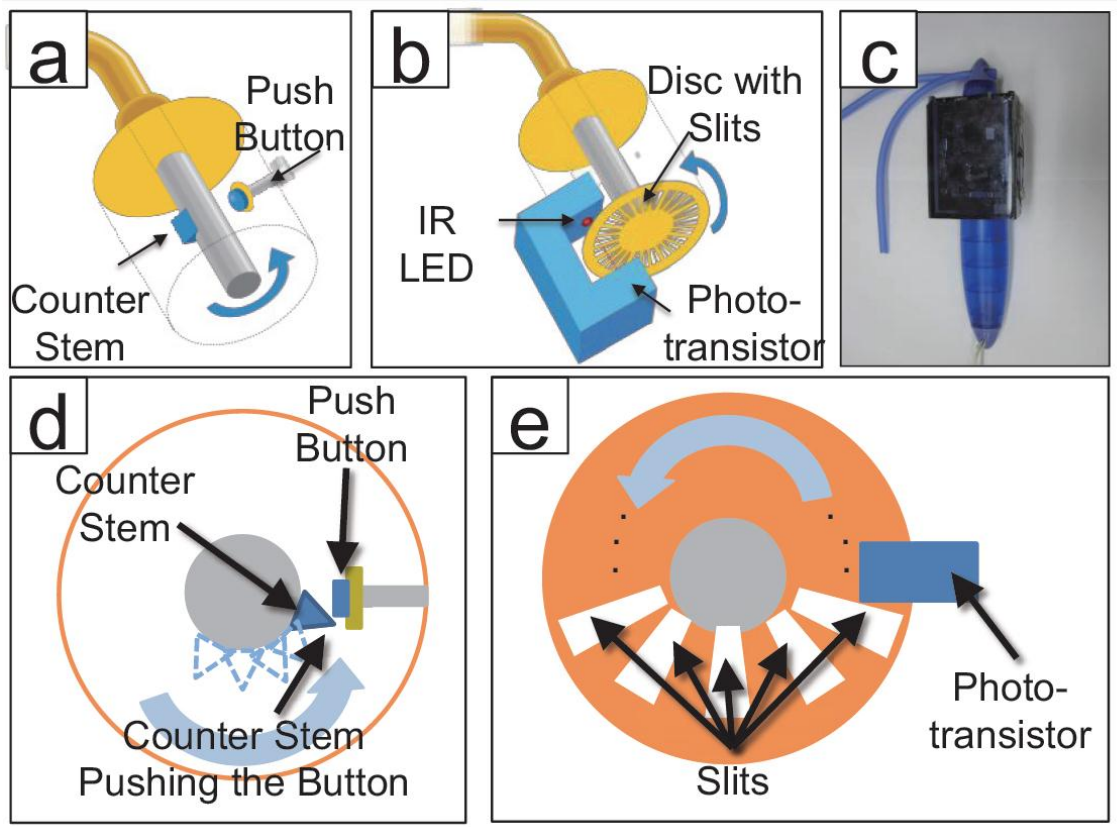




Controller prototype:
hula hoop



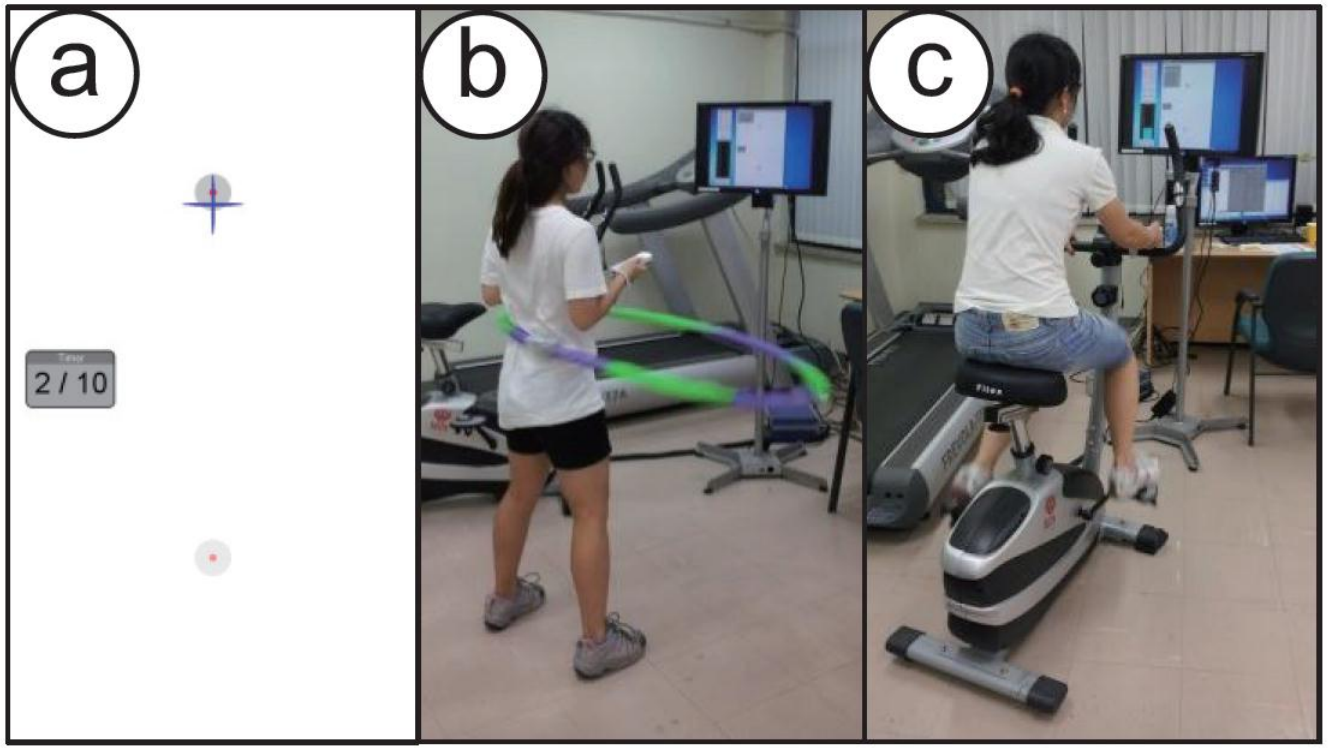
Controller prototype:
jump rope



Controller prototype:
treadmill and stationary bike

Evaluation

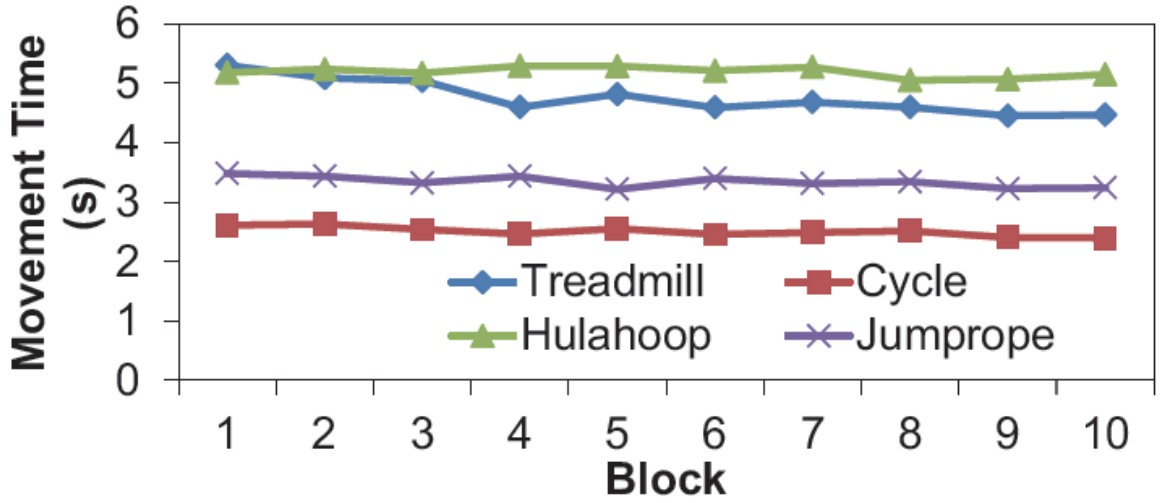
- Point select task (Fitts' law tests)
- High and low intensity targets
- Collect movement times and error



Results

Effects:

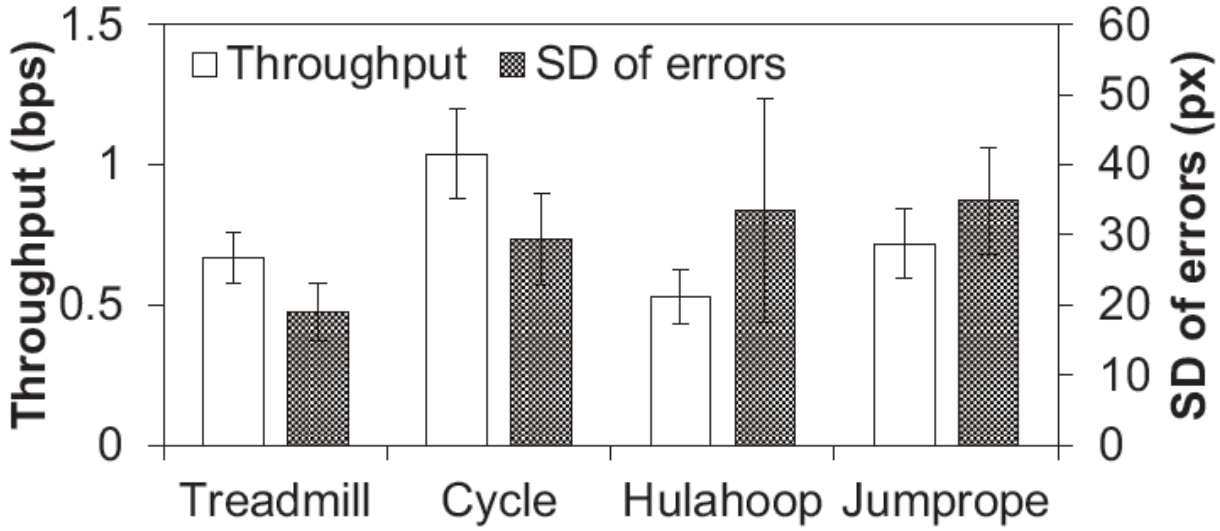
Movement time and learning



Results

Effects:

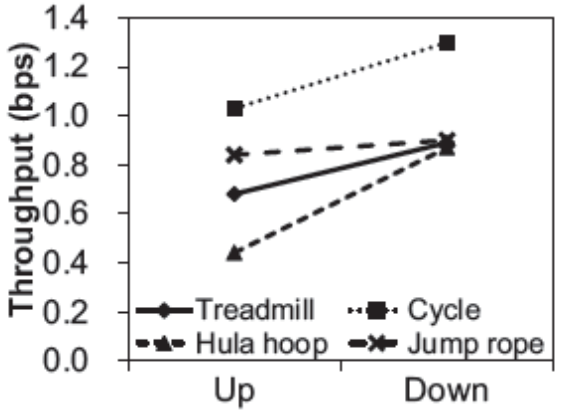
Throughput and SD of errors

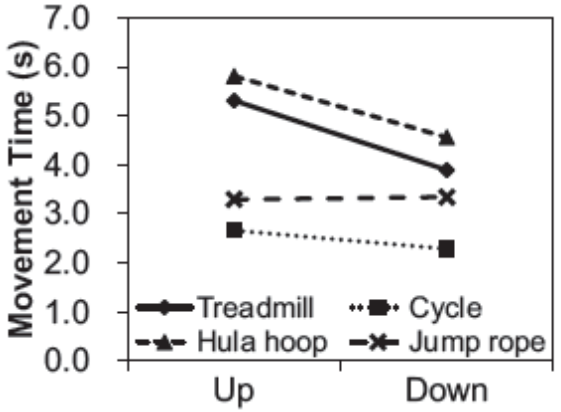


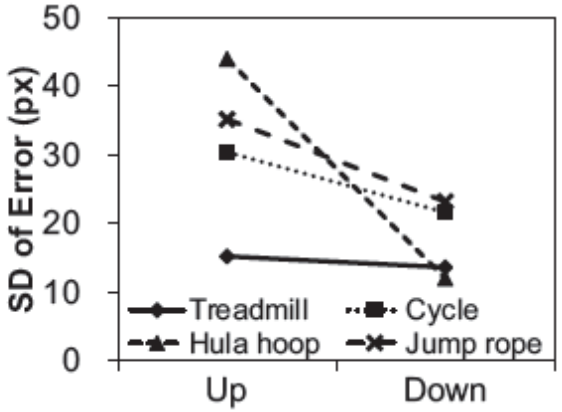
Results

Effects:

Movement direction



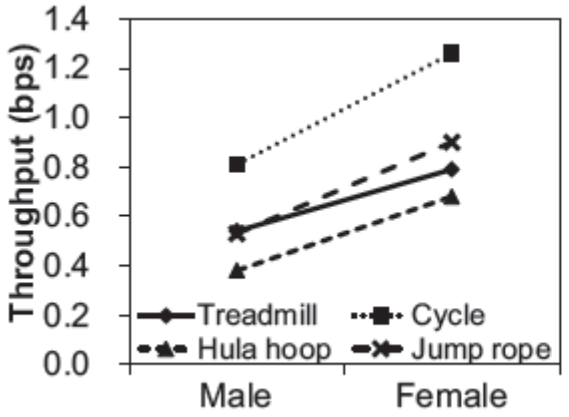


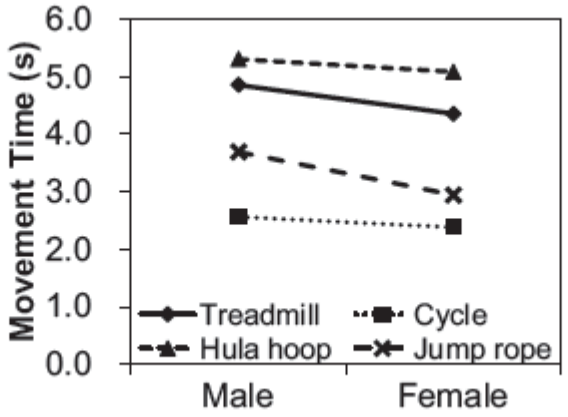


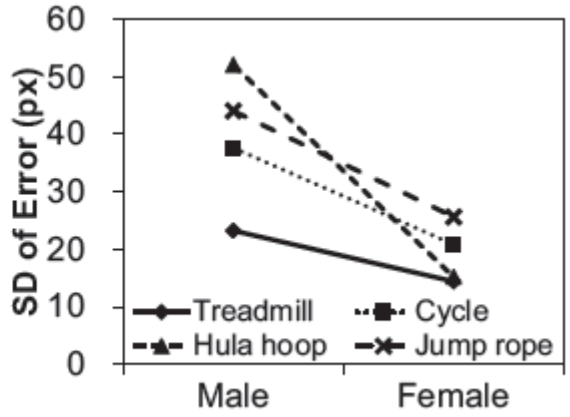
Results

Effects:

Gender







Results

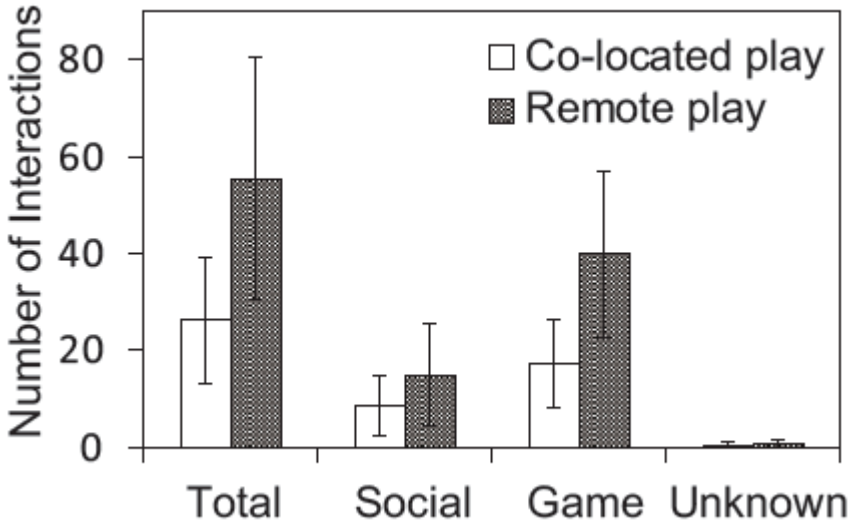
Case Study 1: Balancing and Fairness

Table 1: Game records of the 20 matches

	Homogeneous team	Heterogeneous team
Playing time (sec)	86.30	86.35
# of acquired items	3.35	3.40
# of obstacle collisions	3.30	3.30
# of wins	11	9

Results

Case Study 2: Social Interactions



Conclusion

- Disparate exercises can be turned into fun collaborative activities
- Fair game experiences are achievable
- Players with different exercises can effectively collaborate and compete well while playing the same game.
- Remote exergames did not hinder gaming process, yet promoted more engagement in conversation and exercise.