Review of "Brain Art: Brain-Computer Interfaces for Artistic Expression"

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Anton Nijholt's edited book *Brain Art: Brain-Computer Interfaces for Artistic Expression* is a unique contribution, being the first and only fully comprehensive cover of art and brain computer interface (BCI) projects. For the first time, readers can learn about the enormous scope of BCI experimentation in art and art-related projects, dating back many decades, all in one volume. Importantly, this book is not only for people with an interest in the arts, but is also of high importance to the wider BCI scientific and engineering community.

BCI is mostly an engineering discipline, and the majority of BCI scholars and practitioners are engineers. Engineering and art are extremely different practices, with an inherent contrast between them: engineering is analytic and rigorous, whereas art is often associative and exploratory. This is exactly why BCI engineers and scientists, interested in developing applications or making scientific progress in the field, may find value in reviewing the explorations made by artists or in the scope of science–art projects. The lack of rigorous success criteria in art can be alienating for both scientists and engineers, but this is what most often allows artists to be the first to explore new interaction paradigms and scenarios, long before the more conservative scientific community steps in. Case in point, "hyper-scanning" has been trendy for several years (Babiloni & Astolfi, 2014; Dikker et al., 2017; Uri Hasson, Ghazanfar, Galantucci, Garrod, & Keysers, 2012; Kinreich, Djalovski, Kraus, Louzoun, & Feldman, 2017). Reading through the volume's chapters, one can learn about how attempts in closed-loop EEG explorations looked into dyads and beyond, to groups, as early as the 1960s (Chapters 1 and 4).

An artistic context allows for much richer and more complex schemes than typically practiced in science, a trade-off with rigorous evaluation and hypothesis testing. Art is a perfect sandbox to explore the possibilities of BCIs, and the border between exploratory research and art is blurred. The field of neuroscience has recognized the need to study the brain in so-called ecological conditions. In their influential paper, Hasson et al. showed how you can practice great science using artistic content (or in this case, entertainment content) (U Hasson, Nir, Fuhrman, & Malach, 2004). Relatedly, it is ironic that despite the recognized importance of the sensorimotor loop for brain activity, the overwhelming majority of human brain imaging is still practiced on stationary subjects. Of course, this is a result of the technical constraints and the sensitivity of neuroimaging methods to motion artifacts. Nevertheless, it is not surprising that science–art projects are among those leading the way toward tackling this challenge; see Chapters 9 and 10 for mobile brain imaging (MOBI) paradigms.

BCI (or brain machine interface, BMI) is arguably one of those technologies that have the potential to transform humanity, if and when it becomes mature and pervasive. Such widespread adoption of BCI seems to be en route, though a few decades away. Invasive technologies are high-risk and limited to a very small number of individuals, and EEG-based BCI is limited in bit rate, accuracy, and functionality. How, then, can we anticipate what it will be like when BCI becomes widely available? How can we educate the general public about the huge potential of BCI, as well as about potential risks and challenges either to individuals or to society as a whole? Unlike consumers, who expect low-cost friendly interfaces with very high accuracy and bit rates, artists do not need to wait but are tackling these questions right now. In fact, they have been exploring the implications of closed-loop EEG on individuals and society as early as the mid-twentieth century, paving the way for contemporary BCI research.

The BCI community is pervaded by utilitarian viewpoints. Topics like art and entertainment are often considered of secondary importance compared to communication and health. However, this may reflect a misunderstanding of human nature. Able-bodied people spend a lot of their free time (and money) on entertainment and creative activities, and the same goes for paralyzed patients, who are the first target population for BCI. It is, therefore, not surprising that one of the most important BCI applications ever is in the context of BCI art, namely brain painting (covered in Chapter 15). This is one of the earliest studies taking place with actual patient users of BCI, outside the laboratory. Contrary to the intuitive expectation that such patients' preferred choice of application would be communication, it turned out that they preferred painting—and by far. Not only was this the preferred application, but it was reported as the only BCI application that the patients actually wanted to use outside the study.

Beyond art, several chapters cover highly relevant topics, such as the importance of feedback (Chapter 4), art therapy (Chapter 11), and brain hackathons (Chapter 17). Reading about BCI art can be very frustrating, almost like learning to swim by email correspondence. BCI art is all about first-hand experience. The scope of BCI art projects is impressive, and a lot may be lost, other than in the memories of the audiences. As mentioned in Chapter 3, most projects are not archived or published. Therefore, this edited volume is a crucial piece of documentation for current BCI practitioners, as well as for future historians of human–machine confluence.

References

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