Evolutionary Visual Art and Design

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Summary. This chapter presents an introduction to the different artistic design domains that make use of interactive evolutionary design approaches, the techniques they use, and many of the challenges arising. After a brief introduction to concepts and terminology common to most artificial genetic design, there is a survey of artistic evolutionary systems and related research for evolving images and forms. While the focus is primarily on purely aesthetic fitness landscapes, the survey also ventures into areas such as product design and architecture. The overview shifts from technique to application as organizational strategies, as appropriate. After briefly surveying additional information sources, the chapter concludes with a discussion of major topics of relevance to evolutionary system designers, providing context for the following chapters. It is hoped that this snapshot of the state of the field will increase exposure to projects and issues, discussion amongst participants, and ultimately the accessibility of these techniques and approaches.

1.1 Introduction

In the early 1990s, both Karl Sims and William Latham (with Stephen Todd) followed in the footsteps of scientist Richard Dawkins by combining evolutionary techniques and computer graphics to create artistic images of great complexity [1, 2, 3]. In the succeeding decades, a generation of artists/researchers have recombined, modified, and extended these techniques, beginning the exploration of possible applications of evolution to aesthetic design. This chapter will survey developments in this field, and introduce issues and concepts critical to the approaches described.

The beginning of this chapter briefly introduces basic concepts and terminology used in evolutionary art and design. The middle portion of this chapter presents an overview of many of the aesthetic domains, application areas, and techniques in which artificial evolution has been employed. Determining a categorization strategy from the many possible options was very challenging. At the top level of organization, examples are divided into two-dimensional,
three-dimensional, and four-dimensional sections (image, form, and time). Within these categories, however, two different methods are used.

In the two-dimensional artifacts section, work is discussed primarily in terms of the technique used. Approximately 90% of the examples in the section are applications of nonrepresentational aesthetic image creation, with three to six examples of most techniques. The remaining 3D and 4D domains seem more readily divided by usage, given fewer examples of each individual approach, and greater diversity and balance of application areas. The overview of the field concludes with pointers to additional survey materials. While this chapter will not attempt to venture into the field of evolutionary music, it will frequently traverse the short distance between artistic/aesthetic and more design-oriented subjective fitness applications. While efforts have been made to provide references primarily to works published as papers, books, etc., due to the lack of reliability that accompanies Web-based references, there are quite a few relevant projects, companies, and other resources included that are available only online.\footnote{While this is intended to be a comprehensive survey providing brief coverage of representative works in a majority of the relevant areas, it is likely that many individuals, projects, and problem domains are not mentioned. Please continue to email missing references, which will be added to the growing online database \cite{4}.}

In the space of evolutionary design research, the boundary around projects comprising “evolutionary art” is fuzzy. Are evolved creatures art when presented at an a-life conference versus a gallery installation? Are certain regions of software’s potential design space art, while others are not? Which is the more critical task: the creation of evolutionary art interfaces or the crafting of the design spaces they represent? Very few of those capable of the technical demands of programming evolutionary design software have formal art training. While the products of evolutionary art systems are ostensibly tied to the aesthetic sensibilities of the user, the design of the solution space usually weighs much more heavily in the likely range of visual results.

The remainder of the chapter concludes by introducing a number of concepts and concerns prevalent in the field, including a summary of critical issues to provide context for the remaining chapters. Collectively, these point toward a future in which software, interface, and representation will work together to escape the local minima of current imagery and venture further into new regions in the possibility space of evolutionary art.

### 1.2 Concepts and Terminology

This section will briefly introduce the basic concepts upon which most evolutionary art and design approaches are based. In general, a design firm analogy can be of use. Given a particular design assignment, a staff of artists and designers creates a number of possible solutions. The director decides, using