The Side Effect of a Generative Experiment

Joanna Kabala, MFA, MSc
joanna.kabala@planet.nl

Abstract

This paper discusses the issue expressed in the call for the Generative Art 2002 conference that says: "GA is identifiable as one of the most advanced approaches in creative and design world."
In this paper the value of Generative Art for the art, science and design worlds is described in the reference to a generative experiment. The experiment has been conducted in industrial environment with the aim of defining possibilities for natural interaction of humans with machines. In specific, the experiment examined an option for visual adaptation in accordance to user feedback. In the context of the experiment's outcome the issue of recognizability of Generative Art values is discussed. Generative Art can be identified but is not widely recognized as "one of the most advanced approaches in creative and design world". What makes it difficult for designers to switch to generative thinking and accept immediately Generative Art as the possible way of advancing traditional design methods? And what makes it promising to keep searching for ways of application of Generative Art in contemporary design? Some possible answers, proposed in this paper, aim at contributing to the discussion about the changing role of artists and designers in the contemporary society.

1. Introduction

Generative Art is identifiable as one of the most advanced approaches in the creative world. It is certainly identifiable as such by professionals who investigate this domain in depth. Can Generative Art gain a broader recognition, a wider appreciation and more often usage in art, science and design applications? The most often discussed values of Generative Art focus on *creative* features, such as the big variety of results, the high aesthetic value and the interactive potential of generative techniques. Next to the creative values, there exists also one more important value that is *the integration of domains*. The interdisciplinary character of generative techniques makes Generative Art an outstanding field indeed. This interdisciplinary value that enables sharing of experiences among disciplines is not very common, not as much as it is desirable.

Contemporary artists and designers who work with technology and new media often have difficulties with the definition of the domain of their research or with the unambiguous definition of their productions. Sometimes they cannot even easily say about themselves, if they are artists or designers or scientists. In the context of the discussions around the interdisciplinary techniques, capabilities and needs, Generative Art appears as a coherent stream. And as such, it certainly deserves a broader dissemination and implementation.

This paper tackles upon the integrative character of Generative Art in the three following chapters that try to capture values important for three separate domains - design, science and art. A bit of an insight is given into how the domains communicate and what sort of difficulties they stumble across.

Some examples from a generative experiment conducted by Philips Research in co-operation with Philips Design are used. In order to conduct the experiment, generative software called PAINT was developed. One of its modules, called ShapeEditor, can be considered as a side effect of the generative experiment. It was not foreseen in the project planning, but in the development process it turned out that it is necessary to create it, in order to be able to proceed at all.

2. Design: people want what they like

Generative design allows for the definition of rules of transformation. Transformations might be designed so that, depending on user feedback, each interaction with a computer system produces different results for different users. This is why the conclusions of some previous design research into natural interaction and adaptive systems have pointed to generative design as a potentially optimal technique that could be applied in the adaptive user interface design.

A generative experiment has been set up in order to examine an option for visual adaptation in accordance to user feedback. The research objective was to look for ways of achieving *personalization* in natural interaction of humans with machines. The experiment has been conducted in industrial research environment. Personalization was understood there mainly as a capability of a computer system to match the preferences of an individual user. Matching the preferences is enabled by advanced systems that "know" their users and based on this knowledge, which is being gathered in the interaction process, these systems could adapt so that they could generate results satisfying individual user.

The design issue in this case was to find out how far individual users could influence the final computer image, while putting minimal effort into the interaction. The topic of the experiment was to investigate the interaction process and to find out if visual adaptation is possible so that users could with one gesture of a hand determine the final look of graphical forms on screen. The determination means *user selection*, and similarly to other evolutionary systems it provides quite a chaos that is hard to cope with when working within UI design constraints such as quick system response or clear information structure. The design problem in this experiment was to put some constraints on that chaos. The design idea was to describe the initial population in such a way that would shorten the evolution cycle and that would generate the results that would be less unexpected and more fitting the preferences and aesthetic taste of the user.

The adaptive mechanism designed in the experiment was based on shape grammars and genetic algorithms. The initial design work required an in depth analysis of graphical forms and shapes. The initial, "embryonic" form had to be created as well as graphic elements that define the "adults". The full set of all the graphic elements build up the space that is being searched through by genetic code that selects elements and synthesises the forms based on user interaction.

The prototype made for the visual adaptation test has taken the form of a plane with nine "organisms" exposed at a time. These are shown in the *figure 1*. The plane with figures was used for checking the performance of the genetic algorithms, so this is not the final user interface. In fact, the whole experiment was conducted apart from the potential future application.

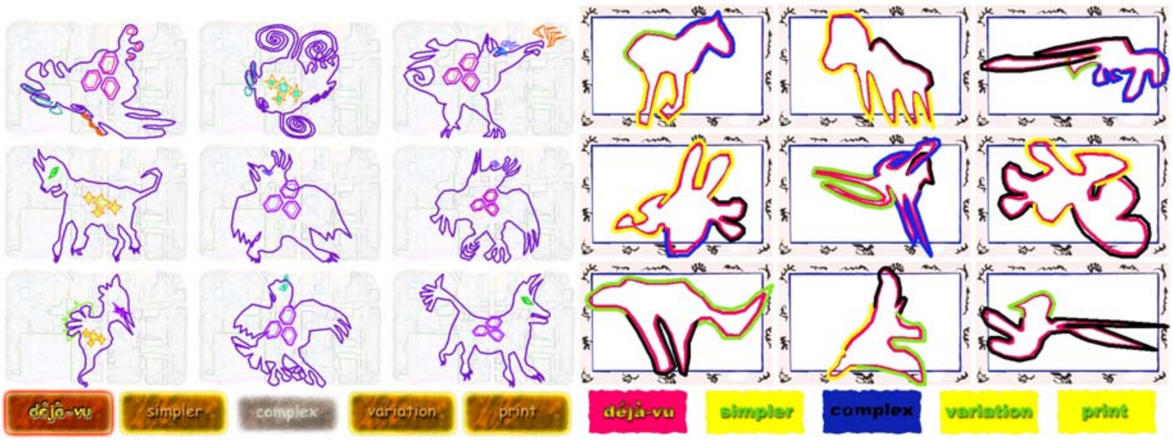

Figure 1: The outcome of the generative PAINT software:

to the left: **The illustration shows the outcome of an interaction session with the PAINT software. From a set of shape grammars a number of forms were generated based on earlier user selections. The "generative avatar" file has 27 embryos of five different species of creatures that in total contain 252 substitution rules at three levels of complexity. The file was used for the exploration of the shape space to find out more and more possible variations of the initially selected form.**

to the right: **The illustration shows creatures that were generated based on the shape grammar set derived from the graphics by Henri Matisse (*The Horse, the Rider, and the Clown*, Plate V from the *Jazz* series, 1947). The "matisseavatar" grammar has 27 embryos and 411 substitution rules at three levels of complexity. It was used to check how quick adaptation towards preferred color happens.**

With respect to the design domain, the work done in this generative experiment seems valuable mainly due to the simple definition of initial user needs. Saying that "people want what they like" was of a help to brake through the stereotype thinking and start looking for natural richness of individualized solutions that are offered by generative design. However, seeing such value was classified as art rather than design point of view. It seems that the user interface design, that in industrial research is dominated by the user-centred approach, tends to produce such clear interaction solutions that chaos (or just richness) produced by generative techniques, although very much natural, is not acceptable as a good enough solution.

3. Science: performance of the code vs. user experience

"People want what they like". Technological reasoning makes it possible to think that it might be conceivable to produce computer systems capable of satisfying individual preferences or even individual aesthetic taste. Preferences can be defined based on earlier choices made. It seems that it could be sufficient to gather information about the choices that users have made under certain circumstances, in order to be able to "predict" their future choice. In the design - research dialogue that has produced the generative software illustrated above, the scientific voice tended to argue that the issue of natural interaction and personalization depends on the system's performance. And that the design, in this case, is a *technically* difficult issue, mainly due to poor performance of existing adaptive (matching) algorithms. Those algorithms aim at enabling definition of user preferences but, in fact, they deal only partially with the big complexity of human needs and wishes.

Science requires measurable data sources. Adaptive and other technologies require high performance of algorithms. But in the domain of user interfaces design what counts is the *user experience*. The notion of the user experience is not really measurable and there is no straight mechanism to relate the user experience to scientific values. In the mentioned experiment, the research was oriented to achieve the maximum system performance, of course to the benefit of the target user. The issue of the user experience was important enough to include the design and art disciplines into the research activities. However, the strongest argument for choosing generative techniques as the research carrier was the fact that genetic programming is acknowledged scientific field.

The final research conclusions drawn from the experiment focused on the weakness of genetic algorithms with respect to the expected performance in a user interface. The main argument against them was based on the slow character of the evolutionary process. The other issue of concern to researchers, this was too many options, too big chaos produced by the generative software. The unique possibility of engaging the domain of art into the industrial research process was of much less importance to scientists. The aesthetic values are not the scientific data, even though these could help to define the user experience.

4. Art: creation

Initially, the generative experiment didn't have any explicit art objectives. The role of artist and designer was to maintain the overall aesthetics of the outcome and to take the humanistic position in the research discussion over adaptive systems and natural interaction. But it might be that this is actually the domain of art that indeed gained in this design-research dialogue and that might benefit most from the outcome of the experiment.

The experiment has used the simplest computer graphics that is 2D outlined linear shapes. The simplicity is a rough condition with respect to visual effects that computer graphics offers. The restriction of dimensions, colors, textures, etc., was assumed to be necessary, in order to learn how to create evolutionary "organisms" that would show *meaningful* (or, in scientific terms: predictable) growth of forms that are determined by user interaction.

A lot of conceptual hand drawings have been done in order to grasp the optimal construction of evolutionary shapes. Shape, as defined by Arnheim is "…visual material, received by the eyes [that] organizes itself so it can be grasped by the human mind. Only for the sake of extrinsic analysis, however, can shape be separated from what it stands for. Whenever we perceive shape, consciously or unconsciously we take it to represent something, and thereby to be the form of a content." [1]. The generative method that has been used in the experiment has emerged from the extrinsic shape analysis. The analysis has led to the parameterization of shapes that enables interactive adaptation. This parameterization has been one of the most difficult issues in the whole experiment. In order to provide a solution some additional programming of a special module within the generative software was necessary. This module, called ShapeEditor, aimed at maintaining the freedom of creation that is known to artists who sit with a pencil in front of an empty piece of paper. However, when targeting at *adaptive* forms, the art and design practice comes in itself close to programming, even when it involves as conventional activity as linear hand drawing. The freedom of hand drawing applies, in fact, only to shapes that are parts of the sets (of "bodies"), out of which the meaningful forms are being synthesised by genetic algorithms based on user interaction.

Artist and designers don't see what they are creating until the generative software will create the image. But these are artist and designers who determine what the software will create (*figure 2-4*). In the earlier times artists could only dream about such a *systematic creation* [2].

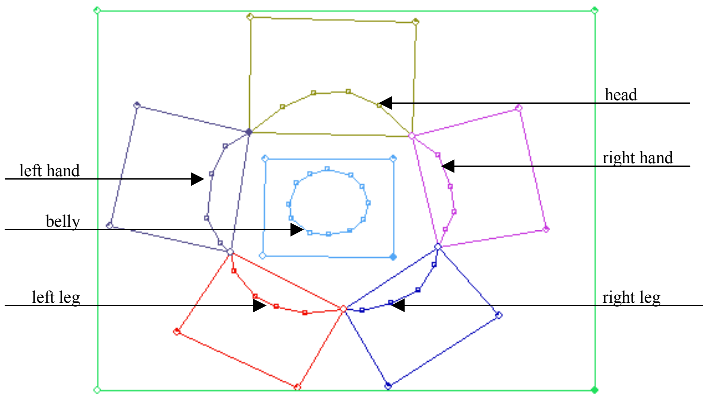

Figure 2: a generic shape grammar of an "embryo" contains a "head", two "hands" and two "legs" in the outline and a "cell" inside, that is in the "belly".

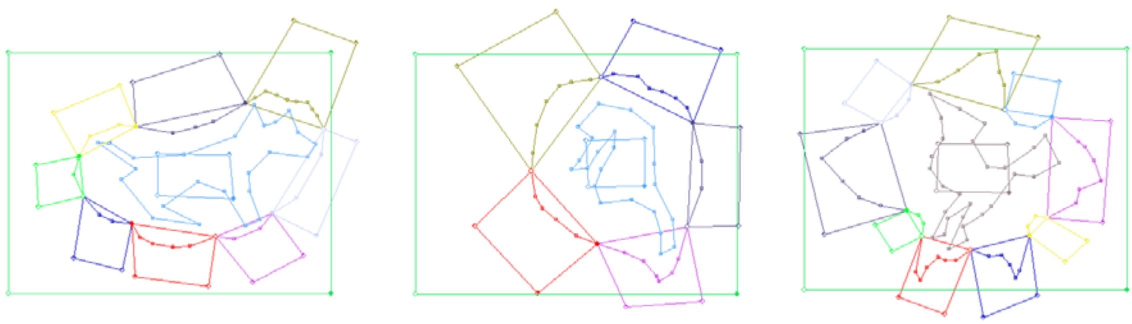

Figure 3: The illustration shows examples of embryos of a "dog", a "seahorse" and a "bird". All forms these are variations of the initial generic form shown in *figure 2*.

Figure 3: The illustration shows a part of the shape grammar set "dogs". The elements of the body have been drawn in the ShapeEditor.

5. Conclusions

In the dialogue between the disciplines, when each discipline works towards its own aims a compromise is often needed. It is rather difficult to distinguish where the input from a discipline starts and where it ends. For example, is the definition of "embryos" art or design or maybe science? But, it is possible to distinguish between values of the outcome for different disciplines involved. Then the interdisciplinary character is better visible.

Design seems to play a good role as a bridge between art and science. Design takes the control over events and questions constantly - *what is it in it for users*. However, this constant design self-reflection makes it actually difficult for designers to switch to generative thinking and accept immediately Generative Art as the possible way of advancing traditional design methods.

In scientific terms Generative Art discipline is maybe not stable enough. But Generative Art gives a practical lesson of the interdisciplinary practice that, although not always measurable, reflects the changes in culture and society.

The domain that certainly benefits form this type of experiments is the domain of art. New tools are emerging that bring fine art back to its roots and into the future in the same time. New tools enable again the classical, but this time software-based analysis of shape and form, and further the analysis of the meaning of shapes and forms and compositions. Even, if those tools are emerging as a side effect of scientific experiments they should be developed further, so that ultimately artists could co-create, for example, some *culture meaning recognition* systems, socially useful tools for multi-cultural information society.

6. Acknowledgments

All illustrations in this paper come from the PAINT generative software developed in Philips Research and are subject to copyright © Koninklijke Philips Electronics N.V. 2001.

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References

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[2] Kandinsky, W. *Point and line to plane*, Dover Publications, Inc., New York 1979