

Scientific Report: ERCIM Fellowship

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Overview of the research

This post-doctoral research has been conducted at the Norwegian University of Science and Technology (NTNU¹) within the SArt² project of Software Engineering group³. The work has been under the supervision of Prof. Letizia Jaccheri and in close collaboration with the PhD student Salah Uddin Ahmed. The goal of the project is to explore the intersection between software engineering and art.

SArt project is relatively young (i.e. initiated in 2006), although the project leader Prof. Jaccheri has been interested in this domain and involved in numerous related activities for several years now. Our first task has been to research on the following questions: How do software engineering and art intersect? How do software engineering and art influence and can involve each other? What has been done until now in this area by other researchers in computer science? For answering these questions we have initiated a systematic literature review. Based on the work on the literature review we have published a paper at the ISD 2007 conference. The paper has three main goals. Firstly, we aimed at promoting interest and discussion in the interdisciplinary field between art and software engineering. Secondly, we have presented our understanding of how the two areas influence on each other and stress on the potential benefits for software engineering - innovation and creativity. Last but not least, we have discussed the process of making a survey of the state-of-the-art, aiming at completeness of the literature review. We have shown the preliminary outcomes of it which might be used as a starting point by other researchers and practitioners in the area. The outcomes of the work had confirmed that both software engineers and artists might profit by further research in this interdisciplinary field.

In parallel with the literature review we (i.e. the members of SArt project) had been taking part in three artistic projects – Sonic Onyx⁴, Open Digital Canvas⁵ and Flyndre⁶. All three projects include artists and software developers working in close collaboration. Each project final outcome is an interactive art installation with a physical construction and is heavily software-dependent for the control of the hardware, the interaction with the users and the artistic expression. In each of the projects our involvement was different. In Sonic Onyx we were acting mainly as observers of the whole project, participating at many of the meetings, closely observing the produced documentation, making informal interviews and questionnaires with the artist, etc. In Flyndre our role might be viewed as both observers and consultants. The observations were mainly historical, as the main project for the production of the interactive installation has been finished at the time the SArt project started. The main project, however, has been under close observation of Prof. Jaccheri and with the participation of students from NTNU under her supervision. We have studied the available documentation on the project, including students' reports and master theses, user guides and application api. Suggestions had been made to the artist-programmer on how to keep the good software engineering practices in the ongoing work around the project. In Open Digital Canvas, on the other hand, SArt has been actively involved in the multidisciplinary group, taking part in the meetings, brainstorming sessions, decision-

¹ <http://www.ntnu.no/>

² <http://prosjekt.idi.ntnu.no/sart/>

³ <http://www.idi.ntnu.no/grupper/SU-grp/>

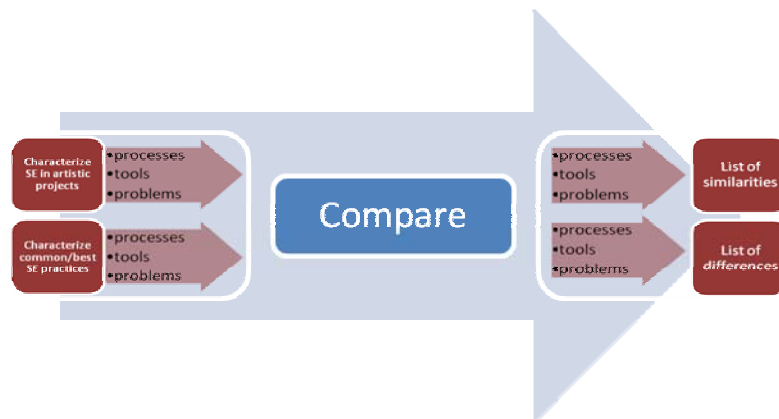
⁴ <http://www.soniconyx.org/>

⁵ <http://veggidi.opentheweb.org/>

⁶ <http://www.flyndresang.no/>

making, etc. The participation in these projects increased our overall understanding of the important issues and problems in artistic projects where software engineers are an integral part of the artwork creation.

Throughout the projects in which we had participated several questions were popping out regularly: How can software engineers help in heavily software-dependant artistic projects? What SE knowledge/theories/tools are necessary in such projects? Does the process and tools for creating software in artistic projects differ from the common/best software development practices? We have utilized the knowledge we gathered within the projects and part of the findings from our literature review (i.e. the articles related to interactive installation art) to characterize the software engineering issues in artistic projects. Further, we have compared these findings with the reported in the literature common practices in information systems development and have analyzed the similarities and differences, as depicted on the figure below.



This last work has evolved into two articles, submitted to the International Conference on Designing Interactive Systems (DIS 2008) and to the International Conference on Software Engineering (ICSE) 2008. We have outlined the key software engineering concepts in relation to the development of interactive installation art. This will give an easy start for artists and will facilitate the creation of common language and understanding within the team. We have also summarized the software engineering issues and solutions reported in published articles describing interactive installations. This collection of experiences from interactive installation art projects might guide the software engineers and programmers in their future practices and direct their attention to difficult issues in this specific domain. We also provide a list of utilized tools. In principle, this work should be relevant to artists who want to communicate with software engineers and to software engineers who want to work with artists. This work will give a roadmap to researchers and practitioners interested in the multidisciplinary domain where software intensive art is developed.

Research contributions

1. Trifonova, A., Ahmed, S. U. & Jaccheri, L. (2007) SArt: Towards Innovation at the intersection of Software engineering and art. *Proceedings of The 16th International Conference on Information Systems Development*. Galway, Ireland, August 29-31, 2007, Springer.

Abstract: Computer science and art have been in contact since the 70's. Our hypothesis is that software engineering can benefit from multidisciplinary research at the intersection with art for the purpose of increasing innovation and creativity. To do so, we have designed and planned a literature review in order to identify the existing knowledge base in this interdisciplinary field. A preliminary analysis of both results of our review and observations of software development projects with artist participation, reveals four main issues. These are software development issues, which include requirement management, tools, development and business models; educational issues, with focus on multidisciplinary education; aesthetics of both code and user interface, and social and cultural implications of software and art. The identified issues and associated literature should help researchers design research projects at the intersection of software engineering and art. Moreover, they should help artists to increase awareness about software engineering methods and tools when conceiving and implementing their software based art-works.: Computer science and art have been in contact since the 70's. Our hypothesis is that software engineering can benefit from multidisciplinary research at the intersection with art for the purpose of increasing innovation and creativity. To do so, we have designed and planned a literature review in order to identify the existing knowledge base in this interdisciplinary field. A preliminary analysis of both results of our review and observations of software development projects with artist participation, reveals four main

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Note: The paper, together with five other articles, was nominated for the best paper award. In ISD 2007 the number of accepted papers was about 90.

- Ahmed, S. U. & Trifonova, A. (2007) Software Engineering Processes Under the Influence of Aesthetics and Art Projects: PhD Study Plan. The 2nd International Doctoral Symposium on Empirical Software Engineering, Madrid, Spain, September 19, 2007.

Abstract: The main focus of the study is to investigate the interdisciplinary domain of art and software engineering for the purpose of understanding the different issues, ideas, and concepts that are worth investigating for software engineering discipline in order to leverage technology to the artists as well as enriching the discipline with the experience gathered from art discipline. The research that this study will focus on can be split into: RQ1) How do software engineering and art intersect, i.e., how do software engineering and art can influence and involve each other? RQ2).How we can characterize the development process for software supported artworks and projects? RQ3) How can we benefit our discipline by incorporating the concepts, the knowledge and the experiences that we gain from the art world? RQ4) How can we leverage technology to artists through Software Engineering i.e., providing better tools, processes and roles? To investigate these, we have elaborated the research questions with sub-questions.: The main focus of the study is to investigate the interdisciplinary domain of art and software engineering for the purpose of understanding the different issues, ideas, and concepts that are worth investigating for software engineering discipline in order to leverage technology to the artists as well as enriching the discipline with the experience gathered from art discipline. The research that this study will focus on can be split into: RQ1) How do software engineering and art intersect, i.e., how do software engineering and art can influence and involve each other? RQ2).How we can characterize the development process for software supported artworks and projects? RQ3) How can we benefit our discipline by incorporating the concepts, the knowledge and the experiences that we gain from the art world? RQ4) How can we leverage technology to artists through Software Engineering i.e., providing better tools, processes and roles? To investigate these, we have elaborated the research questions with sub-questions.

- Trifonova, A. & Jaccheri, L. (2007) Software Engineering Issues in Interactive Installation Art. *Submitted to Designing Interactive Systems Conference (DIS 2008)*. Cape Town, South Africa, February 25-27, 2008.

Abstract: Software engineering has been in contact with new media art for years, although the connections between the two fields have rarely been explicit. In this article we discuss the important software engineering issues that appear in one of the new media art subfields, namely interactive installation art. Our deductions and suggestions are based mainly on reports available in the literature (i.e. published papers). Interactive installation art is often heavily dependent on software and thus software engineering issues are important to consider. Software requirements, which are vague and frequently changeable, appear to be one of the major and most difficult issues to be considered in the development of interactive installation. Timely evaluation, validation and testing with potential users are helpful for successful completion of the artwork Special attention should be paid to the choice of process model and software architecture to allow flexibility. The final goal is to provide a road map for artists who need software engineering skills to communicate with software engineers and/or to act themselves as programmers or software engineers of their artworks. Additionally, software engineers who start working with interactive installation art will profit from this summary of relevant reports.

- Trifonova, A. & Jaccheri, L. (2007) Towards Good Software Engineering Practices in Interactive Installation Art. *Submitted to the International Conference on Software Engineering (ICSE) 2008*. Leipzig, Germany, 10 - 18 May 2008.

Abstract: Software engineering products and processes are important in the production of new media art as new media artworks heavily depends on software. We have run a literature review and analyzed papers published in computer science journals and conferences to establish a knowledge base of the multidisciplinary field of software engineering and art with focus on interactive installation art. In addition we have observed several projects of new media art production.

This paper presents the findings of our review of interactive art installation. It organizes the theme according to five concepts which are: requirements, architecture, validation, process, and tools. Furthermore, we compare our findings with the general practices in contemporary software development. We discuss which issues are peculiar for software intensive art projects and need further software engineering research: 1) Experimentation as a working style of artists; 2) Entertainment or reflection as a final goal; 3) Ideological influence on the choice of technology.

This information should help researchers who work at the intersection between software engineering and the new media art as it provides a map of the published literature and outlines which research issues are peculiar of this multidisciplinary field.

Other contributions to the scientific community

During the post-doc I have participated in several software engineering related conferences (e.g. ISD 2007⁷, IDoESE 2007⁸, ESEM 2007⁹, DT8108¹⁰) and in the Transmediale 2007 international art festival¹¹. These participations contributed to the enhancement of the group's understanding of the studied field and extension of the SArt collaboration network.

I have been a scientific reviewer for the following conferences:

- The Second International Conference on Software Engineering Advances (ICSEA'07), Cap Esterel, French Riviera, France. www.iaria.org/conferences2007/ICSEA07.html
- The 16th International Conference on Information Systems Development (ISD). Galway, Ireland, August 29-31, 2007. <http://isd2007.nuigalway.ie/>
- 2nd International Doctoral Symposium on Empirical Software Engineering. Madrid, Spain, September 19, 2007. <http://www.esem-conferences.org/idoese2007.php>
- The IFIP International Conference on Research and Practical Issues of Enterprise Information Systems (CONFENIS 2007), October 14-16, 2007 - Beijing, China. <http://www.confenis.org/>

Further activities during the post-doc

Between January 15, 2007 and October 15, 2007 I have participated in many of the activities organized by the host institution (NTNU), namely the regular meetings of the software engineering group, seminars and thesis discussions.

SArt group web site was create (i.e. designed and implemented) with my active participation. I was also responsible for the regular updates of its content.

During my stay and with my help, we have enriched the SArt group library (i.e. found and bought relevant books).

⁷ The 16th International Conference on Information Systems Development (ISD). Galway, Ireland, August 29-31, 2007. <http://isd2007.nuigalway.ie/>

⁸ The 2nd International Doctoral Symposium on Empirical Software Engineering. Madrid, Spain, September 19, 2007. <http://www.esem-conferences.org/idoese2007.php>

⁹ International Symposium on Empirical Software Engineering and Measurement (ESEM) 2007. Madrid, Spain, September 20-21, 2007. <http://www.esem-conferences.org/>

¹⁰ NTNU Computer Science Graduate Student Conference 2007. Trondheim, Norway, June 19, 2007. <http://csgsc.idi.ntnu.no/2007/>

¹¹ Transmediale Festival for Art and Digital Culture 2007. Berlin, Germany, January 31-February 4, 2007. <http://www.transmediale.de/>