The Horizon project: "Emotion in lines"

"If I could give you one thing in life, I would give you the ability to see yourself through my eyes". Frida Kahlo.

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ABSTRACT. This artistic project originated as an experiment undertaken to analyse the mental imagery the brain uses for the expression of emotions on a formal, conceptual and iconographic level.

In the interest of understanding the nature of creativity in human beings as a tool that favours innovation and the ability to rediscover ourselves, it is considered essential to dive into its waters, in order to generate new approaches, and to pave new paths, transcending what has been experienced in the world of visual arts until now. After two prior experiments, we decided to approach this knowledge applying new premises. As in previous projects, we contemplated the Artificial Intelligence screen, more specifically, pondering Evolutionary Algorithms (EAs) because these deal with a technique that is linked more directly to biological processes[1] than traditional computing techniques, to draw out everything possible on the subject.

In this area we have adopted as constructive cornerstones towards a new form of creation:

– Connected art.
– Shared authorship.
– The community of artists.
– Interaction with the work.

KEYWORDS. Emotions, evolutionary algorithms, creativity, connected art, generations.

Development

In bio-inspired computing, Evolutionary Algorithms (EAs) are based on Darwin's Theory of Evolution (1859), according to which species evolve in accordance with their habitat, in such a way that groups of individuals change in response to a process of constant competition so as to perpetuate their kind over time. Algorithms are a medium by which the computer solves complex problems, and within the visual arts, we envision creativity, its nature and function as a horizon with a multitude of mysteries that are yet to be explored, which is why we chose this technique. For their adaptation to the study of the keys to creativity in human thought, and what keys those are, it was decided that the computer was to be unplugged[2], so an artists' collective could emulate the process by working in a creative way.

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[1] During the 60s, the researcher, John Holland, principally raised the possibility to incorporate natural mechanisms of selection and survival on a theoretical level to resolve Artificial Intelligence problems.

[2] A concept used for the first time to show that the experiment is carried out being disconnected from the computer in De Vega, F. F., Navarro, L., Cruz, C., Chavez, F., Espada, L., Hernandez, P., & Gallego, T. (June, 2013,). Unplugging evolutionary algorithms: on the sources of novelty and creativity. In *Evolutionary Computation (CEC), 2013 IEEE Congress on* (pp. 2856-2863). IEEE.

Since 2003, and within the framework of the lines of research undertaken by the GEA[3] group (Artificial Evolution Group), an artists' collective participated in several experiments in order to understand artistic creation in greater depth. This line of research not only contributed to the analysis of processes, but also established a new educational and application methodology, and, in its concept, a new artistic model elaborated by "connected" artists[4].

In this artwork an initial population was split into six designs, which were coded in a way similar to a chromosome, created by the participants in the experiment and evolved up to ten generations. From this initial population, each designer selected and crossed a mother and a father, which mutated into a new being of a new population (generation), successively, up to ten generations.

In each generation the genetic information − the physical characteristics of each individual, its phenotype, a result of its genetic information or genotype, chains of genes with complex interactions that form the transfer units of the inheritance − will undergo a series of variations that will be individually analysed at a later stage. Each individual is made up of a combination of spatial values determined by vectors, and designed using the Adobe Illustrator software programme.

From a formal perspective, the designs observe a series of guidelines for the purpose of fully exploiting the expressive possibilities of the design with a minimum amount of resources, and an enlargement of images in each generation through the most diverse generational crosses. In addition, the participants must answer a questionnaire on their design, and the designs of the other participants.

Guidelines

1. Represent an emotion.
2. Use 40 lines. Each one is made up of four straight lines that break in three points. Two horizontal lines have to be kept on the same level and can vary in length from right to left. The other two, which are interposed between both horizontal lines, have total freedom with regard to size and direction.
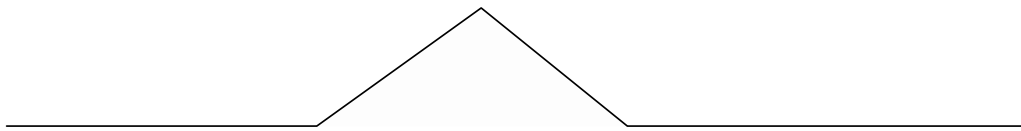
3. Colour: black. Thickness: 1 dot.
4. The four straight lines must also be continuously joined.
5. Avoid overlapping.
6. Save in Illustrator and PDF format.
7. Answer a series of questions each week.
8. The format is DIN A-4 in vertical position, and is expandable to other scales with regard to their display.
9. A collaborative tool in the cloud, named Evo- space[5], has been used, and was created specifically for the experiment, allowing the six works to be uploaded each week, and for the completion of a questionnaire.

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[3] Grupo de Evolución Artificial (Artificial Evolution Group): their lines of research approach the domain of Artificial Intelligence and Parallel and Distributed Systems, promoting interdisciplinary research: http://www.unex.es/investigacion/grupos/gea

[4] The participating artists' collective works with *connective intelligence* as a way to inspire creativity by means of work in a network afforded by technology, in line with the concept established by Derrick de Kerckhove, (1997): Connected Intelligence: The Arrival of the Web Society, Somerville House, USA.

[5] García-Valdez, M., Trujillo, L., Fernández de Vega, F., Guervós, J. J. M., & Olague, G. (April, 2013). EvoSpace: a distributed evolutionary platform based on the tuple space model. In European conference on the applications of evolutionary computation (pp. 499-508). Springer Berlin Heidelberg.

10. The following classification of emotions was chosen for this experiment:
    https://lasaludi.info/lista-de-las-emociones-humanas.html

Therefore, this experiment also represents a journey towards the molecular mechanism of the artwork. Generation after generation, the perspicacity of the perceptive system is analysed to understand its way of selecting, organising, hierarchically ordering and distinguishing everything it observes.

An analysis is undertaken of the formal and conceptual chemistry that exists between the form and the content – including the distribution of the colour, the dots, the straight lines and the maps of the lights and the shadows, and the volumes as carriers of meanings that go beyond the merely visual – that articulates an emotion with the objective of leaving its mark or marks, and to explain the origin of our perceptive experiences on a conscious and unconscious level, in communion with our thoughts. It is hoped to understand the product of mental imagery from the formal and conceptual points of view, to see if there are any repetitive, formal and conceptual patterns, and to ascertain their essence and their relationship to previous patterns in order to reveal what appears as novel. The aim is to understand the operations and transformations that the mental imagery undergoes on a formal, conceptual and iconographic level when it comes into play and appears affected or influenced by a series of very reduced and limited conditions or premises, from the procedural and formal perspectives. It is also deemed necessary to penetrate the link between the form and the content that spark an idea, and to study the syntheses that an idea undergoes in the process of ordering and modelling the forms, in that shift from the "definite" to the abstract, and vice versa. All this is done with the aim of knowing and deciphering the keys or formulas of the "shared" code that humans observe during the creative process, in the field of plastic creation as a product/answer of perception, of consciousness, of the mind and spirit. Once all this is combined, the results are to be coded, which are obtained from the practice by means of the coded language of the EAs, to try to emulate the perceptive and creative system of human beings in the field of Artificial Intelligence.

Premises

The proposed artwork originally comes from a line of research that originated from the GEA (Artificial Intelligence) research group at the University of Extremadura. The project addresses the knowledge of creativity for its possible implementation in algorithms relative to the field of computer science.

This specific case seeks to establish a knowledge basis, and puts forward various experiments necessary for analysis. The research process began in 2012, under the auspices of a project financed by the Spanish National Research Plan named "Propiedades self - en algoritmos Bioinspirados y sistemas complejos"[6] (Self Properties in Bio-inspired Algorithms and Complex Systems) with a team of multidisciplinary researchers from the IT field, and another team from Fine Arts.

As the first experiment, this is how the project titled "XY, Experimenting Human Creativity of Unplugged Evolutionary Algorithms" originated. This proposal hoped to carry out an analogy of the Evolutionary Algorithm process, "unplugging the machine", and prepare human beings to work with the rules of the computer. The series of experiments should give us an answer on the suitability criteria ordered by computer.

With regard to the second "XYZ" experiment, which differs from the first one, a new operation is incorporated known as 'elitism' (from the selections made by all the artists in each generation, the one which is incorporated into the next generation is the one that is chosen the most). A computing platform named "Evo- space" is included, which will be used as a collaborative tool in the Cloud to upload the design and the questionnaire on a weekly basis.

The line of research currently continues in the UEx project with *EPHEMECH: Bio- inspired Algorithms in Complex Ephemeral Environments*[7]. Francisco Fernández de Vega coordinates a multidisciplinary team and maintains different complimentary lines of reasoning:

– The creation of an artistic model.

– The creation of an artistic, educational methodology.

– The creation of a methodology for the museographic context.

– The experimental analysis for the implementation into computer studies.

Biography of the collective

Artists		
Patricia Hernández Rondán Doctorate in Fine Arts from the University of Seville. Professor in the Department of Drawing at the Faculty of Fine Arts, Seville.	Cayetano Cruz Doctor in Fine Arts from the University of Seville. Technical Drawing Teacher for the Industrial Design Degree at the University of Extremadura.	Vicente Albarrán Doctor in Fine Arts from the University of Seville. Technical Drawing Teacher for the Industrial Design Degree at the University of Extremadura
Lilian Navarro Moreno. Fine Arts graduate, University of Seville. Art Professor and doctoral student at the University of Extremadura.	Tania Gallego Lirola. Fine Arts graduate, University of Granada. Secondary School Art Teacher, Autonomous Community of Extremadura.	Itzel Andrea García Mancilla. Engineering graduate, specialising in Digital Graphic Design at CETYS University, Baja California campus, Tijuana, Mexico.

Biography of the collective

Researchers of unplugged evolutionary algorithms and evospace developers	
Francisco Fernández de Vega	Mario García Valdez
Ph.D. in Information Technology from the University of Extremadura, with a European Mention and Extraordinary Doctorate Award. Associate University Professor in the Department of Computer and Communications Technology. The University Centre of Mérida, University of Extremadura.	PhD in Sciences from the Autonomous University of Baja California, Professor in the Postgraduate Department at the Tijuana Institute of Technology.

Each one of these lines continues their progress, and a series of specific awards and honours have been obtained in recent years, which are shown below, in order:

Awards

Amsterdam (Holland). First Prize in Evolutionary Art, Design and Creativity Competition in the Genetic and Evolutionary Computation Conference (GECCO 2013). Exhibition.

Scientific Journal

De Vega, F. F., Cruz, C., Navarro, L., Hernández, P., Gallego, T., & Espada, L. (2014) "Unplugging Evolutionary Algorithms: an experiment on human-algorithmic creativity. Genetic Programming". Springers: Evolvable Machines. Volume 15, Number 4. New York

De Vega, F. F., Cruz, C., Hernández, P., Navarro, L., Albarrán, V., & Espada, L. (2016) "Evolutionar Art". ACM SIGEVOlution. Volume 8 Issue 3. New York

Research Congress

De Vega, F. F., Navarro, L., Cruz, C., Chavez, F., Espada, L., Hernandez, P., & Gallego, T. (June, 2013). Unplugging evolutionary algorithms: on the sources of novelty and creativity. In Evolutionary Computation (CEC), 2013 IEEE Congress on (pp. 2856- 2863). IEEE. Cancún (Mexico). NOMINATED FOR BEST PAPER

Navarro, L., De Vega, F. F., Cruz, C., & F. Chávez: Studying creativity through unplugged evolutionary algorithms, MAEB 2013, 9th Spanish Conference of Metaheuristics, Bio-inspired and Evolutionary Algorithms, 17th-20th September 2013, Madrid (Spain).

De Vega, F. F., Gallego, T., García-Valdez, M., Espada, L., Navarro, L., & Albarrán, V. (July, 2014). When artists met EvoSpace-i. In Evolutionary Computation (CEC), 2014 IEEE Congress on (pp. 2282-2289). IEEE. Behind (China).

Navarro, L., De Vega, F. F., & Cruz, C.: Including the elitism in the creative model through unplugged evolutionary algorithms, MAEB 2015, 10th Spanish Conference of Metaheuristics, Bio-inspired and Evolutionary Algorithms, 4th-6th February 2013, Mérida (Badajoz).

De Vega, F. F., Navarro, L., Cruz, C., Hernández, P., & Albarrán, V. (July, 2016). Analysing creative models based on unplugged evolutionary algorithms. In Evolutionary Computation (CEC), 2016 IEEE Congress on (pp. 4570-4577). IEEE. Vancouver (Canada).

Books

De Vega, F. F., Cruz, C., Gallego, T., Espada, L., Navarro, L., & Hernández, P. (2014): *XY, Experimenting Human Creativity by Means of Unplugged Evolutionary Algorithms*. Mérida: The Parliament of Extremadura.

De Vega, F. F., Cruz, C., Navarro, L., Gallego, T., Espada, L., & Hernández, P. (2015): *Virtual Connections*. Jerez de la Frontera: Jerez City Council.

Cruz, C., De Vega, F. F., Navarro, L., Gallego, T., Espada, L., & Hernández, P. (2015): *Evolutionary Art and Computing: Dialogues of an Experiment*. Cáceres: University of Extremadura.

Exhibitions

2013. The Exhibition Room at the School of Art and Design in Mérida (Spain).

2013. IEEE Congress of Evolutionary Computation from 20th to 23rd June 2013, Grand Coral Foyer, Cancún (Mexico).

2013. GECCO Evolutionary Art, Design and Creativity Competition from 6th to 10th July 2013, Amsterdam (Holland).

2013. MAEB. 9th Spanish Conference of Metaheuristics, Bio-inspired and Evolutionary Algorithms, 17th-20th September 2013, Madrid (Spain).

2014. Patio Noble, Parliament of Extremadura in Mérida (January, 2014). Mérida (Spain).

2015. The "Pescadería Vieja" exhibition room. Jerez de la Frontera (Spain).

2015. "Sede Cabrera" Faculty of Design and Communication of the University of Palermo. Workshop and Conference. Buenos Aires (Argentina).

2016. BACK GALLERY PROJECT. 602 E Hastings Street. Vancouver, BC V6A 1R1 (Canada)

Internet Links

http://merida.herokuapp.com/about

http://xyz-project.herokuapp.com/

http://link.springer.com/article/10.1007/s10710-014-9225-1

http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6557916&tag=1

http://www.asambleaex.es/noticias-2249

http://www.hoy.es/multimedia/fotos/merida/20140109/asamblea-acoge-desde-trabajo- 3071360043506-mm.html

http://m.canalextremadura.es/alacarta/tv/videos/parlamento-extremeno-110114

http://www.cadizprovincia.com/index.php/agenda/exposiciones/item/247-exposicion-virtual- connection-jerez?catid=95

Appendix of images

GEN1-1 | GEN1-2 | GEN1-3 | GEN1-4 | GEN1-5 | GEN1-6

GEN2-1 | GEN2-2 | GEN2-3 | GEN2-4 | GEN2-5 | GEN2-6

GEN3-3 | GEN3-6 | GEN3-4 | GEN3-5 | GEN3-2 | GEN3-1

GEN4-1 | GEN4-3 | GEN4-4 | GEN4-5 | GEN4-2 | GEN4-6

GEN5-1 | GEN5-2 | GEN5-3 | GEN5-5 | GEN5-6 | GEN5-4

GEN6-2 | GEN6-4 | GEN6-1 | GEN6-3 | GEN6-6 | GEN6-5

GEN7-1 | GEN7-3 | GEN7-2 | GEN7-4 | GEN7-5 | GEN7-6

GEN8-6   GEN8-5   GEN8-1   GEN8-2   GEN8-3   GEN8-4

GEN9-1   GEN9-2   GEN9-3   GEN9-4   GEN9-5   GEN9-6