Measuring Aesthetics of Game Behavior

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The paper intends to address the measurement of a facet of game-events particular beauty. More precisely, we present our approach to measuring desirable game behavior from game history. This work shows metrics developed to fundamental aesthetic aspects of games. We deal with a multiplayer turn-based game model. However, one should assume that this model can accommodate games that are, in fact, not based in turns but arbitrarily segmented at a fixed time interval or the end of a recurrent event. We intend to supply a tool that improves the game design process and would be useful to those who see ludic artifacts as a study object.

Intro

The aesthetics of games could be seen as a composition of aesthetics like those of player moves, strategies, gameplay, music, graphic arts, narrative and so on. In this work, we address the measurement of a facet of game-event's particular beauty. We focused our efforts on those aesthetics aspects that emerge from gameplay, or from a set of players' moves. More precisely, we attempt to measure desirable game behavior from the game history.

We look at the match from the beginning until a moment that is not necessarily its end and, based on measurements from its game history, could conclude about its aesthetics. In fact, we attempt to conclude about the infinite set of game-events that can emerge from a single abstract game. To achieve that, we see the observed set of matches as a sample from an infinite population from which we can draw inferences.

Measuring Game Aesthetics

Our approach uses game history [Fig. 1] and an evaluation function to extract information about matches of multiplayer turn-based games.

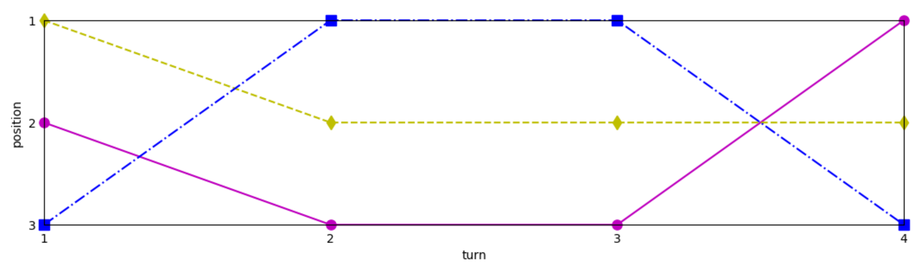

Fig.1 - Game History

We evaluate the player's campaign at the end of each turn but, rather than try to determine if the current game state leads a particular player to win, we compare the players and order their campaigns based on the function's result. Hence, we try, always imperfectly, as stated by Shannon, determine how close to winning the players are.

We translate the definition of desirable behaviors of a game to mathematical formulations and use it to measure the degree of those behaviors occurrence in a match. The measures of a certain number of matches of the same game compose a sample of an infinite population of all the possible matches of that game.

Notation

p	is a player	$P_f(P_\alpha, m_\beta)$	is the evaluation function
P_w	is the winner	$\mathbb{P}(P_\alpha, m_\beta)$	is the probability of winning
P	is the set of players	L	is the set of leaders
$\|P\|$	is the number of players	$\|L\|$	is the number of leaders
M	is the match, a set of turns	L_{change}	is the set of lead changes
$\|M\|$	is the number of turns	$\|L_{Change}\|$	is the number of lead changes
m	is a turn	MDP	is the maximum drama path

Drama

$$MDP(m) = \left\lceil |P| + \frac{(1 - |P|)(m-1)}{|M| - 1} \right\rceil$$

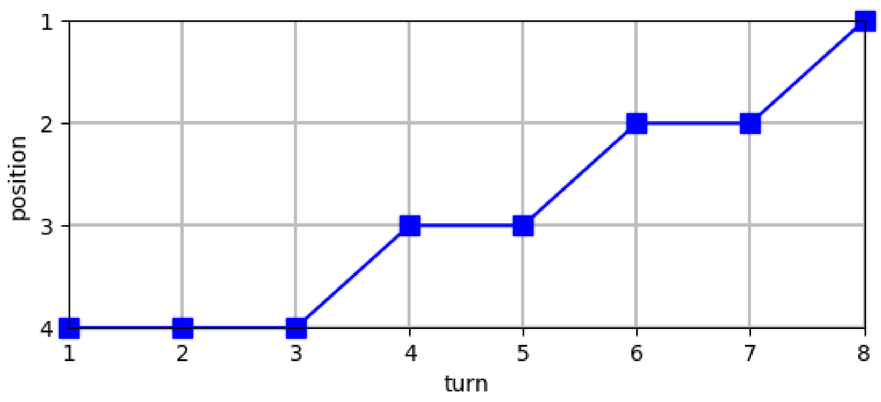

Fig.2 – Maximum Drama Path (MDP) for 4 players and 8 turns

$$Drama\ by\ Path_{mch} = \frac{|\{m | P_f(P_w, m) > 1\}|}{|M| - 1} \times \left(1 - \sum_{m=1}^{M} \frac{|P_f(P_w, m) - MDP(m)|}{(|P| - 1)(|M| - 1)}\right)$$

Uncertainty

$$Uncertainty\ by\ Entropy_{mch} = -\sum_{n=1}^{|M|-1} \sum_{p \in P} \frac{\mathbb{P}(p, m_n) \log_2(\mathbb{P}(p, m_n))}{\log_2(|P|) \cdot (|M| - 1)}$$

Lead Change

$$Lead\ Change_{mch} = \frac{\sqrt{\frac{|L| - 1}{|P| - 1}} + \sqrt{\frac{|LChange|}{|M| - 1}}}{2}$$

As the result of each metric is in the range [0,1], they can be understood as pertinence degrees for fuzzy sets representing the games that have those characteristics measured by the equations. So, they could be combined in a fuzzy aggregation operation to evaluate a game's overall aesthetics.

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