

# Preface

The interweaving of art and science, specifically aesthetics and neuroscience, is an emerging field of research. This phenomenon has sparked interest and expanded across various countries, basing itself on the existing cultural, scientific and artistic environments. In France, we benefit from an existing pluridisciplinary research institution: *Centre National de la Recherche Scientifique* (CNRS, National Center for Scientific Research). Groups of research in this institution aim to bring together researchers from different fields to create networks of common interest. The Aesthetic, Art and Science group, “ESARS”, was founded in 2014 by the Institute of Biological Science of the CNRS. ESARS gathers several research teams from many laboratories and universities across France. In addition to their own field of research, whether it is mathematics, physiology, neuroscience, philosophy, psychology, these teams develop a research line related to creation, creativity and aesthetics.

This without-wall laboratory is a very rich, beehive-like structure. Several meetings have brought together artistic and scientific creations. Not only does ESARS develop pluridisciplinarity, but also transdisciplinarity to create new fields at the frontier of existing ones. Taking methods from one field and adapting it to another allows for hybridization, mutation, and transformation. New paradigms are constantly invented.

In 2013, we organized a meeting in Paris in anticipation for the creation of ESARS. This meeting incorporated formal presentations, art exhibitions, interactive installations and live performances. It covered many areas of neuroscience and aesthetics: mathematical structure of pop music, neurophysiology of creation and art perception, philosophy of art, epistemological questions related to architecture, theater performance, dance, etc. This book includes a selection from these presenters and performers as well as contributions from artists and scientists who joined ESARS afterwards.

Part I of this volume guides us through the complex process of creativity. Alain Londero, Didier Bouccara and Hervé Bozec invite us to explore how visual art impacts the vestibular system of the observer. They also have us question how an artist’s vertigo or tinnitus may have contributed to their creative process. Vincent

Mignerot offers an original hypothesis, stating that creative minds may benefit from “*heueaesthesia*”, a fruitful sensory facilitation of knowledge and skills. Zoï Kapoula presents a study where dyslexic children, who have overall normal intelligence but suffer from reading troubles, might be highly creative when following an adapted educational approach.

Part II of this volume investigates the neurophysiological effect of art on observers. Yannick Bressan studies the neural substrate of “*emergentist adhesion*” in theater. This allows the spectator to perceive a character when she sees an actor, in order to believe in the functional reality in addition to the proximal reality. Amel Achour Benallegue, Jérôme Pelletier and Gwenaël Kaminski, through a cognitive, anthropological, philosophical and experimental approach, illustrate how intrinsic properties of anthropomorphic representations of faces modulate their aesthetical impact. Marine Vernet provides a brief tour on what neuroscience and art can learn from each other and how artwork can intellectually, emotionally and physically move us.

Part III of this volume exemplifies how neuroscience can help us to better understand and enhance our aesthetic experience. Coline Joufflineau and Asaf Bachrach present *Labodanse*. This ambitious project shows how first and third person experimental approaches converge in front of Myriam Gourfink’s choreographic work, which is based on Energy yoga techniques. This perfectly illustrates how unique scientific questions arise from unique artworks. Solène Kalénine evaluates how perception and perhaps sensitivity towards a show by The Baltazars, can be modified after an observer has the opportunity to manipulate the visual effects of the show. Laurent Sparrow demonstrates how physiological measures and eye tracking measures can help to evaluate the well-being and interest of autistic and non-autistic children, who visit a museum with a game device to help increase their engagement.

Part IV of this volume illustrates how better training and learning could be achieved by relying on the potentiation of the art–neuroscience relationship. Daria Lippi, Corinne Jola, Victor Jacono and Gabriele Sofia present a pioneer, collective experience realized during a workshop organized by the *Fabrique Autonome des Acteurs*. They created a challenging training that merged the concepts of attention, mirror neurons and body schema, to help actors improve their ongoing and deliberate practice. Claude Bruter explains that because art and mathematics have the same fundamental aim, representation, art might constitute a great educational tool to understand mathematics. Eglantine Bigot-Doll describes how interacting with various inspirational sources and expressing the results of these interactions through language and adequate software could potentially help students to elicit original architectural creations.

Part V of this volume reveals the creative processes of artists who are inspired by or relate their work to neuroscience. Sophie Lavaud-Forest describes how her project *Matrice Active*, which transforms a painting by Wassily Kandinsky into a three-dimensional interactive dynamic system, can offer new aesthetic experiences as well as novel interdisciplinary artistic-scientific research experiments. Olga Kisseleva and Claire Leroux guide us into the different meanings of time at the

physical, biological/physiological and political/economic levels. Based on these concepts, Olga Kisselva's bio-art installations plays with individual physiology, allowing visitors to accelerate or on the contrary slow down art-clocks' time. Pascale Weber and Jean Delsaux describe their own performing art experience as an experimental configuration allowing them to address multiple questions of embodied neuroscience, including space perception and body movement sensation.

Finally, Part VI of this volume uses mathematical tools, evolutionary-based theories and philosophical considerations to understand and formalize aesthetics. Moreno Andreatta and Gilles Baroin show how mathematical models applied to pop music can reveal the geometry of musical scores and contribute to new musical creations. Julien Renoult guides us through several evolutionary models of aesthetics and explains how one of them, based on the exploitation of efficient information processing, can simultaneously explain the universality of aesthetic experiences and the diversity of beautiful stimuli. Bruno Trentini closes our volume by inviting researchers in neuroaesthetics to join a philosophical tradition and to focus on the exploration of the neural substrate of the "sublime" rather than the neural substrate of the "beautiful". The former would be closely related to the experience of aesthetics.

We hope that this book will reveal the diversity of our neuroscience and art community, which build bridges between multiple disciplines such as cognitive neuroscience, psychology, physiology, evolutionary biology, mathematics, philosophy, anthropology, rely on theoretical and experimental approaches, consider third- and first-person points of view, go back and forth the unique and the ubiquitous and lastly, invent new paradigms for this novel adventure through neuroscience and art.

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