Interactive Genetic Algorithms for use as Creativity Enhancement Tools

Creativity is necessary to good product design. Creativity can arise due to both convergent and divergent thinking, and the interaction between them. In this study we examine an interactive genetic algorithm (IGA) that serves as a creativity tool for users. Using a web based IGA vehicle design tool, currently being developed, we can employ convergent and divergent thinking by adjusting two separate mutation rates that affect the design population. The divergent process will expose a great number of new and unique designs to the user who will be able to select those designs as parents in the next generation and also save them to a type of a "hall of fame" in their design selection process, thereby preserving a concept that they felt was their favorite. Further, if a design is well liked the convergent process will allow the user to take steps to refine their design. We can attempt to evaluate the creative designs of naïve users by asking expert judges in the field of automotive design to rate the creativity of each design.

Providing context for users in actual experimentation is critical to achieving desired results. In this case, subjects will design a "concept" car so that they know that they are explicitly trying to be creative not simply duplicative or seeking. IGAs can be used to assist users in the development of creative ideas. We examine the use of IGAs in vehicle design by allowing users to interact with a population of parameterized vehicle silhouettes. From these silhouettes and from user choices more silhouettes are created and presented to the user. Because the user has a specific task they will base their choices on a number of intuitive and idiosyncratic reasons that they may not be able to actually communicate externally. This tool allows them to communicate those reasons in a natural and simple way.

This study also examines the theoretical benefit of utilizing two different mutation rates to affect design responses in IGAs. The two mutation rates act together on each generation, such that half of the population is controlled by a high mutation rate (divergent thinking), while the other is controlled by a low mutation rate (convergent thinking). Monte Carlo studies will be used to show that if the goal of the user is to find a new and diverse design then that is achievable using this system, but if the user decides to find a specific design this system will also allow that. So, in theory it allows creative expansion along with concept refinement all within one design tool. We expect that the Monte Carlo and human subject studies will support the idea that combining convergent and divergent thinking processes within the IGA will aide user creativity.