

# An Analysis of



# Players' Game Hours

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# Game Operators' Wishes

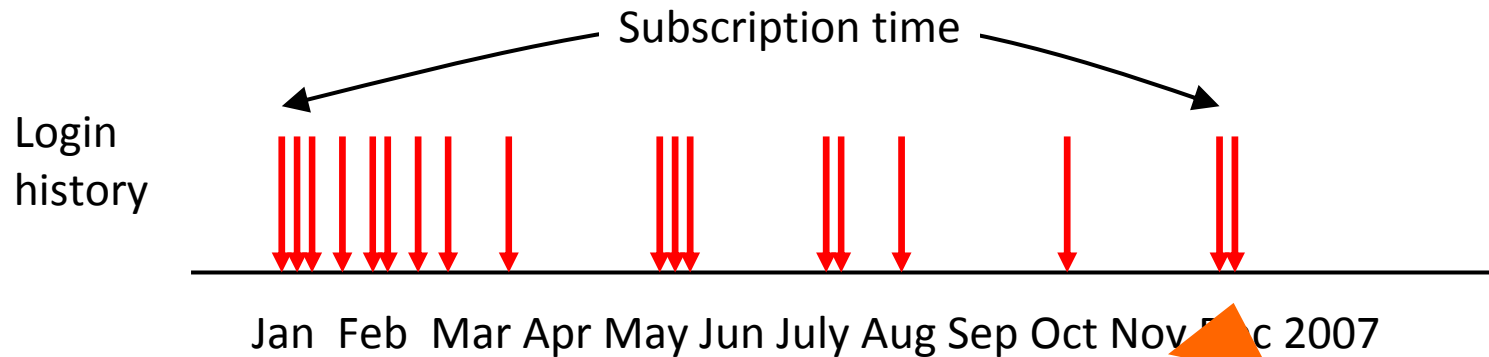
- MMORPG revenue depending on **the number of active subscribers**
  - Monthly subscription fees
  - Selling virtual items (through item mall)
- From game operators' perspective, they are interested to know (predict):
  - **How many players will join a game?**
  - **How long they will stay in the game?**

# User Population Prediction

- Predicting how many gamers will join?
  - HARD; Too many non-technical issues
    - Release date (whether during long vacation?)
    - Artistic design (comic-like or realistic?)
    - Cultural factors (Western- or Eastern-style?)
- Predicting how long players will continue to stay
  - Should be correlated with **the extent of users' involvement**
    - How long they spend in the game each day?
    - How quickly their avatars advance to new levels?
  - That's what we pursue in this study

# User Subscription Time

- User subscription time
  - The length of time since a player joined a game to the time of her last login



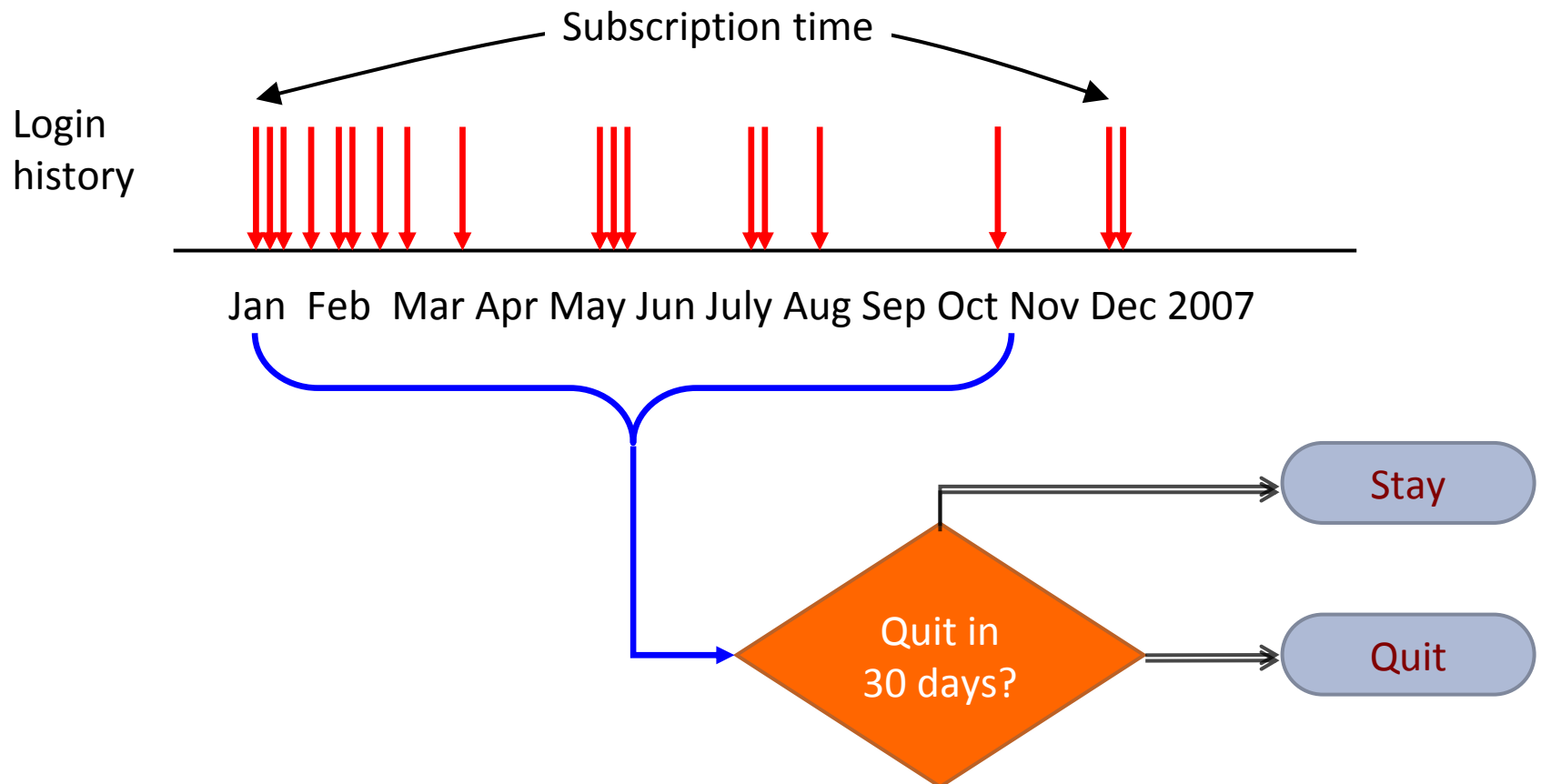
- Unsubscription time (= last login time)
  - Can we predict this time point?

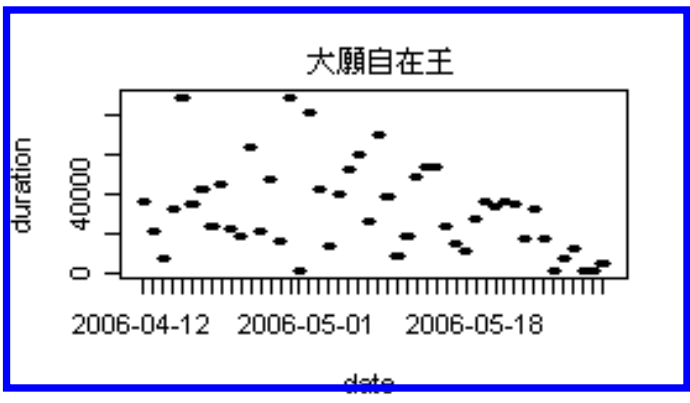
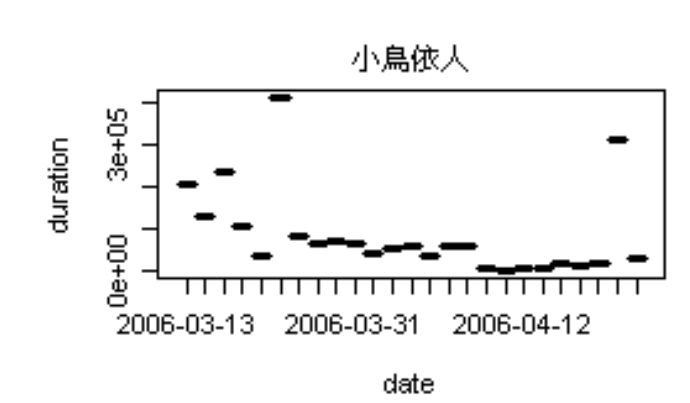
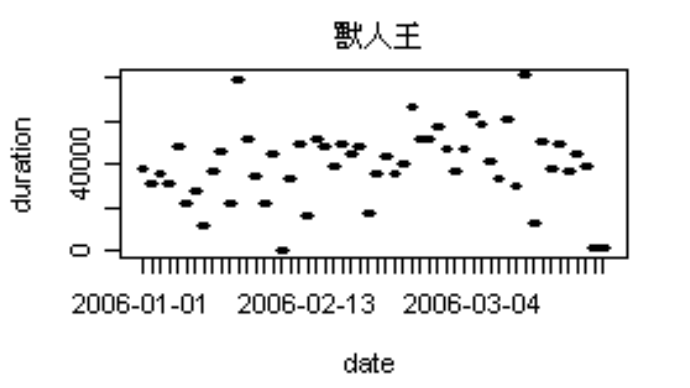
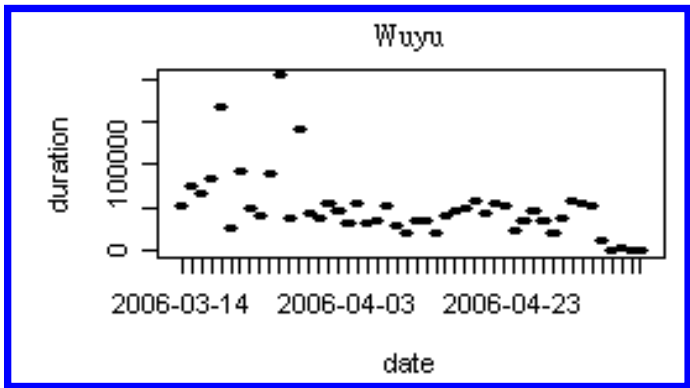
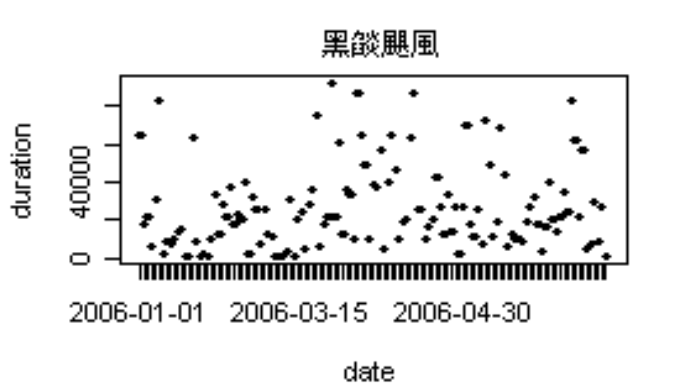
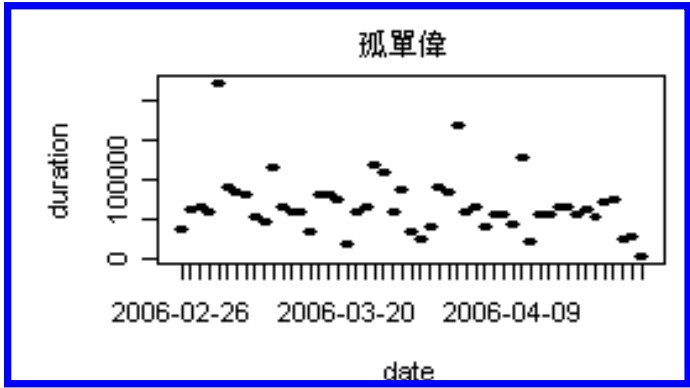
# Applications of Unsubscription Prediction

- **Game improvement**
  - Players' unsubscription → low satisfaction
  - Surveys can be conducted to determine the causes of player dissatisfaction and improve the game accordingly
  - More likely to receive useful comments before players quit
- **Prevent VIP players' quitting (maintain revenue)**
  - For "item mall" model, users' contribution (of revenue) is heavy-tailed
  - Losing VIP players may significantly harm the revenue
- **Network/system planning and diagnosis**
  - By predicting "which" players tend to leave the game → investigating is there any problem regarding network resource planning, network congestion, or server arrangement

# Unsubscription Prediction: Our Proposal

- Rationale: players' satisfaction / enthusiasm / addiction to a game is embedded in her **game play history**





# What We Have Done

- Collect players' game session traces

34,524 WoW players for 2 years

- Analyze the characteristics of the game play time

- Perform predictability study

Short-term prediction is feasible; however, long-term prediction is much more difficult



# Talk Progress

- Overview
- Game trace collection
- How long do gamers play?
- When do gamers play?
- Predictability analysis
- Future work



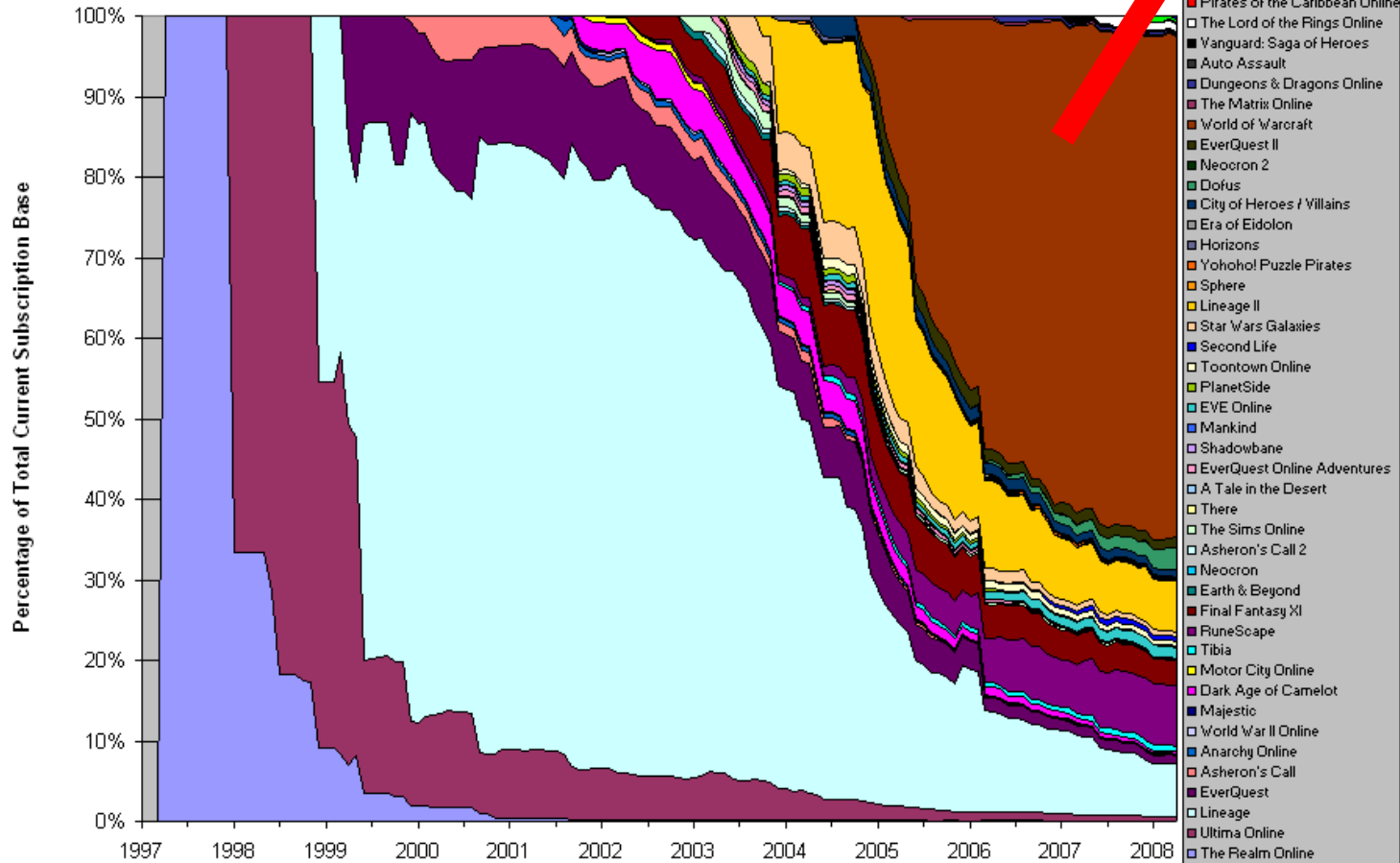


# World of Warcraft



- The most popular MMOG for now

Total MMOG Active Subscriptions - Relative Contribution



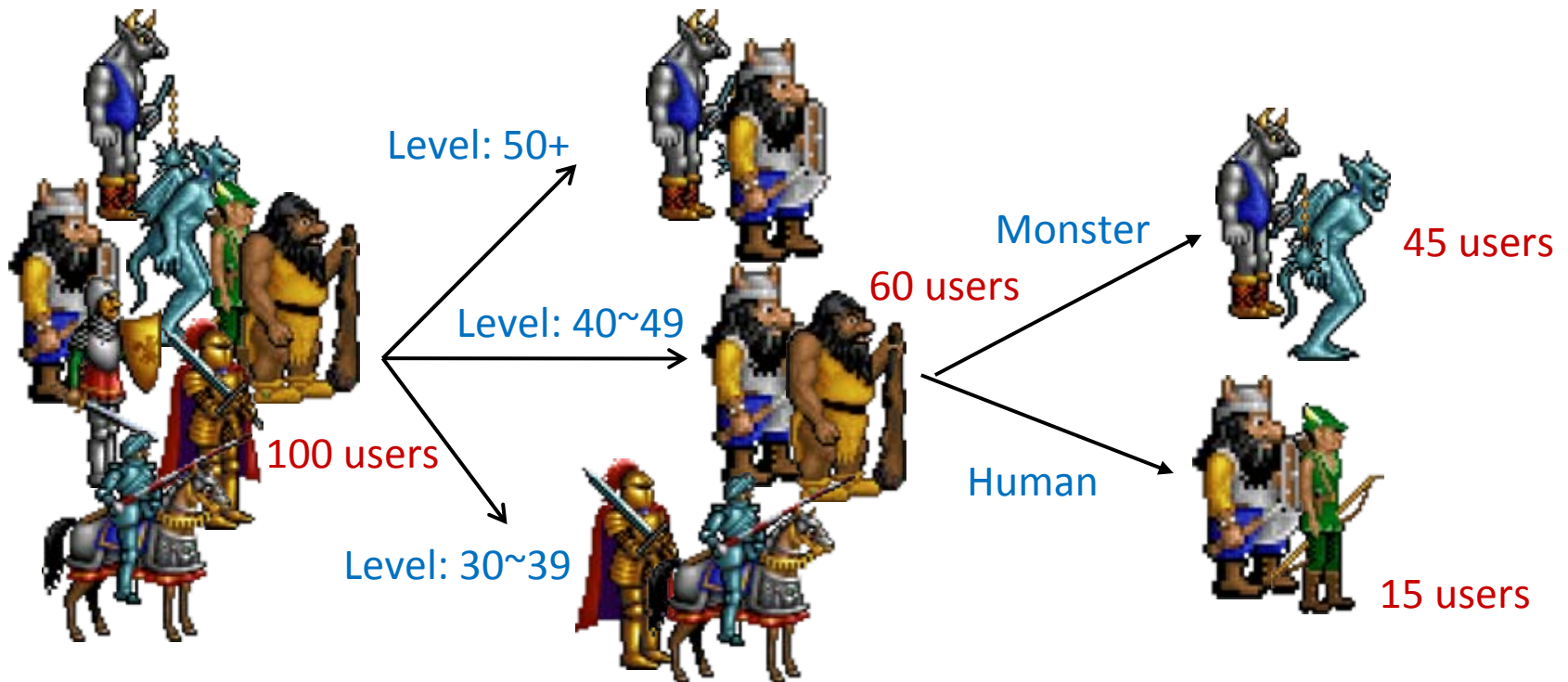
# Data Collection Methodology

- Create a game character
- Use the command '*\who*'
- The command asks the game server to reply with a list of players who are currently online
- Write a specialized data-collection program (using C#, VBScript, and Lua)



# The Limitation of WoW API

- WoW returns at most 50 users in one query
- We narrow down our query ranges by dividing all the users into different races, professions, and levels



# Trace Summary

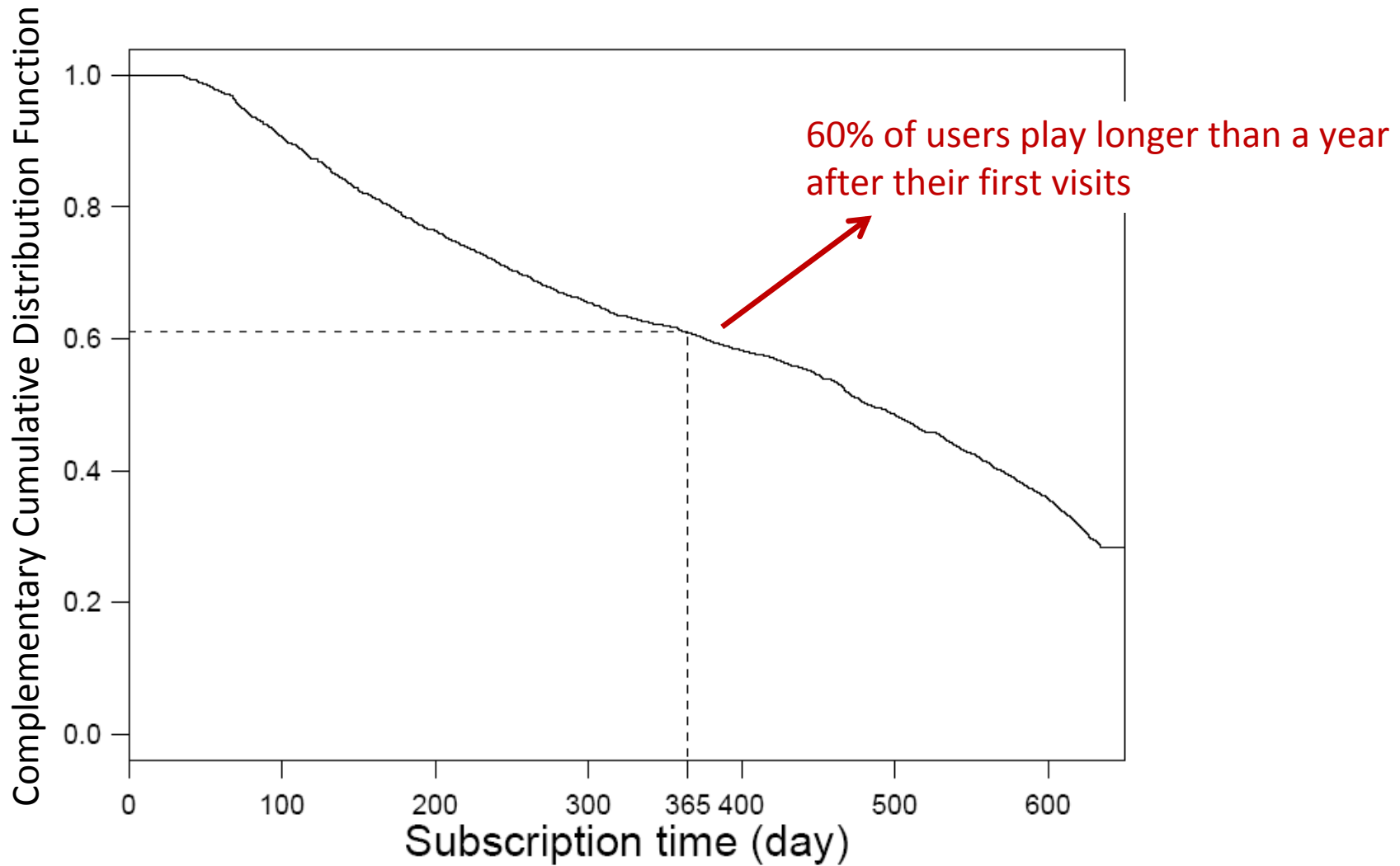
WoW trace	
Start date	2005-12-22
End date	2007-10-17
Length	664 days
Total sessions	1,672,820
Accounts observed	34,521



# How Long Do Gamers Play?

- Unsubscription definition: Assume if player has “quitted” a game if she has not shown up for 3 months
- Analysis in three different time scales
  - Subscription time
  - Consecutive gameplay days
  - Daily gameplay activity

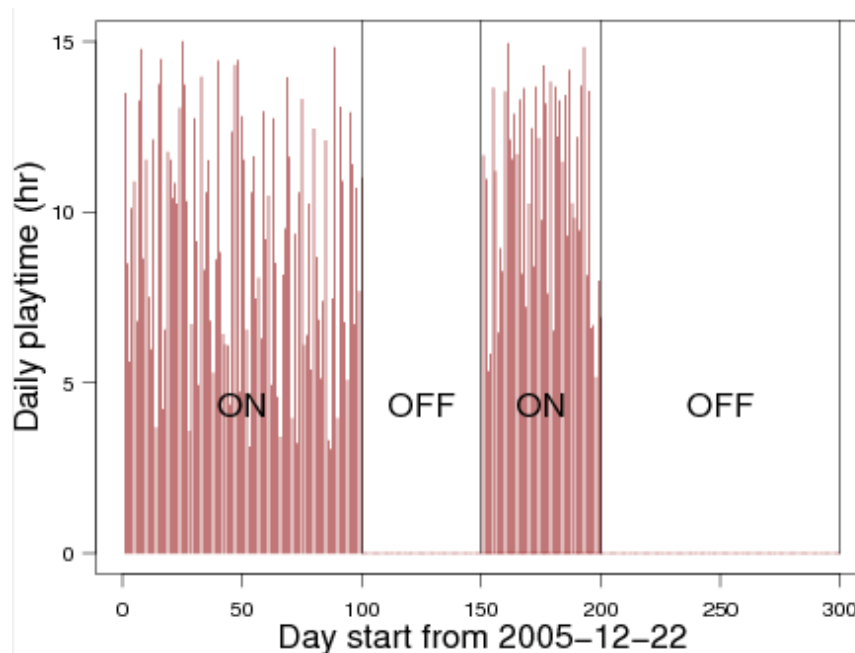
# Subscription Time



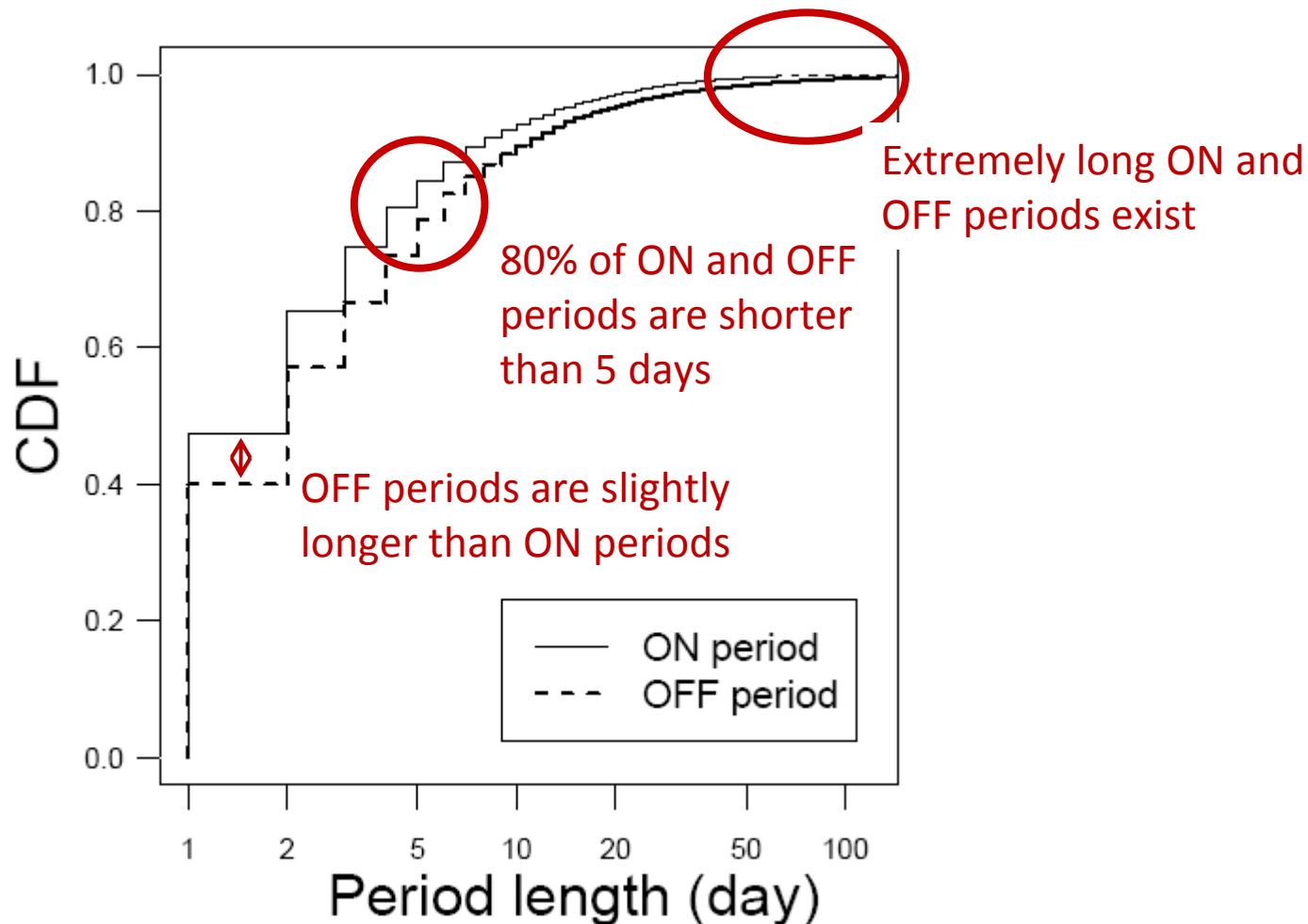


# Consecutive Game Play Days

- Consecutive game play days → an indicator of addiction
- An **ON period** as a group of consecutive days during which a player joins the game everyday
- An **OFF period** as the interval between two ON periods.



# Cumulative Distribution of ON/OFF Periods

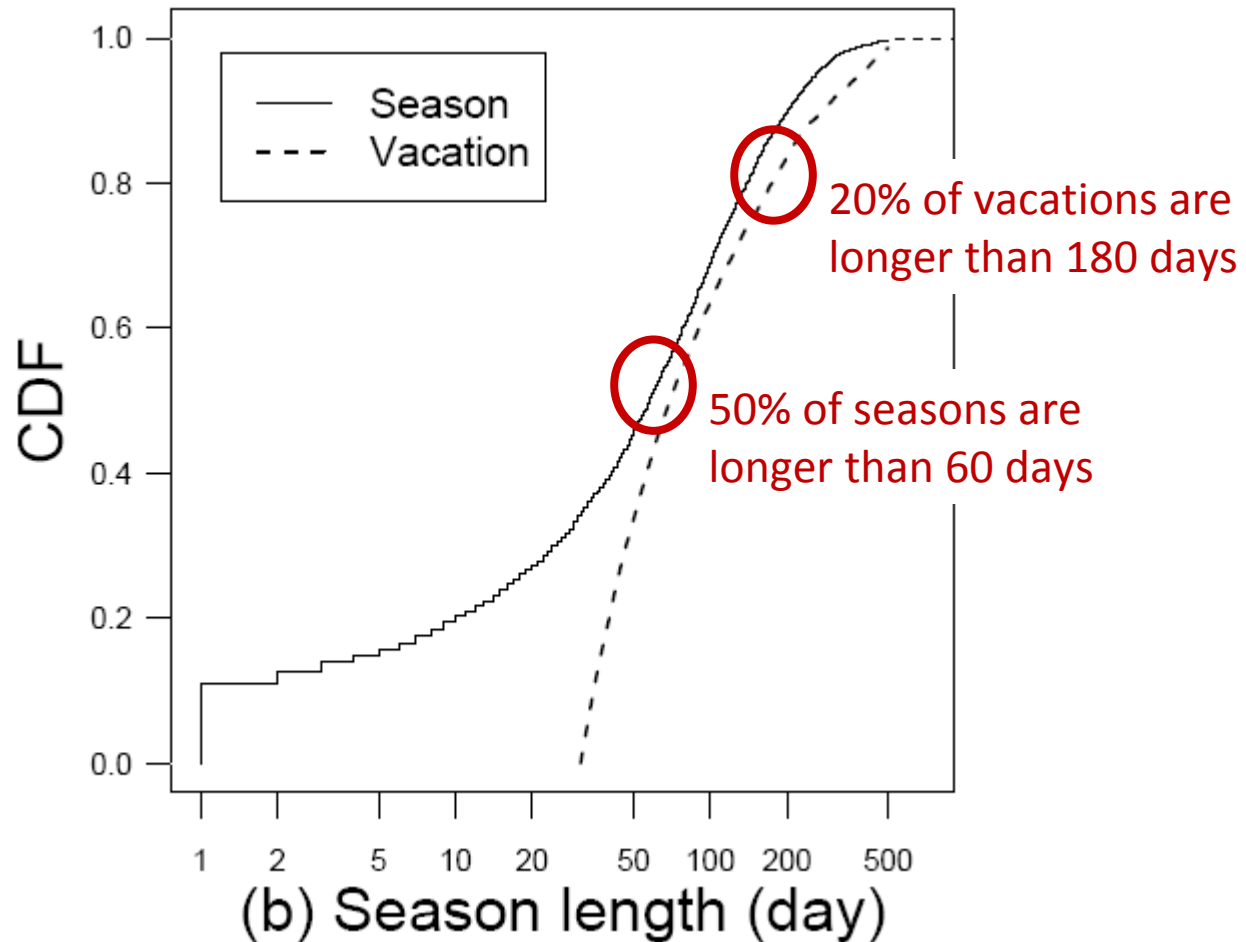


Players tend to alternate between ON and OFF periods within 5 days

# Season and Vacation

- Some **extremely long** OFF periods exist
  - 3% OFF periods longer than 1 month
  - 1% OFF periods longer than 3 months
- Even after a long OFF period, gamers may come back and play game as seriously as before
  - What's the difference between a 3-month OFF period and an "true" unsubscription?
- Definitions
  - **Vacation**: An OFF period longer than 30 days
  - **Season**: An active period between two vacations

# Distributions of Seasons and Vacations

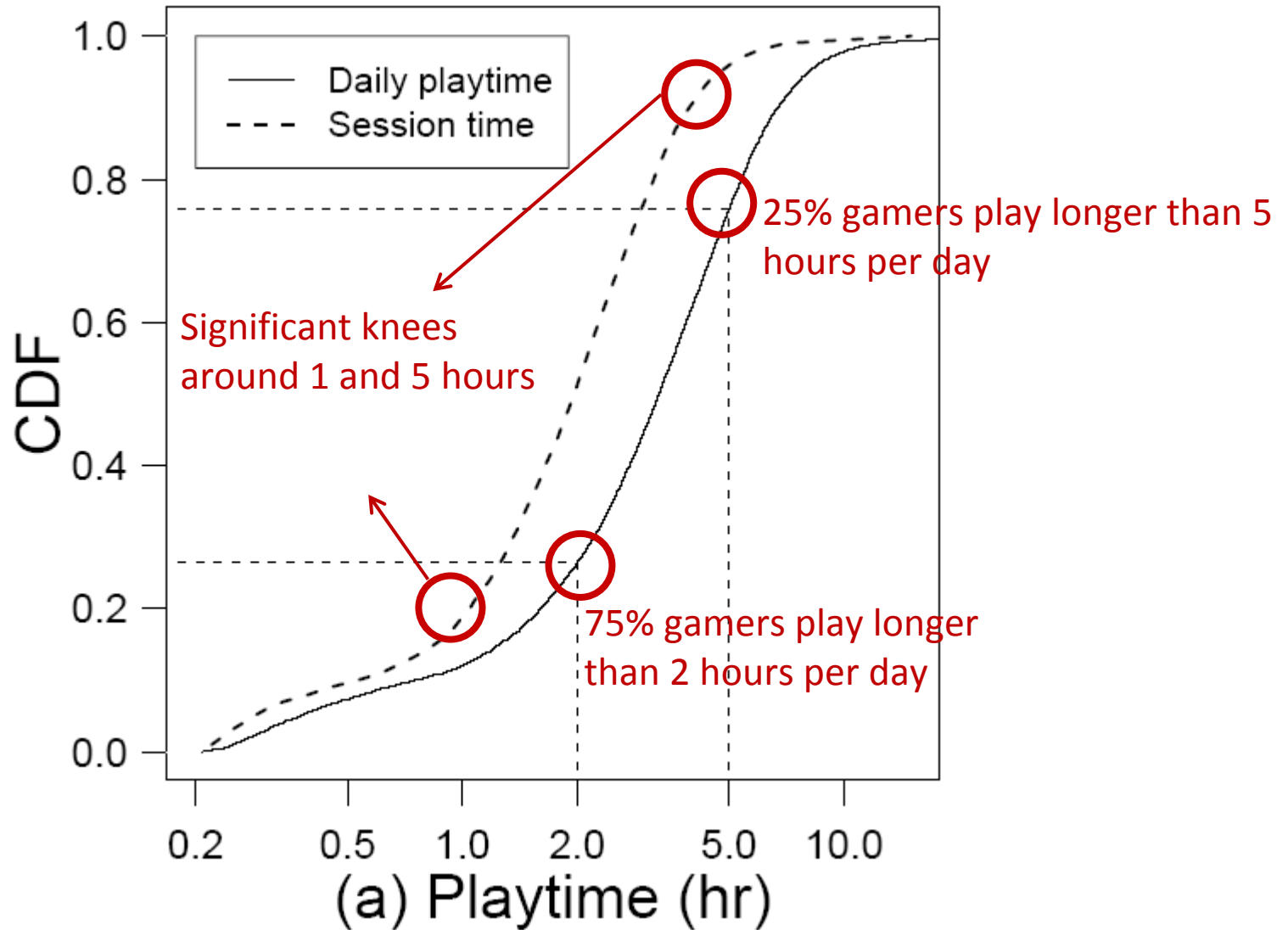


Even after a long vacation (> half a year), 20% of gamers still come back

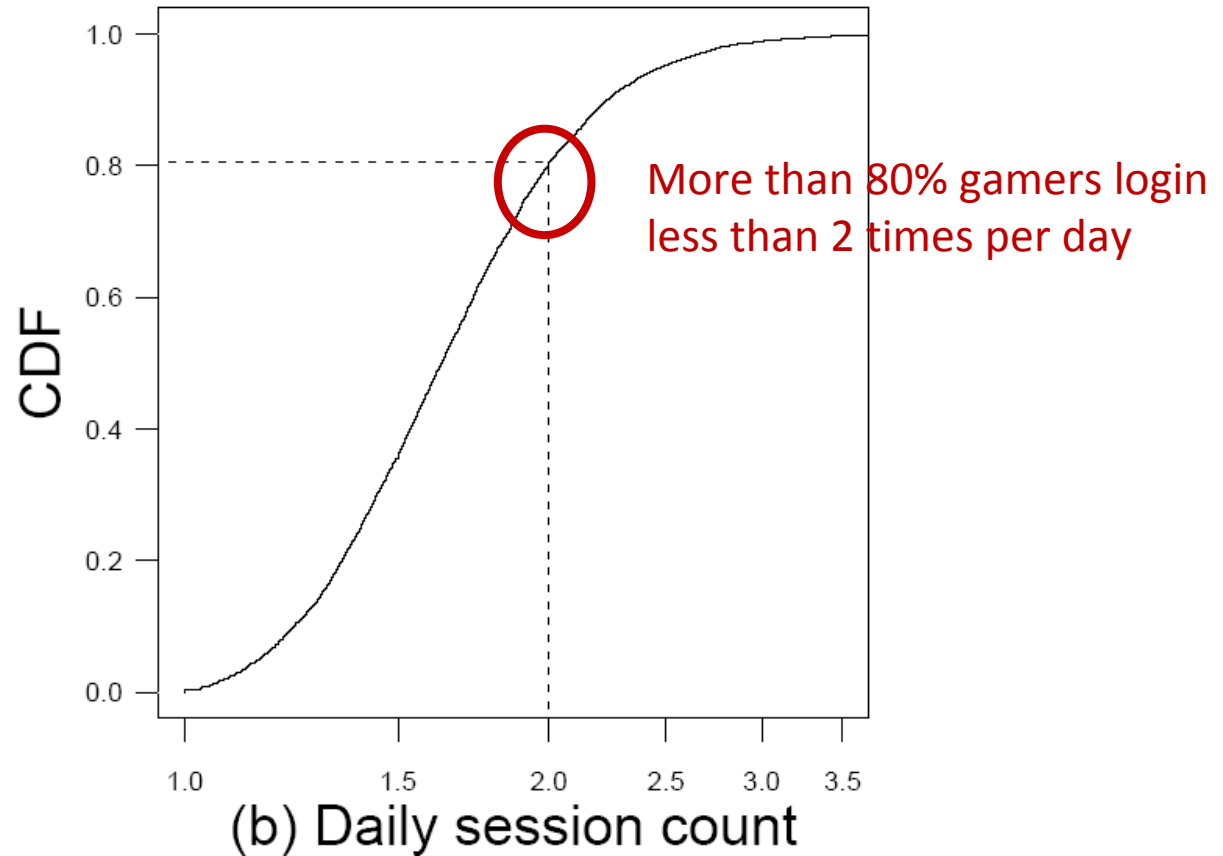
# Daily Activities

- Daily playtime
- Daily session count
- Session playtime

# Daily Playtime and Session Time



# Daily Session Count



The daily playtime is mainly contributed by one or two long sessions rather than a number of short sessions

# Talk Progress

- Overview
- Game trace collection
- How long do gamers play?
- **When do gamers play?**
- Predictability analysis
- Future work



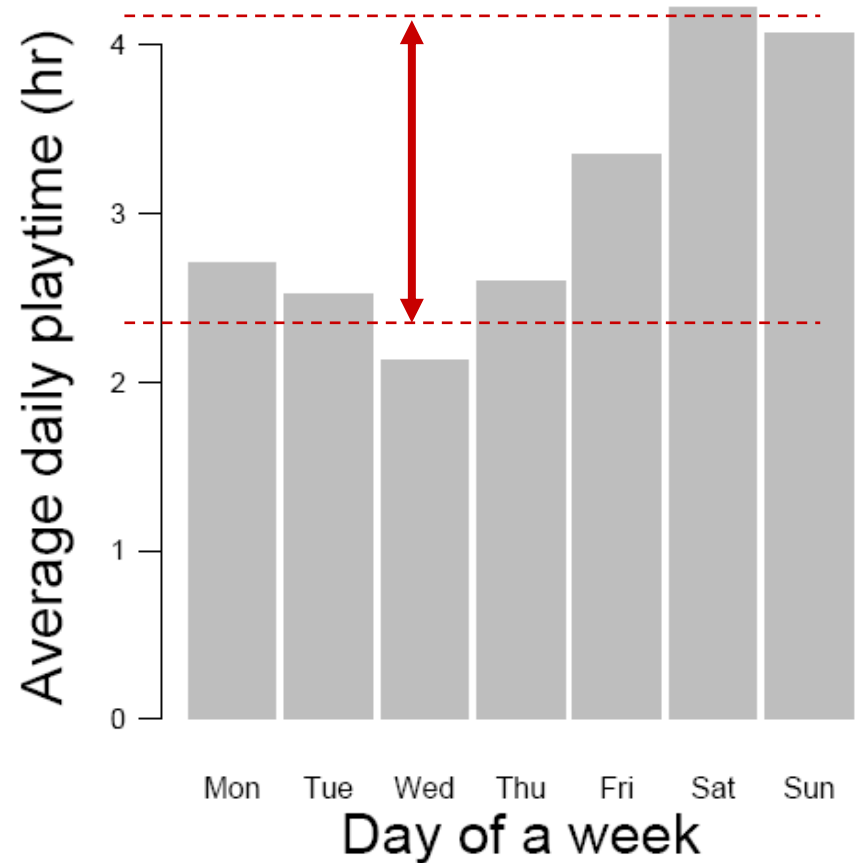
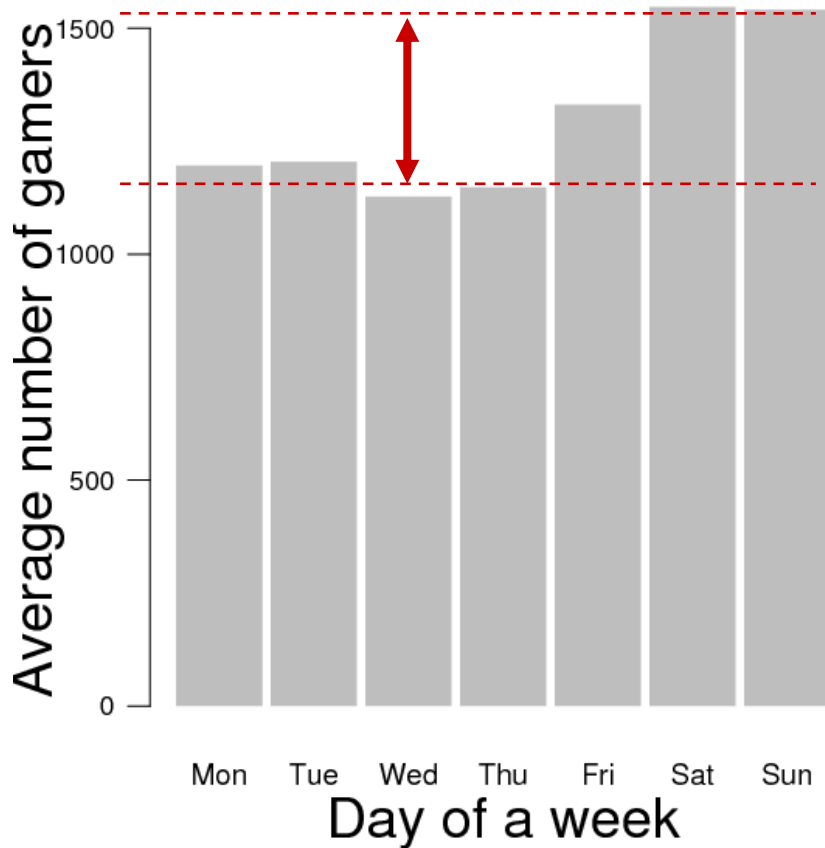


# When Do Gamers Play?

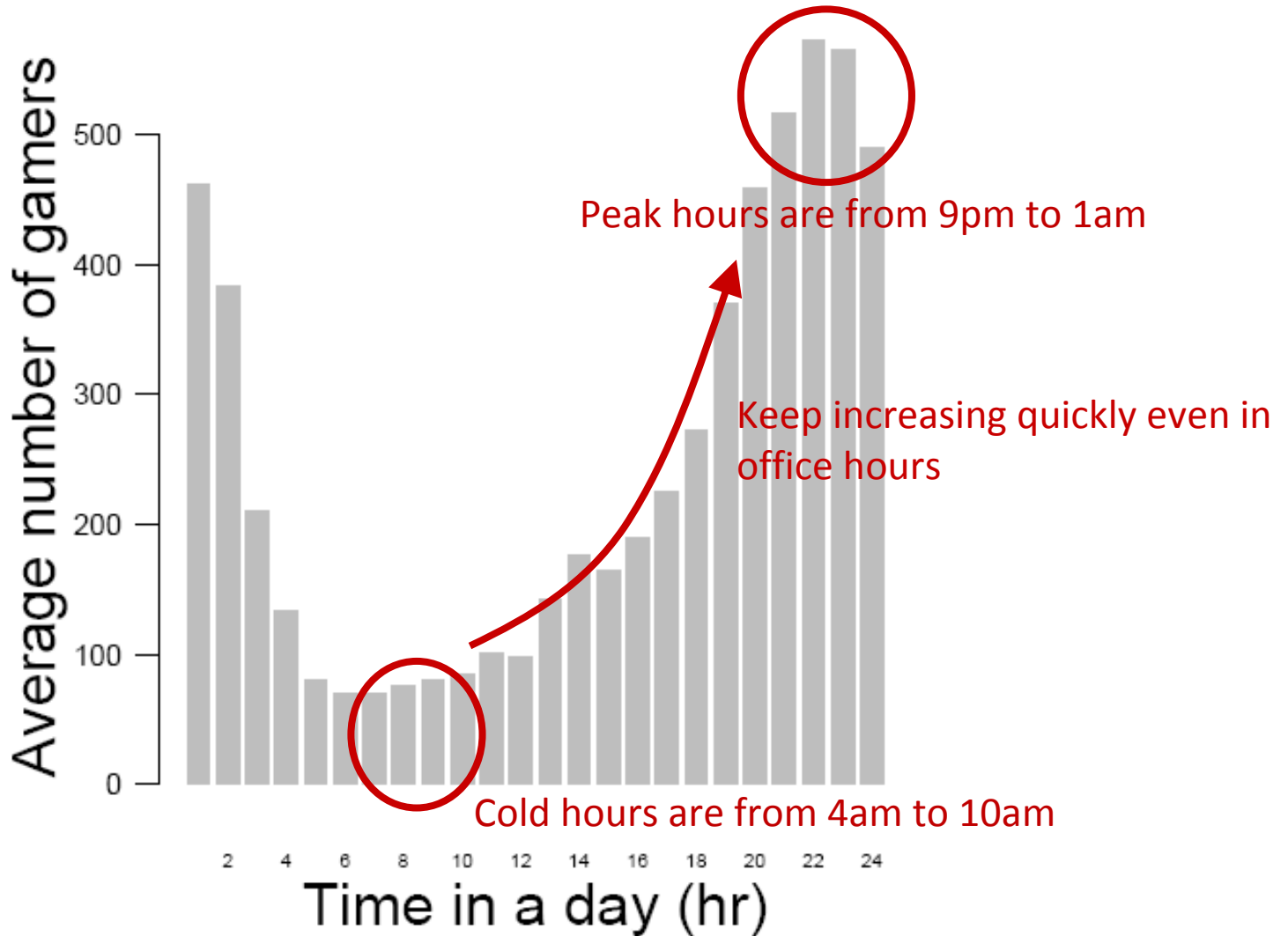
- Average daily playtime on each day of a week
- Average number of gamers in each hour of a day
  
- Our Conjectures
  - Much longer playtime on weekends
  - Much more gamers at night

# Avg. Daily Playtime in a Week

The difference between weekends and weekdays is not large



# Average Number of Gamers at Different Time



# Talk Progress

- Overview
- Game trace collection
- How long do gamers play?
- When do gamers play?
- **Predictability analysis**
- Future work



# Predictability

- Can we predict players' **future gameplay time** based on their game play history?



- Two aspects
  - Predicting long-term behavior based on daily activities
  - Temporal dependence in multiple time scales

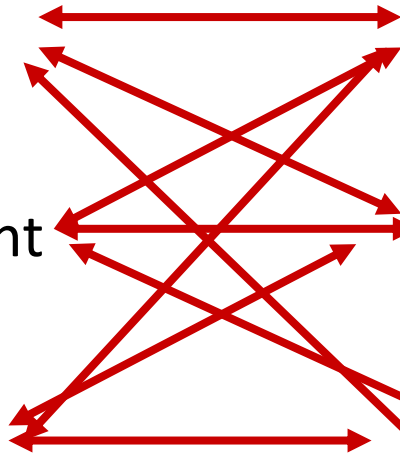
# Correlations between Daily and Long-Term Factors

## ■ Daily activities

- Session time
- Daily session count
- Daily playtime

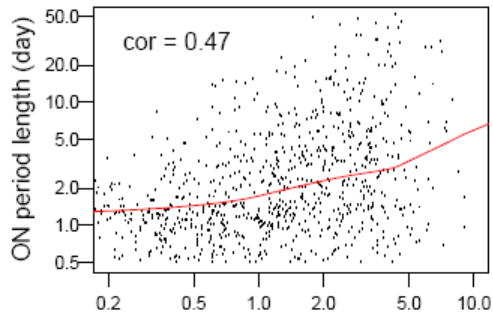
## ■ Long-term behavior

- ON period length
- Season length
- Subscription length

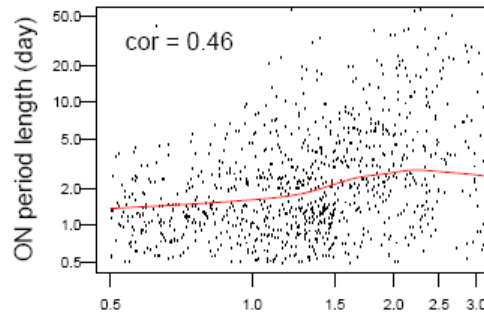


Strong correlation exists?

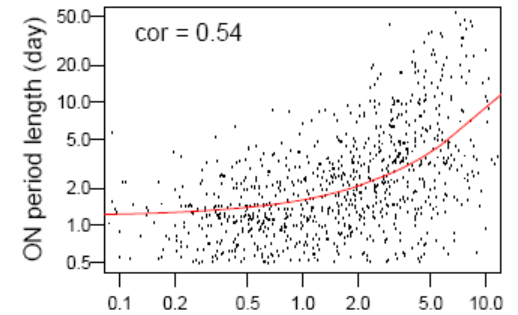
# Correlation between Daily and Long-term Factors



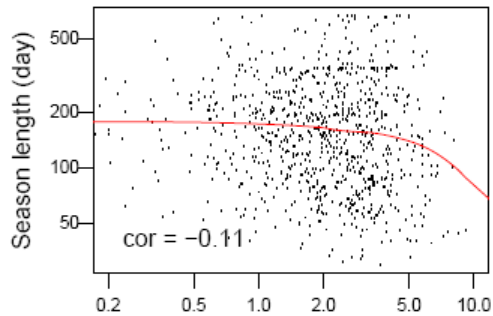
(a) Session time (hr)



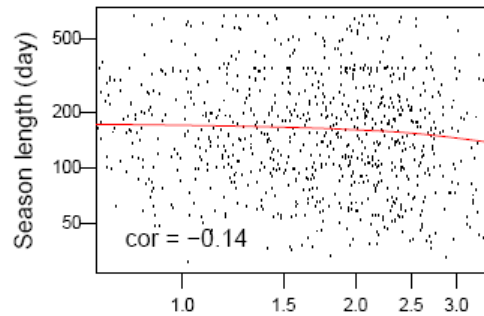
(b) Daily session count



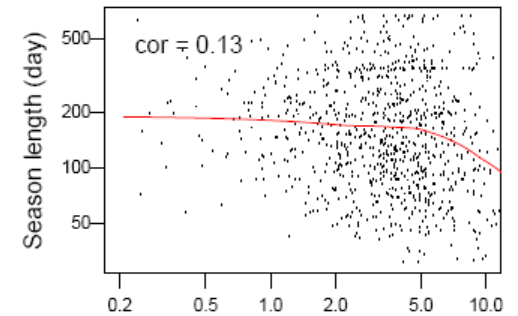
(c) Daily playtime (hr)



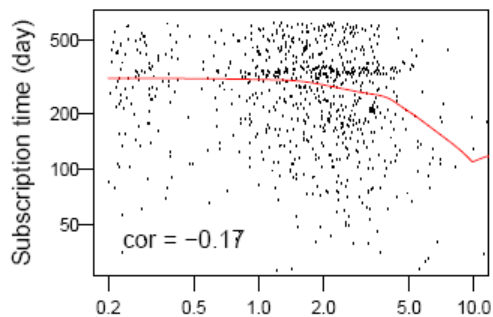
(d) Session time (hr)



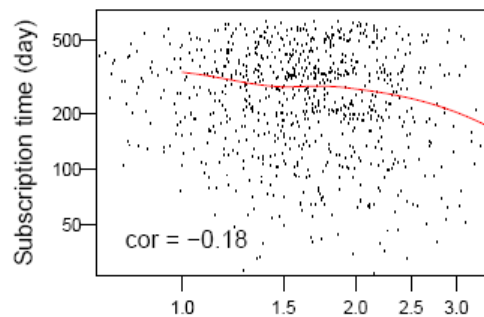
(e) Daily session count



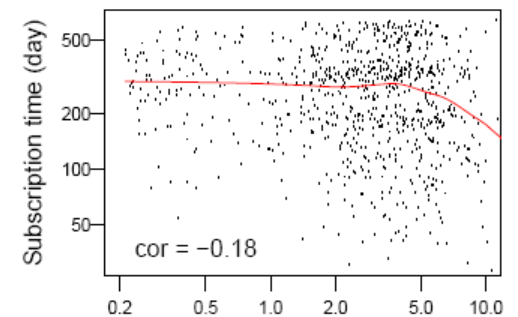
(f) Daily playtime (hr)



(g) Session time (hr)

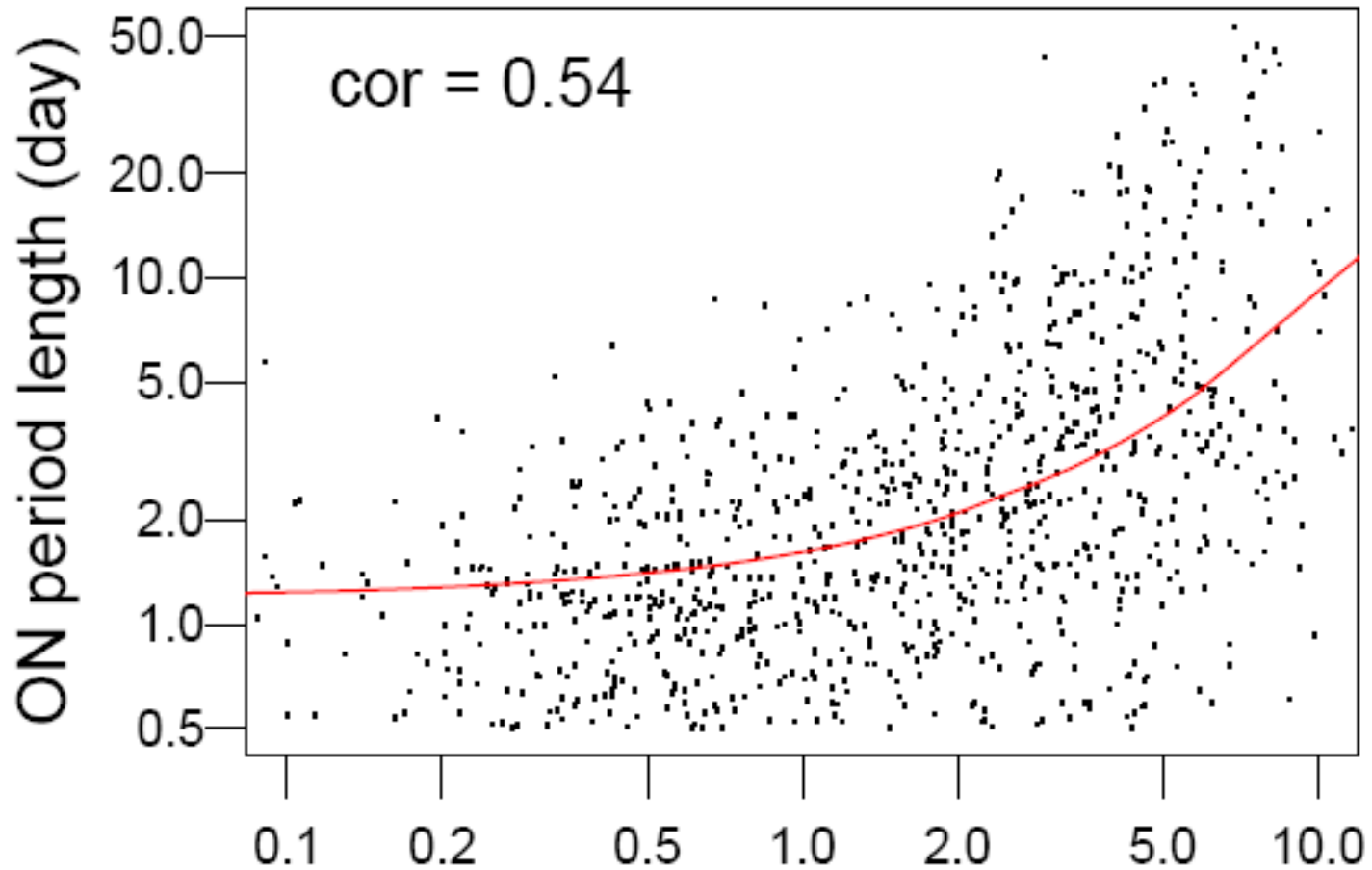


(h) Daily session count



(i) Daily playtime (hr)

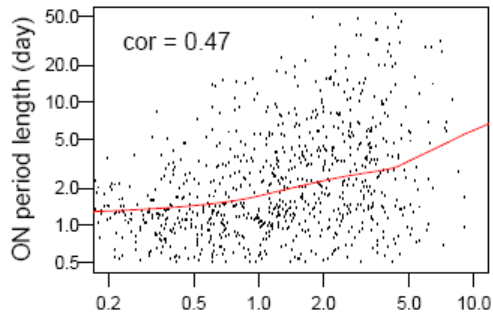
# ON period length vs. Daily playtime



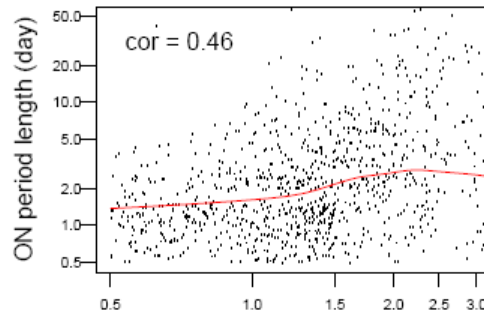
(c) Daily playtime (hr)



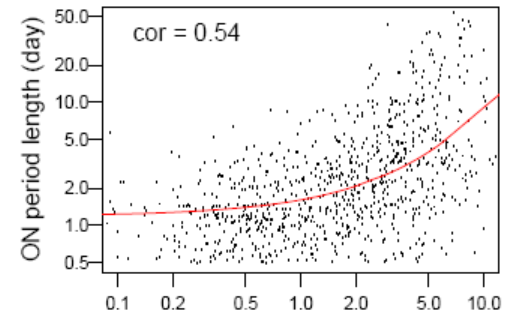
# Correlation between Daily and Long-term Factors



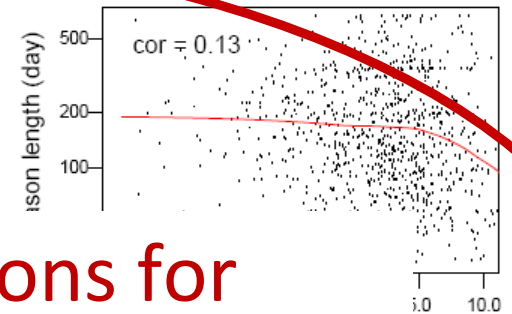
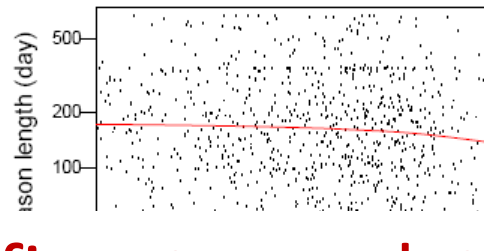
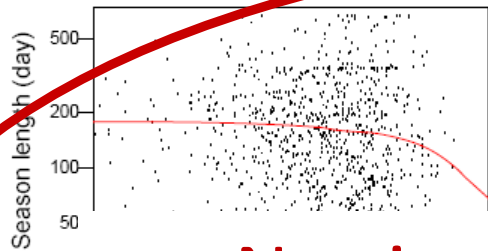
(a) Session time (hr)



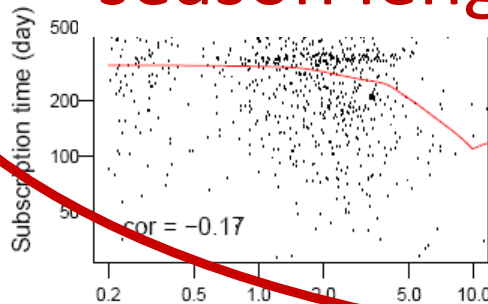
(b) Daily session count



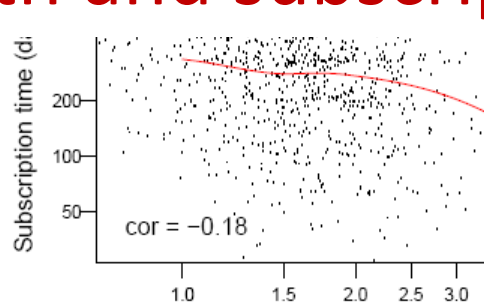
(c) Daily playtime (hr)



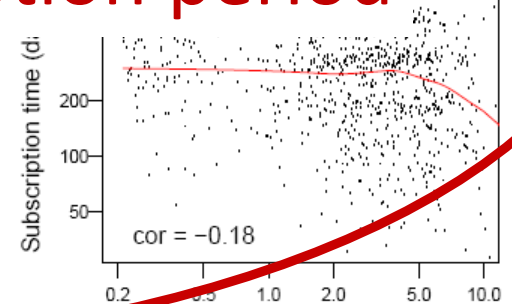
No significant correlations for  
season length and subscription period



(g) Session time (hr)



(h) Daily session count

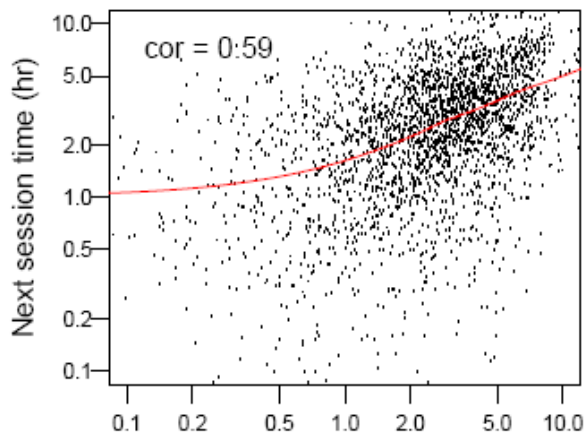


(i) Daily playtime (hr)

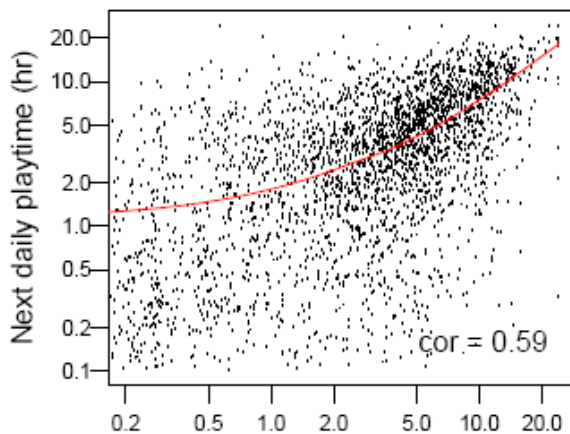
# Autocorrelations of Players' Game Hours

- This session's length vs. next session's
- Today's playtime vs. tomorrow's
- This week's playtime vs. next week's
- This ON period's playtime vs. next ON period's
- This ON period's length vs. next ON period's
- This season's length vs next season's

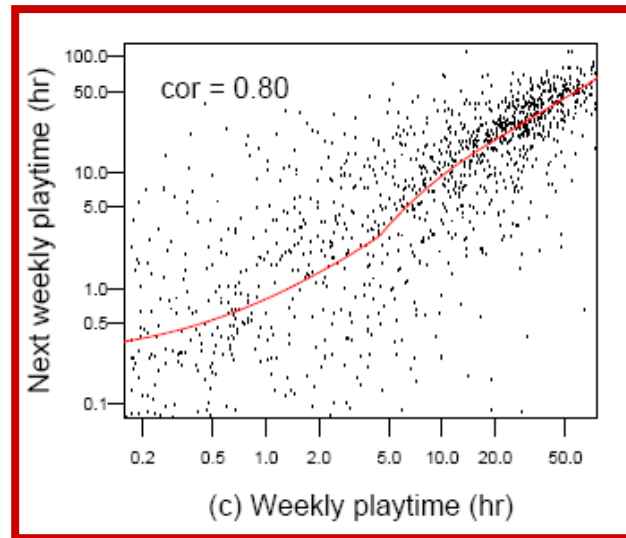
# Players' Game Hours in Consecutive Periods



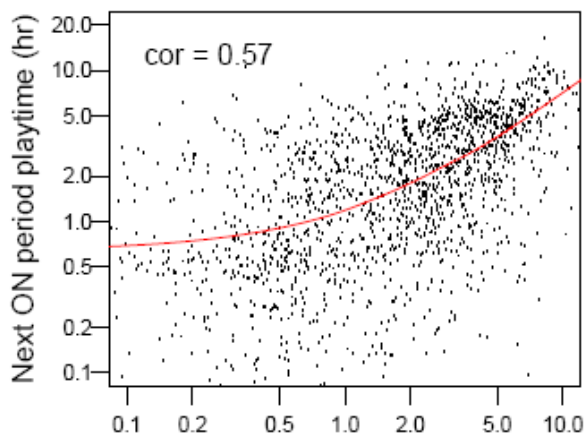
(a) Session time (hr)



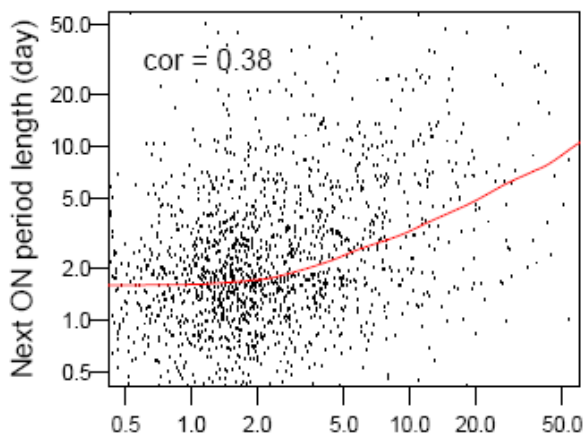
(d) Daily playtime (hr)



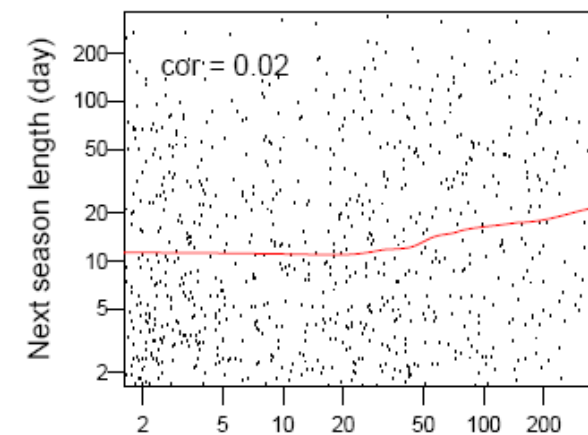
(c) Weekly playtime (hr)



(b) ON period playtime (hr)

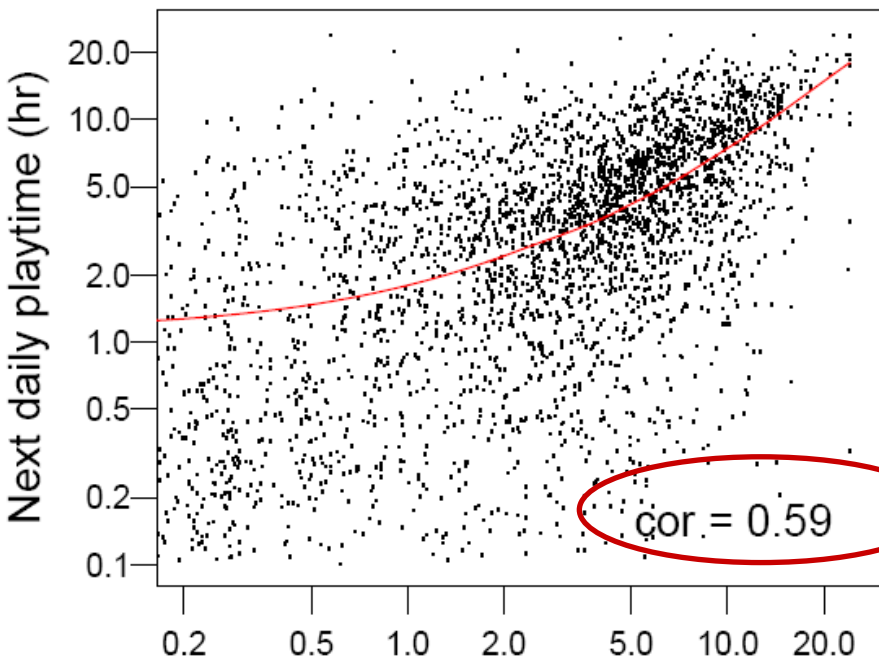


(e) ON period length (day)

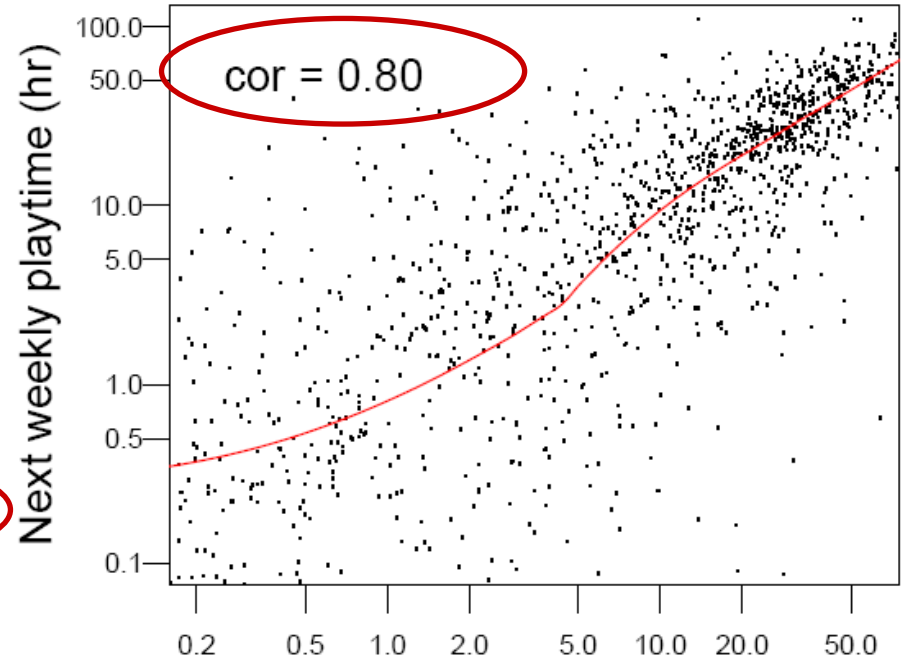


(f) Season length (day)

# Players' Game Hours in Consecutive Periods



(d) Daily gameplay (hr)



(c) Weekly gameplay (hr)

Weekly patterns are the most regular for most players

# Game Play Time Predictability: Summary

	Daily playtime	Session time	Session count
Subscription time	×	×	×
Season length	×	×	×
ON period length	★★	★	★

	Session	Day	Week	ON period	Season
Playtime	★★	★★	★★★★	★★	×
Length	NA	NA	NA	★	×

★★★★: strong correlation ( $\text{cor} \geq 0.8$ )

★★: medium correlation ( $0.8 > \text{cor} \geq 0.5$ )

★: weak correlation ( $0.5 > \text{cor} \geq 0.3$ )

×: no correlation ( $0.3 > \text{cor}$ )

# Talk Progress

- Overview
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- When do gamers play?
- Predictability analysis
- **Future work**



# Work in Progress

- Our results indicate that although **short-term** prediction is feasible, **long-term** prediction will be more difficult.
- We are developing a model that can **predict** whether a player will leave a game.

# Logistic Regression Model for Unsubscription Prediction

- Significant features (out of > 20 features)
  - Avg. session time
  - Daily session count
  - Variation of the login hour (when the player starts playing a game each day)
  - Variation of daily play time (number of hours)
- A naive logistic regression model achieves approximately 75% prediction accuracy (whether a player quits in one month)



# Thank You!

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