Artistic Performance of Open Source Software

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Abstract:
Science and technology communication is important to recruit young students to scientific studies and to increase awareness of technology issues among citizens and decision makers. Software science and technology communication poses specific challenges as software is by its nature not tangible and not visible. Our argument is that Science in Society events which gather artists, developers, researchers, and citizens around an Open Source Software project, are effective for both communicating open source software issues to a broad audience and for collecting open documentation that has both research and artistic value. This paper examines four projects that have been designed according to a combination of both practical and research goals. For each of these projects, one or more artists played a significant role. Moreover, we collected open documentation and published it on blogs and other open platforms. Retrospectively, we drew on performativity theory to reflect on the research questions that guided our study. The analysis of the collected data lead to our results. Our results suggest a model based on: 1) a stakeholder model for Open Source Software events where stakeholders are artists, developers, researchers, and citizens; 2) an open documentation model for Open Source Software events where documentation consists of a patchwork of words, still and moving images, music and sound, and digital code.

Keywords: Open Source Software, Art, Performance, Performativity

Biographical notes: Professor Letizia Jaccheri has a Master in Computer Science from the University of Pisa, Italy, and a PhD in Software Engineering from Politecnico di Torino, Italy. She is a professor at the Norwegian University of Science and Technology since 2002. Her fields of research are: Software engineering applied to Art and Open source software.

1 Introduction

How can we increase knowledge about the intersection between software and art? This question has guided the work of researchers, artists, and technologist in the last 40 years [EWC'05] [Har99] [Fis06]. Given than software has an increased hold on the way people experience art and culture, increased knowledge about
the intersection of software and art benefits cultural industries, which produce media for publishing enterprises, museums, and entertainment. More specifically, increased knowledge about software and art provides both better technology platforms for cultural industries and better conceptual models for decision makers.

Some researchers advocate the neutrality of the researcher with respect to the object of study, for example [WRH+00]. On the other hand, some researchers aim for a combination of practice and research. For example, [DMK04] introduced a model of canonical action research for computer related research. In practice-based research projects, questions are based on interests triggered by practical problems, and the researcher is motivated by the joy of creation as well as the search to produce new knowledge.

Performativity [Has06] [Jac09] [Koz08] theory arose in the context of art studies. According to performativity, research and practice are connected and are equally important. Performativity rely on multiple data collection methods and the associated documentation can be a mixture of images, sound, live action as in theater, and digital code.

Software or program code governs the behavior of computers. Computers and associated software were initially focussed on mathematical calculations, thus the name "computer". Initially software was developed for military purposes (in the 40's). From the 50's to the 80's the use of computers and software was extended to science experiments, banking, hospital, and airport and flight management. The manipulated data extended from only numbers to text, e.g. administrative applications. Gradually, from the 90's, paraphrasing Manovich [Man08], software has taken command. With the advent of the personal computer, multi media, the web, search engines, mobile computing, games, and social media, software has penetrated the life of each citizen of the civilized world. Software has changed the way we work, experience culture, communicate with each other, and learn. People are getting more and more used to interacting with software. However, how many people can answer the question 'what is software'? There is still a lack of knowledge about what software is, what it means to produce software, and what the consequences are for a country investing in software research, development, and education.

A software system is open source if its code is available. Users of OSS are not paying customers but software co-developers. In this work, we chose to focus on OSS and its intersection with art. This choice is motivated by: 1) personal interest and previous research in OSS; 2) practical advantages in event organization (in order to run art and technology events, it is easy to invite people to bring their own laptop on which they can install OSS; 3) significant related work in OSS and art and available OSS for art such as processing [Nob09] [Gro11b], Arduino [Gro11a], and Scratch [atMML11].

The practical goal of our work is to increase interest in OSS by exposing it to a broad audience. More specifically the practical goal is to make OSS visible in the public space and raise public engagement about OSS and its potential to be used in creative activities. Our work ca be interpreted with regards to Science in Society (SiS) events [SMC+09].

We organized SiS [SMC+09] events which involved different stake holders, and for which we collected open documentation (OD) for both research and communication purposes. We believe that SiS events which gather artists,
developers, researchers, and citizens around an OSS project, are effective for both communicating open source software issues to a broad audience and for collecting open documentation that has both research and artistic value. The main results of this work are:

- a stakeholder model for SiS OSS events where stakeholders are artists, developers, researchers, and citizens;
- an OD model for OSS events where documentation consists of a patchwork of words, still and moving images, music and sound, and digital code.

This paper has the following structure. Section 2 summarizes related literature about OSS (2.1), software and art (2.2), and performativity theory (2.3). Section 3 presents four projects. Section 4 concludes with a general discussion.

2 Background

In this section, we summarize relevant issues about software and about performativity.

2.1 Open source software

Software, also called program code, governs the behavior of computers. A software system is open source if its code is available to everybody for inspection, use, and modification. Use and further release of modified versions of an OSS system are regulated by a licence. According to [Boa11], there are, at the time of writing, 67 open source licences. Important examples of OSS systems are Linux operating system, Apache Web server, mysql database system, and processing programming language for artists.

In 1989, the Free Software Foundation published a single licence usable for all software, the GNU General Public License (GPL). This formalized the concept of copy left as opposed to copy right. If an OSS product is licensed under a copy left license, each product that is obtained by modification of the given product must, in its turn, be released as an OSS product with a copy left license. Licenses like GPL that impose copy left constraints are called viral. Not all OSS licenses are viral. Some licenses allow commercialization of the derived versions.

OSS is much more than the possibility to change code. OSS projects are associated with communities of users and developers. The degree of activeness of the community is crucial for an OSS project. Each user of an active community is not isolated but part of a community. Members of each community are connected, and help each other via mailing lists, forums, and IRC channels. Raymond has written “Treating your users as co-developers is your least-hassle route to rapid code improvement and effective debugging” [Ray01]. However, there is not a single model for OSS communities. Rather, as explained in [CH05], different projects have different communities and different communication patterns.

OSS tools in software engineering education have been explored for example in [Kro08]. Open source methods practiced within the new media art context is the topic of [Hal07], which reports about a research project that investigated how open source software has impacted new media art.
From the point of view of the scientist, OSS projects come with an abundance of empirical data, generated through the everyday actions of developers and users. Some OSS projects are characterized by an open development process which allows anybody to propose new versions of the code. Other OSS projects, like for example Scratch and mysql are characterized by a closed process that is open only to the development team. Even for OSS projects with closed process, the community adds value and the user can communicate with other users and with the developers. If the OSS product is a software development tool, like for example Scratch, the user is not only an interactor but also an active producer of digital code. If, more generally, the OSS product is a digital content development tool, like for example GIMP, the user is an active producer of digital content.

For the purpose of our dissemination goal we have developed four criteria to select OSS projects: 1) Openness of the development process; 2) Support for non-technical users; 3) Support for production and manipulation of audio, pictures, physical installations, software programs, and digital storytelling; 4) Sharing of the developed content.

In the context of the research reported in this paper, we have considered Scratch [atMML11] and Arduino [Gro11a].

Arduino has been developed according to a process that is open to newcomers while Scratch is characterized by a closed process. The Lifelong Kindergarten Group at the MIT Media Lab developed Scratch and maintains and manages the cooperative project around Scratch. Scratch is specifically designed for children from age 8 and upwards. A project developed in Scratch is itself an OSS program that other users can build on. This is not the case for a closed source produced animation, like a Flash animation. A closed source produced animation can only be seen in action but one can neither open it to inspect how it works nor modify it. Arduino can be used to develop installations.

Scratch is for digital story telling. Each tool has its own web sites that provides manuals, examples, and forums. Scratch provides mechanisms for the sharing and remixing of media. Scratch has more than 1.5M projects available, created by 500 thousands contributors. Arduino is a programming language in the traditional sense. Scratch has been designed with the specific goal of making programming attractive to teenagerns and children.

2.2 Software and art

The intersection between software and art has intrigued artists, technologists, and scientists since the 60's. Computer-based art has existed since the 60's with artists like Michael Noll and Frieder Nake. The first computer art exhibitions were held in 1965. The Leonardo journal was found in 1968. The first Ars Electronica festival was held in Linz in 1979. In 1989 Jean-Pierre Yvaral produced Mona Lisa (Digital art). Photoshop 1.0 was released in 1990 (Digital photography). In the next years digital cameras appeared on the market. Pictures could be uploaded to computers and manipulated. The first multimedia PC was released in 1991. With the advent and the evolution of the personal computer, the web, software tools like Adobe Photoshop, and electronics tools such as cameras and mobile telephones, there has been an explosion of both production and sharing of digital content. This creativity explosion has involved not only artists but also common people.
Artists need software technology for creating and evolving their artwork [TJB08]. Theoreticians aim at understanding the consequences of software to art practices [Hal07]. Technologists see the contact with artists as a source of innovation [Har99]. Computer science researchers recognize the importance of new media art as a legitimate research field [Oat06]. Tools for creativity are a subject of study within computer science research. ‘New media artists realize their desire for personal expression with powerful development environments that support animation, music, or video editing tools’ [Shn07]. The Linux operating system (developed by Linus Torvalds, 1991) received an art prize at Ars Electronica in 1994, providing an overlap between the software and the art world.

The inner joy of creation has often been identified as an attribute of the open source software developer culture, bringing it, according to Castells [Cas96], close to the world of art. In [Cas01], Castells anticipates that art as a growing area of the Internet, stating that ‘open source art is the new frontier of artistic creation’. He also presents the idea of open source art. For Castells, the Internet not only serves as a means for distribution of artifacts, but also serves as a platform for a process that aims to create new artistic artifacts.

2.3 Performativity

Performativity is a framework for understanding phenomena associated with interactions. According to performativity, theory and practice are equally important. Multiple research methods can be associated with performativity research work. The associated documentation is characterized by still and moving images, music and sound, live action, and digital code. The documentation that is generated by performativity work has dual value as research data and as the result of practical work. Performativity research connects practice to theories by keeping documentation and formulating and reformulating research questions. Performativity has originally been developed to understand artistic phenomena, but it has applications for the creative and cultural industries [Jac09] [Has06]. [Koz08] provides a set of questions and a method for doing ‘phenomenology of lived experience’.

The article in [Mac05] is about the Linux operating system and its role in culture. The paper argues for an increased visibility and significance of software. Moreover, it adapts performativity to include cultural processes in which processes of circulation play a primary role. The analysis is grounded in the circulation of Linux through versions, distributions, clones and reconfigurations. It investigates the role of technical culture-objects, such as Linux and the way they interplay with social practices.

To find the intersection between computer science and performativity, we run a search for ‘performativity’ on the ACM digital library. This search gave 86 results. By reading the abstract of these 86 papers we identified a set of works that can be used to reflect on our work. [Dan05] makes explicit references to performativity theory and links to two instances of performativity: ‘the one coming from the STS scholar Andrew Pickering’ and the other coming from the feminist scholar Judith Butler. [Hug10] investigates the impact of performativity on sonic interaction design and evaluation. The work is centered around the analysis of prototypes created in workshop settings in collaboration with industry. Prototypes
as performatively documentation, produced by the event in users and technologies as an event which produces concrete material object is addressed are discussed in [Dan05]. [LRS*09] reports about a study whose main goal is to explore ‘lifelogging’ supporting tools like SenseCams. A SenseCam is a Microsoft wearable camera which automatically takes pictures. In this work, pictures are used as a source to reconstruct narratives. The notion of productive and transformative event is introduced in [Dan05] to interpret the creative interaction between designers and users. [BDVL94] is a short seminal paper that reports about events in which designers and users play with prototypes by exploiting performance techniques such as improvisation.

3 Open Source Software Events

In this section we write about four OSS events. Each event was planned with the practical goal of gathering artists, developers, researchers, and citizens around software. For each case, we will examine the context, the methods of data collection, the stakeholders, and the produced documentation. Moreover, for each case we discuss the research questions and results against related literature. Figure 1 depicts the model that we use to interpret our cases.
3.1 Researcher Days and Night 2009

3.1.1 Context

The National Science Week in Norway is a nationwide event held every year to make science and research available to the public. This event is connected to a Europe-wide event which brings together both the public at large and researchers once a year on the fourth Friday of September.

In 2009 we participated in the National Science Week with an OSS event centred on Scratch and Arduino, as part of a dissemination project founded by The Norwegian Research Council. The event was held Friday 25th and Saturday 26th of October 2009 in the main square of the city of CityXXXXX (during the day, see Figure 2) and at the UniversityXXXXX (during the evening of the 25th see Figure 3). In UniversityXXXXX, Researcher Days started in 1995. We had participated for the first time in 2008. The number of stands in 2009 was 26.
3.1.2 Methods of data collection

We used a set of predefined questions to talk with our visitors. The questions are available in table 1. The purpose of the questions was to interact with each visitor in a planned way in order to:

1. communicate information about the ProjectXXXX research project and associated activities
2. collect data about the visitor’s attitude about new media art and software with focus on open source
3. ask the visitor about how she/he liked our stand and how we could improve it

Moreover, we took pictures as detailed in section 3.1.3.

3.1.3 Results

According to the proposed model, the results are:

- Stakeholders participating at the event:
  
  **developer**: one student assistant and one researcher.
  
  **researcher**: two researchers (one of which was an International guest), two student assistants.
  
  **user**: public were pupils from local schools (Friday during the day, number of visitors 7,000), students from high school, age 17 (Friday from 18:00 to midnight, number of visitors 1,000) and citizens of the town (Saturday during the day, number of visitors 3,000).
  
  **artist**: one.
  
  **photographer**: two. One photographer took pictures at Researcher Night and the other at Researcher Day.

- Produced documentation:

  **software**: We developed the Arduino program for the lilac gown. The users developed 27 projects.

  **pictures**: 15 pictures are available at ProjectXXXX’s flickr. 24 pictures are available at photographer’s flickr. Of these 24, 8 are about ProjectXXXX’s stand while the others are about other aspects of the event.

  **videos**: none.

  **text**: One article in a National magazine distributed by the major Norwegian newspapers. One blog post at the ProjectXXXX website [Pt11]. One news article in the Department’s web-based news.

  **installation**: One t-shirt (see Figure 2 b and 2 c; one interactive gown (see Figure 3 b and 3 c and Figure 4 c)
3.1.4 Discussion

The event reported here can be seen as a productive and transformative event [Dan05]. While in [Dan05], the designers interact with users through a prototype that is produced by designers and used by users, in this work we go a step further by aiming for a situation in which users become the active producers of prototypes while researchers, developers, and artists take the role of assistants of the performative users.

Our work was strongly shaped by the choice of using Arduino LilyPad [BECC08] and Scratch [RMMH+09]. In the work reported in [BECC08], the primary practical goal is is ‘to spark and support peoples independent interest and motivation; we want to foster new, creative, and contentful youth cultures’. The research goal in [BECC08] is to increase knowledge about how to introduce electronics and programming concepts through an e-textile. The work reported in [BECC08] is about six workshops organized around the Arduino LilyPad construction kit. The research design consists of surveys at the beginning and the end of class designed to assess motivational issues around programming, electronics, sewing and art. The duration of one workshop is one week, three hours per week.

The work reported in [RMMH+09] by Scratch developers and researchers has the main goal of giving a positive message of the use of programming as a medium to creatively express their ideas. The paper describes Scratch design principles that are: thinkable, meaningful, and social. The paper reports about Scratch day, an event that is organized each year all over the world and has a duration of 4.5 hours.

There are three main lessons learnt in our study:

- About Stakeholders: the role of researcher and developer is much stronger than that of artist;
- About Duration: many visitors with short time allocated to each visitor, we do not have control over how long each child or adult will stay at our stand;
- About Questionnaire: it is difficult to combine conversations with note taking, unless filmimg or recording the conversations by which they would be transcribed afterwards. Our focus on research encouraged us to develop a set of questions to structure our conversations. However, it is difficult to combine the conversation part and the data collection. The question that is relevant for this work is ‘Question 4 - Are you interested in open source?’ Of 40 respondents, one answered ‘I have heard the word before’. One answered ‘yes’ to the question ‘Are you interested in open source?’ All the other answered ‘no’ or ‘I do not know what it is’. One answered ‘I am not interested’.

3.2 ITovation

3.2.1 Context

The event took place in the context of an ITovation conference. ITovation is a seminar series at UniversityXXXXX. The idea was to set up an Arduino Lilypad event by customizing the event reported in section 3.1. The ProjectXXXXX event had a duration of 30 minutes during the break (see Figure 4).
<table>
<thead>
<tr>
<th>Question 1 - Have you heard about the ProjectXXXXX competition?</th>
</tr>
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<tbody>
<tr>
<td>If yes: What have you heard?</td>
</tr>
<tr>
<td>If no: ProjectXXXXX is a competition where you have to combine art with software. An example is a sculpture which changes shape, sound or color depending on the text-messages it receives from the audience.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2 - Are you interested in IT?</th>
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<tbody>
<tr>
<td>If Yes: What is it that interests you the most?</td>
</tr>
<tr>
<td>If no: Do you know what IT stands for? IT means Information Technology. Everyone should have some basic understanding of what IT is and why it is important. IT is a part of your everyday life. It is what makes your computer, your mobile phone or the smart board in your classroom work.</td>
</tr>
</tbody>
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<tr>
<th>Question 3 - Are you interested in digital art?</th>
</tr>
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<tbody>
<tr>
<td>If yes: ProjectXXXXX gives you an opportunity to work with digital art in a structured setting where you can communicate with others working with digital art and get professional help.</td>
</tr>
<tr>
<td>If no: Art raises questions about human life, and digital art raises questions about our interaction and dependence on IT.</td>
</tr>
</tbody>
</table>

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<tr>
<th>Question 4 - Are you interested in open source?</th>
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</thead>
<tbody>
<tr>
<td>If yes: ProjectXXXXX gives you an opportunity to explore open source tools.</td>
</tr>
<tr>
<td>If no: The open source movement challenges the notion that someone should own and make money off the programs on which we base our everyday technological life.</td>
</tr>
</tbody>
</table>

| Question 5 - How do you like the ProjectXXXXX stand? What would you like to see more of? What made you stop at this stand? |

Table 1 Conversation at the research days and night 2009.

Figure 4 ITovation: a) the developer demonstrates how to connect Arduino to its components through crocodiles; b) zooming on Arduino LilyPad; c) One researcher wears the Lilla Gown. Two visitors, a woman and a young girl talk with the researcher about the Lilla Gown.
1. Are you a student?
2. Do you work?
3. Do you know what instrumentation is?
4. Have you heard about NCEI? (NCEI is the instrumentation cluster in Trøndelag consists of companies that supply advanced management and communications solutions to companies in offshore, maritime, fish farming, energy and medicine.
5. Do you agree with this definition? Instrumentation is: the installing, maintaining and calibrating of devices that are used to automate industrial processes. In automated manufacturing and production, such devices control and measure things like temperature, pressure and flow of process.
6. Do you think people could better understand what instrumentation is if we could have more workshops like this in environments like museums?

| Number of Yes | 12 | 25 | 21 | 11 | 21 | 25 |
| Number of No  | 17 | 4  | 7  | 18 | 6  | 4  |

Table 2: What is Instrumentation?

Table 3: Twenty-nine respondents to the six questions.

3.2.2 Methods of data collection

We designed the questionnaire shown in Table 2 and we took pictures.

3.2.3 Results

The results are:

- **stakeholders:**
  - **developer:** one student assistant.
  - **researcher:** two.
  - **user:** Participants to a conference sponsored by the local IT industry and organized by UniversityXXXXX. 200 participants.
  - **artist:** one (the same as in the case reported in 3.1).
  - **photographer:** one professional.

- **documentation:**
  - **software:** no software developed, we reused the objects developed for Researcher Night (Section 3.1).
  - **pictures:** - 26 of which 3 are about ProjectXXXXX.
  - **text:** - Questionnaire (see Table 2, Table 3, and an analysis report.
  - **installation:** none, we reused the objects developed for Researcher Night (Section 3.1).
3.2.4 Discussion

The goal of ProjectXXXXX’s participation at ITovation was understanding how to bring NCEI instrumentation technology to public spaces, like museums with the aim of empowering citizens (particularly youth) with increased understanding of technology and its creativity opportunity. We reused the installations and the settings developed for the project reported in section 3.1. The duration of the ITovation event was only 30 minutes and the audience was in a different mood than the audience at Researcher Days. The main lessons learnt from this event are:

- **reuse**: it is possible and it is effective to reuse event design and components developed for one event can be reused into another one even if the two events differ in duration and kind of visitors. The novelty of this work is that we have used Arduino Lilypad in an event directed toward adult audience.

- **sponsors**: This event was commissioned and sponsored by the Norwegian Centre of Expertise Instrumentation (NCEI) which saw the potential of our dissemination activities. The questions in Table 2 were developed to test NCEI and our assumptions.

3.3 ProjectXXXXX@XXXXXX Celebration

3.3.1 Context

The ProjectXXXXX@XXXXXX Celebration event was held on the 14th and 15th of September 2010 in the context of the Celebration of the 100 years anniversary of UniversityXXXXX. Two installations were exhibited: ArTime by Artist1 and Object-Project by Artist2. The two artworks both communicate a message about UniversityXXXXX’s women history.

The idea behind Object-Project (Figure 6) is to reflect on the history of women in technical education and research, in the history of UniversityXXXXX. The title refers to Simone de Beauvoirs thoughts on how men traditionally have defined their activities as projects, dynamically directed towards future achievements, while women often are seen as static objects, focused on the present situation, defined in relation to something outside themselves (for instance the needs or desires of men). The artwork presents historical pictures of women at UniversityXXXXX.
Figure 6  ProjectXXXXX@XXXXXX Celebration Object-Project a) Day 2: Two students (two different hands) interact with Object-Project and manipulate the displayed pictures. The girl whose face is visible looks concentrated and happy; b) Day 1: an adult visitor interacts with Object-Project in a contemplative way; c) Day 2: A girl and a boy interact with Object-Project and play with a picture of a young woman and a young man.

Sometimes the woman is active, sometimes passive. Visitors were invited to touch the screen and ‘smudge’ the picture with their fingers. Visitors were able to change history by altering the picture. The installation had been implemented in Max/MSP/Jitter.

ArTime (Figures 5) focuses on the interaction between old and new technology. It explores the physical versus the digital domain and use new media in its sonic and visual expression. For this event, both sonic and visual expressions were customized with content that reflect on the history of women in technical education and research in the history of UniversityXXXXX.

3.3.2 Methods of data collection

The researcher and the artists agreed not to use intrusive data collection mechanisms like interviews and questionnaires during the event, but rather to exploit:

1. Automatic logging of interactions of ArTime;

2. A guest book (see Figure 5 c) in which one girl writes her comments in the guest book.

3. Pictures taken at given intervals of 5 minutes

Concerning the visiting students, we asked each group of students if they would allow us to take, use, and publish pictures of them. All students were positive to this. We did not ask colleagues who visited the exhibition on the first day. The production of meaning in the artwork could be affected when a visitor is aware that s/he is being observed while experiencing the work. When, as in our case, the researchers are part of the settings they observe, they may influence the settings.

3.3.3 Results

- Stakeholders:
**developer:** the two artists were also developers. For the case of ArTime, the piece had been developed by a group of five students, one of which is the artist here.

**researcher:** One (the author).

**user:** One thousand XXXXXXX employees participated in the celebration on the 14th and circa 200 persons visited our exhibition. 400 pupils age 15 visited our exhibition on the 15th.

**artist:** two.

**photographer:** : one

- documentation:
  
  **software:** processing and MAX MSP programs.

  **pictures:** - 147 raw pictures and a set of pictures (tagged).

  **installation:** ArTime and Object-Project.

3.3.4 Discussion

The reason why ProjectXXXXX participates in the XXXXXX 100 years celebration has to be seen in light of the general goal of ProjectXXXXX of disseminating knowledge about digital art and open source software for creativity. To evaluate ProjectXXXXX participation at XXXXXXXX festival, we have to assess how the general ProjectXXXXX dissemination goal is achieved.

The research questions that guided our reflections during this project were:

- Does the relation of the visitor to software change as a result of the visit to our exhibition?

- What feeling does the visitor develop toward the artworks?

- Does the visitor develop any feeling (like curiosity, creativity, irritation, etc.) for the underlying software technology?

Our questions can be easily compared with those of the research work reported in [GFD09], in which the relation between interactivity and user satisfaction and creativity are explored. When reflecting about interactivity in computer based art, one possibility is to ask participants questions. In [Bil07], for example, participants are asked to describe their interactive experience with computer-based installation and to reflect about the associations triggered by the experience.

For the first day, it functioned very well to have a camera on a tripod that took pictures at a regular interval of 5 minutes. This was not possible for the second day, as 8 groups of 50 students visited the exhibition at regular intervals and there were too many persons in the room to be able to take meaningful pictures. So, the photographer had to take pictures manually. Tagged and partly manipulated (to focus on details) pictures are made available. We had made a conscious choice not to ask questions, and we base our reflections on the analysis of these pictures. Comparing the pictures from day 1 (adult audience) and day 2 (young people age 15), we note that young people come closer to the artworks than adult people. On
the other hand, we remember that young students were visiting the exhibitions in groups of 50, and the room was crowded while the students were there. Moreover, the students had a limited time to play with the installations, while the adult visitors could stay in the room as long as they wanted. Another difference between the two visitor categories is that the students were somehow forced by their schools to visit the artworks while adults could choose between several offerings during the night of the 100 year celebration party. All of these issues make it impossible to make a generalization about how our research questions ‘Which feeling does the visitor develop for the artworks?’ and ‘Does the visitor develop any feeling (like curiosity, creativity, irritation, etc.) for the underlying software technology?’ map to the two categories of young students and university employers.

It is interesting to compare Figure 5 b, which shows a playful adult, with figure 6 b, which shows a resting adult who has engaged in a contemplative relation to the Object-Project. Figure 6 c depicts a situation in which a girl and a boy plays with a picture displaying a woman and a man. While we cannot see completely the faces of the girl and the boy, this picture reflects a romantic, almost sensual, feeling. In this way, we go beyond the emotion of playfulness which is often referred to in technology and art works, like for example [LRS+09].

3.4 Computer + Art = Creativity (K+K=K)

3.4.1 Context

The concrete focus of K+K=K is the OSS Scratch and the ReMida education pilasters of reuse and creativity. In the framework of festivalXXXXX, ReMida Center and the UniversityXXXX offered a workshop program for children. The project was partly supported by UniversityXXXX and the XXX Council for Culture. Each workshop lasted two days during October 2010. Participants of the first workshop were 15 pupils from School A. Participants of the second workshop were 14 pupils from school B. All children were 12 years old. ReMida center works according to Reggio Emilia’s educational principles [EGF98]. This means that the initiative for creative actions should spring from the child himself. ReMida centers are ‘magic places’ with a lot of appealing objects where children start to work without needing to be activated by adults. The adults function as assistants.

The plan for each workshop looked like this:

- Short demonstration of a Scratch project;
- Make physical characters (Figure 7 a), take pictures (Figure 8 and edit cutout images;
- Scratch tutorial 1 (Figure 9 a): Sprite Animation: change costume, movement, sound and graphic effects;
- Make a storyboard and start making scenes in Scratch (Figure 7 b and 7 c);
- Scratch tutorial 2 (Figure 9 a): Change Scenes: broadcast block, check the value of a variable, actions from sensors;
- Finish programming (Figure 10 c);
Figure 7 K+K=K - a) Day 1 - 10:07 - One group happily make physical characters; b) Day 3 - 14:28 - At the end of the first day of the second workshop, the group had developed one stage and 6 sprites: Mario, Klementine and 3 daughters of Klementine; c) Day 1 - 13:16 The story board developed by one group.

Figure 8 K+K=K - a) Day 1 - 09:42 - artist programmer takes pictures of a physical object; b) Day 1 - 09:26 - Remida artist takes pictures of a physical object; c) Day 3 - 09:39 - The senior researcher takes pictures of a physical object.

- Decorate a room for exhibition and install artworks (Figure 9 b);
- Presentations (Figure 9 c);
- Closing discussion.

The connections from Scratch to the physical world by means of light, sound, and touch sensors were implemented by home-made sensors connected to the PC’s by Arduino boards.

3.4.2 Methods of data collection

We took 360 pictures, 197 short video clips, and notes. Moreover the produced Scratch projects were saved at the MIT Scratch website under the user ProjectXXXXX. The photographer took 9 pictures.

Participants were two artists, one PhD student, four Master’s students, one senior researcher (the author), and one project manager. One of the artists was responsible for ReMida and the other (hereafter called the programming artist) has a background as a technology artist.

Concerning permission, we asked the school teachers about the possibilities of taking pictures and publishing them. The teachers replied that all students had given permission to the school to allow the usage of pictures.
3.5 Results

- stakeholders:
  - **developer:** two Master’s students.
  - **researcher:** four (one senior researcher, one PhD student, two Master’s students).
  - **user:** 29 pupils, all 12 years old.
  - **artist:** two.
  - **photographer:** one.
  - **project manager:** one.
  - **school teacher:** two.

- documentation:
  - **software** - 6 Scratch projects.
  - **pictures** 190, 10 taken by the photographer
  - **videos** -
  - **text** - handwritten notes.
  - **sound** -
  - **installation** - 6 installations documented by videos and pictures.
The workshops were announced in festival documentation. The local newspaper (with 140,000 readers) devoted an article to the workshops. The university newspaper devoted an article to the workshops. One edited video of 60 seconds is available. A project report was written by two students in 2010 and a master thesis by one student in 2011. One article appeared in a National journal about Drama education in school.

3.6 Discussion

The goals of the project were:

*Long-term perspective: through encouraging creative expressions in the intersection between art and technology: 1. Pupils’ interest in science is strengthened; 2. Pupils’ interest in arts is strengthened; 3. Creative alternatives to digital media use, rather than pure consumption of video games, should be emphasized.*

Goal 1. is the most relevant one for the purpose of this document. How to evaluate one person’s interest in science in general and in computer science in particular is an issue that has been attacked for example in [BECC08] by asking people directly about their interest in programming and art before and after a Science in Society event. In this project, there was an initial agreement between the project manager, the 2 artists, and the senior researchers that this kind of survey-based research should not be carried out during the workshop time in order to avoid stealing time from the creative activities. We agreed that we could take pictures, videos, and notes during the workshops and that interviews with the pupils should be run after workshop completion.

We have worked intensively with the visual documentation to reflect on the roles of the different participants and their relationships to art and technology objects. In the process of selecting pictures, we deleted all the pictures we took of the objects to be animated; all the pictures about not relevant interaction between pupils and master students, all duplicates pictures that were too dark. Pictures have been classified according to tags like ‘Scratch’, ‘Physical’, ‘Artist Programmer’, ‘joy’, ‘boredom’.

Concerning roles, our pictures give evidence to the fact that roles are not stereotyped. Figure Figure 8 depict 3 different persons with different background performing the same task. The three persons are: a) the programming artist, b) the ReMida artist, and c) the senior researcher. The three act as assistants for the children, and are doing the same action. They take pictures of the physical objects to be digitalized into Scratch.

Moreover, pictures 8 a and 9 a show the programming artist in two different roles: tutorial teacher (9 a) and assistant making pictures of physical objects (8 a).

In [RMMH+09] Scratch technology is evaluated as a driver for digital creativity by giving a message about the positive and creative sides of exploiting such technology in settings for children. Our analysis of the pictures show a situation that is more nuanced than the situations described in [RMMH+09]. Our pictures show situations in which the boys and girls are happy or playful (10 a); tired or bored (10 b); concentrated (10 c). It is possible to count the number of pictures that convey a notion of happiness, concentration, or tiredness. However, this information would not be objective as photographers are trained to take pictures
of joyful situations, so there could be an over representation of these positive feelings. A deep observation of a few pictures and subsequent reflection can bring important insight to the relationship that the individual develops to the making and interaction with the objects of art and technology.

All in all, this project looked for for a balance between research, programming, and art. Researchers are trained to have a plan, artists like to have a looser plan. It is difficult to be an observer, helper, and organizer at the same time. We had discussed and assigned roles from the beginning but it was not always possible for everybody to keep her/his own role as assistance to the children had to be prioritized to observation activities.

We can reflect on the digital versus physical dimension by referring to the work in [Ish08] whose goal is to ‘empower collaboration, learning, and design by using digital technology and at the same time taking advantage of human abilities to grasp and manipulate physical objects and materials’.

A new empirical study based on interviews with the pupils to evaluate the long term effects of this project has been completed and it is available.

4 Conclusions

The relationship between computing and art have been explored for a long time by both artists, theoreticians, and computer scientists. In the computing world, the relationship with art is mostly visible in the subfield of Human Computer Interaction. In section 2.3 we reported about a set of works at the intersection between computing and performativity. Yet again the intersection is not new, as it takes us back to at least 1994 [BDVL94].

The novelty of our work is that we look at the intersection of software engineering and art. While HCI research focuses on the use of computer systems, software engineering is concerned by the development and evolution of software. In the practical work we report in this paper, we have designed and implemented events in which the users have been empowered to be the producers of fragments of OSS code. In this way, we have exploited performance techniques to let users become producers while developers, artists, and researchers act as enablers and observers during the events. Developers and artists are themselves actors of the creative process that has the purpose of designing the events and producing the artefact that serve as components to the event. The prototypes developed for the four events can be divided into two categories: those developed by users and those developed by artists and developers. Most of the Scratch projects have been developed by users at our events. On the other hand, the gown developed at Researcher Night (section 3.1) and used for ITovation (section 3.2), ArTime and Object-Project (section 3.3) were developed by a cooperation between artists and developers.

Our work was based on the assumption that SiS events which gather artists, developers, researchers, and citizens around an OSS project, are effective for both communicating open source software issues to a broad audience and for collecting open documentation that has both research and artistic value. We have used several data collection methods. Both questionnaires and pictures were used for the cases reported in sections 3.1 and 3.2. For the fours cases, we aimed at a
balance between art and technology. However, the first two cases were designed by researchers and run in research contexts. The last two cases (reported in sections 3.3 and 3.4) were designed by teams composed by artists and researchers and it was decided not to use data collection methods that could shift the attention of the users from creativity activities to answering to questions. The role of pictures as both artistic and research documentation became more important in the last two cases. Our results suggest:

1. a stakeholder model for SiS OSS events where stakeholders are artists, developers, researchers, and citizens. The work reported in this paper identifies the importance of a stakeholder model to reflect on the intersection of software and art and gives concrete examples of art and software projects and the involvement of the different stakeholders. In this work we discussed how the roles of artist, researcher, developer, and audience are important to be able to plan and reflect about art and software projects. At the same time, these roles are not fixed, and each person can play different projects different roles.

Evaluation methods of user experience require a search for a balance between the research goal and the artistic goal. The criteria for successful art events can be different from the criteria for successful research. While artists may see evaluation activities as disturbing, evaluation activities have to be integrated in a way that they become acceptable from an esthetics point of view.

An important question that arises when reflecting about our stakeholder model and the different goals is: ‘is art instrumental to technology dissemination or is art for art?’ Another important dimension is the role of creativity in the intersection of software and art. A superficial view of the intersection may lead to a model that categories artists as creative and engineers and researchers as analytical. ‘Creativity is often thought of as a trait exclusive to artists and primarily an individual activity’ [APMHA09]. However our projects show situations in which is it difficult to distinguish between the social creativity of researchers, developers, and artists. Moreover, we point to situations in which the role of the user is crucial to define the level of creativity.

2. an OD model for OSS events where documentation consists of a patchwork of words, still and moving images, music and sound, and digital code. Central to our work is the ProjectXXXX blog [Pt11] with its 84 blogposts from 4th February 2009 to 2nd March 2011 and its 31 pages organized into two main pages (Research and Dissemination). The ArTē blog links to a web of resources, among which we mention two flickr spaces; a picasaweb space; a repository of Scratch programs; and a space for raw data [Pt11]. The ProjectXXXX blog has been visited more than 23,220 times (June 2011).

The resources offered by the ProjectXXXX blog are released under a Creative Common Attribution 3.0 licence and can be reused and adapted for the design of OSS events which aim at communicating issues to a wide spectrum of users. These can include as decision makers in the public sectors,
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children, and people in society in general with special focus on actors who traditionally are not connected to the open source world, such as women.

Knowledge about tools for creative productions, like Scratch and Arduino and models of how to exploit these is one of the important issues at the intersection between art and software that is brought to light by our work.

Acknowledgements

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References


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