

THE FUTURE OF EVOLUTIONARY DESIGN RESEARCH

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The use of evolutionary algorithms to optimise designs is now well known, and well understood. The literature is overflowing with examples of designs that bear the hall-mark of evolutionary optimisation: bridges, cranes, electricity pylons, electric motors, engine blocks, flywheels, satellite booms - the list is extensive and ever-growing. But although the optimisation of engineering designs is perhaps the most practical and commercially beneficial form of evolutionary design for industry, such applications do not take advantage of the full potential of evolutionary design.

Current research is now exploring how the related areas of evolutionary design such as evolutionary art, music and the evolution of artificial life can aid in the creation of new designs. By employing techniques from these fields, researchers are now moving away from straight optimisation, and are beginning to experiment with explorative approaches. Instead of using evolution as an optimiser, evolution is now beginning to be seen as an aid to creativity - providing new forms, new structures and even new concepts for designers.

In the *Department of Computer Science, University College London*, research is concentrating on these avenues. We are investigating the capabilities of creative evolutionary design, examining how evolution can generate its own representations of designs by evolving developmental processes. We are applying evolutionary design techniques to architecture, showing how evolution can provide many alternative and useful designs, with explanation and justification to clients. We are investigating how evolution can suggest alternative pipeline designs, and how aesthetic cars can be evolved, 'inspired by' many existing models.

Nevertheless, despite the blossoming research at UCL and other departments around the world, there are few major collaborative projects for evolutionary design. Currently, Napier University's EvoNet and its sub-group 'EvoDes' provides the only major example of a network on this subject, but its activities seem to be limited to optimisation and engineering. Clearly there is a need for a larger-scale network with a much broader outlook, which should be formed with the specific aim of promoting the dissemination and growth of research in this area. I would encourage a carefully thought out plan with clear objectives and aims. I suggest the following:

1. **Dissemination.** The creation of a network designed to encourage transfer of knowledge between evolutionary design researchers. Regular workshops and conferences hosted by the different members of the network would aid in this, but perhaps the most useful medium would be the internet, with the creation of a web site, comprising archives of papers, code, lists of researchers in this area, and an electronic mailing list.
2. **Advancement of research.** Specific targets should be set to start up new collaborative research projects between different members of the network. For example, each member should provide details of their interests and funding requirements, and members should suggest sources of funding. Dates should be set for proposals, and adhered to. Information about industrial partners who are interested in collaborating/sponsoring research in this area should be shared amongst members.

In order to promote the growth of research in this area, we must stop working in isolation and start to form coherent and directed plans for future investigations. If this can be achieved, then perhaps a 'European Network on Evolutionary Design' could lead the world in the investigation and exploitation of this promising new way to aid designers.