

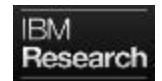
MobyDick

An Interactive Multi-swimmer Exergame

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(KAIST)

Taiwoo Park (Michigan State University)

Inseok Hwang (IBM Research Austin)



A group of people are exercising in a gym. They are holding dumbbells and performing shoulder presses. The background shows a stone fireplace and gym equipment.

50%
of persons drop out of exercise
within 6 months

Wilson & Brookfield, 2009

Reasons for Exercise Drop-out

Lack of

-  Social interaction
-  Motivation
-  Poor body image
-  Expense & Time

Len Kravitz
University of New Mexico



A photograph of a man from behind, wearing a grey t-shirt and dark shorts, pedaling on a stationary bike. He is immersed in a virtual environment displayed on a large screen in front of him. The screen shows a city street scene with buildings, trees, and a road. A white 3D model of a person is walking on the street. The top of the screen has a digital display showing 'kcal', 'km/h', and 'time'.

“A digital game where the outcome of the game is predominantly determined by physical effort.”

Florian Mueller
University of Melbourne

Exertion Game

A woman with braided hair, wearing a dark tank top and shorts, is playing tennis in a video game. She is in mid-swing, holding a white tennis racket. The background shows a bright, colorful sky.

Adapting exertion activities

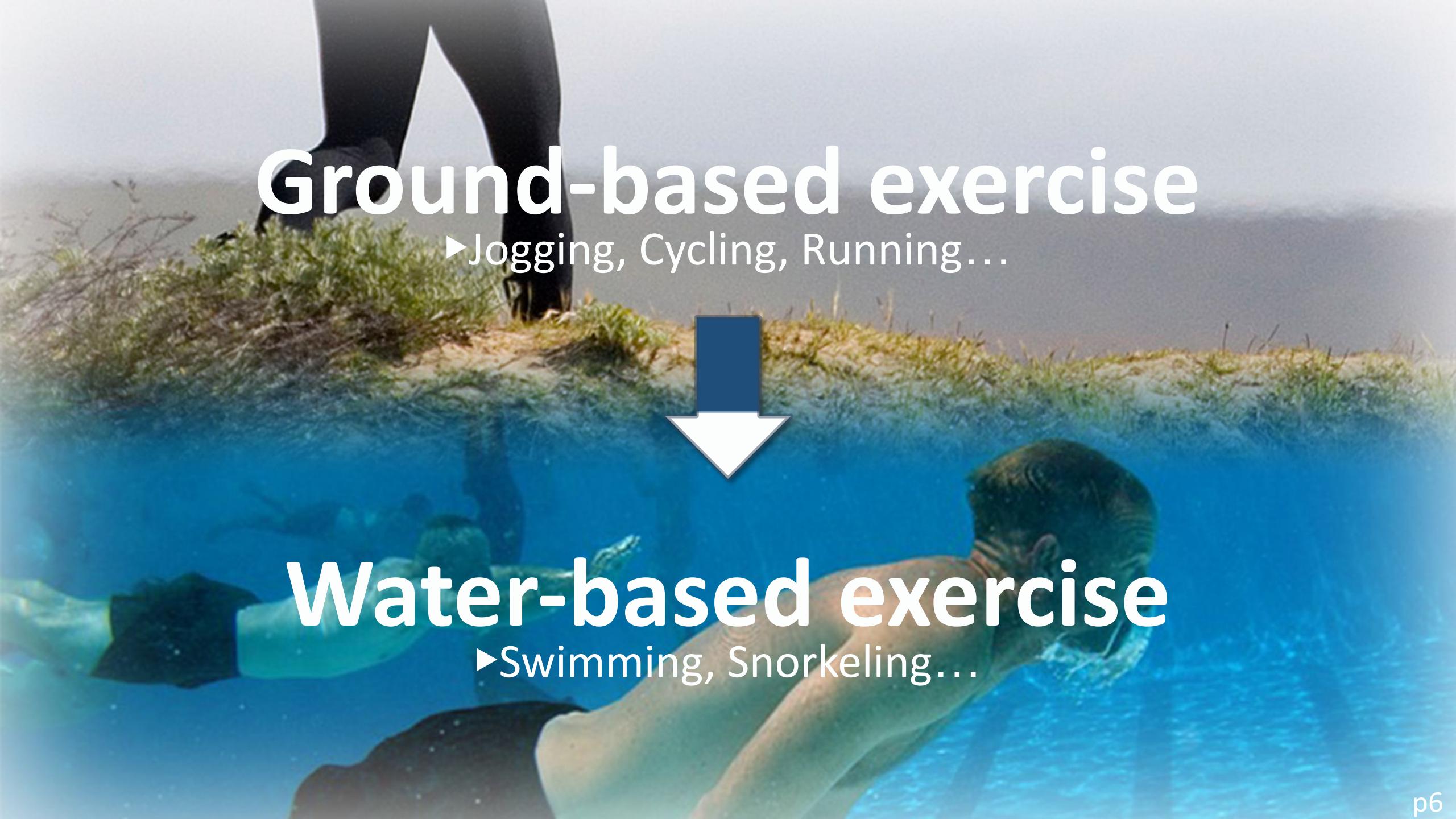
► PCGamerBike, Kinect Sports



A composite image showing two women jogging. On the left, a woman with blonde hair is jogging outdoors in a park-like setting with trees and a fence. On the right, another woman with dark hair is jogging in an urban environment with buildings and a bus in the background. Both women are wearing headphones and appear to be smiling or laughing. A large white text box is overlaid on the image, containing the title.

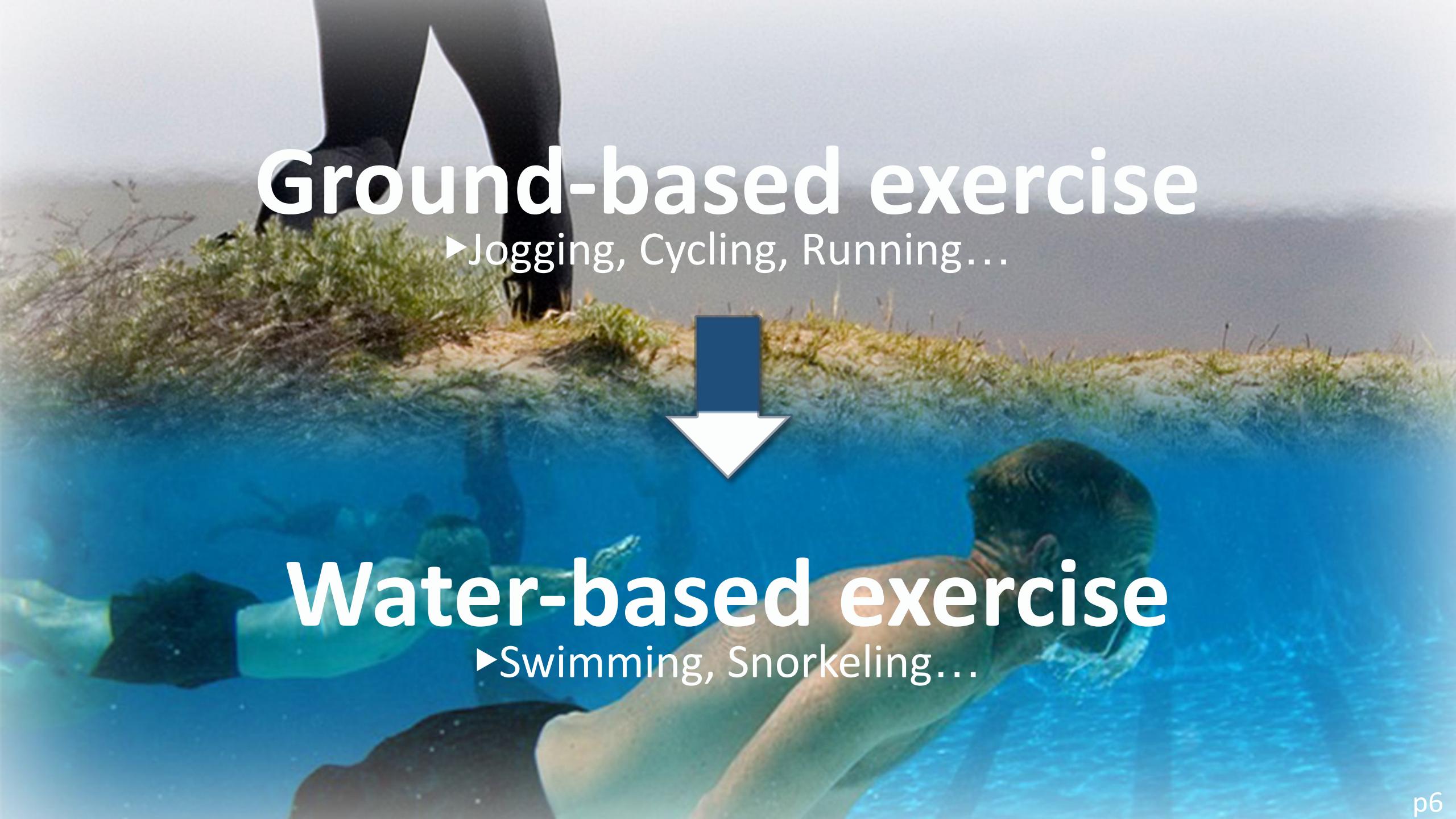
Supporting social interaction

►Jogging over Distance [CHI '07], Remote Impact [CHI '08]

A photograph of a person jogging on a grassy hillside. The person is wearing dark athletic gear and is captured mid-stride. The background shows a hazy landscape with hills under a clear sky.

Ground-based exercise

► Jogging, Cycling, Running...

A photograph of a person swimming in clear blue ocean water. The person's head is above water, and their body is partially submerged. The background shows the vast ocean and a clear sky.

Water-based exercise

► Swimming, Snorkeling...

A photograph of a swimmer performing the butterfly stroke in a pool. The swimmer is in the middle of the stroke, with arms extended forward and legs kicked powerfully. Red lane lines are visible in the water. The background shows the edge of the pool.

Transforming
swimming
activity into
multi-player
exergame

MobyDick Game.mp4



How to enable
wireless
communication
among **swimmers**

A swimmer wearing a black Speedo swim cap and goggles is performing the butterfly stroke in a swimming pool. The swimmer's arms are extended forward, and they are in the middle of a pull. A large amount of water is splashing around their head and arms. Two white exclamation marks are overlaid on the image, one near the swimmer's head and another further back towards the right side of the frame.

How to recognize
swimming activity
in real time



How to
design
an **exergame**
considering **swimming**
contexts



Research Agenda

NETWORKING PERFORMANCE IN THE POOL



How to enable wireless communication among swimmers

SWIMMING STROKE RECOGNITION



How to recognize swimming activity in real time

GAME DESIGN AND USER STUDY



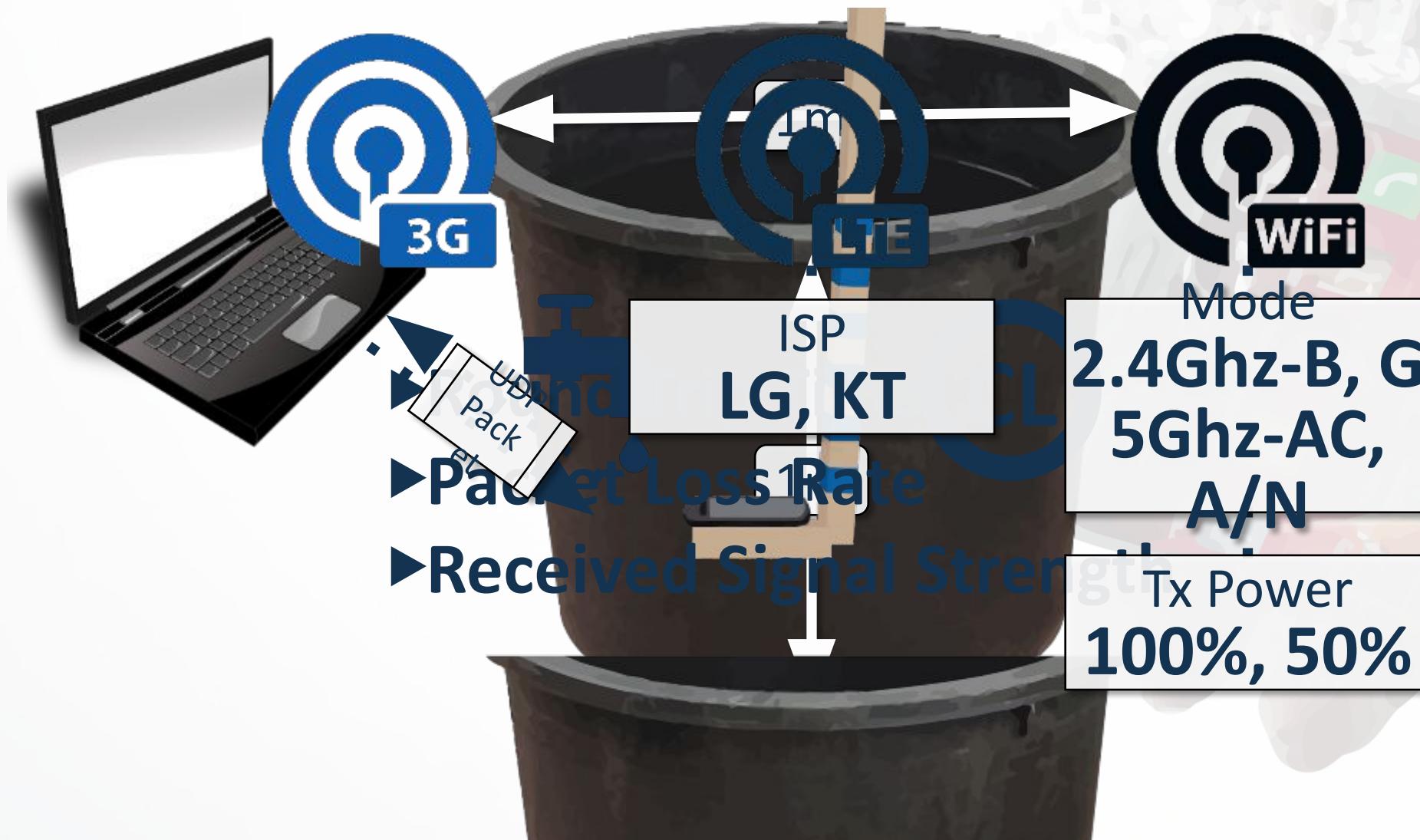
How to design an exergame considering swimming contexts

1. Networking Performance in the Pool

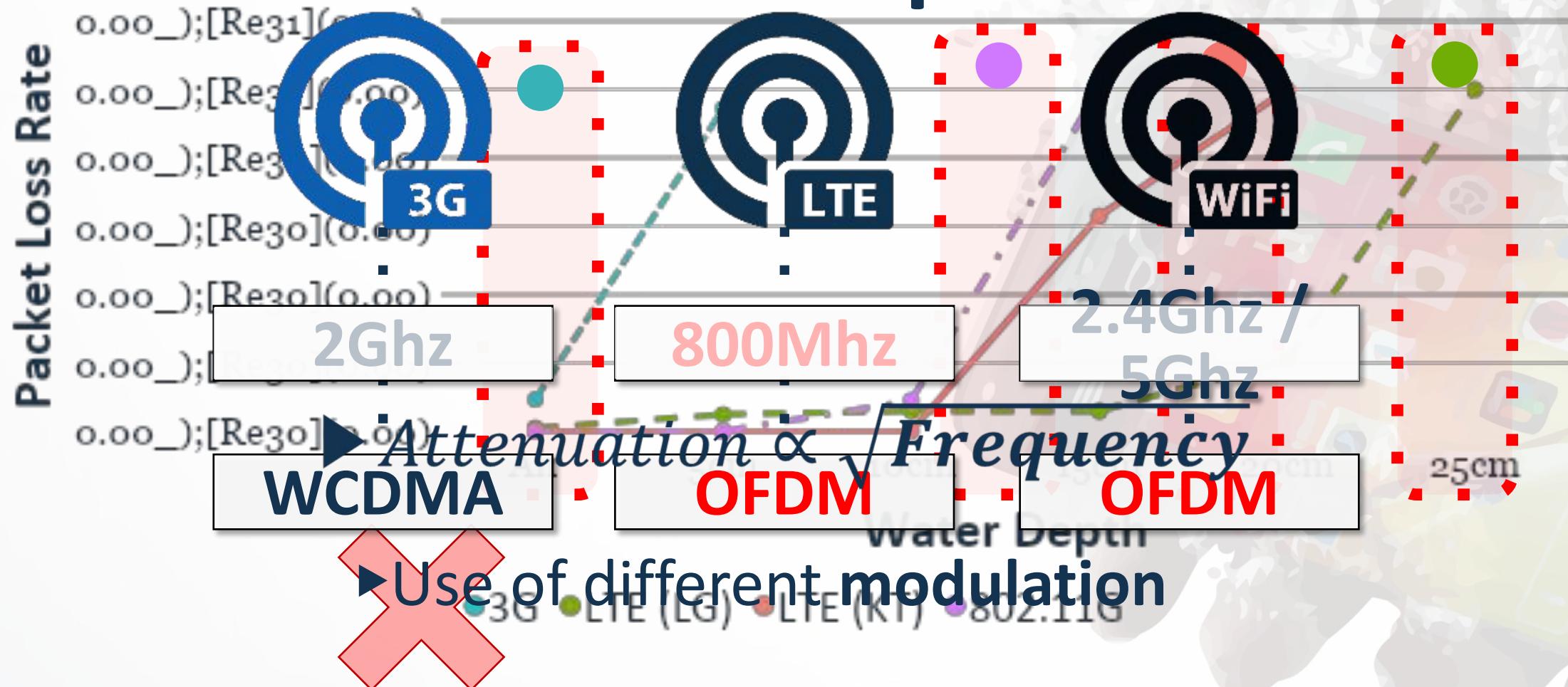
- ▶ Network performance by **water depth**
- ▶ Network **reconnection time**
- ▶ Network performance by **swimming styles**



Experimental setup



Network performance by water depth



The depth of 20cm...?

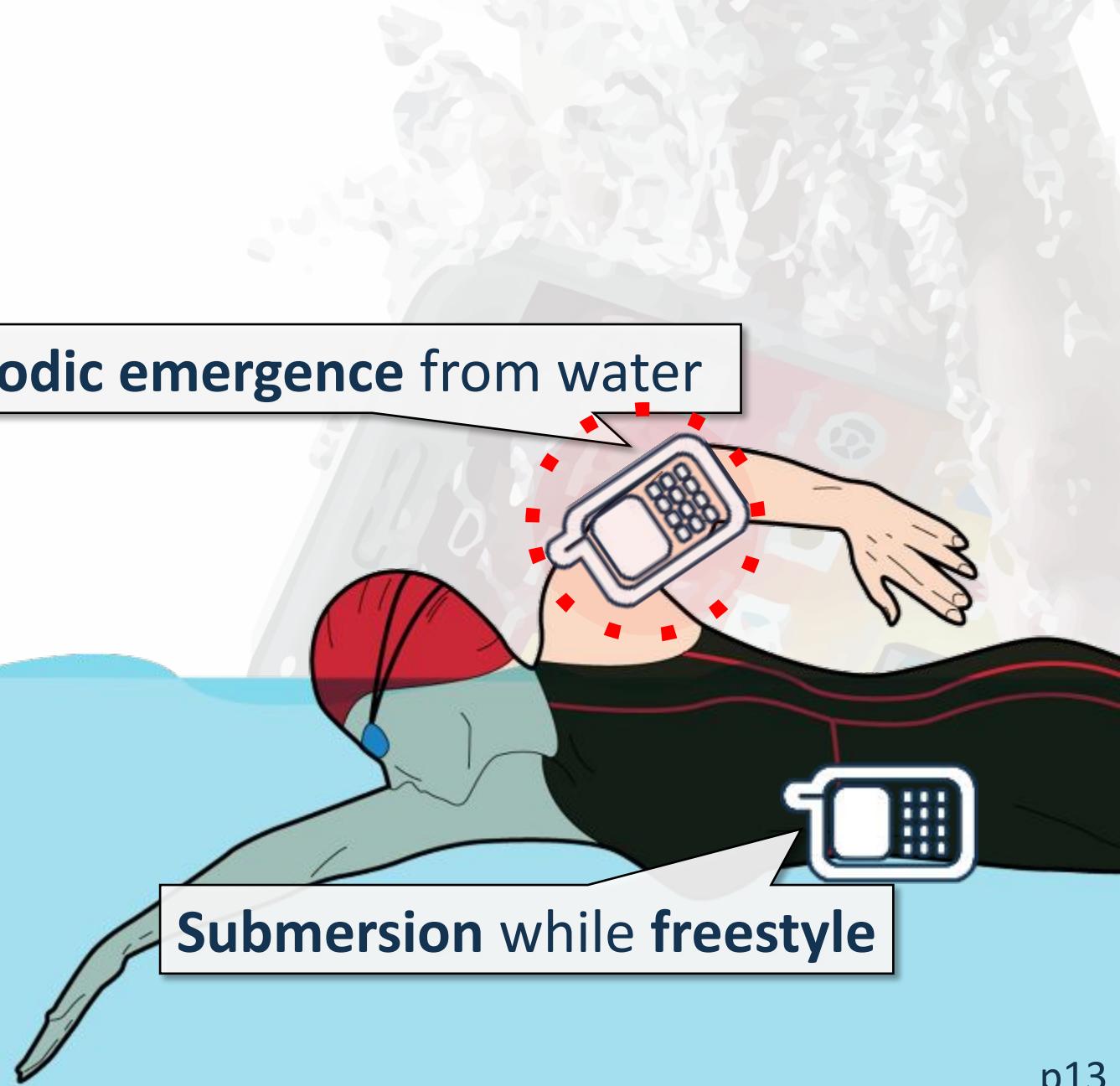
Available while swimming?

Still poor channel conditions...

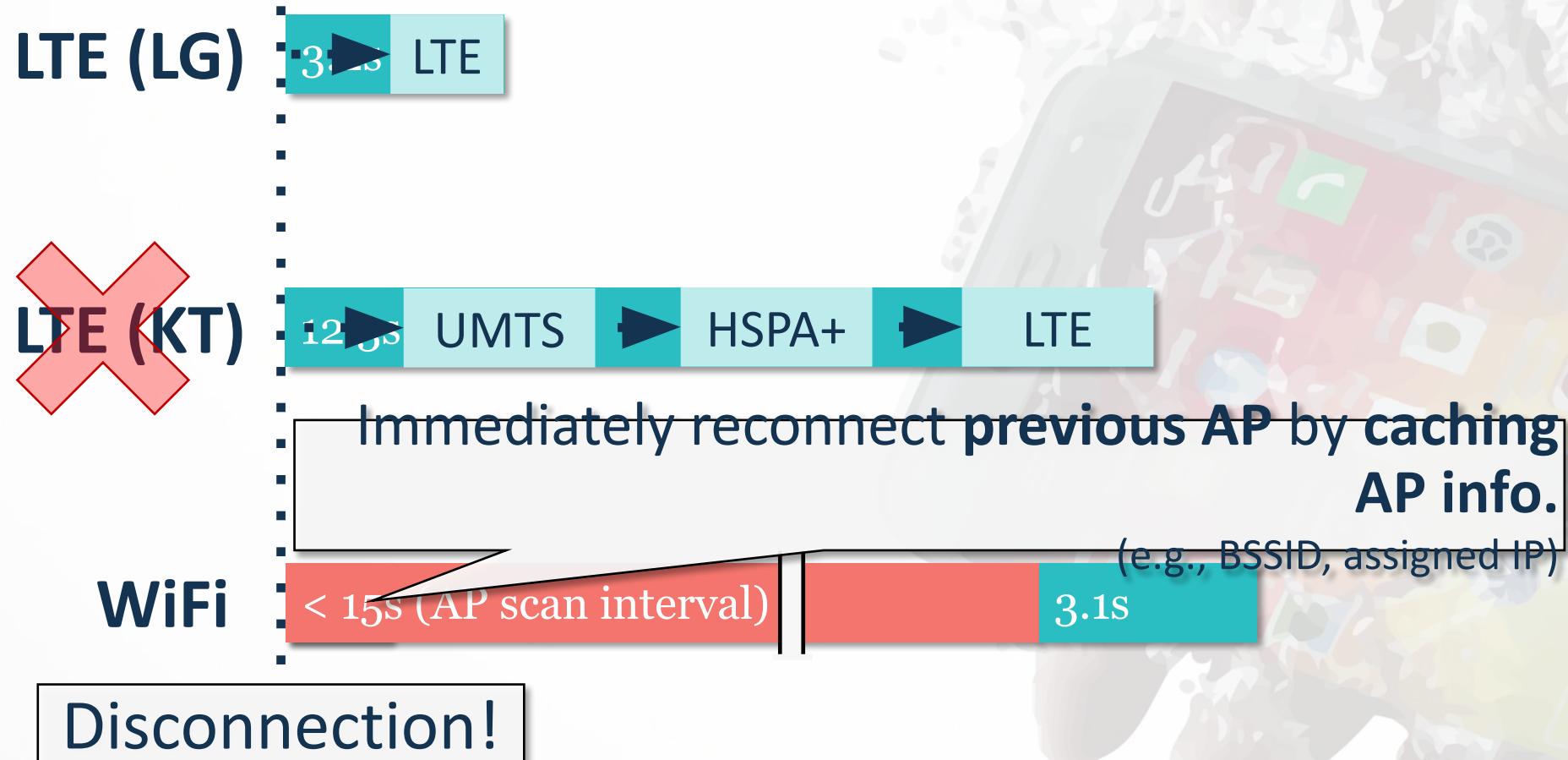
Disconnection might occur!

Periodic emergence from water

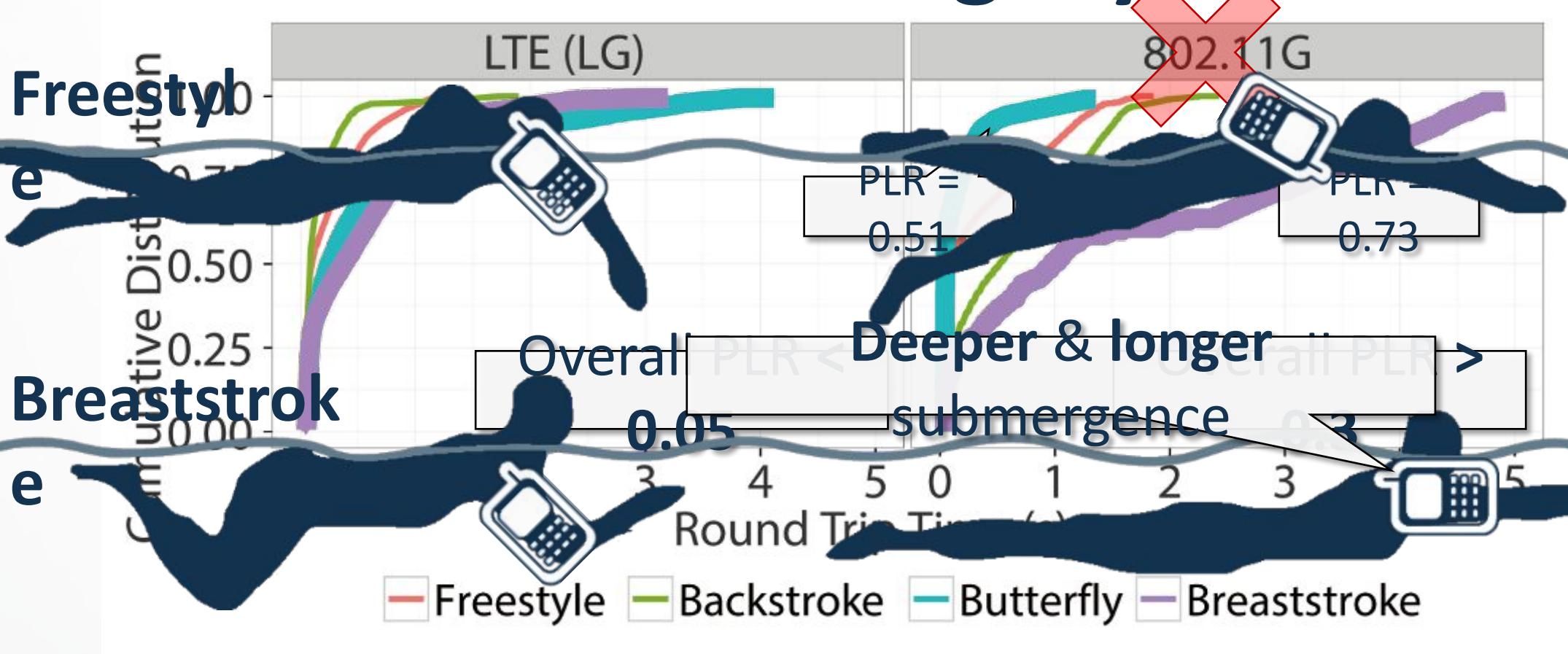
Submersion while freestyle



Network reconnection time



Network performance in swimming styles



| | |
|--|--|
| <p>LTE</p>  <p>most robust under swimming contexts</p> | <p>SWIMMING STYLES</p>  <p>significant performance variation</p> |
| <p>WATER DEPTH</p>  <p>performance degradation /occasional disconnection</p> | <p>RECONNECTION TIME</p>  <p>need enough time to re-establish connectivity</p> |

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How to design an exergame considering swimming contexts

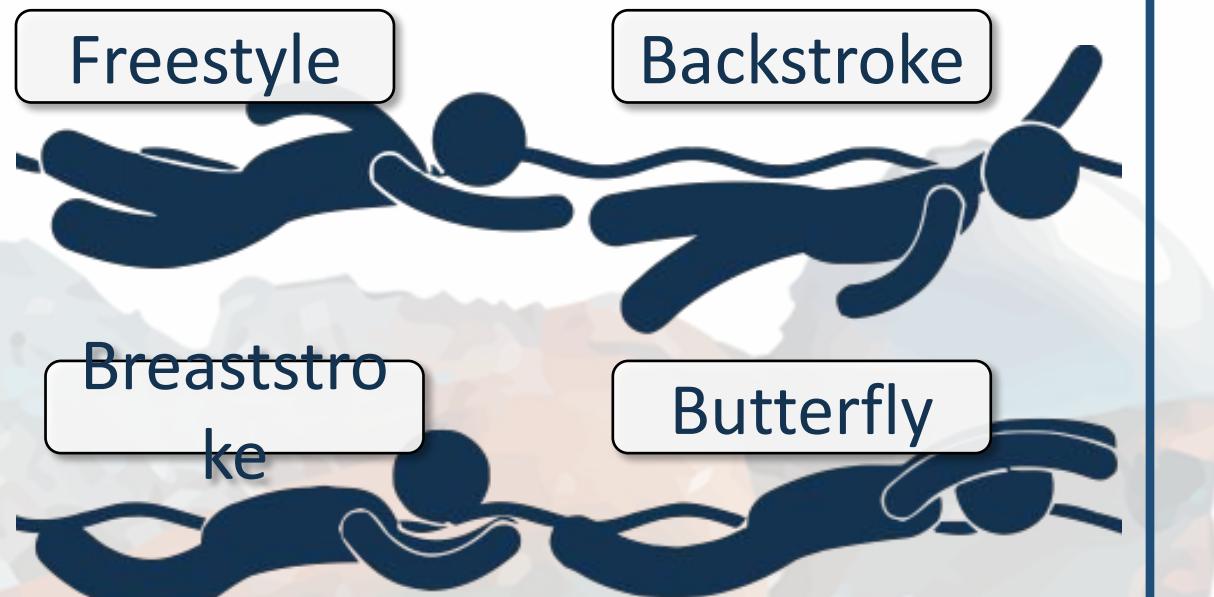


2. Swimming Stroke Recognition

- ▶ Swimming style classification
- ▶ Stroke timing detection

Intrinsic swimming activities

Swimming Styles

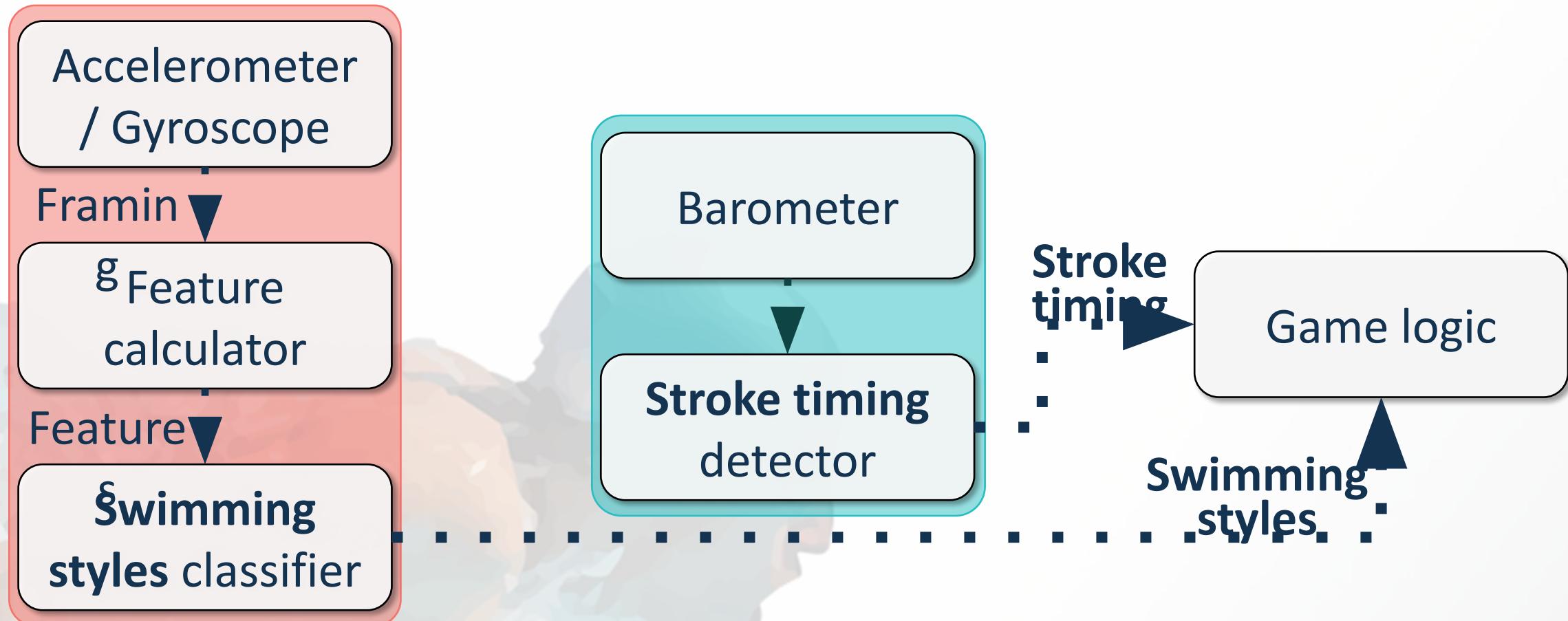


Stroke Timing

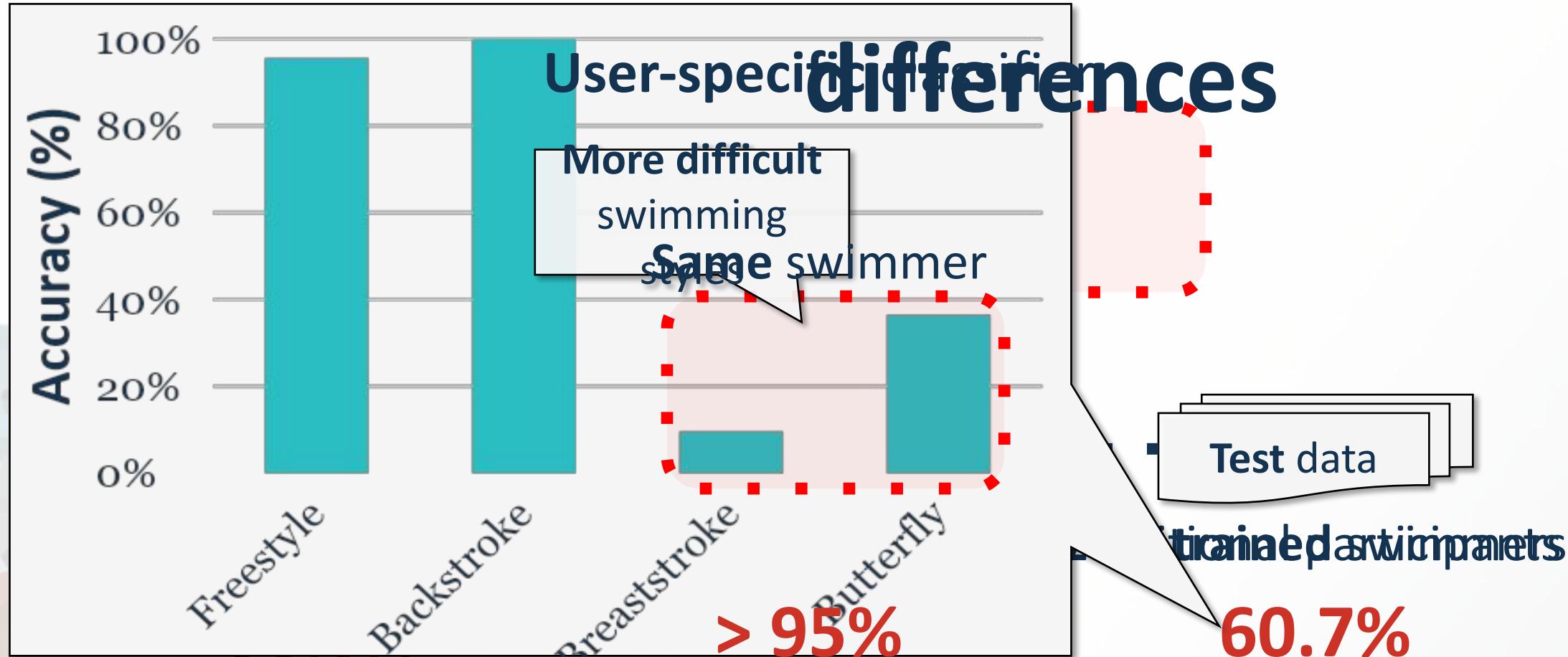
Stroke Timing.wmv

StrokeSense

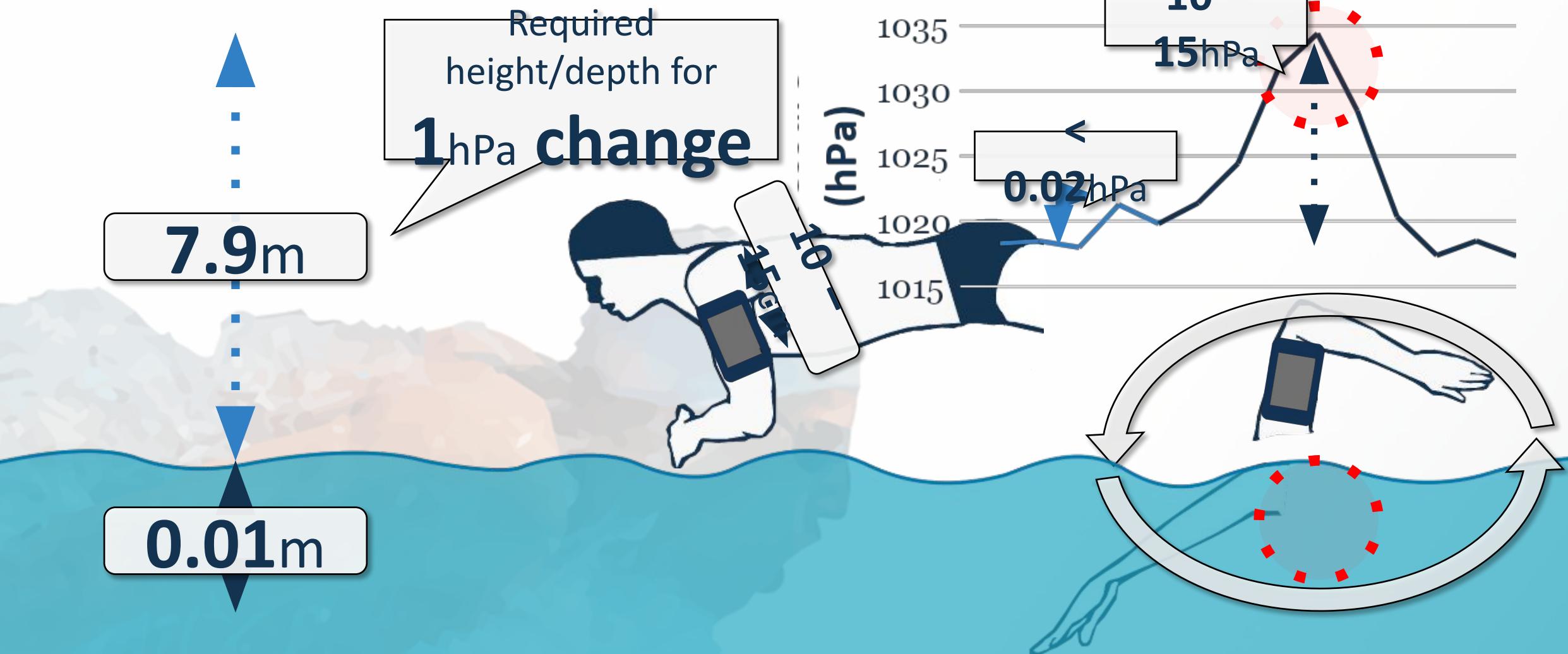
swimming styles& stroke timing recognition system



Swimming styles classification & Effect of skill level



Stroke timing detection using barometer



STROKESENSE



swimming styles &
stroke
timing recognition
system

SKILL DIFFERENCES



user-specific swimming
styles classification

BAROMETRIC SENSOR



stroke timing as peaks of
barometric values

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SWIMMING STROKE RECOGNITION



How to recognize swimming activity in real time

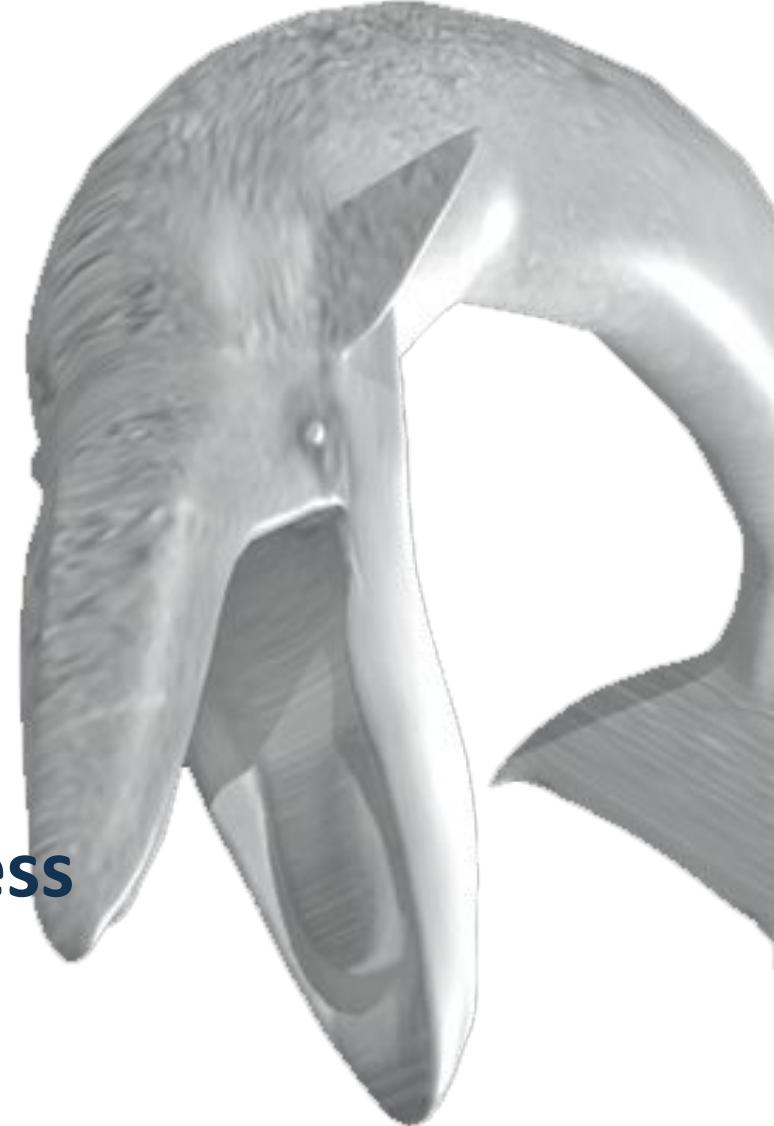
GAME DESIGN AND USER STUDY



How to design an exergame considering swimming contexts

3. Game Design & User Study

- ▶ Mapping swimming activities into the game
- ▶ Multi-player collaboration with social awareness cues
- ▶ Loss- and Latency-tolerant design

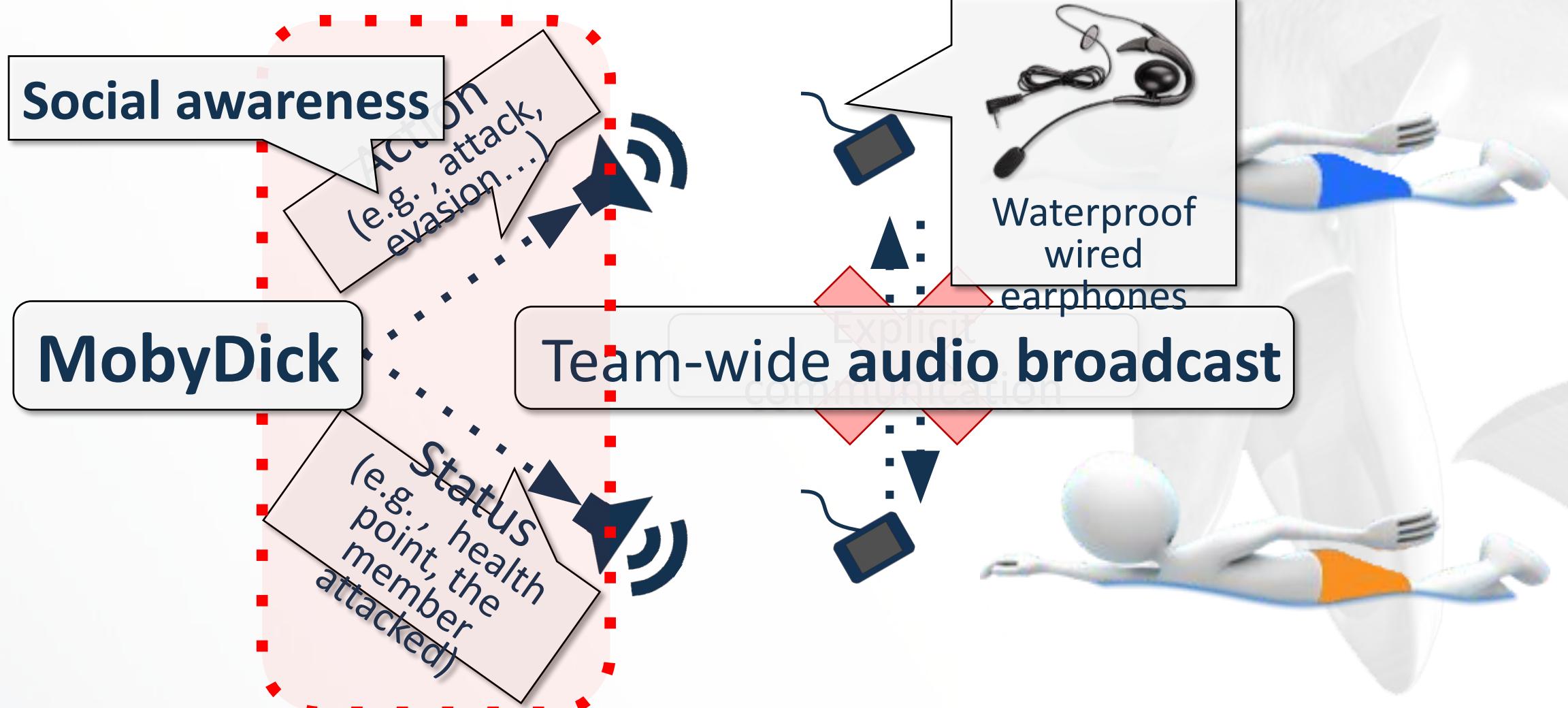


Mapping
swimming activities
into the **game**

Swimming Styles Mapping.wmv



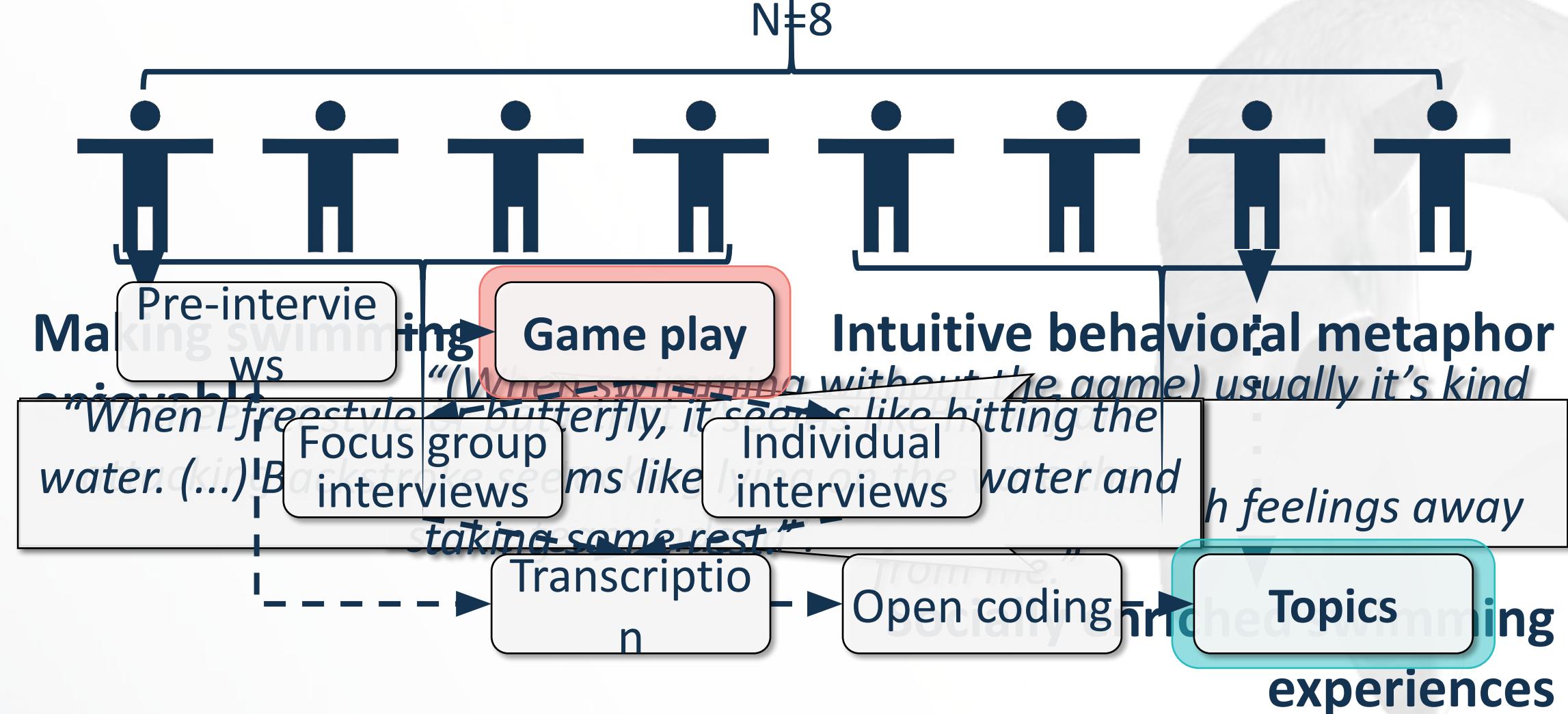
Multi-player collaboration with social awareness cues



Loss- and Latency-tolerant design



User study



Future Work

SWIMMING STYLES CLASSIFICATION



general classification model considering the unique characteristics of swimming

EXERCISE INTENSITY



adapting swimmer's condition into the game (e.g., heart rate)

GROUP FITNESS SWIMMING



explore novel social interactions in group fitness swimming

Summary

| | | | | |
|---|---|--|---|---|
| NETWORKING PERFORMANCE IN THE POOL |   | the most robust network under water. LTE degrades network performance over time and it takes enough time to reconnect. |   | water depth degrades network performance. Swimming styles influences network performance. |
| SWIMMING STROKE |  | swimming styles & stroke timing |  | user-specific stroke classification to cover skill level |
| RECOGNITION GAME DESIGN |  | recognition mapping swimming styles into game commands |  | multi-player collaboration with social awareness cues |
| AND USER STUDY | | |  | barometric loss- & latency-tolerant game design |