

# MobyDick

## An Interactive Multi-swimmer Exergame

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**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 person is seen from behind, walking on a treadmill. The treadmill is positioned in front of a large projection screen that displays a virtual city street scene. The person is wearing a light-colored t-shirt and dark pants. The virtual environment includes buildings, a street with a white pedestrian crossing, and a yellow figure in the distance. At the top of the screen, there are game statistics: 'kcal', 'km/h', 'km', and 'time'. A 'START' banner is visible on the left side of the screen. The overall scene is dimly lit, with the primary light source being the projection screen.

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

Florian Mueller  
University of Melbourne

# Exertion Game



# Adapting exertion activities

► PCGamerBike, Kinect Sports



# Supporting social interaction

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



# Ground-based exercise

▶ Jogging, Cycling, Running...

# Water-based exercise

▶ Swimming, Snorkeling...

A photograph of two swimmers in a pool. One swimmer is in the foreground, performing a butterfly stroke, with their arms extended forward and water splashing around them. Another swimmer is visible in the background, also performing a butterfly stroke. The pool is filled with blue water, and red lane dividers are visible in the foreground and background.

Transforming

**swimming**

activity into

**multi-player  
exergame**



*MobyDick Game.mp4*



How to enable  
**wireless**  
**communication**  
among **swimmers**



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



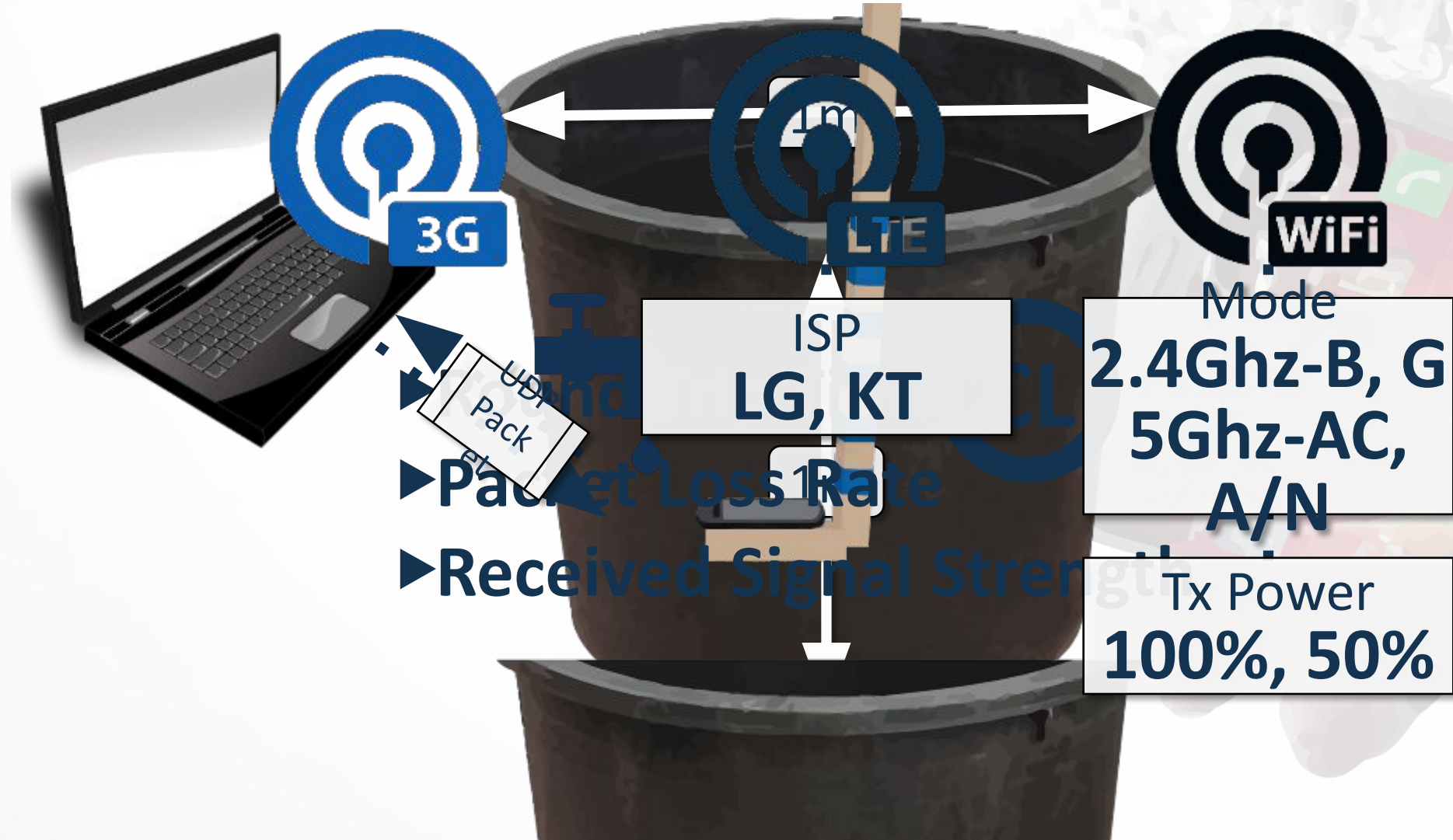
How to design an exergame considering swimming contexts

# 1. Networking Performance in the **Pool**

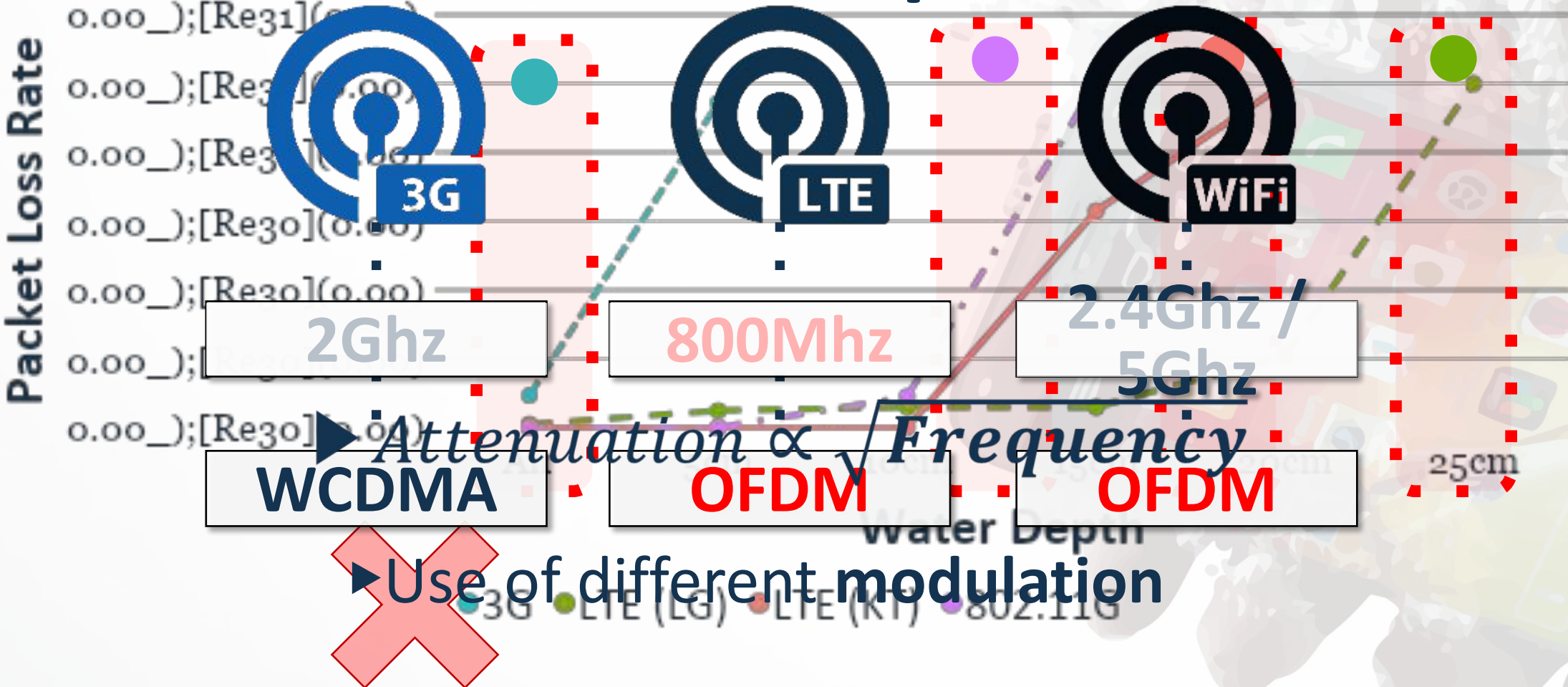
- ▶ Network performance by **water depth**
- ▶ Network **reconnection time**
- ▶ Network performance by **swimming styles**



# Experimental setup



# Network performance by water depth





The depth of 20cm...?

**Available**  
while **swimming?**

Periodic emergence from water

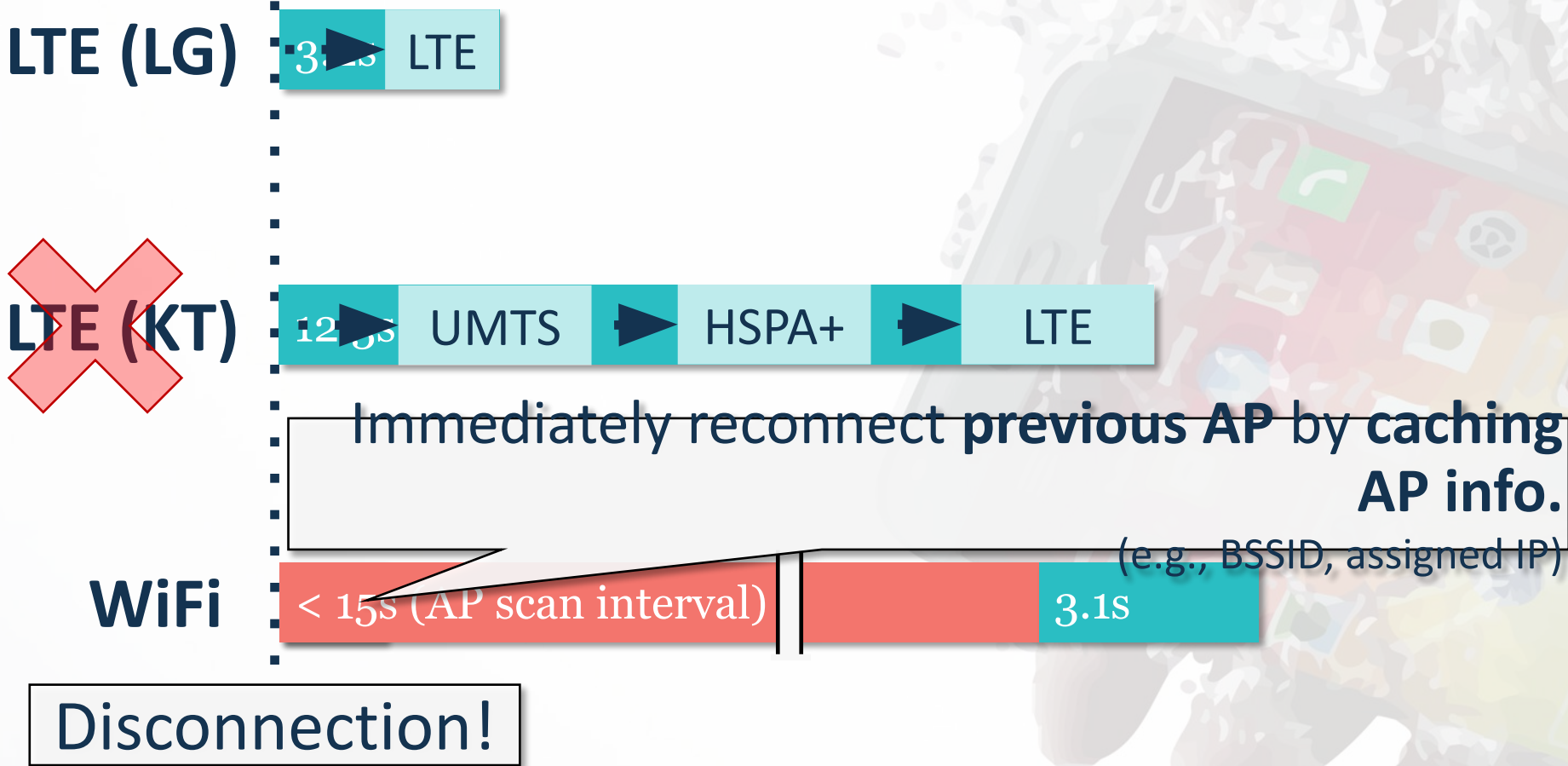
Still poor channel conditions...

**Disconnection**  
might **occur!**

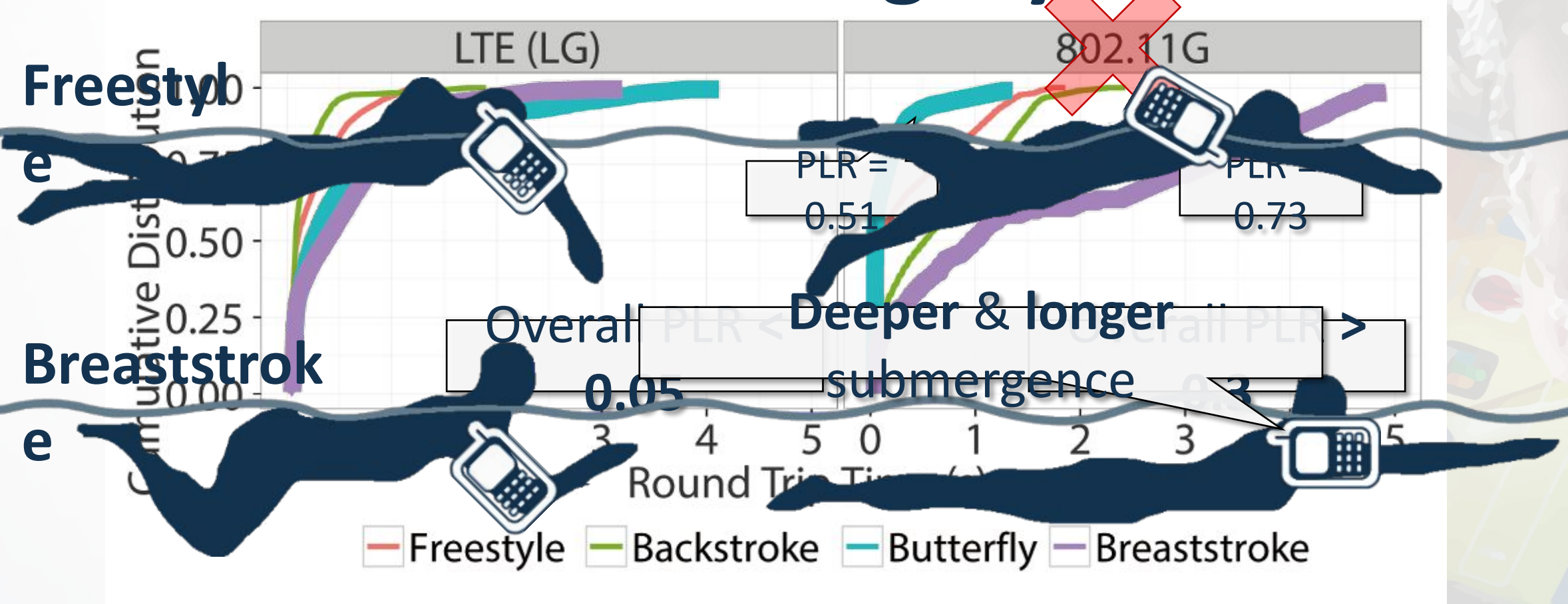
Submersion while freestyle



# Network reconnection time



# Network performance in swimming styles



LTE



most robust under swimming  
contexts

SWIMMING STYLES



significant performance variation

WATER DEPTH



performance degradation /occasional  
disconnection

RECONNECTION TIME



need enough time to re-establish  
connectivity

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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

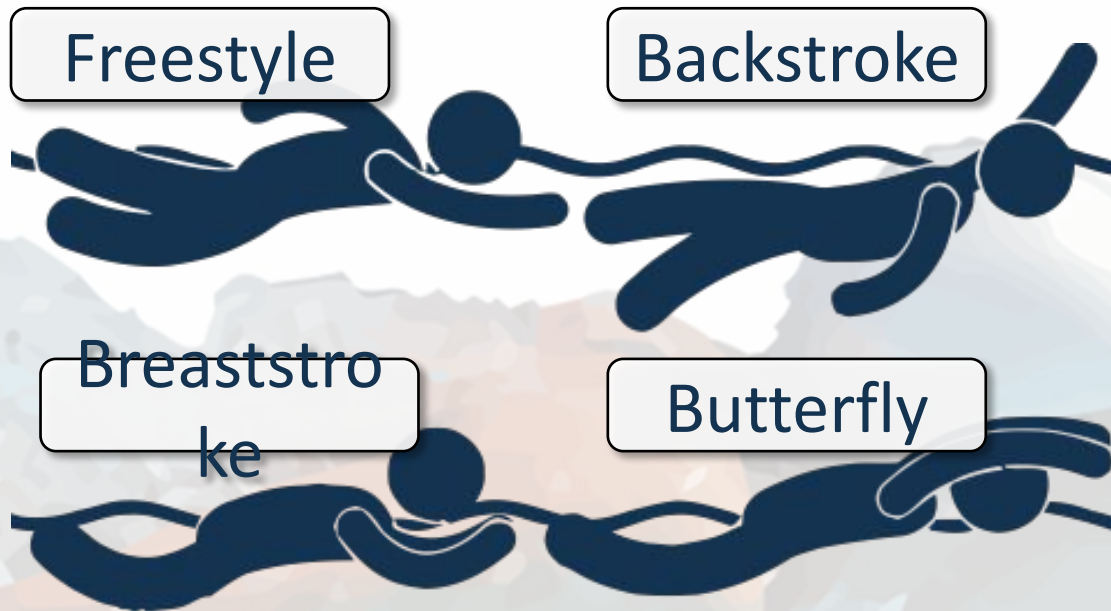
## 2. Swimming Stroke Recognition



- ▶ **Swimming style classification**
- ▶ **Stroke timing detection**

# Intrinsic swimming activities

## Swimming Styles

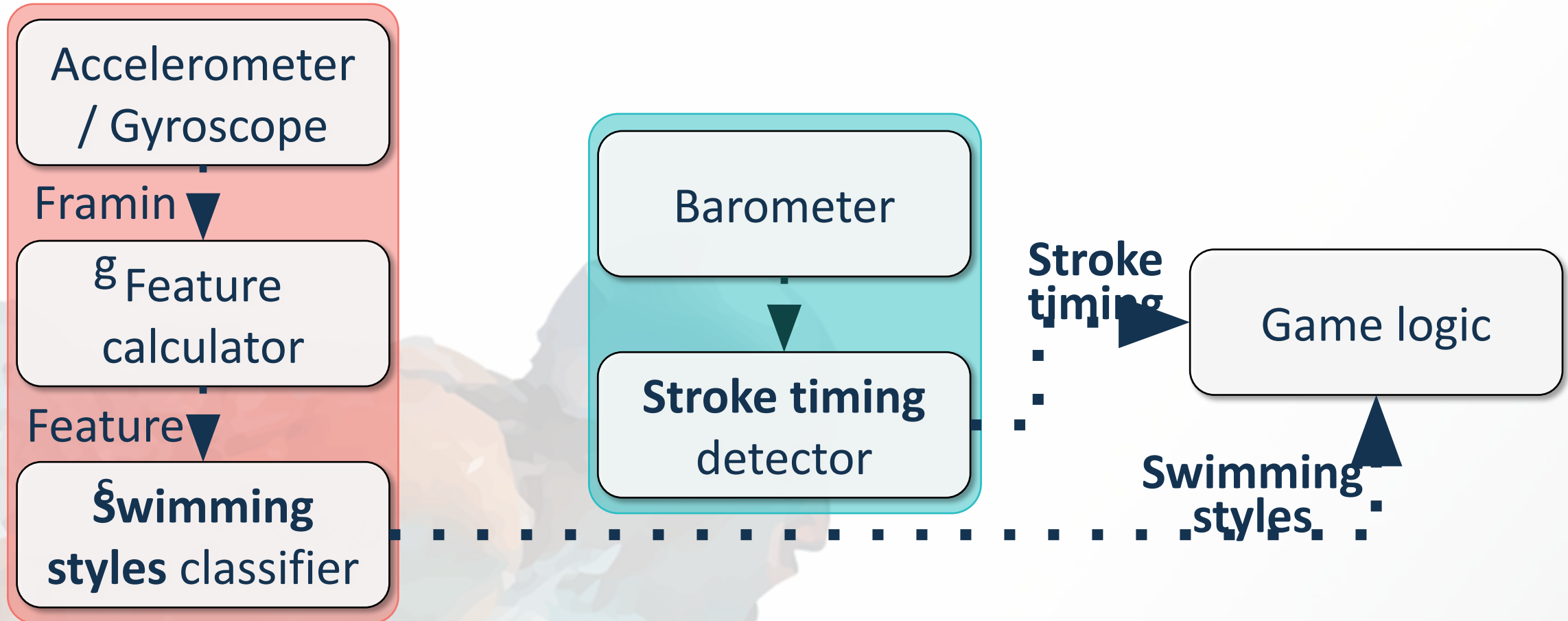


## Stroke Timing

*Stroke Timing.wmv*

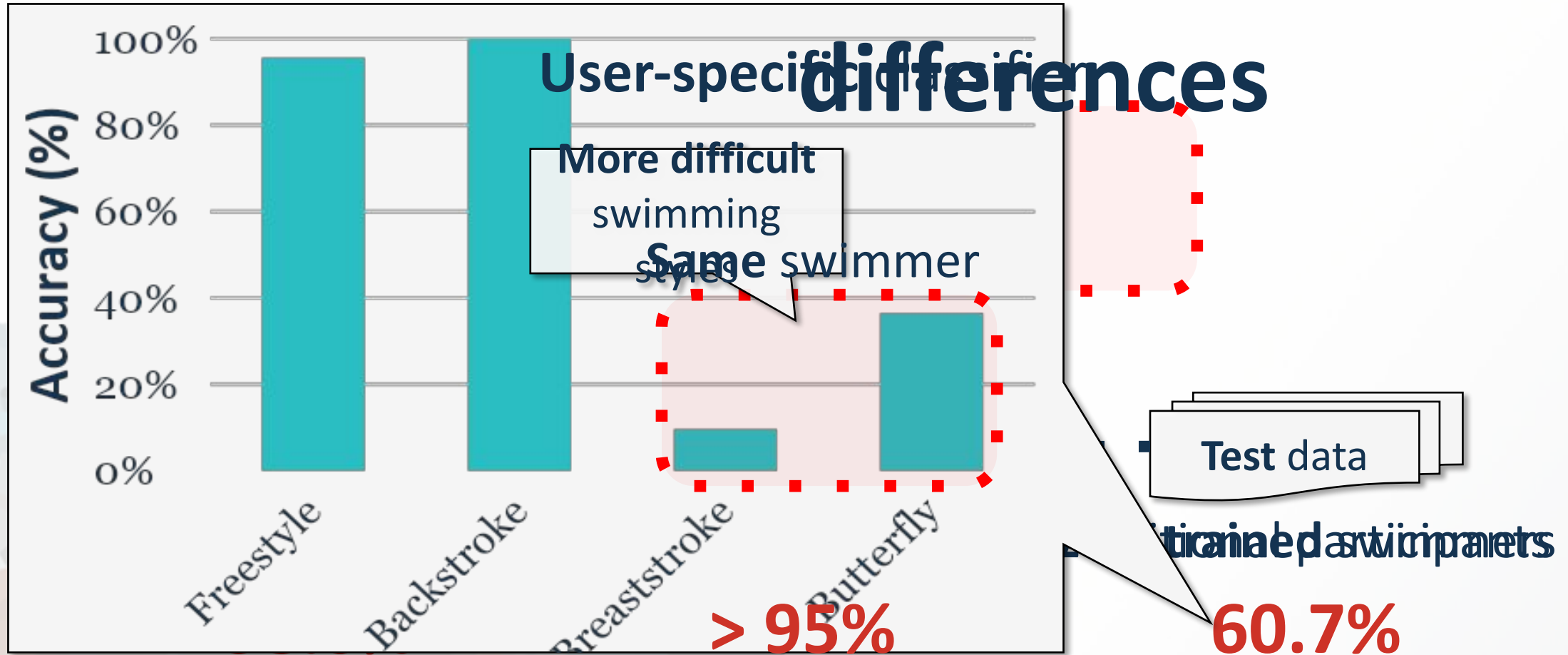
# StrokeSense

swimming styles & stroke timing recognition system

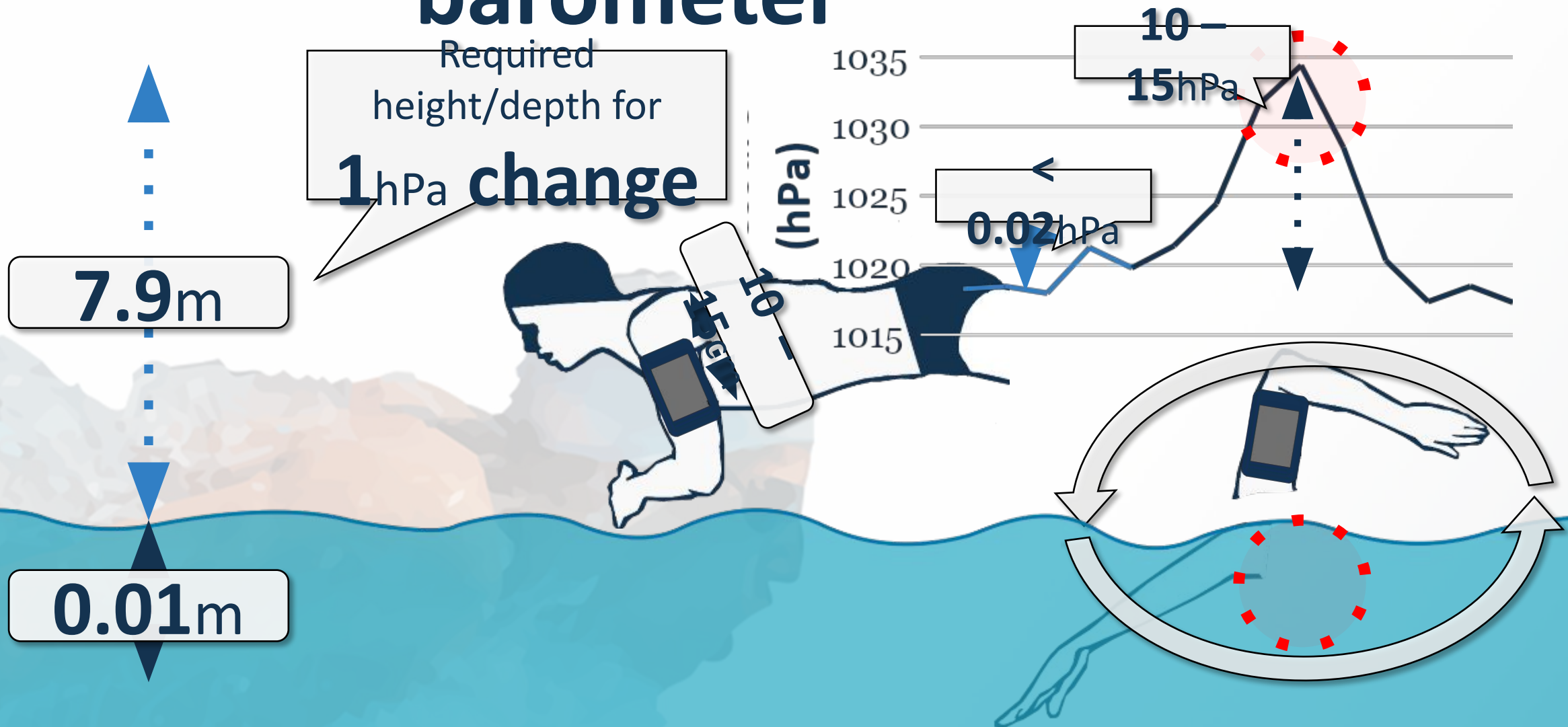




# Swimming styles classification & Effect of skill level



# 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  
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How to recognize swimming activity in real time

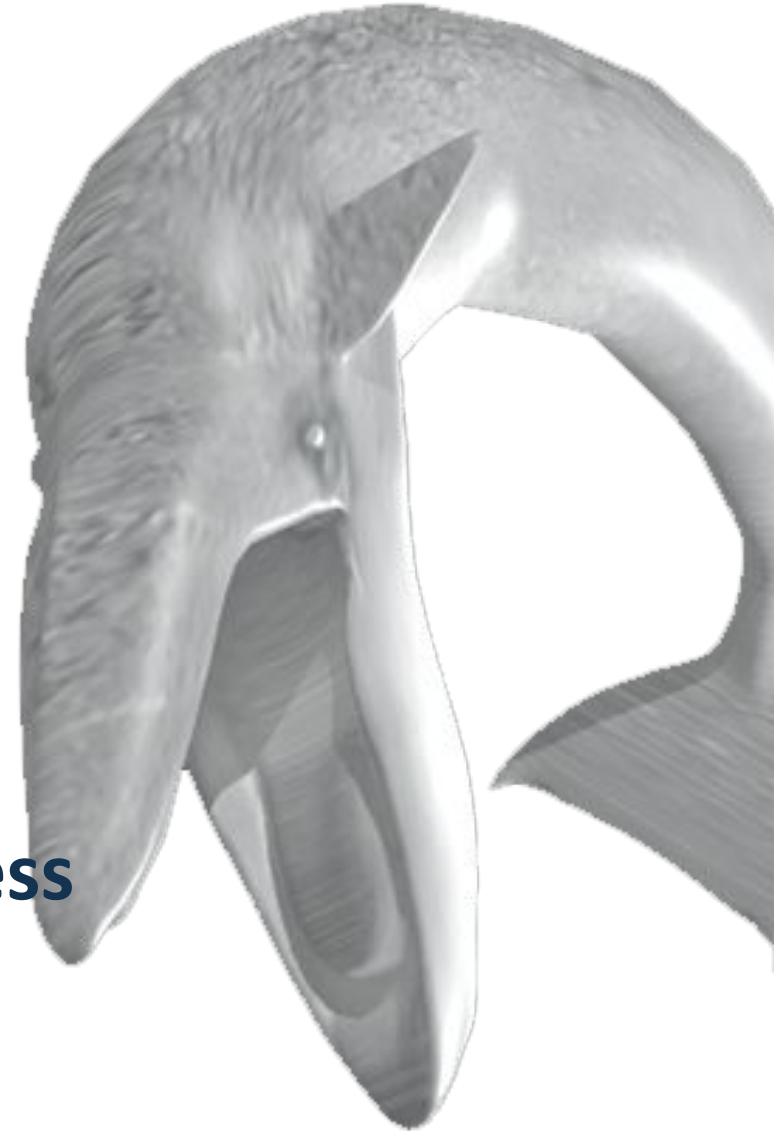
GAME DESIGN  
AND  
USER STUDY



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



**Social awareness**

Action  
(e.g., attack, evasion...)

**MobyDick**

Status  
(e.g., health point, the member attacked)

**Team-wide audio broadcast**

Waterproof wired earphones

# Loss- and Latency-tolerant design

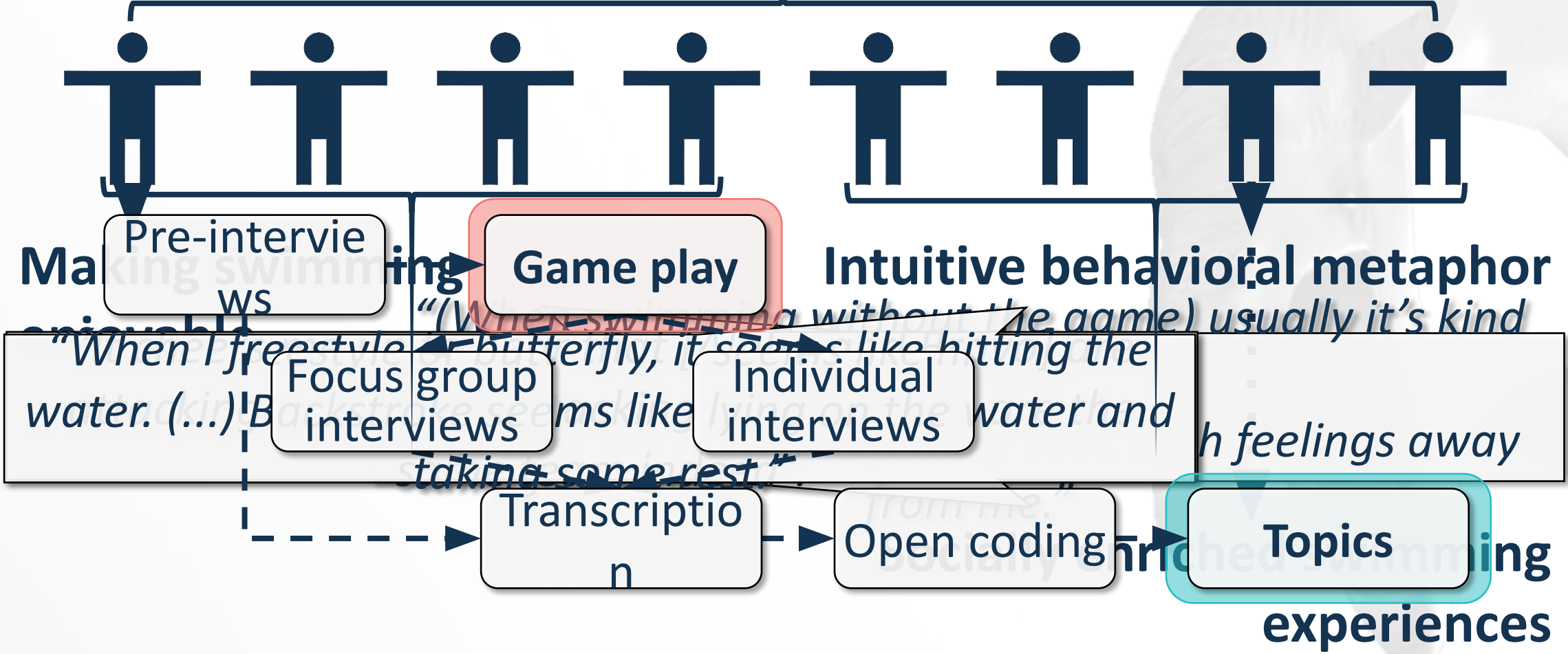


Swimming freestyle frequency works for updates increase



# User study

N=8



# 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 need enough time to reconnect



water depth degrades network performance  
swimming styles influences network

SWIMMING  
STROKE



swimming styles & stroke timing



user-specific classification to cover skill level



stroke timing detection using

RECOGNITION  
GAME DESIGN  
AND  
USER STUDY



recognition mapping swimming styles into game commands



differences multi-player collaboration with social awareness cues



barometric values loss- & latency-tolerant game design