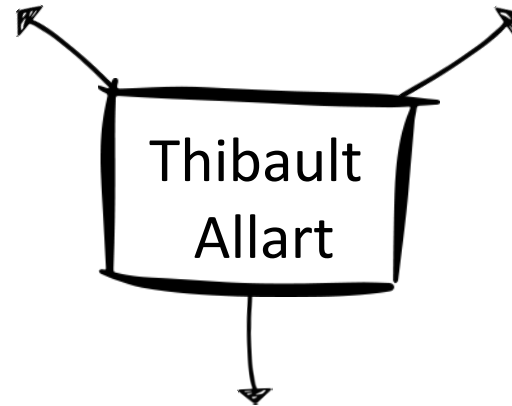


Difficulty Influence on Motivation over Time using Survival Analysis

FDG 2017

Guillaume Levieux
CEDRIC - Paris



Cédric

CNAM - Paris
Guillaume Levieux
Stephane Natkin

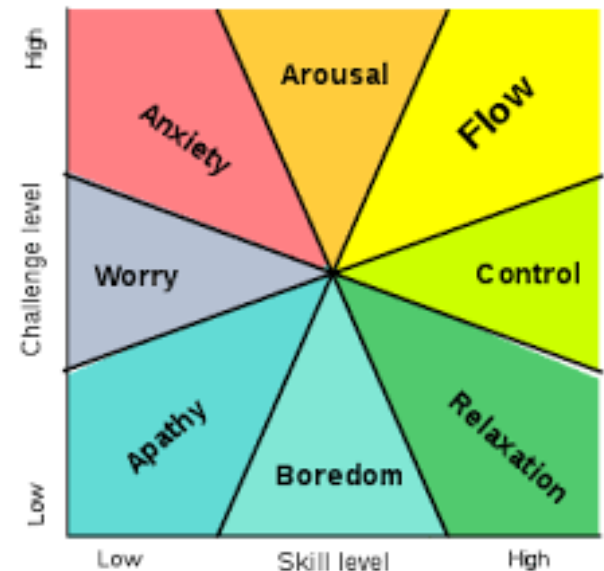
Goal of this paper

1. Estimate impact of difficulty on player motivation
2. Compare two AAA games, with different gameplays
3. Use only telemetric data (lots of players but less details and more noise)



Why difficulty ?

- Theories of v.g. fun / enjoyment
 - [Malone1982] : challenge, curiosity, fantasy
 - [Ryan2006] : SDT -> competence, autonomy, relatedness
 - [Koster2005] : fun = learning
 - [Csikszentmihalyi1991] : flow



Still many question about difficulty

- Different types of difficulty ?
- How to estimate difficulty ?
- Objective and subjective difficulty ?
- Optimal level of difficulty ? (and more complex links between difficulty and motivation)

Estimate Objective Difficulty

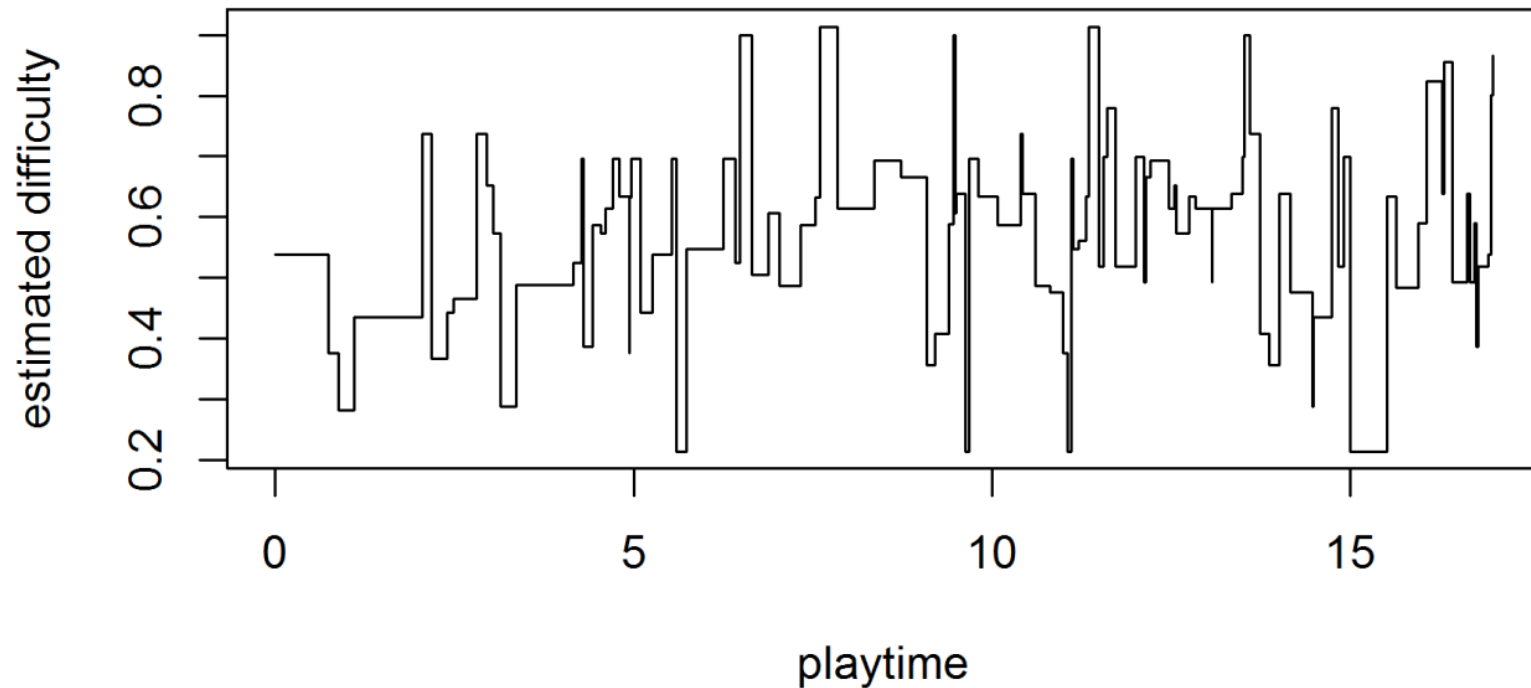
- Define a challenge and win / fail conditions
 - (First place where you and the players can diverge)
- $P(\text{fail} \mid \text{challenge params, player skills})$
 - Can be estimated (e.g. logistic regression)
 - Easy to understand
 - Allows comparison between games

Estimate Players' Skills

1. Decompose gameplay and evaluate specific mechanics
 - Need tracking at this level of detail (not the case for us)
2. Mixed effect model
 - One additional value per individual to tweak the model
 - Represents each individual's specific abilities.

$$y = X\beta + Zu + \epsilon$$

Difficulty Curve (Rayman Legends)



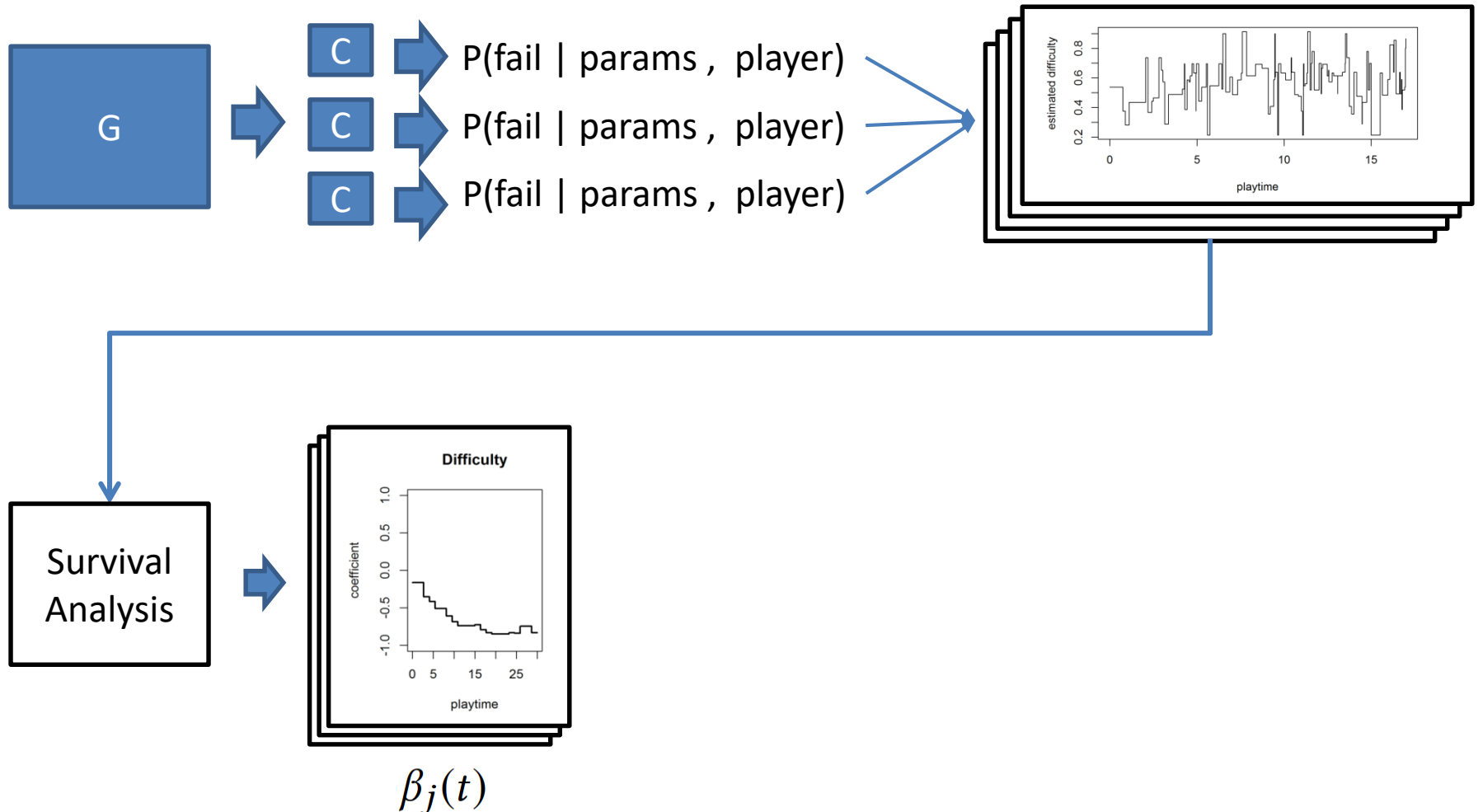
Influence on motivation

- Playtime = motivation
 - The more you like a game, the longer you will play this game.
 - Only value from logs : no questionnaire
- Influence of difficulty on playtime
 - Same as influence of smoking habits on life span
 - Survival analysis : impact of variables on time to event.

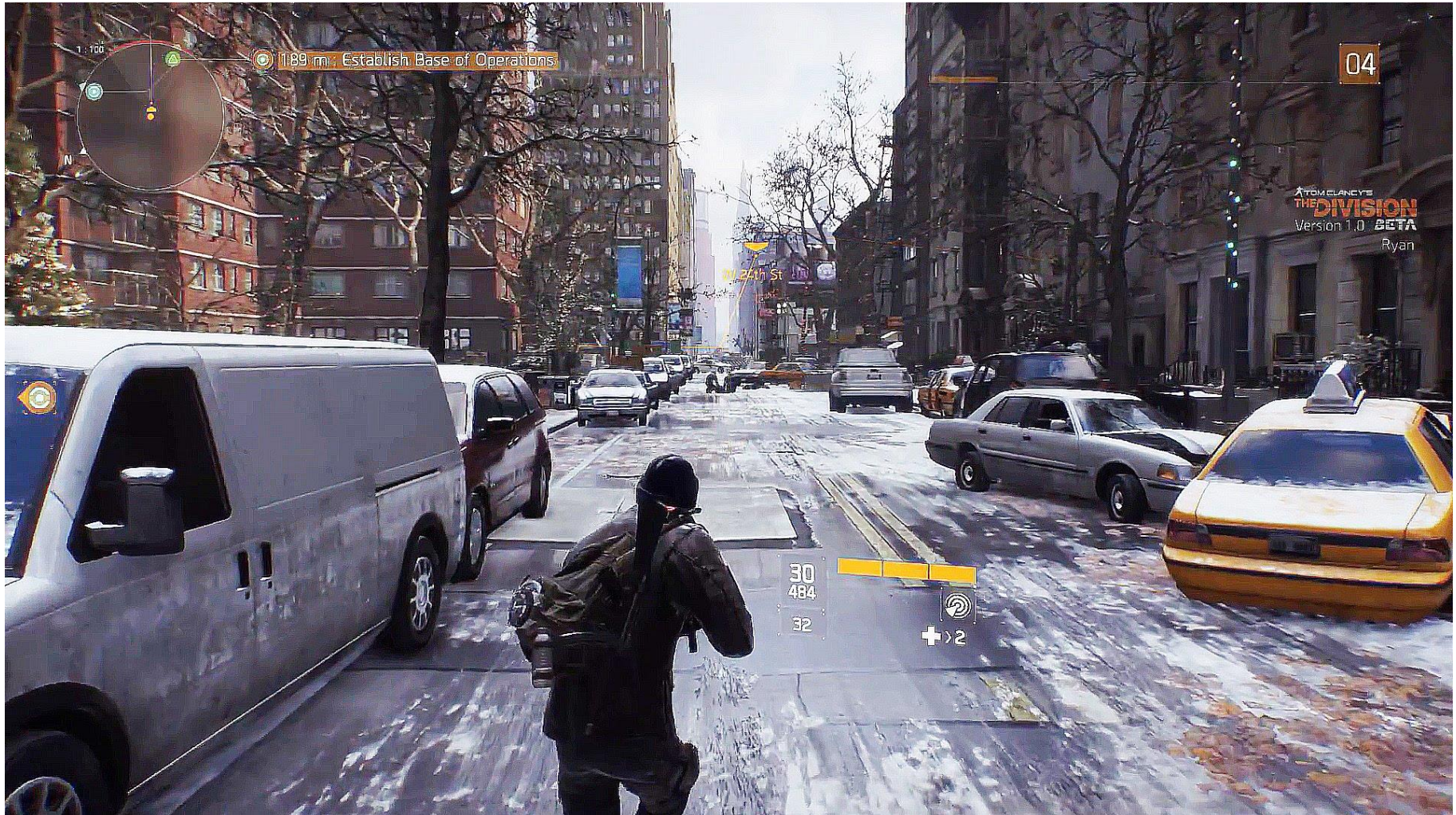
Survival Analysis

- Longitudinal data
 - Could be summarized (mean, max, sum, last)
 - Survival analysis uses the whole dataset
- Problem
 - Takes much more time to compute than with a snapshot
 - Plus we want time varying coefficients
 - Current methods cannot handle 100 000 of players
- Proposed method (CoxTv) :
 - Support huge databases (SGD, streaming, penalties)
 - Gives $\beta(t)$
 - Please refer to the paper for more details.

Pipeline Summary



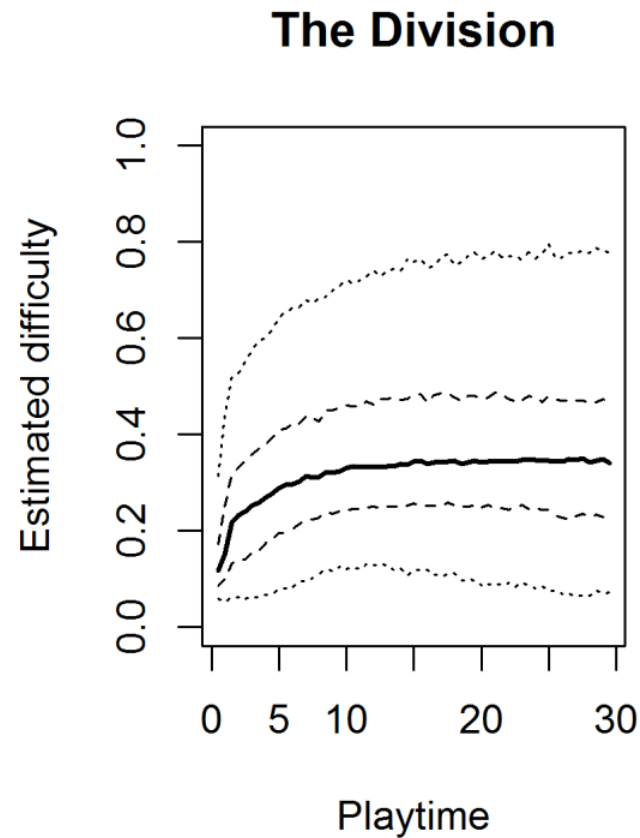
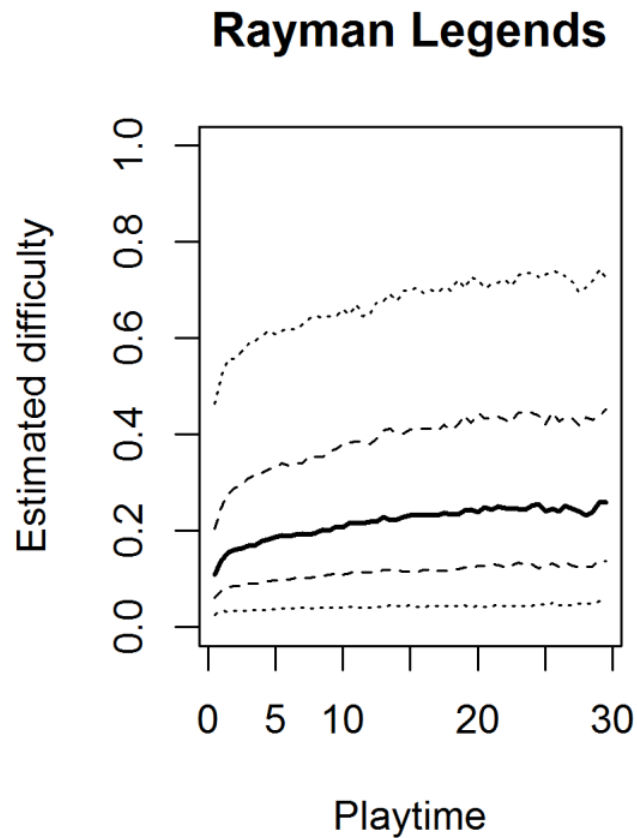
The Division



Rayman legends

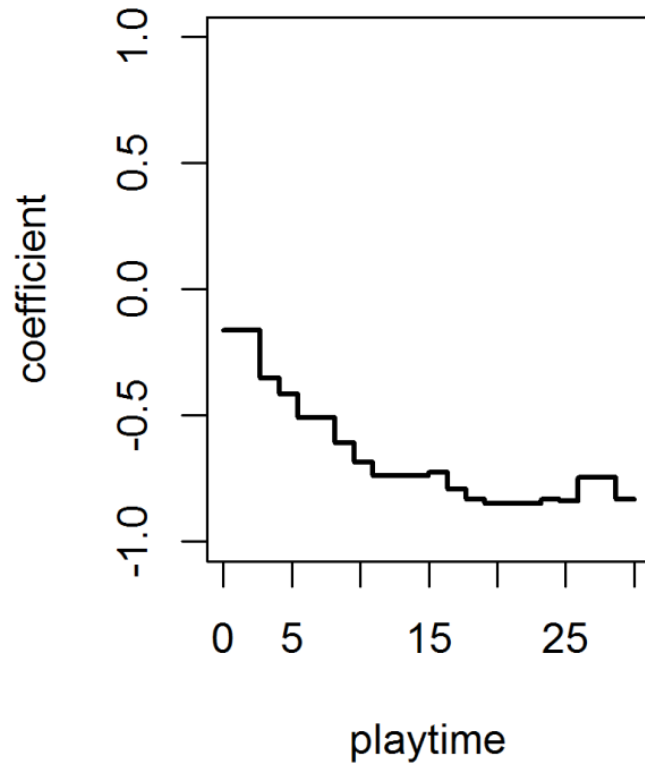


Difficulty Estimation

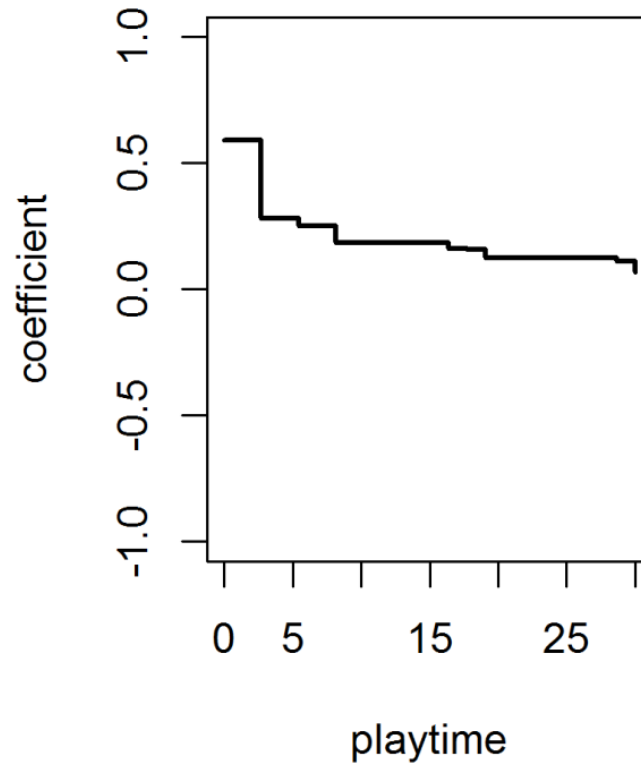


Rayman Legends

Difficulty

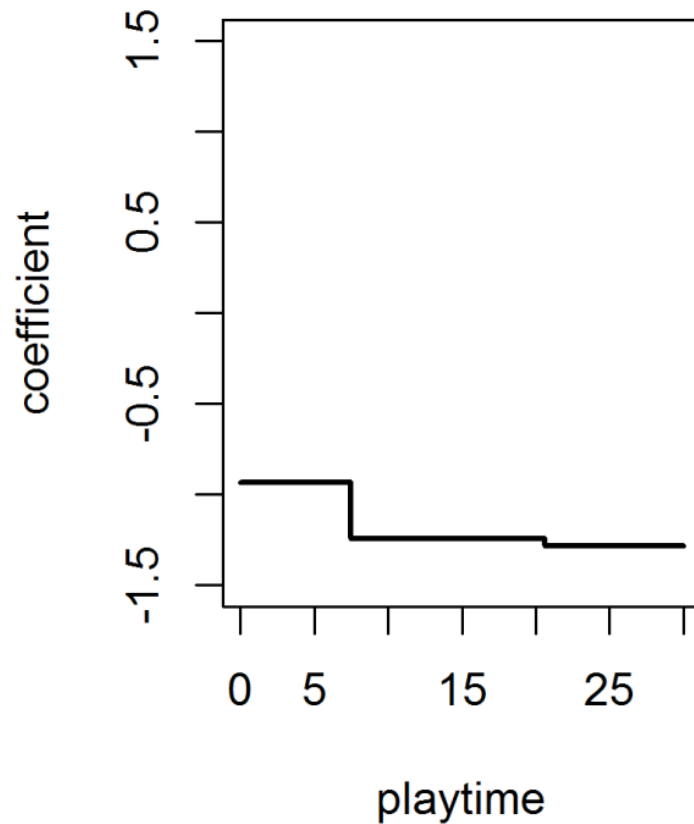


Difficulty variation

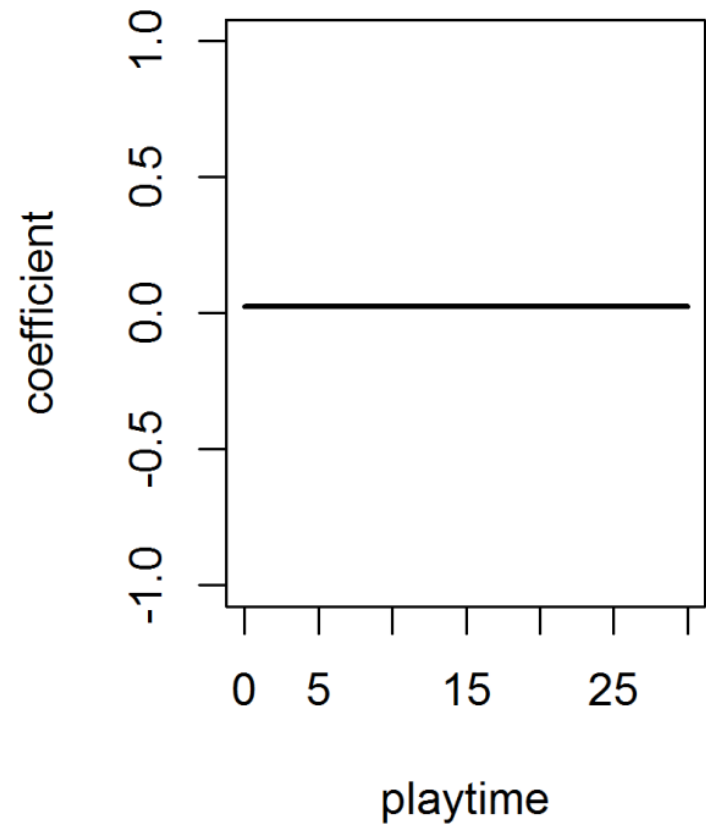


The Division

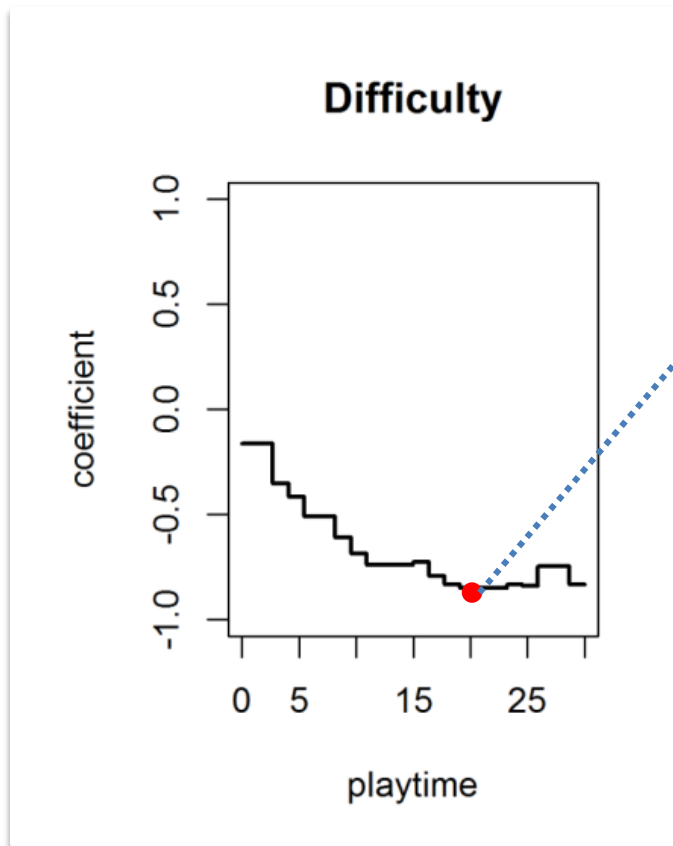
Difficulty



Difficulty variation

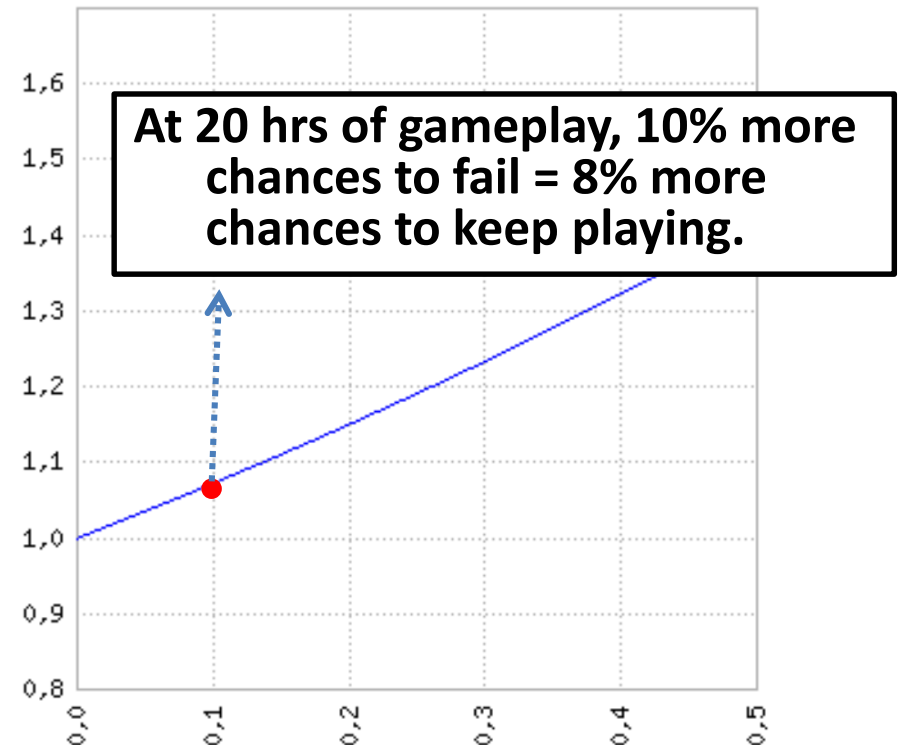


Reading the $\beta_j(t)$



$$B(20) = -0.7$$

$$F(x) = \exp(0.7 * x)$$



Results

- In both games, players may like a **higher level of difficulty**
 - All the time in The Division
 - After a few hours of playtime in Rayman Legends
 - 70% to 80% chances to win is not really uncertainty
- In Rayman Legends, players may not like **variations of difficulty** during the first hours of gameplay.
- The division is slightly harder, but players may like to raise the difficulty even more than in Rayman.

Discussion

- In The Division :
 - the player can manipulate the difficulty through the gameplay
 - Failure can be attributed to avatar strength : temporary, modifiable external cause so lower impact of failure on motivation
 - failure is punitive (start all over again)
 - Prepare as much as possible for each mission and thus they lower difficulty
- In Rayman Legends :
 - you can't upgrade your avatar to modify difficulty
 - failure is more linked to skills, and thus may have a higher impact on motivation
- Only correlation, not causation
 - Players that play longer may tend to seek harder gameplay ? i.e. does it come from player personality or from gameplay ?

Takeaways

- Longitudinal data ? Try CoxTv R package (email us)
- Difficulty is to be considered wrt time
 - Early failure can be harmful, especially if failure cause is only skill
- Difficulty is to be considered wrt to punishment
 - Players may try to limit difficulty if punishment is too hard

Questions ?