

A brief introduction to

Behavioral Profiling in Games



Industry in Change

In one decade: 200mio. -> 2+bio. consumers

- 100 bio USD global market 2016
- Global consumers/market, across demographics

Business models have changed ->

- Games as a product ->
- *Games-as-service*

Explosion in user data

- **Billions** of monthly game sessions
- **Hundreds of millions** of daily users
- **Thousdands of TBs** captured daily
- **Exponential increase** in data flow



Industry in Change

Games are now **big data -> game analytics**

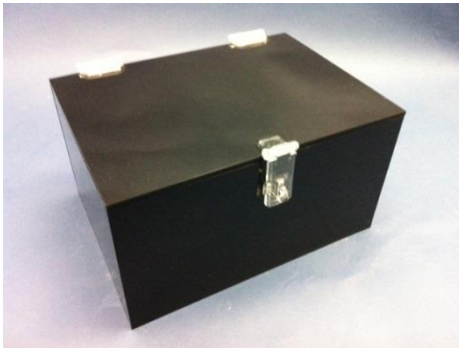
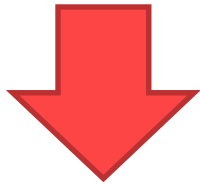
Players drive revenue -> understanding their behavior is essential

Challenges:

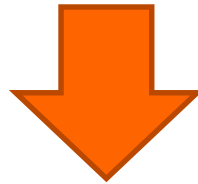
- Complex **information systems**
- Longitudinal data, high-dimensional, millions of users ...
- **Time-sensitive** information
- Need to **combine multiple data sources** /types
- **Productizing models**
- **90% SMEs** – limited analytics capacity



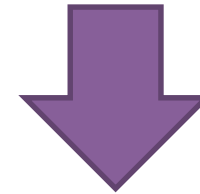
Industry in Change



70% of the industry



27% of the industry



Maybe 3% ?

(by number of companies)







UX is King



UX

UX drives **everything** in games: engagement, revenue, interaction time ...

Must focus on the **user as a person** – with motivations, personality, needs ...

- And the **context** of play

Always ask **what** players do or would do, and **why**



Big Data Specialties in Games



Innovation in **analytics**, **user research**, **design** and **business models**

Ability to handle high-dimensional, volatile, voluminous, high-frequency and longitudinal behavioral data

Collaboration between analytics, user research, strategy and design -> understanding how these feed into each other

Strengths in user-focused big data/analytics





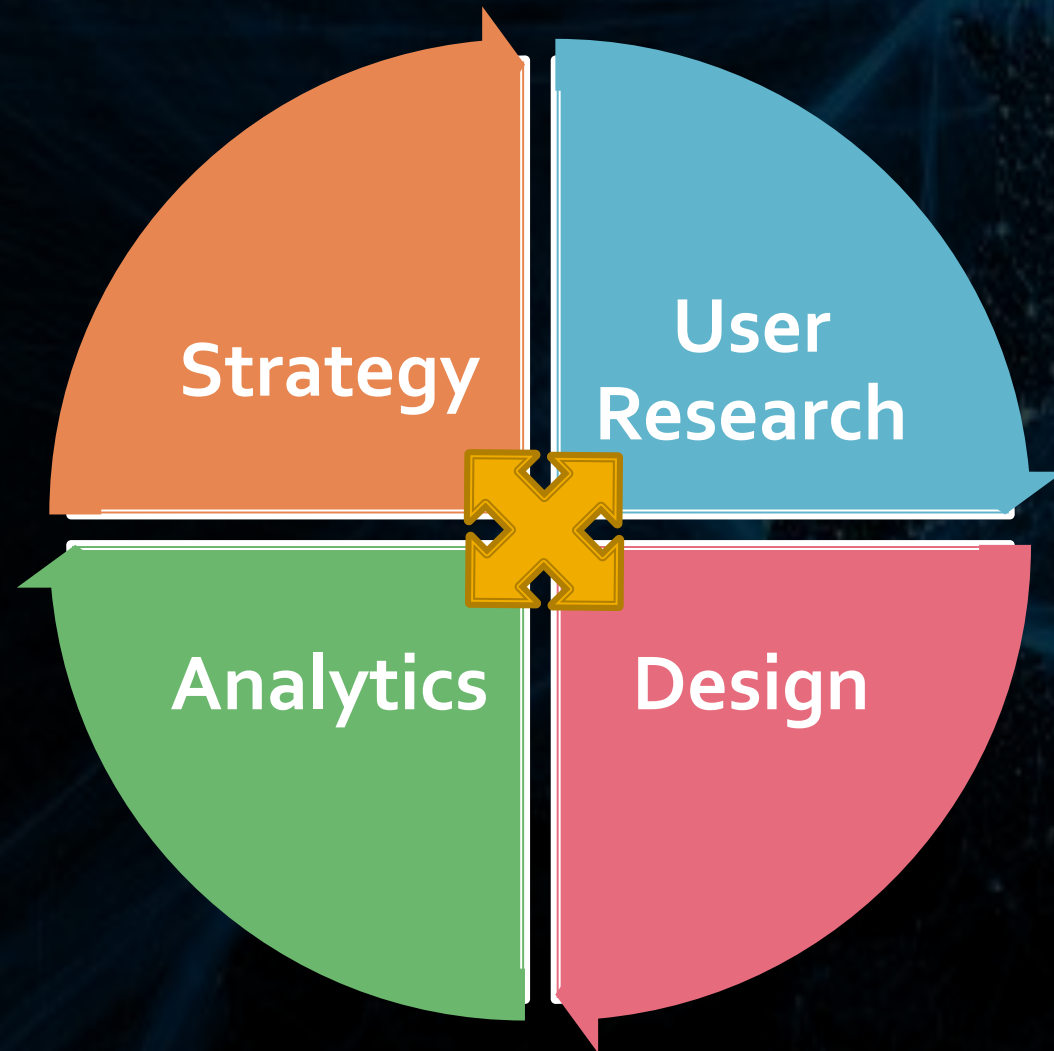
Why player profiles?

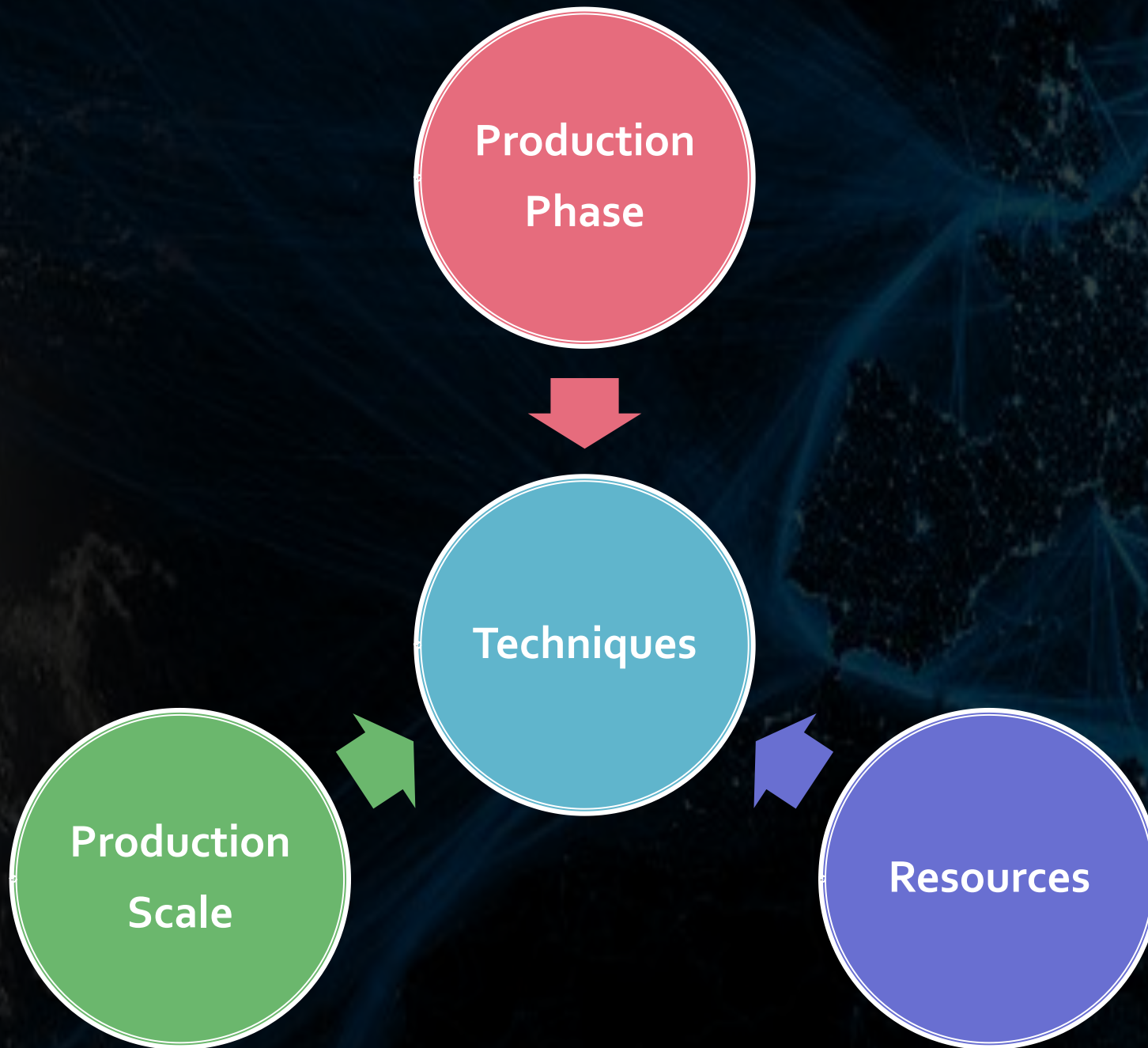


Why player profiles?

- Allows considering users in a **non-abstract, quantifiable** way
 - Understanding about **who** the players are, **how** they are/will be playing and **why**
 - **Fantastic boost** for prediction, informing retention strategies, migrating players between games, informing design ...
 - Useful during **entire project lifecycle**

The User Information Cycle in games





Theory or data driven

2 types of profiles in analytics/user research: **Protean** and **Player**

Protean profiles: based on **theoretical** models + design/product **intent**

Widely used for design

Can be defined from day 1

Must be kept updated to be useful: *feeding in design changes and user behavioral/testing data*

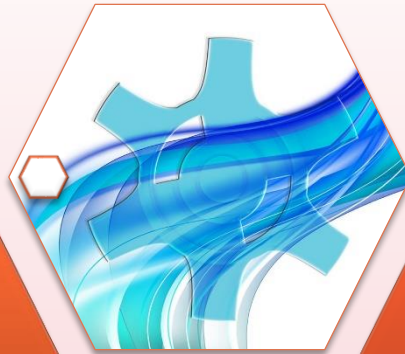
Player profiles: based on **data – any data**

- From: earliest user testing
- Continually updated during production
- Continually used during post-launch





Dynamic
Historical
behavior



**Spatio-
Temporal**
Multi-dimensional
behavior



Predictive
future
behavior



Psychographic
Behavior,
demographics,
psychology



Contextual
Game-external



Snapshot
Current
behavior



Psychological
Behavioral
drivers



Lifetime
All behaviors



*Psycho-
predictive*
State
prediction

Snapshot profiles



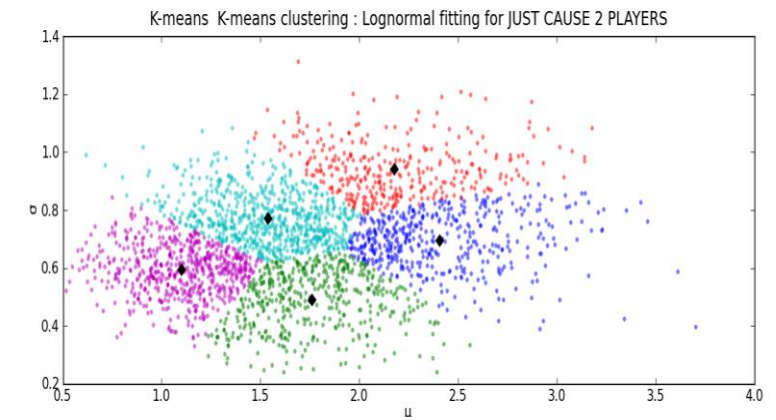
What: Investigating patterns of behavior at the **operational** level

Why: Understanding:

- The *state of the players right now*
- *How* they are playing the game
- Useful for **keeping a watch out** on the community: unusual behaviors, general patterns, typical problems, extremal behavior etc.
- Efficient for the purpose, but **limited shelflife!**

Data: Behavioral telemetry

Methods: Cluster analysis, PCA, segmentation, AA.



Battlefield 2 - Bad Company 2: SI/M profiles



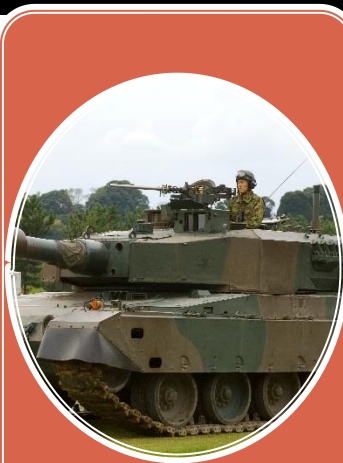
Assassin



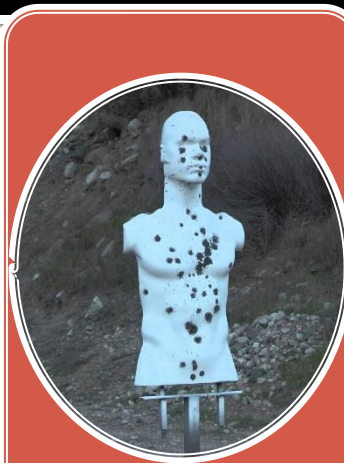
Assault



Assault-
Recon



Driver



Target
Dummy



Veteran



Medic



Snapshot profiles



Each different **playstyles**, and different things that **keep them in the game**:

"Driver": drives, flies, sails – *all the time* and favors maps with vehicles

"Assassin": kills – afar or close – no vehicles! Always walks – favors small maps

"Target dummy": unskilled novices – **high dropout unless they quickly transfer to another cluster**



Contextual profiles



What: Investigating behavioural patterns **outside** the game environment itself

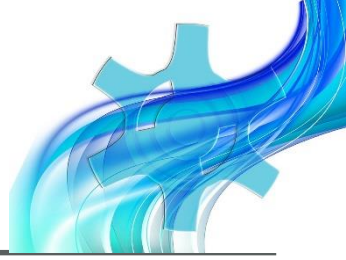
Why: Understanding the context of play and entry points to play

Data: Location of play data, attribution data, social media, physical movement, other games/apps installed, demographics, geographic information, etc.

Methods: Segmentation, clustering, attribution models, behavioural funnel analysis, qualitative methods (e.g. social presence impact)



Dynamic profiles



What: Sequential profiling across a temporal or progression dimension

Why: Snapshot profiles have a limited lifetime

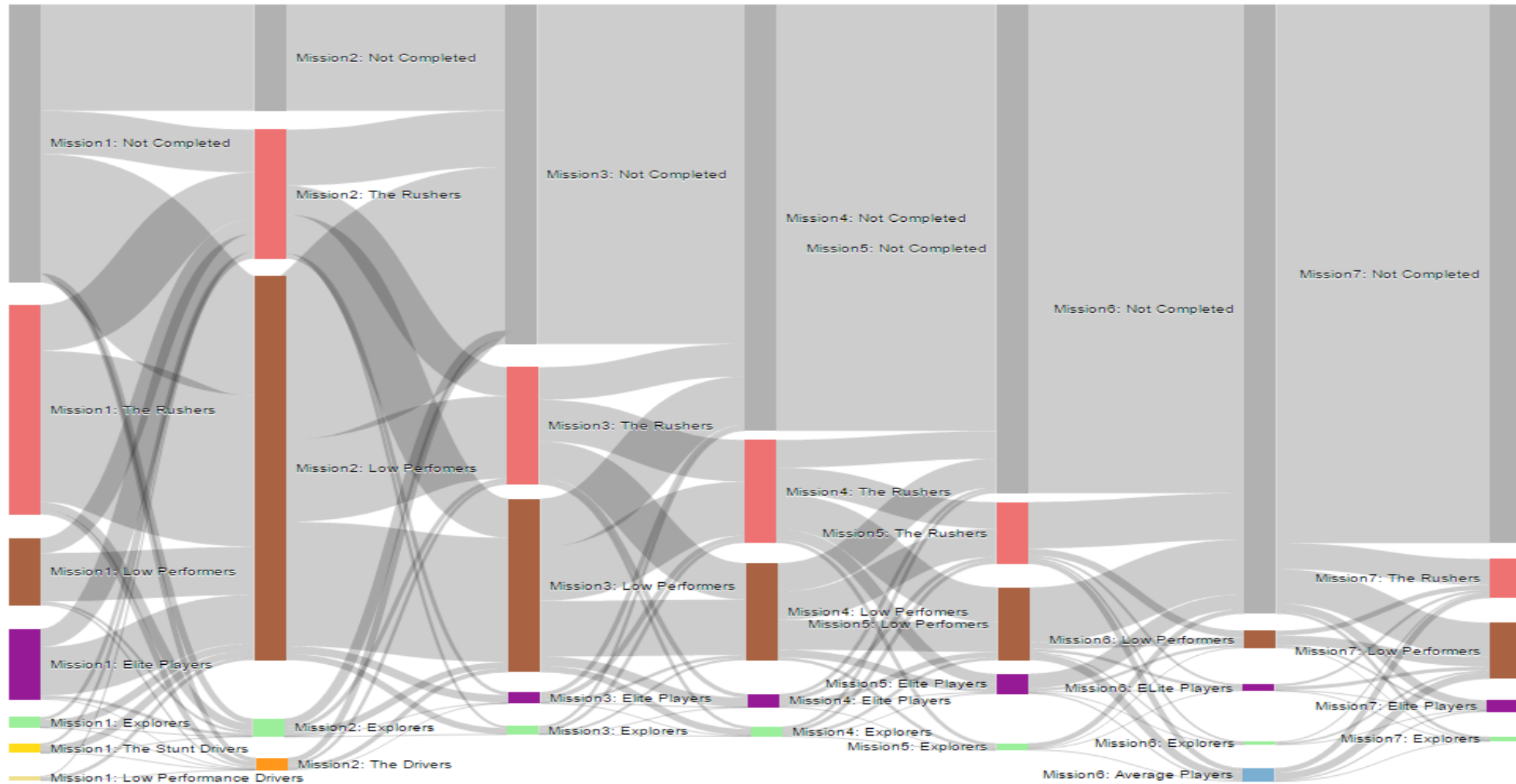
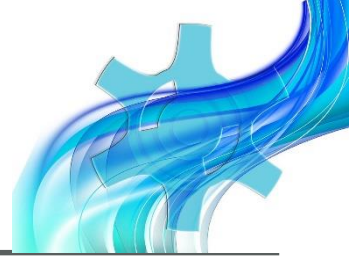
- -> **iteratively & continually renew profiles**
- 24h/7d cycle typical
- Provides the basis for **historical analysis** and predictive profiling

Data: Behavioral telemetry as a function of progression dimension

Methods: Cluster analysis/segmentation + sequence analysis, binned according to progression dimension.



Dynamic profiles



Spatio-Temporal Profiling



What: Investigating how people use the virtual environment

Why: Capturing the *actual dimensions of the user experience* in 3D games

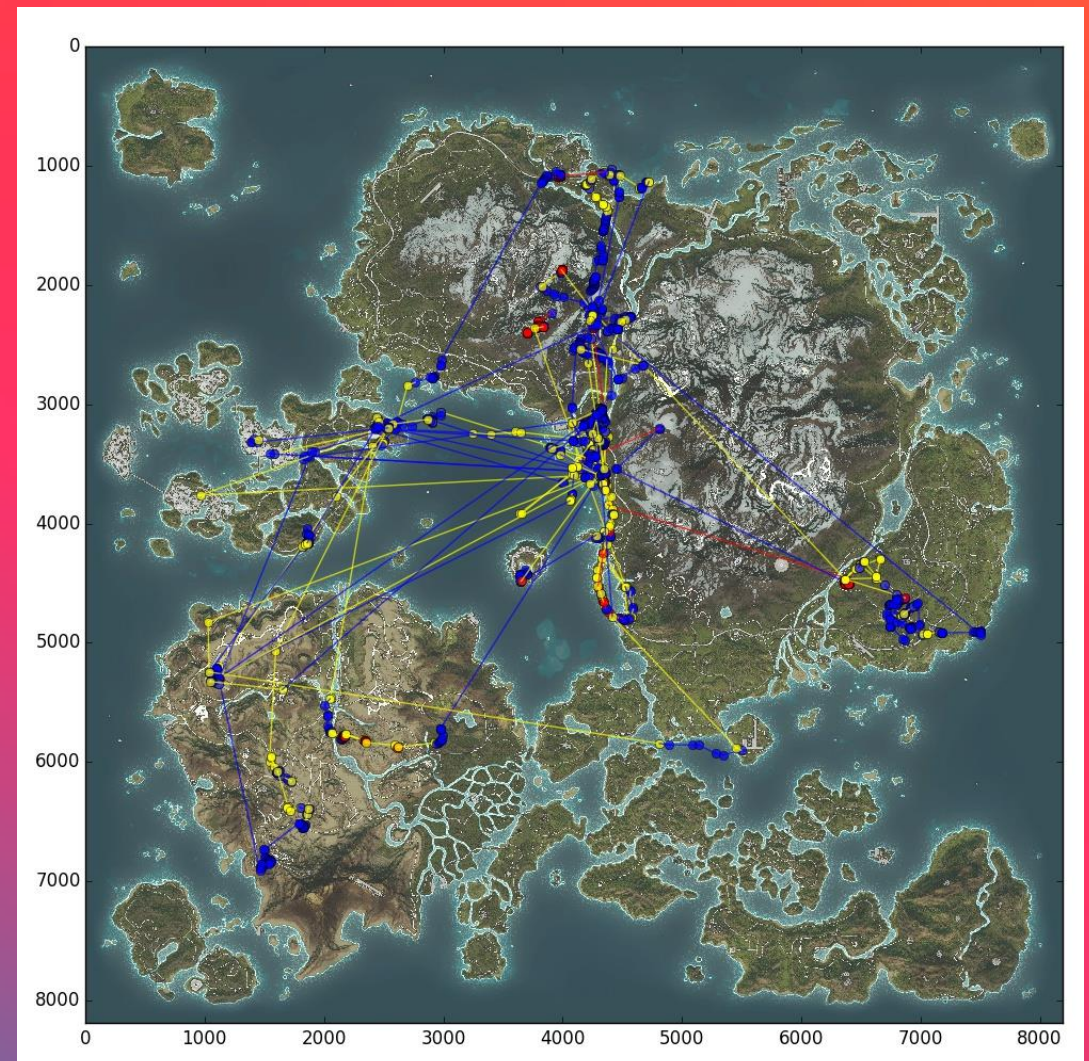
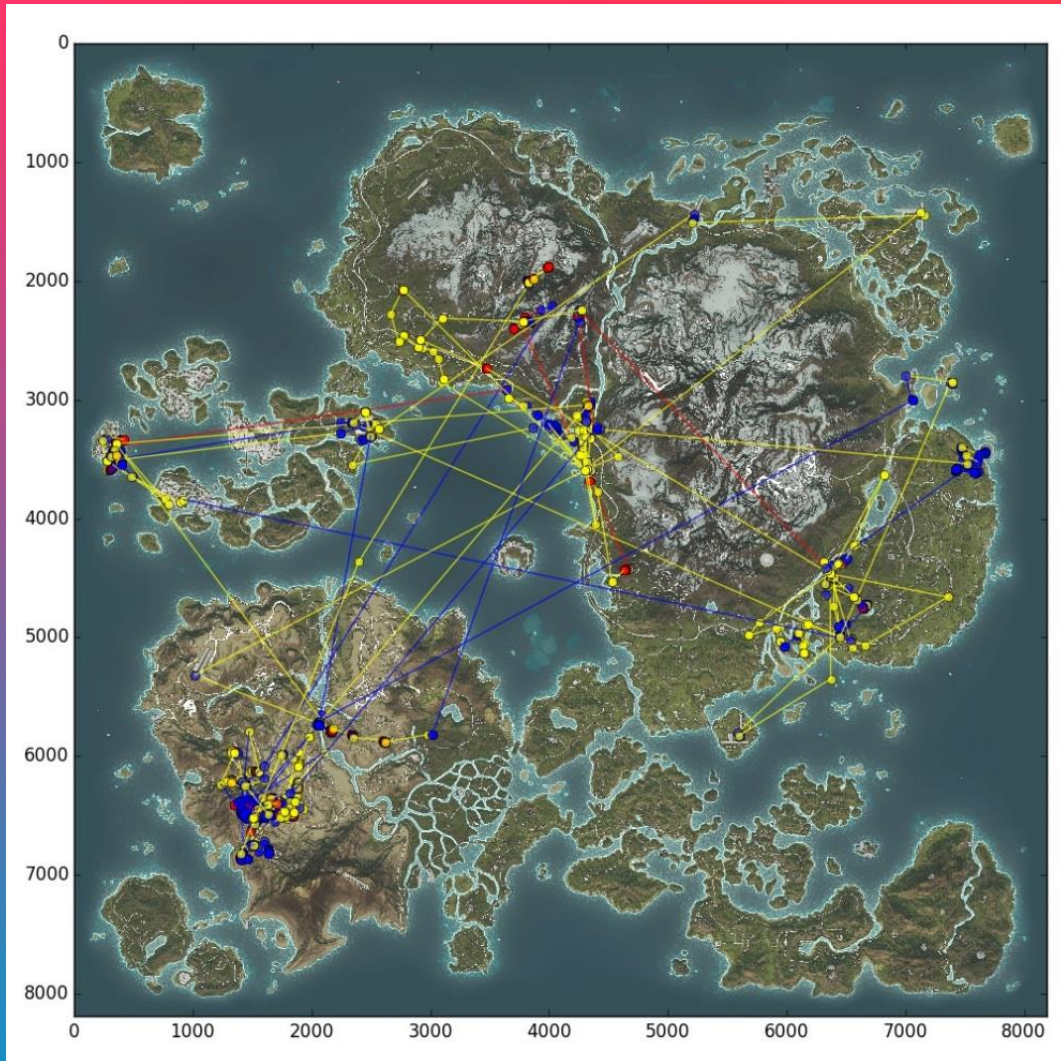
- Temporal profiles can be similar, *but spatial behavior different*
- Lots of inspiration in GIS, game AI, traffic, Architecture, Ecology ...

Data: Spatio-temporal data from virtual environment or real-world

Methods: Clustering of trails, action-sequence mining, heatmaps



Identical non-spatiotemporal profiles – but spatial behavior different!



Psychological profiles



What: building an understanding of the psychology of the player

- motivation, engagement, personality, etc.

Why: behavioural telemetry tells us what players do, **can only infer why.**

- We need to understand the psychological drivers of behaviour.
- Self-Determination Theory, Flow, Big5, MBTI etc.

Data:

- Model building: combining observational/experimental lab work
- Testing: behavioural telemetry, contextual data etc.

Methods: **user research techniques** (observation, interviews ...), **operationalized psychological theories, behavioural telemetry** (or contextual data)



Psychographic profiles



What:

- Traditionally psychographic profiling: personality traits, values, attitudes, interests and lifestyle.
- In games combines any of: **behavioural**, **psychological** and **contextual** data

Why: Psychographic profiles allow combining profiles

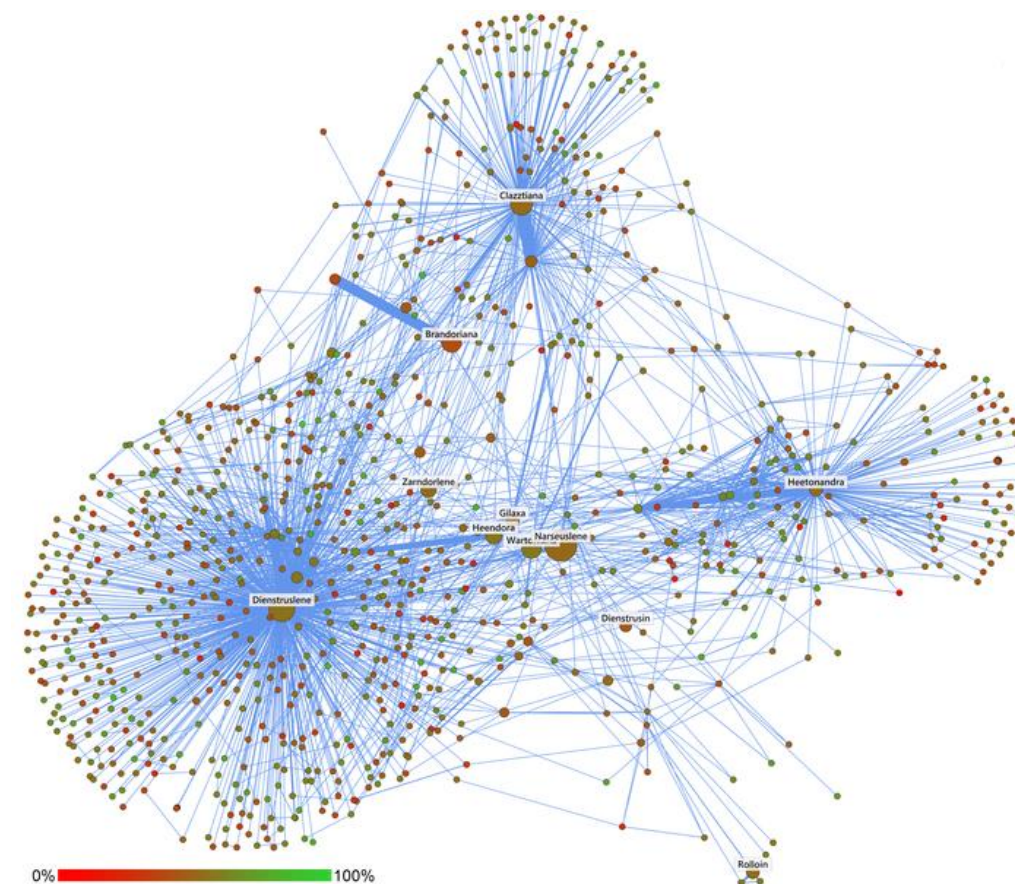
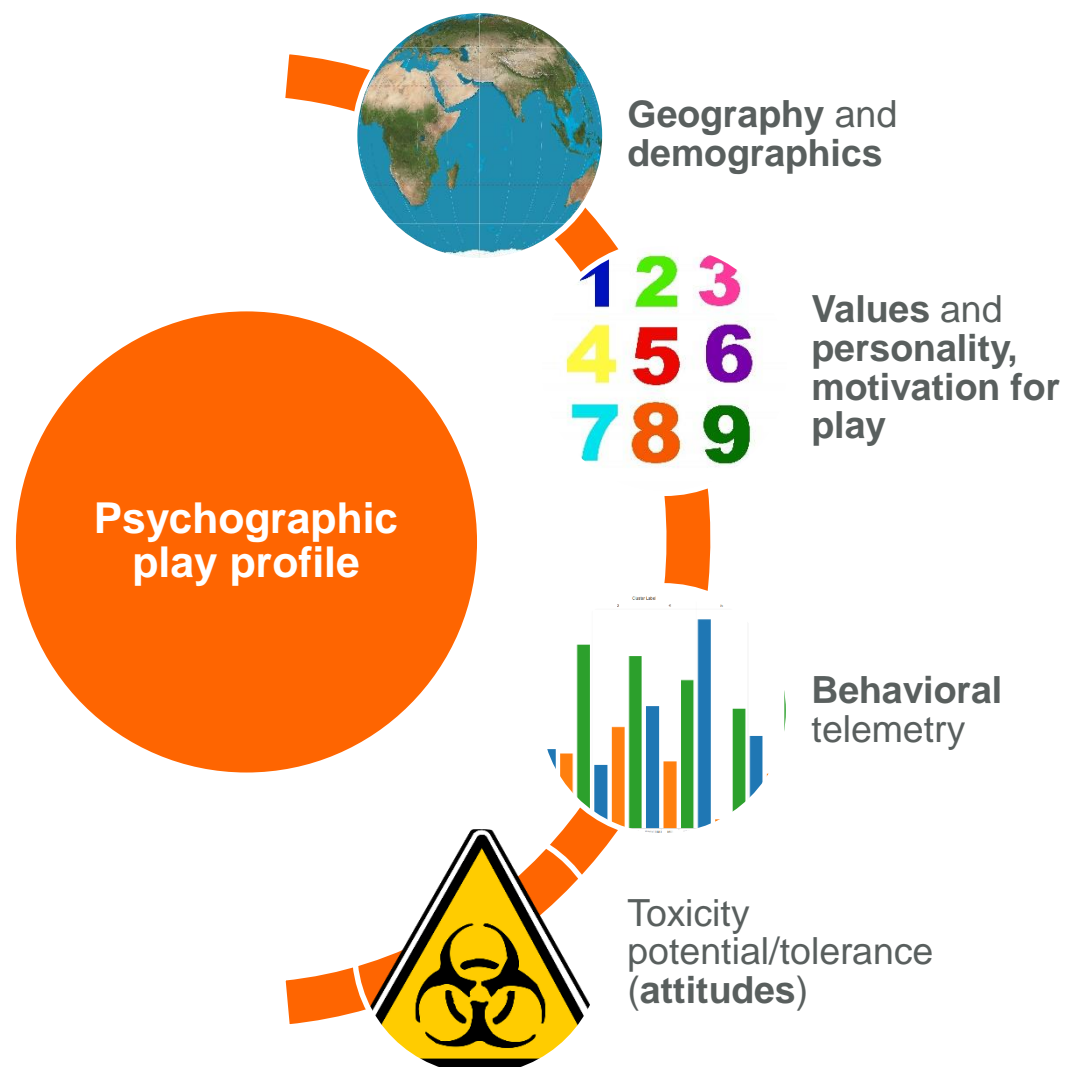
- Allows describing **what** a player does and **why** in one coherent framework
- Useful for feeding into recommender systems and adaptive mechanics

Data: As for behavioural profiles + psychological profiles

Methods: Unsupervised machine learning, notably soft clustering



Social matchmaking in games



Predictive profiling



What: Categorising players based on an understanding of what will happen in the future for **specific touchpoints**

Predicting churn, retention, conversion etc. -> a form of *shallow profiling*

Why: predicting what players will do allows intervention and prevention

- *Deep profiles* can be **input features** in predictive models
- *Shallow profiles* can be used to **augment deep profiles** (e.g. retention strategy profiling)

Data: Behavioural telemetry

Methods: Supervised ML – DTs, random forest, tensor flow, survival models, recurrent nets ...



Lifetime profiling



What: Building and understanding of the player across their “lifetime”

Why:

- Anticipating the sum total of a feature associated with a player, e.g. **CLTV**
- Predict across *many* aspects, *multiple future touchpoints*
 - Purchases, likely obstacles to progression, predicted social activity and value, engagement ...
- With some exceptions (**purchasing, social**) largely unexplored topic – can require big data across many games

Data: Behavioural telemetry (typical)

Methods: Supervised ML for sparse data – classifiers, tensor flow, recurrent nets ...



Psycho-predictive profiles



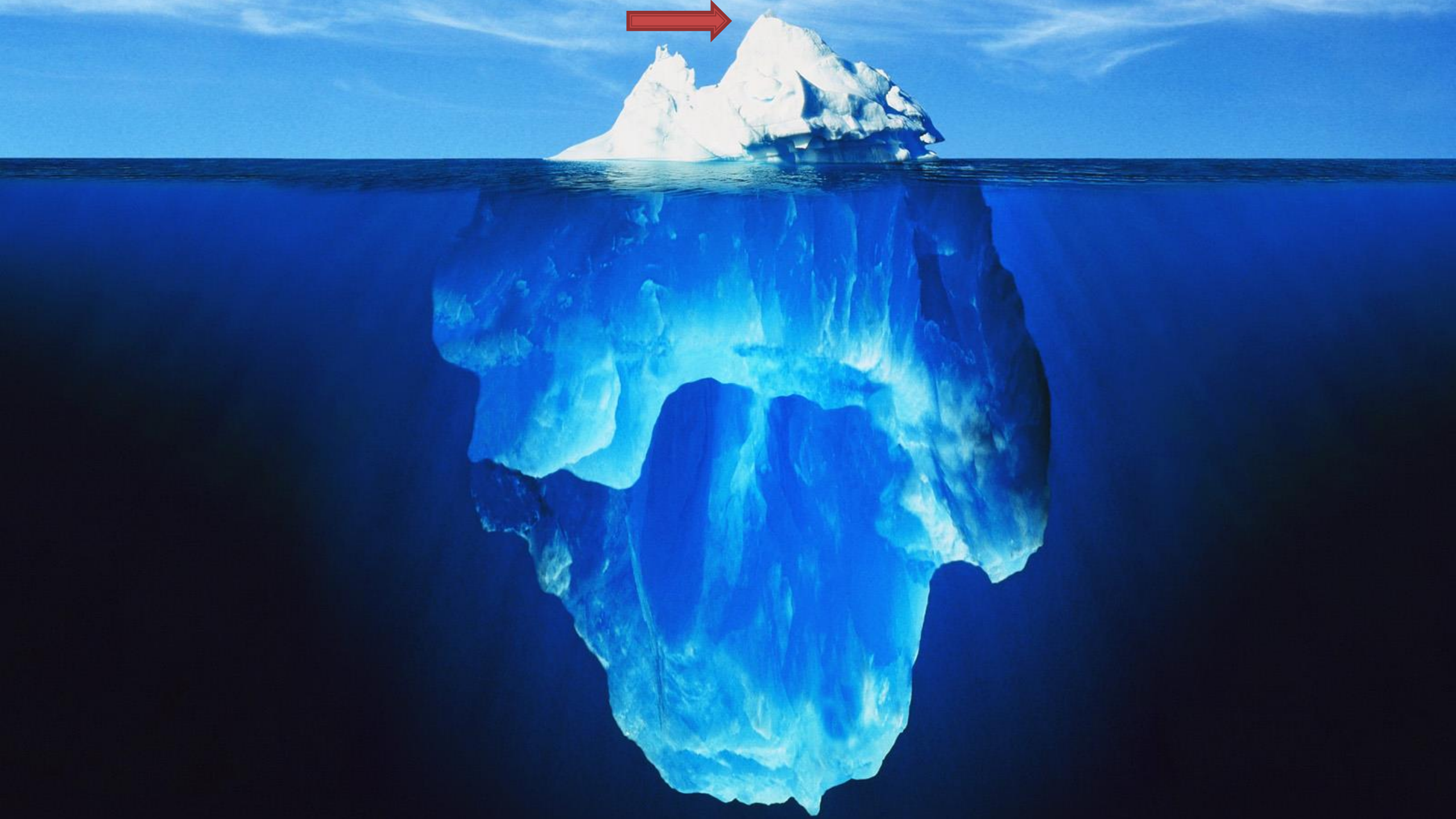
What: Predicting the **future psychological state** of the player

Why: Understanding the psychological state of the player provides information for **revenue optimization** (item sales, ads) and **game adaption** (e.g. stress prediction and prevention)

Data: Everything we can use to understand the psychological state of the player and the resulting behaviour (!)

Methods: Currently largely unexplored.





6 Profiling Takeaways

1. **Keep the focus on the users as people:** needs, requirements, user experience, behavior, psychology ... -> **UX is King**
2. Integrate a deep feedback loop between **analytics, user research, design** and **strategy**
3. **Need-driven:** cost resources to build profiles, must be justified by a need
4. **Verified** by or driven by data (behavioral, attitudinal, model ...)
5. **Dynamic** and time-sensitive (*timed for their purpose*)
6. Easy to **explain** and to take **action** on by the relevant stakeholder



5 Warnings

1. Not an **objective** process
 - **Choices**: algorithm, normalization, pre-processing, interpretation ...
 - *Potential for bias and bad decisions at all steps*
2. Can **integrate varied data** sources - even theory – take care cross-correlating
3. In practice: **algo-/model-generated** group profiles are non-distributive
4. Key challenge is (always...) **feature selection**
5. **The lure of machine learning**: descriptive stats and simple profiles: often fast & surprisingly useful



Thank you

Reading material + slides on: andersdrachen.com

Digital Creativity Labs: digitalcreativity.ac.uk

Contact: anders.drachen@york.ac.uk

