

# Toward playful and creative experience with Open Source Software Tools

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**Abstract**—The ArTe contest encourages students of age 13 to 15 to work in meaningful cooperative projects with the goal of producing novel forms of new media art. The ArTe project is focused on the relationships between new media art and openness, organized around three topics: the relation between the author and the audience, the media of the artwork, and the tools used to realize the artwork. This paper presents eight open source tools evaluated according to the ArTe goals.

*new media art, open source software (key words)*

## I. INTRODUCTION

Software plays an important role in new media art as artists use software based tools, like picture and video manipulation programs, in their artistic processes ([1][2]). For some artworks, like for example software intensive interactive installations, software is not only part of the development tools but a central part of the artwork itself [2]. Computer based art has existed since the 60's with artists like Michael Noll and Frieder Nake. With the advent and the evolution of the personal computer, the web, software tools like Adobe Photoshop, and electronics tools as cameras and mobile telephones, there has been an explosion of both production and sharing of digital content. This creativity explosion involves not only artists but also common people including children and teenagers.

In the last five years, we have been studying the relationships between contemporary art and software with focus on open source software (OSS) ([4][5][6][7][8][9][10]). ArTe [20] is a newly started project that has the goal of disseminating Information Technology (IT) issues to teenagers (13-15) with focus on creativity, cooperation, and openness of processes and content. The ArTe contest encourages students of age 13 to 15 to work in meaningful cooperative projects with the goal of producing novel forms of new media art. Artworks must address openness issues. The ArTe project wants to convey a story about new media art and openness, organized around three topics: 1) The relation between the author and the audience. 2) The media of the artwork. 3) The technology used to realize the artwork.

The long term goal of the ArTe project is to disseminate IT issues to teenagers with the purpose of recruiting them to IT studies. Moreover, the project aims at making IT visible in the society. IT people will reflect on software and be aware of its creativity and aesthetics issues. IT people will be aware of other aspects of software, like music, video, story telling that have a big economic impact as they are driving the game industry, one of the most growing industry in the world. Artists will benefit from an explanation of software terms and tools in a language that has technical foundations and is used to conversations with artists as well. Audience, including young people, will read a new story about software. Software has now entered each house and each mobile telephone but most of the people remain unaware of software issues. The provided tools are all available for downloading and use for each one who wants to enrich his creativity possibilities by learning how to experiment with pictures, sound, video, story telling, and even simple programming. Normal audience will be empowered by an increased knowledge about tools and new media art possibilities that will transform them from users to producers of meaningful content.

The stakeholders of project ArTe are a) people in the society, including teenagers; b) IT people; c) artists.

The rest of the paper is structured as follows. Section II gives the theoretical context by summarizing the concepts in both new media art and openness that are important for this specific work. Section III describes tools and their evaluation. Preliminary conclusions and plans for further work are given in section IV.

TABLE 1: THE COMPETITION ANNOUNCEMENT.

The ArTe contest encourages students of age 13 to 15 to work in meaningful cooperative projects with the goal of producing novel forms of new media art. Artworks must address openness issues. The competition is open at International level but we focus our recruiting toward Norwegian schools. The competition will be open from 1st of May 2009 and will close the 30th October 2009. By new media art, we intend all forms of art that exploit information technology (IT). Examples of new media art are, but are not limited to, digital images, videos, music, games, digital stories and poems, interactive installations. The projects can address openness in different ways. This means either exploitation of one or more OSS tools, or re-use of artworks with open licenses such as creative commons when developing own artwork. By OSS tools we mean tools that are available for everybody and that can be not only downloaded and used but also inspected and modified. Central to the competition is the ArTe website ArTeNTNU.com which provides examples of both new media artworks and open source tools. Through the web site the participants can reach ArTe experts who will provide assistance during the process. The jury will evaluate the submissions according to three main parameters: the artistic message of the artwork, the technical quality and innovativeness, the cooperation level. All prizes will be given to humanitarian purposes suggested by the winning groups. In addition, the winning groups will receive attention in the local media and will be acknowledged for both their humanitarian contribution and their artistic and technical work. The jury consists of researchers, industry professionals and artists. Contributions should be submitted under a Creative Commons Attribution 3.0 license. Participants are encouraged to use open source software tools and free data formats, but this is not a mandatory requirement.

## II. BACKGROUND

The text of the competition is available in both English and Norwegian at the ArTe web site. Table 1 displays the most important part of the competition call. The text fragment “Participants are encouraged to use open source software tools and free data formats, but this is not a mandatory requirement” reflects the discussions we have in the project. On the one hand, we aim at encouraging students and schools to use both open source tools and open formats. On the other hand, we do not want to exclude from our competition students that are already proficient in other tools and other formats.

In this section, we give a brief historical reconstruction of technology and art from photography, to film, computer, Internet and web. Then, we introduce openness issues, with focus on licenses and formats.

### A. New media art

Art and technology have been in contact since ancient times. Here we briefly look at the following periods:

**1800 - 1900** In years 1826-1827, French Joseph Nicéphore Niepce manages to develop the first photographic picture.

Later on, in 1888 Kodak produces the first portable camera and it becomes possible for normal people to take their pictures outside the photograph studio. During 1800, romanticism art conveys strong feelings and targets middle-class audiences rather than courtly patrons. Authors are the big classical ones like Goethe, and Beethoven. Film Technology sees birth in 1895 when Lumieres brothers produce the first film camera.

**1900 - 1940** In 1907 Lumieres brothers produce their first color video. The Italian writer Filippo Tommaso Marinetti launches the Futurist movement, an art movement inspired by technological inventions such as film, air planes, and fast trains. Futurism embraces many forms of art: painting, sculpture, design, film, fashion, textiles, literature, music, and architecture. Breton publishes first Manifeste du Surrealisme. The work of artists such as Marcel Duchamps (b. 1887 - d. 1968) shifts the focus of art from absolute objectivity to the personal. Artists become free to express them self with any medium about whichever subject. Moreover Duchamp explores the role of audience interactivity.

**1940 - 1970** ENIAC (Electronic Numerical Integrator and Computer) is introduced at the University of Pennsylvania in 1946. In 1951 the first UNIVAC is commercially available. Andy Warhol produces Marilyn Monroe Diptych in 1962 (Pop art). Artists are no longer afraid to mix different media and to copy what other have done. American A. Michael Noll and German Frieder Nake experiment with computer produced art. In 1965 the first computer art exhibition is held in New York.

**1970 - 1980** Political oriented artists as Les Levine and Frank Gillette experiment with video art. Other forms of art and culture than books, painting, and sculptures become more and more accepted by a larger audience. Participation of spectators becomes important. The first ars electronica festival is held in Linz in 1979.

**1980 -1990** The Free Software Foundation publishes a single license usable for all software, the GNU General Public License (GPL) in 1989. This formalizes the concept of copy left as opposite to copy right. In 1989 Jean-Pierre Yvaral produces Mona Lisa (Digital art)

**1990 - 2000** Photoshop 1.0 is released in 1990 (Digital photography). In the next years digital cameras appear on the market. Pictures can be uploaded to the computers and manipulated. The first multimedia PC is released in 1991. Important components are the CD-ROM drive and the sound card. The performance of microprocessor-based computers has reached the point that real-time generation of computer music using more general programs and algorithms become possible. In 1991, the first Web server is installed at the Stanford Linear Accelerator Center in California. In 1992, the portable browser is released by CERN as freeware and the world has 50 Web servers. The Linux operating system (developed by Linus Thorvald, 1991) gets an art prize at Ars Electronica in 1994. The company Google is established in 1998.

**2000 - 2009** In the second generation web, Web 2.0, users become the producers. At the time of writing (2009), there are 150 millions users on Facebook sharing pictures and videos, 100 millions pictures on Flickr, 130 million Creative Commons Licensed licensed works. 1.574 billion people are using the

Internet. Skype has, at the time of writing, more than 450 Millions of user accounts. Around year 2009 there are more than 3 billion mobile phones while the world populations is 6 billions. Even cheap mobile phones come with picture and video camera giving the possibility to each user to take and share pictures and videos at each time. The number of people that access the web through a mobile is greater than the number of people who access the web with the computer. The new Ars Electronica Center opens in Linz. The core of the center is a 1,000-m<sup>2</sup> space in which artists and scientists, school kids and college students, parents and children can experiment, work and play. The question artists and spectators are invited to work together to address is: “What is the impact of the technological development on me and my life?”

### B. Openness

Computers were originally invented as machines to make calculations. This is why they are called computers, from the Latin word “computare” that means “to calculate”. Some pioneers soon recognized that computers can be exploited as machine to produce and to share culture. Cultural objects can be books, music, video, games, and software itself. In ArTe, we look at cultural objects from three perspectives: author-audience; media format; and tools. Openness and freedom are similar terms in this context. In ArTe we use both the term free and open.

Here we will focus on two important openness issues that are licenses and formats.

#### 1) Licenses

A license poses constraints about who can use and make copies of a cultural objects. An important license is the GPL (Gnu Public License). GPL introduces an important cultural change as the the term copyright is replaced with the idea of copyleft. Copyleft licensing gives all recipients of a file the right to use, copy, modify, and distribute it, while forbidding them from imposing further restrictions on any copies they distribute. While GPL was conceived for software, Creative commons provides a family of licenses that enables an author to specify the constraint he wants on the cultural objects he produces. The license that governs the content of the site Artentnu.com and its submissions is one of the creative commons family. Organizations that want to build business models around OSS have developed licenses, like for example the Apache licenses that are less restrictive than GPL with respect to commercialization.

#### 2) Formats

Open formats are standardized by International standardization bodies such as ISO. Proprietary formats are developed and owned by single organizations or groups of organizations. Common file formats are summarized in Table 2.

<b>Sound</b> <b>open</b> ogg FLAC, ogg Vorbis, ogg Speex <b>proprietary</b> mp3, mp4, m4a, wav (Microsoft), aiff (Mac)	<b>Pictures</b> <b>open</b> : xcf, png, svg, tiff <b>proprietary</b> : jpeg, gif
<b>Video</b> <b>open</b> : ogg Theora <b>proprietary</b> : mov, wmv, avi, mpg	<b>Document</b> <b>open</b> : odf, pdf, html, xhtml, xml, css z <b>proprietary</b> : doc, ppt

### III. OSS TOOLS

OSS denotes those computer programs that are available for free use, inspection, and modification of source code. It is software that can be downloaded and used for free and whose code can be seen and changed. We have chosen eight contemporary tools which are open source and which make possible to produce pictures, animations, sound files, digital stories, and interactive installations.

Each tool is linked to its web site from which is can be downloaded and installed. For each tool we give a short description. For those tools which have a clear commercial alternative, we list this alternative and its price. Each tool is available for Linux, Mac OS and Windows when not differently specified. Some tools, like Scratch are not a free version of an existing commercial tool but new unique tools developed with the goal of enhancing learning and creativity of young adults.

Other lists of OSS tools for students and school are available and they partly overlap with ours. There are lists are for example at schoolforge [21].

We have chosen the tools by having in mind the ArTe goals.

**Openness:** For each tool we look at the degree of openness of its source code and format of the developed files.

**Support for teenagers:** For each tool we look at the degree of support for teenagers. We have discarded those tools that require knowledge of mathematical or programming concepts that goes beyond the knowledge required to a teen ager.

**New media art:** We have tried to select a set of tools that enables production and manipulation of audio, pictures, physical installations, software programs, and digital stories.

**Cooperation and sharing:** We look at the degree of support for cooperation and sharing.

**Information Technology:** One of the goal of the ArTe project is attracting students to IT. While evaluating tools we ask ourself the question: “does this tool make its users aware of IT issues, such as programming?”.

#### A. Arduino

Arduino [11] introduces the concept of open source hardware. It is intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino boards can be build by hand by following the instructions that are available for free. Boards can be purchased. A kit to participate to an Arduino workshop costs

TABLE 2: FILE FORMATS.

50 Euro. Arduino is not designed especially for teen-agers and specific Arduino workshops with skilled teachers should be organized to facilitate the creative use of this tool. It is however not impossible for motivated teen agers to be creative with Arduino. The Arduino web site provides a gallery of example projects.

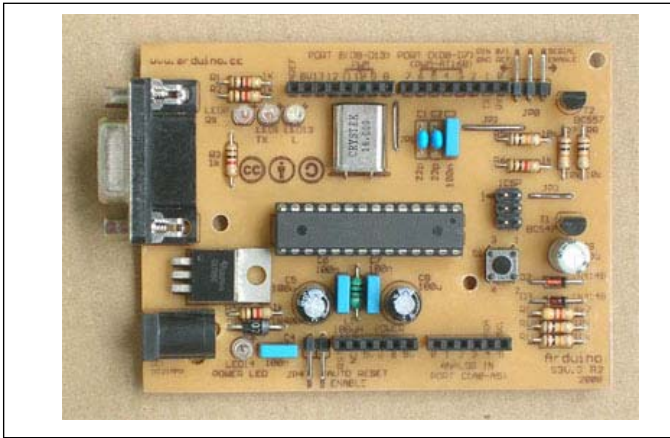


Figure 1: Arduino Board

#### B. Audacity

Audacity [12] supports sound recording, editing, and saving in different formats. It is simple to use. Tape style, rewind, fast forward, play, and record functionalities are offered. To cooperate in Audacity with all tracks and edits, one should save an Audacity project. To play the current work in other media programs or send it to others, one can export audio files such as ogg, wav, and mp3. Commercial alternatives are Apple Logic Studio (USD 499), Cubase (\$599), and Garageband (free with Mac OS X).

#### C. GIMP

GIMP [13] supports picture manipulation and retouching. It comes with several languages in addition to English. It supports the majority of picture file formats, such as jpeg, png, gif, xcf (that is the native format of GIMP) and the native format of photoshop. If several persons want to cooperate by using GIMP, they should always exchange xcf files as they provide a richer representation. To full benefit of GIMP, one should understand the concept of layers. Adobe photoshop (price USD 1000) is its commercial alternative. GIMP offers both basic and advanced features. GIMP offers tutorials for beginners and advanced users. One can create animated GIF.

#### D. Inkscape

Inkscape [14] is a vector graphics editor. The main difference between a product created with this family of tool, compared with the products created with pixel based tools (like GIMP), is that images can be scaled up more easily. It uses the W3C standard Scalable Vector Graphics (svg) file format and other formats can be saved. The alternatives are Sodipodi (OSS), Illustrator, CorelDraw, or Xara X. Extensive documentation is available. As far as we know there are no

specific adaptations of Inkspace for children or teen agers. In the same way as GIMP, an advanced use of Inkspace may require hours of study and experimentation that are beyond the spirit of the project ArTe. However we choose to provide Inkspace for its suitability to develop scalable images for devices such as mobile telephones and other hand held devices. Galleries with Inkspace developed art are available.

#### E. OpenOffice.org

OpenOffice.org [15] offers word processing, spreadsheets, presentations, graphics, and databases. It supports both odf (Open Document Format) and Windows formats such as doc and ppt. Microsoft Office 2007 is the most important commercial alternative (Home and student license costs USD 149). OpenOffice.org is developed according to an open process.

#### F. Processing

Processing [16] is a text programming language designed to generate and modify images, animation, and interaction. Beginners can write their own programs after only a few minutes of instruction, but more advanced users can employ and write libraries with additional functions. The system facilitates teaching many computer graphics and interaction techniques including vector/raster drawing, image processing, color models, mouse and keyboard events, network communication, and object-oriented programming. Libraries extend Processing with sound management, send/receive data in diverse formats, and import/export to 2D and 3D file formats. Originally, processing was built as a domain-specific extension to Java targeted towards artists and designers. Processing can be downloaded and installed on your machine. Before installing processing, one can experience its powerful graphics and artistic possibilities by accessing the examples. Processing operates on text files with extension pde.

#### G. Scratch

Scratch [17] is a programming language that makes it easy for pupils from the age of 8 to create own interactive stories, animations, games, music, and art — and share creations on the web. Scratch is developed by the Lifelong Kindergarten Group, at MIT Media Lab. The group wants to share both the software and documentation of the scratch tool. But the development process is not open. In other words, persons external to the group cannot participate to the development of the tool. “With Scratch, you can create characters that dance, sing, and interact with one another. Or create images that whirl, spin, and animate in response to movements of the mouse. Or integrate images with sound effects and music clips to create an interactive birthday card for a friend, or an interactive report for school.” A project declares sprites and each sprite is associated with scripts, costumes, and sound. The scratch file have extension .sb Scratch takes as input pictures (format png), sound files (Windows wav files) and enables to record sound files. “Once you’ve created a Scratch project, you can share it on the Scratch website, the same way you might share videos on YouTube or photos on Flickr.” There are 361.483 projects available with a total of more than 9 millions scripts and more

than 2 millions sprites created by more than 50.000 contributors of the more than 200.000 registered members.

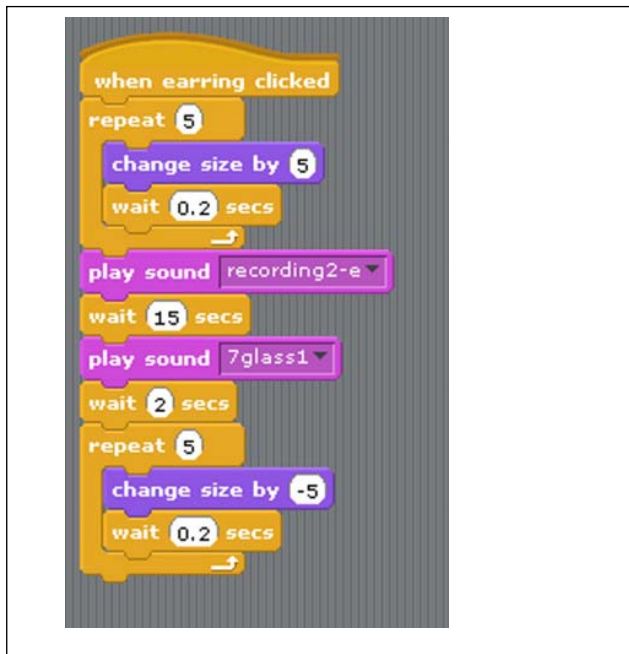


Figure 2: A Simple Scratch Program.

#### H. Tux Paint

Tux Paint [18] is a free drawing program for children ages 3 to 12. It combines an easy-to-use interface, and fun sound effects. It is ideal for those who want to make a basic use of drawing tools and be creative from the first minute. Tux paint can be used by small children but it can also be used by more advanced users who want to extend it by creating their own brushes and stamps (both images and sound). A stamp is a picture (png), with a sound (ogg and .wav), and an explanation text. Tux Paint allows to save files and open them again. It does not offer layers (Like GIMP) nor advanced color or filter management.

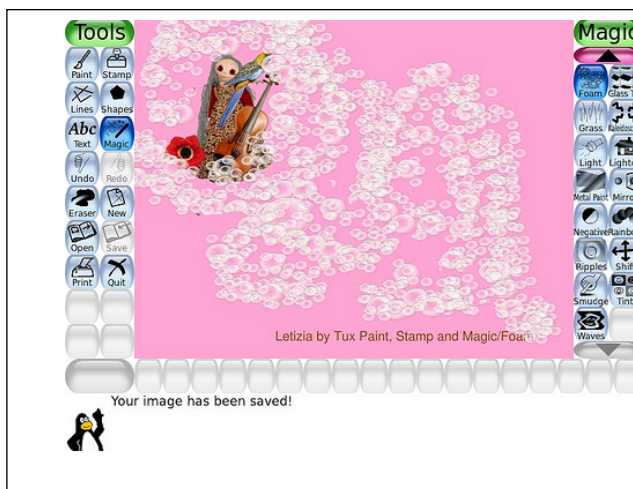


Figure 3: Tux Paint interface.

However, it is not intuitive, without reading the instructions, where the files are stored nor in which format. Depending on the operating system, Tux Paint will save files in different places. Scalable stamps in svg format can be created by using Inkscape. There are more than 100 stamps available. There is a gallery with hundreds of projects where children can submit and share their own projects. An alternative to Tux Paint is Microsoft Paint.

#### I. Summary and discussion

We have presented eight tools that we have chosen with the ArTe goals in mind. We have looked at other tools. Here we mention Alice [32], which we have discarded from the list as it offers facilities that are similar to those offered by Scratch but it is more difficult to comprehend and use.

Here we summarize how the different tools relate to the ArTe goals.

##### 1) Openness

The source code of all eight tools is open and available for inspection. All the tools but Scratch are developed according to a process that is open to newcomers. GIMP, Audacity, Inkspace, OpenOffice.org, and Tux Paint support open formats. Arduino and Processing are programming languages which operate on text files. Scratch saves files in its own proprietary format sb.

##### 2) Support for teenagers

Scratch is specifically designed for children from age 8 and teen agers. Tux Paint is for children 3 to 12. All the other tools are not specifically designed for teenagers.

##### 3) New media art

Arduino can be used to develop and program *installations*. Processing has been developed by artists to be used by artists to program artistic *pictures* and *animations*. Audacity enables to manage *music* files. GIMP, Inkspace, and Tux Paint are *picture* manipulation programs. Scratch is for *digital story telling*. OpenOffice.org enables to develop powerpoint style *animations* and *text* files.

##### 4) Cooperation and sharing

The eight tools come with a web sites that provides manuals, examples, and forum. Scratch and Tuxpaint provides mechanisms for sharing and remix of media. Scratch has more than 300000 projects available created by 50.000 contributors.

##### 5) Information Technology

Arduino and Processing are programming languages in the traditional sense. Scratch has been designed with the specific goal of making programming attractive to teenagers and children. The other tools do not require programming.

#### 4 PRELIMINARY CONCLUSIONS AND FURTHER WORK

ArTe is a competition for teenagers who want to engage in playful creation of open multimedia content by exploring the possibilities of OSS tools. ArTe offers a web site that describes the OSS tools in a new media art contest.

Our hypothesis is that the stakeholders of project ArTe will benefit of the project as follows:

*People in the society*, including teenagers, will read a different story about software. Software has now entered each house and each mobile telephone but most of the people remain unaware of what software is. The provided tools are all available for downloading and use for each one who wants to experiment with pictures, sound, video, story telling, and programming. People will be empowered by an increased knowledge about tools and new media art possibilities that will transform them from users to producers of meaningful content. This goal can be evaluated by looking at the statistics of the ArTe website and by engaging in dialogues with audience when ArTe is presented at dissemination events, like the Research Days in Trondheim. The effects of ArTe on teen agers participating to the contest, can be evaluated, in the short term, by analyzing submissions both quantitatively and qualitatively. Moreover, interviews with participants have to be planned and organized. The research questions that we have in mind are about tools, formats, and cooperation and creativity process.

- RQ1 Which tools and which media formats will students prefer and why
- How will students in a group cooperate?
- Which will be the themes of the artistic contributions?
- Will students establish a connection between the humanitarian purpose of ArTe and the artistic message of their contribution?
- Will students reuse and remix existing media?

*IT people* will reflect on software and be aware of its creativity and aesthetics issues. IT people will be aware of other aspects of software, like music, video, story telling that have a big economic impact as they are driving the game industry, on of the most growing industry in the world. This hypothesis is confirmed by the participations of IT industry both as jury experts in the ArTe competition and as sponsors. This goal can be evaluated by presenting ArTe in National and International IT contexts and engaging in dialogues with experts.

*Artists* will benefit from an explanation of software terms and tools in a language that has technical foundations, but it used and trained to conversations and cooperation with artists as well. This hypothesis is confirmed by artists participation in the jury and conversation with them. This goal can be evaluated by presenting ArTe in National and International art and technology contexts and engaging in dialogues with artists.

Our list of OSS tools is not intended to be static but we aim at improving it by analyzing the feedback's we receive from students and other stakeholders.

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