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Working group

Creating and Looking at Art with Logo eyes

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Computation provides new tools for self-expression even in areas that one would not dare to enter without the access to computers. I remember leading a PD course for teachers in informatics during which a shy young woman handed me a piece of an old calendar with a painting by Vasarely (Fig. 1, leftmost) and ask me if it could be modeled by means of the Logo turtle.

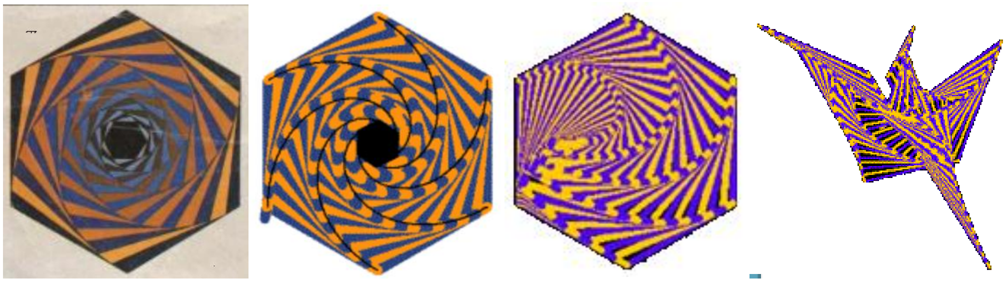

Fig. 1 – Vasarely's *Los Angelis* and Logo variations on it

After a short discussion we figured out that she could use the *Four-bug problem* (modified for 6 turtles in this case) by connecting the positions of the turtles at regular intervals of time alternating the color of the trace. From there on we created variants by modifying the parameters in the initial setting of the problem (e.g. the strength of the attraction, the number and the positions of the turtles). A sufficient number of experiments can even produce realistic images (Figure 1, rightmost). And variations on a theme are in fact *the crux of creativity.* Furthermore, *one can come to an understanding* of such fundamental cognitive processes *as pattern perception, extrapolation and generalization* **only** by modeling them in the *most carefully designed and restricted microdomain* [1].

Thus the study of the structure of knowledge and creative processes from procedural point of view has emerged as opposed to a more declarative point of view typical for the traditional education. Computation provides an appropriate framework for dealing with notions of *how to* and *what if* rather than with notions of *what is*, which already has an impact on the way we teach art (fine arts, music, literature). Both fine art and informatics have a specialised vocabulary of notions and use a specific syntax. The abstract art speaks rather of things *to be seen*. Similarly, Logo is a language suitable for dealing with phenomena which we could better understand by modelling them …

What is valuable in programs in a microworld tuned to a particular domain (art in this case) is that they could be used as glass-boxes. In addition to provide an accessible enough formalised description of the process of generation, one can play with them long enough to check their flexibility. It is in this sense that we talk about *Logo as editor of ideas* (the editing process including corrections, modifications, refinement and enrichment of the program).

Ideas of identifying what is essential in a specific painting, in the author's style, or even – of a period in art, could be found in the wonderful book of James Clayson [2]. Good practices in the context of visual modelling with students of different age and cultural background demonstrate the applicability of Clayson's ideas. An inspirational synergy among mathematics, informatics and art has been achieved within the pre-service and in-service teachers in mathematics and informatics at Sofia University, as well as with younger children [3, 4]. The first stage of the modelling process was to identify fundamental elements in paintings characterized by their vibrant colours and sharply patterned geometric forms (e.g.

de Still group, Kandinsky, Sonia Delaunay, Escher, Pencho Balkanski) and then to create stylized versions of those by Logo procedures. The next stage was to understand the *balance* (Mondrian) and the *forces-tensions living in the painting* (Kandinsky). The students created *working definitions* of balance according to different criteria (e.g. determining the weight of an element by its size, complexity, color) and tested them in a number of iterations, concentrating on the phenomenon to be modelled. The students realized that the abstract paintings contain a harmony whose laws could be revealed and their hypotheses about those laws could be materialised in computational form to be verified experimentally.

Of course, visual modelling should not be reduced to imitation only. This process contains (to use the phrase of Hofstadter) *unpredictable predictability*. In other works, we can expect the appearance of new stylistic attributes depending on the rank in which we vary the random variables. After leaving the frames of the strict imitation we could be inspired by new combination of forms and colours and get new insight leading to a new formalization – a process supported by the enormous potential of the computer to make various combinations in short time and by our human potential to interpreted new abstract structures

Recent programs in artificial art that can tweak photos to mimic the style of famous painters are already widely available. There are even apps that do this, such as DeepArt. But even more ambitious is a new system designed to produce images in unconventional styles from scratch.

This working group will consider the issue: *How to harness the Logo culture of "making things happen, making things work" so as to open the eyes of young people to the beauty around them?*

Research questions

- How is the integration of art, mathematics and computational design relevant to the interests of students of different age? (cf. [5-8])
- Under what conditions should the traditional introduction of abstract notions in art (e.g. structure, style, harmony, rhythm, balance, tension, etc.) be preceded by "working definitions" in computational form to be verified experimentally?
- Do we need continuous computational media providing the whole range, from easy means for making sketches up to means enabling you to create the tools you need? And is such a continuity best achieved by integrating direct manipulation interface with full programmability?

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