

Traditional Painting Revised: The Ambient Intelligence Approach to Creativity

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Abstract. Today, many forms of art are influenced by the emergence of interactive technologies, including the mixing of physical media with digital technology for forming new hybrid works of art and the usage of mobile phones to create art projected on public spaces. Many artists and painters use digital technology to augment their work technically and creatively. In the same context many believe that the time of transition from traditional analogue art to post-modern digital art, that is, to an art grounded in codes rather than images has arrived (<http://www.artnet.com/magazineus/features/kuspit/kuspit8-5-05.asp>). The research work described in this paper contributes towards supporting, through the use of Ambient Intelligence technologies, traditional painters' creativity, as well as methods and techniques of art masters. The paper presents the design and implementation of an intelligent environment and its software infrastructure, to form a digitally augmented Art Workshop. Its practical exploitation was conducted in an Ambient Intelligence (AmI) simulation space and four feasibility studies were conducted. In each of these studies an oil painting was created following an alternative, yet accredited by artists, approach.

Keywords: Ambient Intelligence · Painting · Creativity · Art · Art creation

1 Introduction

Today, many forms of art are influenced by the emergence of interactive technologies. Technology based on the evolution of image processing software can simulate the process of painting, by replacing physical with digital media. This has resulted in the production of novel art forms such as digital architecture, digital painting and digital sculpture. Digital painting is today the most acknowledged computer aided art style. Computer art applications make it possible to do things that are possible in no other medium. An original sketch can be saved, and then limitless additional copies of that sketch can be altered and saved. To accomplish this same sort of artistic deliberation with traditional media might take weeks. There are however disadvantages to digital painting too. Many artists feel that digital painting removes from art the magic and

sentiment of mixing colors, overlaying layers, grading, scrubbing, etc. For those thinking that painting is exactly about that, painting itself has not been affected by the digital revolution. The research work reported in this paper aims to fill this gap through the exploitation of Ambient Intelligence as a means to provide real time support for artistic creation.

Ambient Intelligence (AmI) presents a vision of a technological environment capable of reacting in an attentive, adaptive and active (sometimes even proactive) way to the presence and activities of humans and objects in order to provide appropriate services to its inhabitants [1]. This paper builds on the evolution of AmI, and the penetration of technology within art experiences, to provide novel means of traditional painting, by offering seamless integration of the physical and of the digital worlds to provide digital support for physical painting. The proposed approach, rooted in the concept of a digitally augmented traditional art workshop, allows visual artists to naturally interact with art knowledge and resources, during the art education and creative processes. The practical exploitation of this research work is demonstrated through the creation of four oil paintings. The Artist's activities are facilitated by technology from the conceptual generation of the painting to its composition and implementation.

2 Related Work

The evolution of computing technology was rather influential for art creation. Novel forms of art have risen such as digital painting and digital architecture. The computer has enormously expanded creativity by allowing for a greater exploration of chance, and thus the creation of more complex aesthetic "permutations". It has also given us a more efficient means of producing art that never existed before¹. This digital revolution has resulted into the emergence of a new group of digital artists. David Hockney is a well-known artist facilitating modern technology for creating digital paintings currently on display at Paris's Pierre Berge-Yves St. Laurent Foundation². In the same context, entire galleries have focused on digital art. Since 1979, Ars Electronica has sought out inter-linkages and congruities, causes and effects³. For those interested in the field several journals of digital arts have been created. Today, Leonardo is the leading journal for readers interested in the application of contemporary science and technology to the arts⁴.

Research has experimented on the combination of digital and physical media such as the medium of paper and the medium of computation. Several prototypes of laboratory notebooks that combine PDAs and graphics tablets with paper notebooks to permit users to (e.g.) annotate, store, and evaluate their handwritten paper notes [2]. Still, other efforts have employed alternative types of integration: the HyperGami and Popup Workshop programs [3, 4], for example, enable users to design paper polyhedral and popup cards, print out templates on a colour printer, and assemble a tangible folded object.

¹ <http://www.artnet.com/magazineus/features/kuspit/kuspit8-5-05.asp>.

² <http://www.hockneypictures.com/home.php>.

³ <http://www.aec.at>.

⁴ <http://www.leonardo.info/leoinfo.html>.

Coelho et al. explored “pulp-based computing” embedding electronics into lovely hand-made papers and the Graffiti Research Labs group conducted a variety of playful experiments with conductive paints and paper (Graffiti Research Labs). Buechley et al. (2009) created a construction kit for paper computing that enables people to, relatively quickly and easily, meld the creative affordances of paper and computation to make interactive paintings and sketches [5].

In the same context, research has proposed novel forms of Art in public spaces. Especially in the research topic of light art or light graffiti (for example, Blinkenlights⁵) the concept mobile interactive art such as the MobiSpray has been proposed. MobiSpray provides a novel, portable, gesture-controlled art tool for creating large-scale, full-colour projections in the environment in real time. Furthermore several drawing interfaces have been proposed such as Cho’s motion-sensitive brush [6]. In Drawn [7], painted ink forms appear to come to life, rising off the page to interact with the very hands that drew them. Remote interactive graffiti [8] invites distributed internet participants to “draw” via a browser-enabled interface on a common (installation based) canvas. In the same context, land art⁶ or environmental art⁷ (for example, Christo⁸) can be mentioned, in which the landscape and the artwork are inextricably linked, and the intention of the artist is to cause no harm to nature or the environment through the artwork.

Traditional painting has not yet been considered as a potential field of exploitation. This paper moves forward into applying such technologies to painting towards supporting AmI augmented creativity. A modern Art Workshop was designed from scratch, transferred and equipped within an AmI simulation space. The results of this process are explored through the creation of four oil paintings within the workshop, each of which represents an alternative scenario of art creation.

3 The Creative Process & the Modern Art Workshop

Undoubtedly Art and especially painting is about embedding a concept to a medium. The medium is the mode of expression or communication used by the artist to convey the concept at hand. Regardless of the medium employed, the creative process is essentially the same and entails some common unifying factors⁹:

- The **technical understanding of the medium** consists of knowledge of the materials that the artist is working with and knowledge of how it may be manipulated to fit the conception of the artist. In the case of painting, this might include knowledge of the behavior of different types of paint and the degree to which they can be intermixed, transferred to a surface, blended, etc.
- **Expression** is the ability to decide what to produce, and make choices about the manner of production.

⁵ Blinkenlights: <http://www.blinkenlights.net/>.

⁶ Land art: http://en.wikipedia.org/wiki/Land_art.

⁷ Environmental art: http://en.wikipedia.org/wiki/Environmental_art.

⁸ Christo and Jeanne-Claude: www.christojeanneclaude.net/.

⁹ http://en.wikibooks.org/wiki/Introduction_to_Art/What_is_the_Creative_Process%3F.

- **Communication** is equally important as expression. Many artists use the elements and principles of visual design to effectively convey the intended information. These rules can be strictly applied, used as loose guides, or intentionally broken to achieve balance, impact, or more thoroughly communicate or express the concept.
- **Application** of this technical understanding to an expression of art desires so as for the artist to communicate with his/her audience applying his/her acquired skills about the medium on the selected support.

Based on the discussed principles the art workshop is defined as a physical place enriched with AmI technologies where the creative process is carried out. Traditional methods of creating art meet with the state of the art of ICT allowing the artists' creativity to evolve. This representation of the artist workshop has been conceptually defined in 3D (see Fig. 1) so as to create interaction scenarios using personas [10]. Based on this design a simulation space within FORTH's AmI Facility was populated with technology to form the Art Workshop: (a) a **Design Space** populated by a Samsung SUR-40, (b) an **Art Creation space** created using a PC, a roof-mounted Kinect sensor for blob tracking on the wall, a touch panel PC and a short throw projector and (c) a **Model's plane** consisting of a wirelessly adjustable light, a high definition camera and a PC. The technological infrastructure is facilitated by AmI applications running unobtrusively within space offering the appropriate facilities to artists so as to (a) develop a **technical understanding of their selected medium**, (b) **express & communicate** their work and (c) **apply** technical skills and compositions.

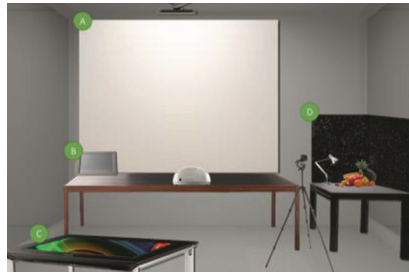


Fig. 1. 3D design of the modern Art Workshop

3.1 Developing a Technical Understanding of the Selected Medium

Technical understanding stands for knowledge of the materials that the artist is working with and knowledge of how it may be manipulated to fit the conception of the artist. In this sense the **Design space** (Fig. 1, Sect. C) allows artists to use tangible objects in painting for educational purposes. Such material can be placed on top of the surface to reveal their “secrets” (tubes, brushes, mediums, etc.). The **Design space** can also be used to access reference material for a number of art-related issues such as art styles, movements, techniques, etc. In that respect, colour mixing is essential when mastering a medium though it can prove to be fascinating, fun or frustrating, depending on the

experience of each artist. The *Design space* and the *Art Creation space* (Fig. 1, Sect. A) offer colour mixing facilities that can be used for studying famous paintings or during art creation. Colour mixing takes place virtually in the artists preferred medium (e.g. oil colours) and using the artists preferred colour series (e.g. a series of virtual tubes from a specific colour manufacturer). Additionally, mastering colour theory which is important for developing a technical understanding happens through the provision of a colour wheel that shows primary, secondary, tertiary, warm, cool and complementary colours as used in colour theory when painting.

3.2 Expressing and Communicating Artistic Work

Expression is about making decisions while communication stands for selecting the appropriate means of propagating decisions. The art workshop offers alternative means of evaluating subject matter so as to lead as close as possible to the artist's initial desires and expectations. To facilitate this process the **Design space** (Fig. 1, Sect. C) offers an interactive surface where materials can be located from the artist's collection or extracted from the Internet. A suite of artistic concepts has been specially designed for artists through the combination of several image processing filters. These ready to use concepts can be applied into photographs, allowing the artist to easily evaluate several combinations. As part of the Artist's explorations in shapes, forms, lights and shadows, the **Design space** (Fig. 1, Sect. C) allows artists to experiment on different composition schemes by importing simple (e.g. cubes) and complex items (e.g. vases) into a 3D scene. Artists can manipulate 3D objects and select the appropriate lighting scheme of the composition. Last but not least, the **Model's plane** (Fig. 1, Sect. D) is the location for the artist to arrange and validate subject matter in physical form (Fig. 1, Sect. A). At the same time the artist can take control of the framing of compositions (for communication) and separate the actual subject matter from the space not involved in their creation.

Communication goes beyond expression in that the artist has to also select the vocabulary of visual elements so as to define the means of communicating with his audience. To this end, through the **Design space** (Fig. 1, Sect. C) the artist gains access to a range of facilities for creating compositions: (a) a digital sketchbook, (b) physical media synchronization, (c) composition surface, (d) design and organization elements, (e) composition schemes used by Art Masters (such as golden rectangles, spiral, diagonal lines etc.), (f) perspective grids, (g) artistic concepts (texture, hue, light etc.), (h) collection of sketches used as reference material, (i) cropping and integration facilities and (j) interactive space to preview previous works.

3.3 Applying Technical Skills and Compositions to Artistic Creations

The application of the artist's expression so as to communicate with his audience through art happens within the **Art Creation space** (Fig. 1, Sect. A). In this area real time support to the artist is offered through the augmentation of the artist's creative process. The surface becomes the artist's cavalette where a virtual painting frame is projected. The artist can align the canvas with the painting frame, allowing interaction to happen within the canvas (the canvas becomes a fully capable multi-touch surface). Therefore,

information can be projected in real time on the painting surface, allowing the artist to test inline artistic concepts. A number of assistants are available to the artist for performing various crucial activities. In order for the completed work of art to be previewed hanged and virtually framed within the **Art Creation space**, a virtual adjustable painting frame can be used. The frame itself can be scaled to cover the area of the painting, while its colour can also be adjusted.

4 Architecture

A generic view of the employed architecture is presented in Fig. 2. For the knowledge layer, three ontology meta-models were developed: (a) the Art model (extends the CIDOC-CRM¹⁰), (b) the User Profile model (extends the User Profile Ontology¹¹) representing users, attributes and preferences and, (c) the context model representing the Art Workshop both in terms of space and available devices. Class libraries have been generated to support knowledge extraction through direct integration, the middleware and web services. The computer vision infrastructure builds on image processing libraries, device drivers and SDKs to provide a collection of filters, blob detection and tracking using Kinect [9], raw image processing and gestures, postures tracking etc. Both the knowledge and Computer vision infrastructure are integrated to the middleware to support their usage in a distributed environment. Interactive applications facilitate a common UI framework created specifically for art creation. These applications request from the content adaptation and personalisation layer to adapt the content provided based on each user while the scenario manager is responsible for organising the way that the suite of applications collaborates and adapts to user actions in the context of application scenarios.

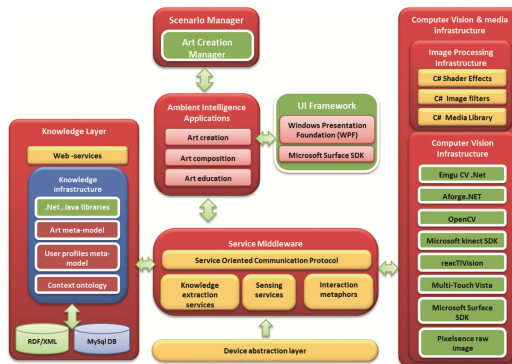


Fig. 2. Abstract service oriented architecture

¹⁰ cidoc: <http://www.cidoc-crm.org>.

¹¹ User Profile Ontology: <http://wiki.gpii.net/index.php/Ontologies>.

5 Proof of Concept: The Creation of Four Oil Paintings

In order to prove the feasibility of the proposed concept and its practical exploitation within a simulation space, four works of Art (feasibility studies) were created (see Fig. 3). Each of these projects employs different aspects of the hardware and software deployed for exploring the feasibility of the proposed approach. The paintings presented in this section (physical oil paintings) were all created and recorded (using a setup with four cameras) in a time span of two to three hours. This section presents an overview of the workshop in action as illustrated by Fig. 4.

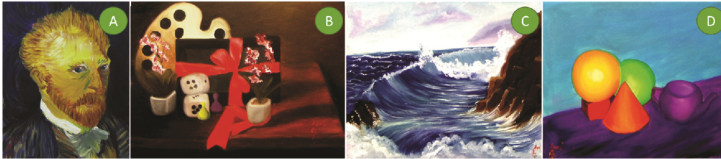


Fig. 3. Paintings created within the art workshop: (a) a reproduction of a self-portrait by Vincent Van Gogh (Sect. A), (b) a physical still life composition (Sect. B), (c) a geometric seascape composition (Sect. C) and (d) a composition exercise using 3D models (Sect. D).

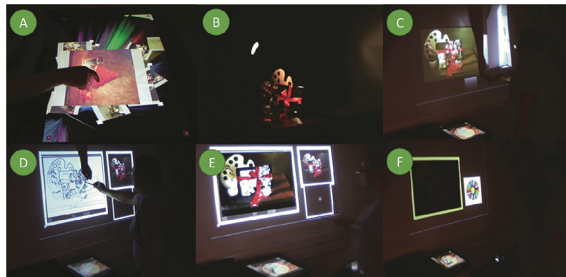


Fig. 4. Intermediate steps for the creation a still life composition using the workshop

For this painting session the artist initially uses the **Design space** to study a number of still life compositions to select the most appropriate visual arrangement (Fig. 4, Sect. A). Having done so, he is setting up the still life composition in the **Model's plane** and adjusts lighting so as to achieve a dramatic chiaroscuro effect (Fig. 4, Sect. B). Having completed the placement of subject matter, the artist moves to the **Art Creation space** and previews the composition within the canvas. The camera located in front of the composition is projecting the composition allowing the artist to frame the part of the composition to be painted (Fig. 4, Sect. C) and then loads the composition for painting. The artist reveals the sketch of the composition and projects it on the canvas. Then, he uses a charcoal stick to trace the composition within the canvas (Fig. 4, Sect. D), and virtually creates the appropriate colour mixtures to form the palette of colours for this painting session. Having completed the conceptual definition of the painting to be

created, the artist moves into the actual creation process (Fig. 4, Sect. E). Finally the artist selects the most appropriate painting frame and colour (Fig. 4, Sect. F).

6 Discussion and Future Work

This paper has addressed the facilitation of an Aml environment to host a painting studio that can support any painting style that involves an artist applying pigments (with a brush, a pencil, a stick etc.) or items (silver-gold leaves, collage media etc.) in a painting surface (canvas, wood, paper etc.). Four oil paintings were created focusing on all the creative steps from background research to concept generation, composition and painting. Current limitations include a maximum canvas size of 1.20×1.0 m due to the usage of a single Kinect sensor for tracking touch within the art creation space, which is considered large enough for the majority of small art projects. There is a general impression that traditional is messy and therefore not technology – friendly. This research work employs and augments the creativity of the artist while keeping his hands clean. During painting, the usage of technology is limited and only if desired by the artist. Finally, in the context of the scenarios run within the in vitro simulation space, light was limited due to the quality of the projector used (1000 ansi lumens). In the context of future improvements, the support of larger scale projects is considered a top priority, testing the limits of both the design and art creation infrastructure. Additionally, it is important to test the workshop for different art styles and exploit the concept for art education and training.

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