

# Exploring Contemporary Painting through Spatial Annotations Using RFID Tags

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## ABSTRACT

*One of the least explored RFID application-domains concerns the areas of entertainment and culture. This paper proposes a mobile application -conceived for and with a contemporary artist- allowing the spatial annotation of paintings and the delivery of multimedia related interpretation material to the concerned public, through the combined use of RFID tags and NFC (Near Field Communication) mobile phones, serving as delivery platforms. The paper reports on the design and implementation of the application as well as on the results of a first, proof-of-concept, evaluation.*

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## 1. Introduction

The main use of RFID (Radio Frequency Identification) technologies has been up till now mainly related to business, product identification and traceability. These approaches often refer to Electronic Product Code (EPC) standards [ABB\*07]. Less common approaches deal with ubiquitous games, smart puzzle games, or even museum visits [SAA\*09]. This paper introduces a mobile application, making use of RFID and NFC (Near Field Communication) technologies to foster interactivity between a contemporary painter and his public.

Following the process of transition from analogue to digital audio guidance systems and then to fully fledged mobile multimedia guides, the RFID technology has been so far scarcely employed, alongside other solutions such as declarative geolocalisation, Wi-Fi, Bluetooth, Infrared and AR (Augmented Reality) solutions, all aiming to assist the concerned public in obtaining the right information on the right spot during a cultural visit [Dam08].

Within the context of contemporary art exhibitions the RFID has resuscitated at least twice the interest of artists and gallery owners. A Gallery in New Hampshire, USA, placed RFID tags next to the artworks. Visitors could borrow a PDA together with an RFID - Bluetooth pen that triggered and then bluetoothed to the PDA the ID of the artwork on display, causing the PDA to display information on the selected work [Pro05]. Additionally, Baard reports a contemporary female artist embedding RFID tags to her

sculptures, claiming that "the idea of objects no longer being anonymous, that's incredible to someone who makes objects" [Baa09].

The application and prototype explored in this paper differentiates itself from these approaches in that several RFID tags are used to spatially annotate several details of an abstract painting. The annotations contain multimedia content specifically prepared by the artist in an effort to initiate a better comprehension but also a dialogue with the concerned public. This paper is organized as follows: Section 2 analyses the background of the project and the requirements analysis process. Section 3 presents the system architecture and implementation. Section 4 looks into the modalities of interaction design and content creation while section 5 reports on the first results obtained by displaying the annotated painting to 75 visitors. Conclusions and directions for future work are visited in the last section.

## 2. Requirements analysis

Olivier Haberman, co-author of this paper is a contemporary artist and painter [Hab10]. As in contrast with a certain assumption that wants a piece of contemporary art standing out for itself, without any further interpretation material being necessary [Fre01], he positions himself with the opposite view and cares for creating works that can be understood, being accessible and intelligible to those who care to look and interpret them. Taking as a prerequisite this point of view, it seemed more than appropriate to cre-

ate an application that would allow the artist to decipher, explain and shed light on the artistic intentions and motivations that gave birth to a piece of work. However and in order that the proposed system becomes easy and intuitive to use by the widest possible audience, without limitations of time, space or ability to access technology, some specific requirements had to be taken under consideration. The proposed application should be ideally low-cost but also robust and should be easy and intuitive enough to be used both by the artist and the concerned public.

### 3. System architecture and implementation

The system architecture and implementation is rather simple and relies on the use of RFID tags, used for spatially annotating the painting and NFC (Near Field Communication) mobile phones (aka Nokia NFC6131). The RFID tags are used as triggers causing the mobile phones to exchange information with a server that contains the data the artist wants to provide. Different types of media can be delivered such as audio, text, images, short videos or references to web sites allowing the download of dynamic content.

Passive RFID tags were chosen because they are cheap, they are very thin and they can be read or written by using mobile NFC phones providing a flexible tool that enables the communication of the painter with his public.

The RFID tags are embedded behind the painting canvas, at the exact spot that the artist wants to annotate. This way the tags are invisible to the public and do not alter the nature and character of the painting.

Each RFID tag contains a unique ID. The handset device reads the tag and gets the corresponding ID. The ID is then sent to the server that responds by sending the associated data that has been prepared by the artist: sounds, pictures, and very short videos can be associated. 2G and 3G mobile phone networks can also be used for the data transfer. The communication framework that has been used for the paintings annotation is part of the uGASP project [PGS08]. The overall framework is implemented in Java 2 Micro-Edition (J2ME) on the mobile phone, and, on standard Java on the server side. The server is set up as a multimedia web service oriented database so that its content can be updated any time by the artist or any administrator to comply with the artist's requirements.

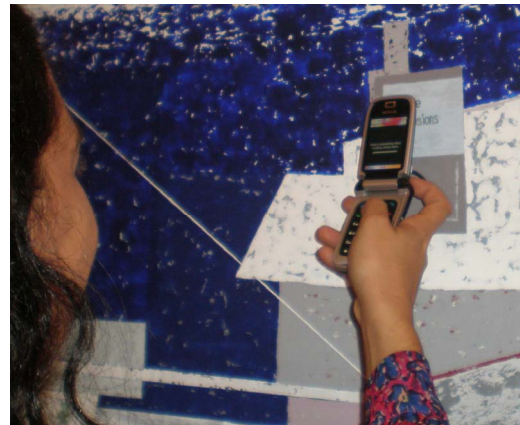
### 4. Interaction design and content creation

Designing interactive and compelling experiences with artists can prove in practice to be a real challenge. This is because as [GWB07] have pointed out, in such cases, the artist has to identify the technology, appreciate its role, understand how it works, apply the technology concept in the design phase, then develop and create what has been designed while, on the other hand, the collaborating engineers have to accept going through a relative process, identifying, appreciating and understanding the role of their enhancements or technical interventions and their smooth and seamless integration in an always unique in character work of art.

In order to demonstrate the feasibility of our approach, a painting entitled "Infinite Abstraction" was selected, after several participative design sessions held with the artist.

The underlying subject the artist wanted to put forward in this work was the infinite dimension and importance of human communication and expression, in general and through art. Seven areas of particular interest for the understanding of the painting were identified by the artist who subsequently also created the accompanying multimedia content to be delivered through the NFC-enabled mobile phone. These areas were annotated using passive RFID tags that were positioned on the back side of the canvas, behind each one of the annotated painting details. The content provided by this first prototype had the form of audio, image and text. The audio recordings were further classified in two types: a. recordings with the voice of the artist, providing information about his work and allowing the public to get closer to the thoughts of the painter and b. non-figurative audio creations, specifically conceived to "augment" the painting. Similarly, the text and visual annotations either gave additional insight into the painting or offered an additional view over a painting detail proposing different artistic media.

All the visitors have to do is to look at the painting and approach, following their intuition, the mobile NFC mobile phone close (and not more than 2cm) to the painting areas for which they believe that an annotation might be available (Fig.1).



**Figure 1:** Revealing the hidden content behind the painter's annotations using the NFC enabled mobile phone.

So as to give an example of the process followed for the creation of the "hidden", behind the annotations, content, a contemporary photographer was invited to contribute providing a photo, representing his view over the issue of communication; a group of children chose to present their own analysis of the topic through the creation of a soundtrack they composed and performed themselves. Other examples of provided content include the "hidden" textual annotation behind the artist signature, providing information about the identity of the painter and the different materials used on the canvas.

## 5. Usability tests and evaluation

A first, pilot evaluation was conducted with the initiative of the artist, in order to provide a proof-of-concept validation with regards to the acceptance of the application by the concerned target group.

### 5.1 Evaluation methodology

In order to obtain a first feedback from the targeted users of the proposed application, 3 visiting sessions were organized in which approximately 75 persons participated. The visitors were briefly instructed about the use of the phone and were then encouraged to explore the painting using the mobile phone as they like. All participants were informally observed, while 48 of them, aged between 12 and 56 years old, took also the initiative to complete the proposed questionnaire regarding their impressions from using the application.

The questionnaire that was proposed to the visitors included 11 open-ended questions relative with the ease of use, the identification of the painting's spatial annotations, the multimedia content provided as well as with the conscious choice of using a mobile phone as a platform for delivering the painting-related interpretation material. An additional question concerned possible post-visit functions such as the possibility to keep some track or souvenir of the viewed and explored annotated painting.

### 5.2 Visitors' feedback

The first point to check was whether the participants managed to intuitively discover all the included by the artist multimedia annotations. 9 out of 10 visitors managed to discover all of the annotations, with the remaining pointing out that they did not think of searching for an annotation close to the artist signature, perceived as being "outside" the content of this "intelligent", annotated painting. Out of these 9 visitors that did activate the tag hidden behind the signature of the painter, 7 judged the information regarding the title, format, type of pigments used, date of creation and artist information sufficient and satisfactory. The other 2 declared that they would have liked more information about the artist and / or the painting.

Regarding the ease of use of the mobile phone, 8 out of 10 participants considered the manipulation of the phone to be easy or very easy. The remaining 2 commented that they'd rather download all the available content at once, so that they listen and see all available content in a row, while contemplating the painting. The necessary time span from the triggering of the content to the actual download was not perceived to be too long.

As for the suitability of the proposed multimedia interpretation material, 8 out of 10 visitors found the photos to be clear and readable while for the remaining 2, the screen size of the NFC phone was judged to be too small for the delivered multimedia content. As to whether the actual content of the NFC-delivered accompanying images were thought to contribute to a better understanding

of the painting, only 4 out of 10 of the participants did recognize the provided material as symbolic material giving additional insight into the painting or highlighting the treatment of a similar issue by different artistic media. Another 4 thought that the pictures were confusing and raised more questions than the ones they answered. Finally for the remaining 2, the relationship between the photos delivered through the mobile phone and the painted canvas seems to have been aligned with the intentions of the artist.

The quality of the audio commentaries, delivered in the majority of cases through the use of headphones was considered to be clear and comprehensible by all of the participants. However, the recordings of the voice of the artist seem to have been understood and appreciated better than the audio, non-figurative works created for the painting. It seems that for the large majority of the participants, the painter's audio commentaries created a direct link with the artist, his artistic intentions and the painting's symbolic references and that it gave more intensity to the message and the meaning of the annotated piece of work.

It is also interesting to comment on the answers provided for the open-ended question "would you rather prefer that the content was delivered to your own mobile and not –as it is most often the case in museums– to a museum provided delivery platform?" 8 out of 10 viewers considered this factor of paramount importance and provided various reasons for that, such as the fact that one is more familiar with the modalities of use of a personal mobile phone, but also reasons such as the fee for borrowing a mobile audio or multimedia guide or even reasons related with the hygiene of loaned devices.

Equally interesting were the answers that were provided in another question, asking the spectators whether they would have liked to keep part of the content on their own mobile phone. Many visitors noted that they would enjoy being able to have a souvenir of the artist-authored material, to consult later or even demonstrate it to others, so as to share their experience. Some visitors also noted that this souvenir could take the form of a reproduction of an object or painting along with a short message from the artist himself.

### 5.3 Lessons Learned and Future Directions

The results of the first experimentations regarding the annotated –using RFID tags– painting were very encouraging. Among the particularly appreciated application elements was the chosen delivery platform, as the familiar look and feel of the mobile phone made the concerned public feel quickly at ease with the modalities of manipulating the system and discovering the "hidden" interpretation material.

Several informal conversations of the artist with the participants of the evaluation sessions, confirmed that the step-by-step discovery of a contemporary abstract painting using the proposed system, strengthened the relationship between the artist and the audience, and gave a new dimension to the encounter and discovery of the selected piece of work.

Following some of the public's feedback given after viewing the painting with the NFC mobile phone, several new ideas concerning the nature of the delivered content were generated. For example, in order to avoid the confusion between simple audio commentaries and audio, non-figurative accompanying pieces of work, in the future, the later will be accompanied by an explanatory audio message highlighting the relationship with the main work.

Moreover, some of the participants, proposed the creation of a new module that would allow a two-way communication with the artist, i.e. enabling the public to annotate the painting with personal ideas, thoughts or feelings.

## 6. Conclusions and directions for future work

This paper presented a robust, mobile RFID application that comes to enrich the already existing wide array of possible RFID applications, providing an example of use of the RFID technology in the domain of entertainment and culture. Our case study proposed the spatial annotation of an abstract contemporary painting, using RFID tags and NFC-enabled mobile phones for the delivery of accompanying multimedia interpretation material to the concerned public. A first, pilot-evaluation proved that the application is robust enough and reliable while the feedback received from the approximately 75 participants who tested the application was largely positive and at times even enthusiastic. One of the key findings of our case study was that the combined use of RFID tags and NFC-enabled mobile phones made all participants feel very quickly at ease with the proposed application.

A point that needs to be stressed out is that the delivery platform proved also to have some constrains, mainly because of the small size of the display. However, as RFID applications become even more popular and generalized it is quite probable that in the near future the wide network of RFID applications will push other device makers to adopt the RFID technology, opening up new horizons in the conception of mobile and interactive interpretation media that could be proposed both to artists and –subsequently- their public. In this case other features could also be implemented, such as specific modules allowing the personalization of the delivered content or its bookmarking so that it can be consulted at a post-visit phase.

Finally, we would also like to highlight the particularity of the life-circle of the proposed application and approach, which was the fruit of an enriching and intense collaboration between interaction designers, computer science engineers and a contemporary artist, who entrusted and inspired the interaction design and implementation team. Future work includes the experimentation with other types of media (video, pointers to web sites, etc) and interactive features, the annotation of new paintings and the organization of new demonstration and evaluation sessions.

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