Cognitive Ergonomics on the Move: Art Ecosystems are a New Application Domain

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Abstract. The unprecedented state of contemporary art is due to the integration of advanced science and technology. The complementary and coordinated development of art and technology is expected to gradually revolutionize people's traditional perceptions in a wide range of art domains. This revolution belongs to artists as well as to the increasingly different types of other stakeholders. This paper explores the changing process of the role of cognitive ergonomics in aesthetic creation, participation, and experience. The value of experience as component of CE for the modern art domain is discussed.

Keywords: Cognitive ergonomics, Experience design, Art, Values, Art ecosystem

1 Introduction: CE Applied to the Domain of Art

When Information Technology started to be applied by artists, some early adopters of Cognitive Ergonomics (by then mostly labeled "Human factors") quickly discovered the relevance of considering the technical opportunities to be a new challenge for their domain [1], [2], [3], and the applications of CE gradually changed and broadened [4].

New types of technical opportunities for the arts still trigger expansion of the domain [5], [6]. Consequently, from the domain of art, especially the new developments where ICT is part of the toolbox of artists, the art audience, and of all other stakeholders, there are clear needs and requests to CE. In our examples we focus on visual art, which is a domain where we are currently practicing and teaching.

2 Pre-History of CE in Art

Brushes and paint developed (and standardized in individual visual art cultures (like Chinese calligraphy, western watercolors; ….) to enable the painter. A standardized set of sticks enabled the Chinese shadow puppet player to move, even with a single hand, simultaneously, the head, body, both arms and both legs of his puppet. In the early stage, artists' operation are mainly perceived as motor skill activities.

Standards for usable tools developed for individual cultures of image creation, script writing for performances, stage maintenance (including travel, building, and storing), and actual performances or exhibitions, and even for the different roles that enabled performances (e.g., shadow puppet shows: setting the stage; building the puppets and props; animating an individual character; speaking the voice of a character; manipulating the light source.

In due time, visual art approaches towards motion developed. In relation to this, the operations of the artists and performers changed, including a gradual transfer from mainly perceptual motor skill activities to cognitive activities, and gradually included application of ICT.

Animated films have gone through a series of paradigm changes: drawing images on celluloid film to computer-generated animation; hand-drawn original paintings on paper, animated lines after the use of software to color, shoot, synthesize motion pictures, and finally through post-editing software to complete the final film; paperless animation, hand-painted board and electronic pressure pen and other tools instead of the original. Currently, the whole process is run with the help of computer and software. After modeling, 3D animators complete all the production of virtual scenes directly through post-editing software [7].

Movies have also gone through the film strip era, and now contemporary film is completely produced with the help of computer technology and high-tech equipment: camera monitors, computer screens and even terminal devices. Virtual Reality and Interactive visual art are other branches that have shown the same type of development.

Traditional ergonomics does not completely support the changing practice. Human factors like as voice, posture, head tracking and gaze, now being used as, both, input and output of art related computer technologies like multimedia technology and virtual reality technology, are increasingly used in dynamic visual art, interactive art, brain-computer interface art and other emerging art forms. The scenarios of creating, preforming, an exhibiting now extend beyond the artist's workshop and the gallery to museums, laboratories, internet-based auction houses, and public spaces.

3 CE Coming of age

Even when Cognitive Ergonomics started to be considered a science of design, some researchers that focused on art considered their domain a potential application domain [1]. However, mainstream CE, as well as it's shadow (or mirror) HCI, for a long period found most of its applications in supporting process control, car design, early work, military applications, and other "serious" domains where "usability" was the core criterium for acceptability, and, hence, the main goal.

Related to this, in many traditional design cases, only one type of stakeholders was the intended beneficiary: the user. This rather single-minded approach gradually became obsolete, with the development of "Service design" as a new branch of user-centred application domain [8]. where many different stakeholders needed to use, understand, and experience the product of design.

4 From Usability to User Experience

The focus of the user-centred design goals gradually shifted. Vyas et al. [9] aimed at "playful interaction", and introduced a wholistic view on experience, that includes 4 aspects of an artifact to be designed [10]:

- understanding the meaning;
- emotions activated by the artifact;
- feeling attracted vs. repelled;
- tendency to act;

The UPA (Usability Professionals Association) changed its name to UXPA (User Experience Professionals Association) in 2012. The Curriculum guidelines recommendations by ACM [11] changed the knowledge domain Human-Computer Interaction into Experience Design starting with the IT2017 guidelines.

5 User Experience Includes Values

Apart from the aspects of experience as discussed by Vyas, in many domains there are aspects of values attributed to artifacts (and to humans, societies, and natural phenomena). The values attributed by a person to an artifact will often depend on the context and the individual's current role: an art lover my value a painting as too expensive when considering buying at an auction, but may value the same painting as charming when enjoining a chat in a friend's living room, or value it as unique when writing a paper on early impressionist style characteristics. In the domain of arts, we will have to consider the value aspect of individual experiencing an artifact is, both, dependent on the context, and on the individual knowledge, triggered emotions, tendency to act, and general feeling of being attracted vs. repelled.

Values are also influenced by the culture an individual may be considered to part of. Hofstede [12] shows that geographical cultures (often labeled by country names) different systematically and strongly at dimensions like individualism (in the art domain: valuing conformism or deviation from style or trend); power distance (valuing to consider social or religious structure and distance); masculinity (valuing reference to specified gender roles); uncertainty avoidance (valuing semantic precision vs. indeterminacy); short term orientation (e.g., valuing reference to heritage), and indulgence (valuing freedom and cultural independence).

Even if we should keep in mind the actual values attributed by people in their current context, the geographical culture of the location where people refer themselves to will, on average and in the sense of probability, the geographical value dimension concepts may be relevant predictors of some of the values people attribute to artifacts in their current context.

6 CE Should Consider Values

Promoting cooperation in the field of art requires CE to recalibrate the limitations of their old research field. As we have stated above, with the development of science and technology, artists and their works will be more diverse, and the number of stakeholders of art will increase.

Contemporary visual arts live in a diverse and vibrant ecology: Artists work in a globally influenced, culturally diverse, and technologically rapidly advancing world. Their art is a dynamic and eclectic combination of materials, methods, concepts, and subjects that challenge traditional boundaries and defy easy definition.

Stakeholders of current and future visual art should understand their new roles. CE is still an alien domain for most artists. They should develop insight and learning ability for new techniques and paradigms, and they should expect blended creative patterns. Universities and Art schools should understand the importance of interdisciplinary collaboration and education. And students should recognize the need for these "hybrid" skill sets [13].

Galleries should be tolerant for novelties and encourage artists to innovate and experiment. Audiences should improve their understanding of contemporary art and become happy to co-create. Contemporary visual arts move to a cross disciplinary or interdisciplinary context, related to the development of science and technology and the change of human aesthetic ability. A new type of cross-border artists is coming out, and the evolution of society will make the space of art broader, thus, inferring that the new ecological environment is crucial and urgent. And an evolving CE is a new and promising approach to the art ecosystem.

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