

Automatic Game Balancing

Vanessa Volz

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StarCraft II, Blizzard (Browder [Bro11])

E-Sports

- clarity of actions on the screen
- balance between skill and uncertainty
- diversity of feasible tactics



Figure 1 : Baneling attack ©Blizzard

Left 4 Dead, Valve (Ambinder [Amb11])

Physiological Signals

- to incorporate player sentiment
- dynamic decisions on pacing and difficulty (i.e. opponent placement)
- increase game immersion



Figure 2 : Left 4 Dead AI Director ©Valve

Halo 3, Bungie (Griesemer [Gri10])

Longevity

- unfairness: inherent uncertainty creates tension and excitement
- balancing process = several passes of small changes



Figure 3 : Halo 3 cover art ©Bungie

Dominion, Rio Grande Games (Vaccarino [Vac14])

Robustness wrt additions

- multiple rounds of play-testing
- analysis of resulting gameplay
- small changes \Rightarrow significant consequences: due to interaction of cards



Figure 4 : Envoy Promo Card ©Rio Grande Games

Game Balancing as an Optimisation Problem

Working Definition: Game

Set of constitutive and operational rules that define

- number / roles of players and game objects allowed in given situation
- valid interactions between them

Working Definition: Game Balancing

Parameters of game rules are modified to

optimise (multiple) balancing goals

Game Balancing Examples

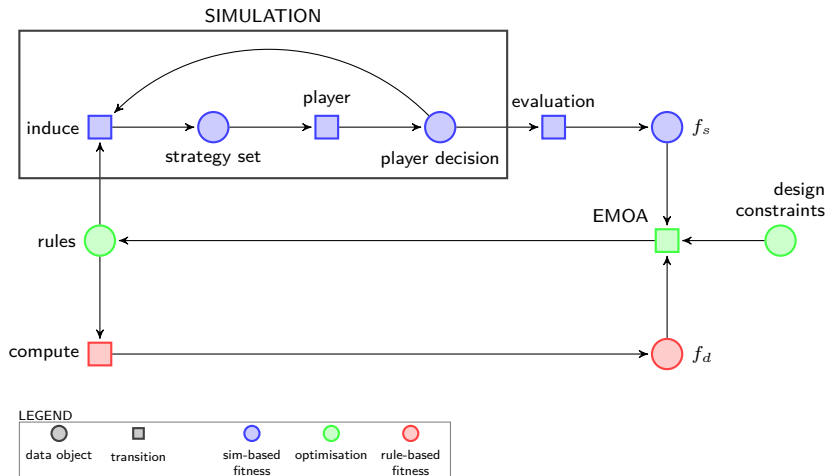
TORCS

- Prototype: tracks with parameter set
 - friction
 - rolling resistance
 - roughness (amplitude and wavelength)
- Possible goals:
 - Fairness: Same win rates for different drivers
 - Suspense: Finishing time differences small

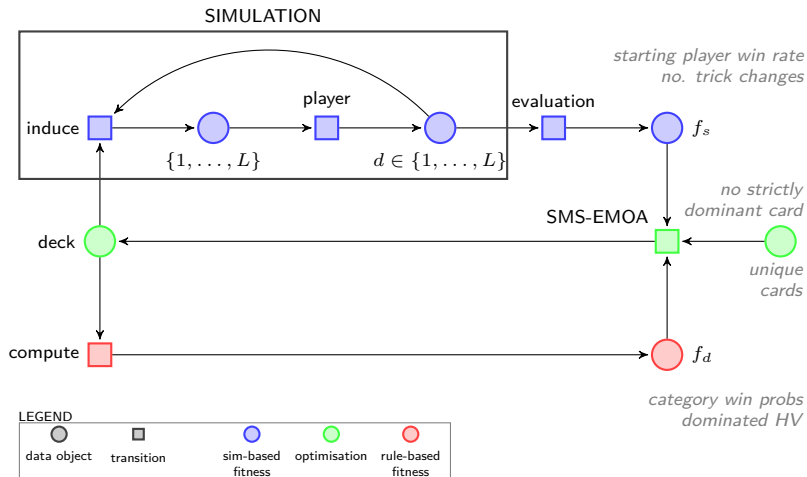
Top Trumps

- Prototype: $K \times L$ matrix (K cards with L categories)
- Possible goals:
 - Fairness: Minimise starting player advantage
 - Suspense: Maximise number of trick changes
 - Fun: Balance player preferences (future work)

Automatic Game Balancing Framework



Automatic Game Balancing Framework: Top Trumps



Future Topic

- Fitness Approximation
 - Simulation: AI-controlled players
 - Non-deterministic games: Significant measurements
 - Computational cost: Surrogate models

- Result Analysis
 - Exploratory landscape analysis
 - Optimisation

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