Co-creating Game Content using an Adaptive Model of User Taste

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Mixed-initiative procedural content generation can augment and assist human creativity by allowing the algorithm to take care of the mechanisable parts of content creation, such as consistency and playability checking. But it can also enhance human creativity by suggesting new directions and structures, which the designer can choose to adopt or not.

The proposed framework generates spaceship hulls and their weapon and thruster topologies in order to match a user's visual taste as well as conform to a number of constraints aimed for playability and game balance. The 2D shapes representing the spaceship hulls are encoded as pattern-producing networks (CPPNs) and evolved in two populations using the feasible-infeasible 2-population approach (FI-2pop). One population contains spaceships which fail ad-hoc constraints pertaining to rendering, physics simulation and game balance, and individuals in this population are optimized towards minimizing their distance to feasibility. The second population contains feasible spaceships, which are optimized according to ten fitness dimensions pertaining to common attributes of visual taste such as symmetry, weight distribution, simplicity and size. These fitness dimensions are aggregated into a weighted sum which is used as the feasible population's fitness function — the weights in this quality approximation are adjusted according to a user's selection among a set of presented spaceships. This adaptive aesthetic model aims to enhance the visual patterns behind the user's selection and minimize visual patterns of unselected content, thus generating a completely new set of spaceships which more accurately match the user's tastes. A small number of user selections allows the system to recognize their preference, minimizing user fatigue.

The proposed two-step adaptation system, where (1) the user implicitly adjusts their preference model through content selection and (2) the preference model affects the patterns of generated content, should demonstrate the potential of a flexible tool both for personalizing game content to an end-user's visual taste but also for inspiring a designer's creative task with content guaranteed to be playable, novel and yet conforming to the intended visual style.

Related Work

A. Liapis, G. N. Yannakakis, and J. Togelius, "Adapting Models of Visual Aesthetics for Personalized Content Creation," *IEEE Transactions on Computational Intelligence and AI in Games, Special Issue on Computational Aesthetics in Games,* 2012, (to appear).

A. Liapis, G. N. Yannakakis, and J. Togelius, "Optimizing Visual Properties of Game Content Through Neuroevolution," in *Artificial Intelligence for Interactive Digital Entertainment Conference,* 2011.

A. Liapis, G. N. Yannakakis, and J. Togelius, "Neuroevolutionary Constrained Optimization for Content Creation," in *Computational Intelligence and Games (CIG), 2011 IEEE Conference on,* 2011, pp. 71–78.

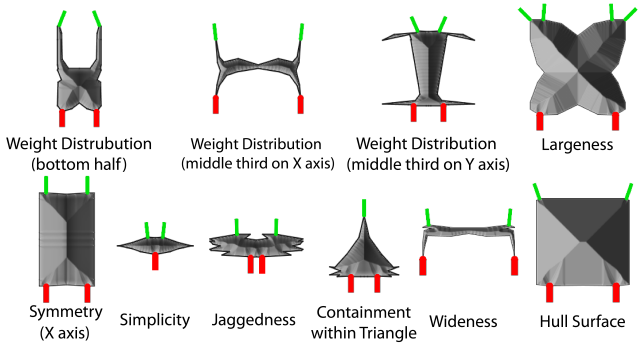

Figure 1: The fitness dimensions used to evaluate spaceships' visual properties and sample spaceships optimized for each fitness dimension. Weapons are displayed in green and thrusters in red.

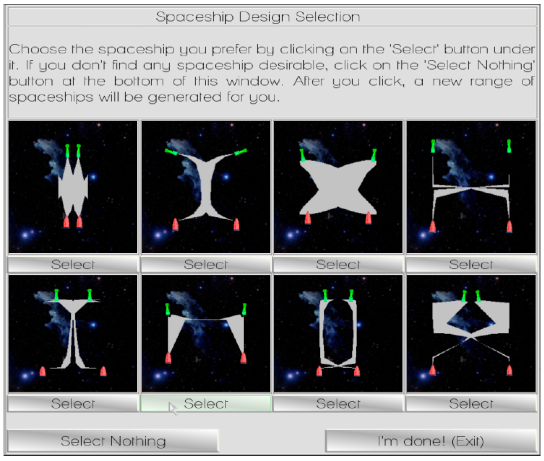

Figure 2: The graphic user interface for spaceship selection.