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Using a Contextual Focus Model for an Automatic Creativity Algorithm to Generate Art Work

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Abstract

We sought to implement and determine whether incorporating cognitive based contextual focus into a genetic programming fitness function would play a crucial role in enabling the computer system to generate art that humans find "creative" (i.e. possessing qualities of novelty and aesthetic value typically ascribed to the output of a creative artistic process). We implemented contextual focus in the evolutionary art algorithm by giving the program the capacity to vary its level of fluidity and functional triggered dynamic control over different phases of the creative process. The domain of portrait painting was chosen because it requires both focused attention (analytical thought) to accomplish the primary goal of creating portrait sitter resemblance as well as defocused attention (associative thought) to creativity deviate from resemblance i.e., to meet the broad and often conflicting criteria of aesthetic art. Since judging creative art is subjective, rather than use quantitative analysis, a representative subset of the automatically produced art-work from this system was selected and submitted to many peer reviewed and commissioned art shows, thereby allowing it to be judged positively or negatively as creative by human art curators, reviewers and the art gallery going public.

Keywords: Evolutionary Systems, Genetic Programming, Contextual Focus, Creativity, Computational Modelling

1 Introduction

Creativity is a complex set of cognitive process theorized to involve, among other elements, attention shifts between associative and analytical focus (Gabora, 2000), novel goals (Luo and Knoblich, 2007), and situated actions and difficult definitions of evaluation. Computational creative systems (CES) strive to model a variety of creativity's aspects using computer algorithms from evolutionary 'small-step' modifications to intelligent autonomous composition and 'big-leap' innovation in an effort to better understand and replicate creative process (Boden, 2003). The focus by some researchers on replicating creativity in computational algorithms has been instrumental in learning more about human cognition (individual and collaborative) and how creative support tools might be used to enhance and augment human creative individuals and teams. All these aspects

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continue to evolve our perceptions of creativity and its role in computation in the current technology-saturated world.

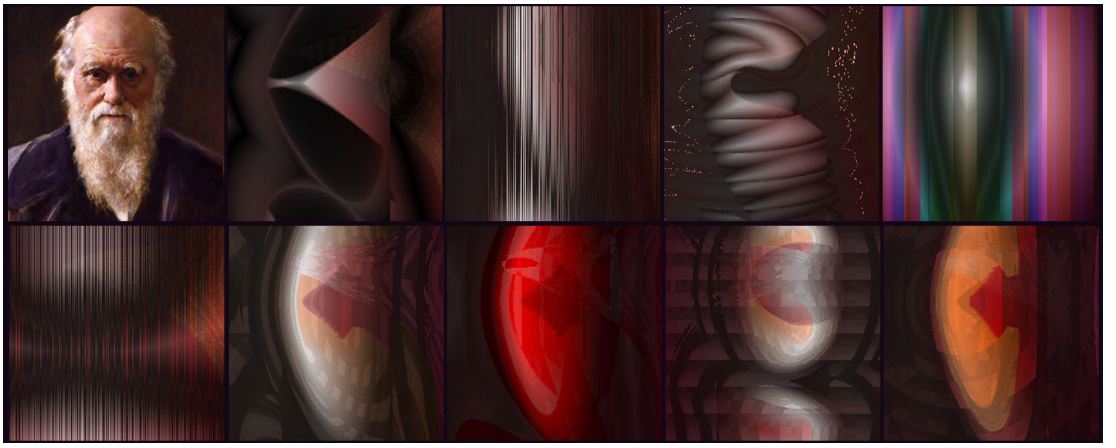

Figure 1. Source Darwin image (top left) with examples of our evolved abstract portraits created using our DarwinsGaze autonomous creative genetic programming system.

Systems modeling creativity computationally have gained acceptance in the last two decades, situated mainly as artistic and research projects. Several researchers in computational creativity have addressed questions around such computational modeling by outlining different dimensions of creativity and proposing schema for evaluating a "level of creativity" of a given system, for example (Ritchie, 2007; Jennings, 2010; Colton, Pease and Charnley, 2011). While there is ongoing research and scholarly discourse about how a system is realized, how the results are generated, selected and adjusted and how the process and product are evaluated, there is less research about direct applications of creative cognitive support systems in real-world situations.

2 Contextual Focus: Associative and Analytical Thinking

We explore creativity from theories of cognition that attempt to understand attentional shifts between associative and analytical focus – what we call “contextual focus” or “contextual fluidity”. The existence of two stages of the creative process is consistent with the widely held view that there are two distinct forms of thought (Neisser, 1963; Piaget, 1926; Sloman, 1996). It has been proposed that creativity involves the ability to vary the degree of conceptual fluidity in response to the demands of any given phase of the creative process (Gabora, 2000, 2002; DiPaola & Gabora, 2009). Again, this dimension of variability in focus is referred to as contextual focus. Focused attention produces analytic thought, which is conducive to manipulating symbolic primitives and deducing laws of cause and effect, while defocused attention produces fluid or associative thought which is conducive to analogy and unearthing relationships of correlation. Thus, creativity is not just a matter of eliminating rules but of assimilating and then breaking free of them where warranted. Said another way, divergent or associative processes are hypothesized to occur during idea generation, while convergent or analytic processes predominate during the refinement, implementation, and testing of an idea. This is referred to as contextual focus because it requires the ability to focus or defocus attention in response to the context or situation one is in. Defocused attention, by diffusely activating a broad region of memory, is conducive to divergent thought; it enables obscure (but potentially relevant) aspects of the situation