Embarrassment as a Divergent Process for Creative Arts in the Immersive Virtual Environment

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Abstract
In our virtual environment studio at Michigan Tech, a performing artist makes analog and digital penwald drawings, lying down on a huge canvas, dancers create music and visuals by dancing, and children and a puppy make interactive arts together. In each case, there are different embarrassing moments (e.g., how, what, and who) to audience and even an artist. However, those embarrassing moments are real points that "make arts arts". Our works are highlighted in the line of embarrassing points of traditional arts and implications of embarrassment for design research are discussed.

Author Keywords
creativity; divergent thinking; interactive sonification; virtual environment

ACM Classification Keywords
H.5.5. **[Sound and Music Computing]**: Methodologies and Techniques

Introduction
The concept of art has been rapidly changing. More accurately, the value of particular artists after Duchamp can be weighed according to "how much they questioned the nature of art" or "what they added to

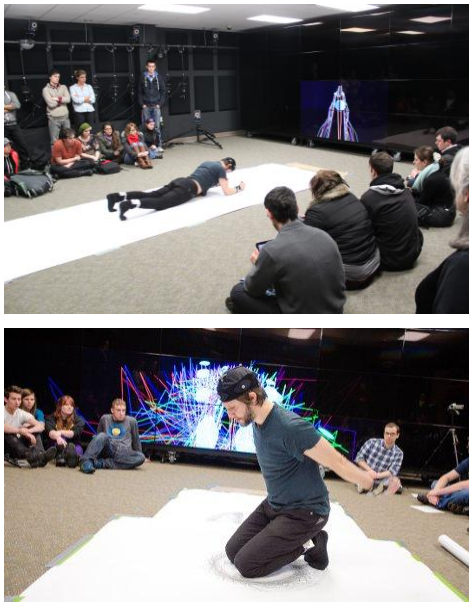

Figure 1. Penwald drawing. The unconventional ways (how) of his embodied drawing embarrass audience.

the conception of art" [Kosuth, 1969 cited in 1]. Since then, the history of arts has demonstrated that breaking social norms, stereotypes, and role expectations defines arts, by *embarrassing* critics and audience. Considering that the original meaning of aesthetics is the study of our perception of the entire environment (not just of an "object of beauty") [2], we are likely to acknowledge that technological advances have accelerated the advent of new aesthetics. More dramatically than futurists envisioned, arts and technologies have been *re*integrated in the contemporary art [3] and technologies have enabled embarrassing points in arts even more. The present paper describes in our immersive virtual environment, how technologies encourage and enable (1) artists to shift how they do arts, (2) artists to change and integrate their expected role with unexpected roles, and (3) children and animals to be involved in the artistic process, all of which are new variations of embarrassment of the art history.

Virtual Environment System Configuration

Taking embodied interaction and interactive sonification into account, we have developed a novel immersive interactive sonification platform, "iISop" at Immersive Visualization Studio (IVS) at Michigan Tech [4]. The iISoP features a Vicon tracking system utilizing 12 infrared cameras that track users' location, movement, and gesture, using specific reflective objects that are strapped to users' body parts (e.g., arms, legs, hat, etc.). A display wall visualizes corresponding graphical user interfaces (GUIs) written in C++ using the OpenGL framework. The display wall consists of 24 (6x4) 42" multivision monitors controlled by 8 computers that display representations of the tracked objects in real time. Position, velocity, acceleration, time, proximity to other objects, and holistic affective gestures are recorded and analyzed to generate appropriate sounds (speech, non-speech, music, etc.) based on our own sonification algorithms programmed in JAVA (JFugue Library). For more details of the system configuration, see [4].

Embarrassment at How

The first project to show "how our technology shifts the way artists do arts" is the collaboration with a performing artist, Tony Orrico. In our Mind Music Machine lab, Orrico demonstrated two types of penwald drawing pieces, wearing sensors that made real-time visualization and sonification. For one piece (Figure. 1 top), he laid his face down on a huge piece of paper on the ground, holding graphite pencils in both hands. He pushed off a wall, jetting himself forward on top of the piece. He dragged his graphite pencils along with him; as he writhed his way back to the starting position over and over again, he left behind himself a pictorial history of his motion. For the second piece (Figure. 1 bottom), Orrico knelt on a large sheet of paper, striking it with graphite as he swung his arms in a pendular motion, and slowly revolved atop the mat. While he was drawing these pieces on the paper canvas, his movements created digitalized drawings on the virtual canvas (multivisions). Putting the canvas on the floor or drawing with the artist's entire body made our audience embarrassed, but the ideas are not totally new. In 1940-50s, Jackson Pollock put the canvas on the floor instead of an easel. Nam June Paik laid his face down on a big canvas and drew using his hair in his masterpiece "Zen for Head" (1962). They showed extreme gestures of the body, broke the traditional form, entered the inside of the drawing because of its huge scale, and thus, their work was not limited to the canvas, but expanded to the entire space of the room [5]. In the same line, we added a tracking camera and

Figure 2. Dance-based sonification. The unconventional outcomes (visuals and sounds) of dancing embarrass audience.

gained a tweaked version of digitalized master pieces. The data – the artist's (i.e., an expert's) body motion – recorded during the performances are crucial to a deeper understanding of how an expert functions. The data could contribute to designing an expert system that can help untrained adults or children do arts. We analyze their behavior patterns, processes, error-correction, and do data mining, and utilize those data in terms of training novices or having them create arts without any training or learning. We can create visualization or sonification by translating novices' basic (artistically non-meaningful) activities into meaningful outcomes.

Embarrassment at What

The second project to show "how our technology change and integrate artists' expected role with unexpected roles" is the dance-based sonification project. The ultimate goal of this project is to have dancers improvise music and visuals by their dancing. Dancers still play an expected role (dance), but simultaneously integrate unexpected roles (improvise music and visuals). From the traditional perspective, this might embarrass dancers and audience, but certainly adds aesthetic dimensions to their work.

In this project, we adopted emotions and affect as the medium of communication between gestures and sounds. To maximize affective gesture expression, expert dancers have been recruited to dance, move, and gesture inside the iISoP system while being given both visual and auditory outputs in real time. A combination of Laban Movement Analysis and affective gesturing was implemented for the sonification parameter algorithms [6]. In a top down affective dimensional design, four basic emotions were considered first: angry, happy, sad, and content. Each basic emotion is represented on a two dimensional coordinate plane with axes of activity and valence [7]. For the recognition of these four affective states, personal space and movement effort are interpreted by the Vicon tracking system and utilized by the visualization and sonification algorithms. An example of the sonification logic would be high effort and high personal space (e.g., content) results in raising the octave of the audio output, changing to an instrument with a brighter timbre, increase in volume speed and stochasticity at which the notes are played. This fusion of different genres of arts gathers norms and rules of each genre, and thus, contributes to creating a new convergent process as well as a divergent process.

Embarrassment at Who

The third project to show "how our technology expands the subject of arts" is an on-going children-robots-animals interaction project. Since 1960s' *happening* [8], integrating the audience as a key part of the artwork has been a crucial milestone. With the technology that facilitates this collaboration, we wanted to go one step further, by making audience the subject of arts. Children have been recruited to either control remote controlled drones, interact with autonomously moving robots (e.g., Darwin, Romo, etc.), or even play fetch with a puppy inside the iISoP (Figure 3). Children try to control those, but they have their own intentionality (i.e., control-display ratio of the drone, autonomy of the robot, and the puppy's own will). Based on the specific mapping parameters, visual and auditory outputs are displayed to represent current position and kinetic characteristics of all players. A philosophical question about "intentionality" of Cognitive Science is explored with respect to a main agent of composition, such as "who is controlling/composing music and sound, the child,

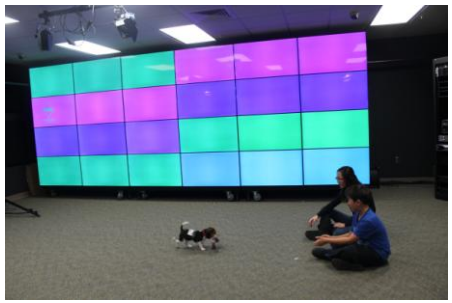

Figure 3. Children-animal interaction. The unconventional subject/agent of artworks embarrass audience. Their unexpected behaviors and outcomes even embarrass a producer and an artist.

robot, animal, or programmer?"

To analyze contemporary arts in this era, Mitchell [9] proposed a new aesthetic framework, the "biocybernetic reproduction", which can be defined as "the combination of computer technology and biological science that makes cloning and genetic engineering possible" (p.483). However, it can refer to the new technical media that are transforming the conditions of all living organisms in its broader sense. The word "cybernetics" stems from the Greek word, "steersman" of a boat and thus, suggests a discipline of "control and governance" [10]. Based on that, cybernetics is "the entire field of control and communication theory," whether in the machine or animal. Then, "bios" refers to the sphere of living organisms which are to be subjected to control, but also resist the control [9]. Taken together, biocybernetics refers to the field of control and communication; and yet simultaneously, it relates to the resistance to control and communication. Therefore, it innately embarrasses artists and audience but simultaneously encourages artistic inspiration just because of that resistance. Here, animals serve not as an object, but as a subject of the art work. The music score for children-animal interaction could be like ||: Go fetch! :|| This piece looks like a repetition, but it will likely generate different music patterns because of a puppy's autonomous behavior at every time, which is referred to as the biocybernetic reproduction.

Conclusion and Future Works

Our goal was to make a design research platform that allows researchers to conduct all of the artistic experimental research in a single platform. Faste and Faste [11] proposed a new framework of the relationship between design and research. Among their framework, we focus on "Research through Design" or embedded design research, in which designers practice their craft to seek new knowledge and to gain insight for the possible outcomes. We believe artists' and designers' novel embarrassing processes can pose unique questions and thus, inspire researchers' future directions. To devise a fully interactive system, we cautiously review the possibility of anthropomorphism of the iISoP. To this end, it needs to evolve further with higher intellectual capability.

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Short Bio

Philart is an Assistant Professor of Cognitive Science and Computer Science at Michigan Tech. He received his PhD in sonification from Georgia Tech. His resesarch yielded more than 100 publications. As a former professional sound designer, he has worked for LG, Samsung, GE Electric, Hyundai-Kia Motors Company, Toyota, etc.