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ICT ART CONNECT  
ACTIVITIES LINKING  
ICT AND ART  
PAST EXPERIENCE  
FUTURE ACTIVITIES

ICT ART CONNECT.study • DECEMBER 2014



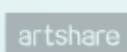
# ICT ART CONNECT ACTIVITIES LINKING ICT AND ART PAST EXPERIENCE FUTURE ACTIVITIES

ICT ART CONNECT.study • DECEMBER 2014

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→ [www.ictartconnect.eu](http://www.ictartconnect.eu)

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## MOTIVATION

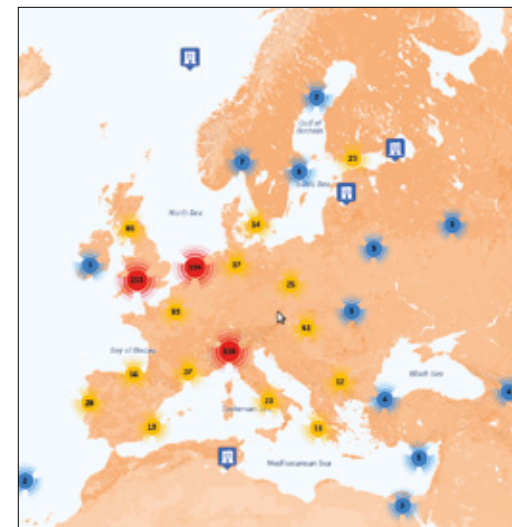
Innovation is about starts. A constant eruption of new beginnings resulting from the creative disruption of established thinking. This is exactly what artists are very good at: criticizing the establishment and formulating new problems.

The constant appropriation of new technologies by artists allows them to go a step further in actively participating in society. By using ICT as their expressive medium they are now able to prototype solutions, create new products and to make new economic, social and business models. By using traditional mediums of expression and thinking about the potentials of ICT they propose new approaches to research and education.

The European Commission is recognizing the emergence of vital arts and research communities who work jointly on unique uses of technology. The result is ICT ART CONNECT: Activities Linking ICT and Art: Past Experience - Future Activities. The study by means of qualitative research reveals new evidence for the integration of the Arts as an essential and fruitful component within research and innovation in ICT. The underlying aim of this study is to contribute to enhancing creativity and innovation in society, technology, science, and education.

The ICT ART CONNECT study connected artistic communities of ICT researchers at all levels, including institutions, companies and individuals. In sequence with previous actions and in coordination with ongoing projects promoted by the European Commission, it gave origin to a new online platform named after the new DG CONNECT initiative. STARTS - Science, Technology and the Arts brings together artists and researchers to creatively innovate in ICT.

The ICT ART CONNECT.interactive map



# KEY FINDINGS



**CRITICAL APPROACH TO TECHNOLOGY**  
To think out-of-the-box is a well known objective in innovation processes. Artist, however, are more interested in getting rid of the box. It is this disruptive approach that is seen has fundamental to create a critical approach to technological developments. One interviewee even expressed the opinion that the integration of artists in technological research processes can be instrumental for the attribution of meaning to new technologies. A solid critical approach is fundamental for competitiveness based in knowledge and creativity.

**CLOSE-TO-MARKET OUTPUTS**  
Results of art and technology research projects are in their majority in the form of proof of concept. Knowledge is materialized in concrete applications and very often including usability testing in their in early stages. Results are therefore closer to market.

**INNOVATING ARTISTIC PRACTICES IN A GROWING DIGITAL SINGLE MARKET**  
A recent study found that the culture and creative industries (CCI) contributed with 4,2% of GDP of Europe in 2012. The majority of the total revenue is attributed to the visual arts, well above advertisement and TV. Innovation of these artistic practices can be instrumental to increase competitiveness transversely in the digital single market.

**INFORMATION VISUALIZATION**  
Another study tells us that 90% of current data was produced in the past 2 years. Artists have been engaging in a very productive ways in dealing with this data. The area of Information Visualization is a growing one and helps us to better understand this exponentially growing amount of data.

**CREATING NEW TECHNOLOGIES**  
Many artists have been at the origin of new technologies. The example of the Berlin-based company ART+COM is key. The company created the Terravision system in 1994 that many consider to be the prequel to Google Earth. It can be said that the artistic origin of one of the most successful worldwide on-line platforms lies in Europe, but was commercially explored elsewhere. More recently, Eduardo Miranda has developed the new bio musical computer which potentials will certainly take some time to be unveiled.

**SCIENCE COMMUNICATION**  
The context of science museums is where a relevant number of art, science and technology collaborations have been taking place. This projects join scientists and artists in order to better communicate scientific achievements.

Why should artists integrate teams in ICT research projects?

This is the main question generally asked by the study by means of interviews, a survey, desk-research, an open call, a symposium and a number of round-tables. The questioning builds up from the assumption that we are nowadays living technological evolution longtime predicted by artistic visioning, such as an example Leonardo Da Vinci's inventions, and focus on contemporary developments. Shortening the period of time to integrate such visionary futures in concrete present realities is a commonly accepted good reason for the referred integration. However, there are a number of others summarized bellow.

**SOCIAL INNOVATION**  
Projects such as the open hardware platform Arduino also show how artistic practice can lie at the basis of later technological developments with a tangible economic and societal impact. They have a concrete impact on the growth and jobs objective by enabling more people to experiment with open source digital technology. This exponentiates the probability of the creation of new products and services and contributes to socially driven innovation processes which distinguish EU from other players in the global markets.

**INNOVATION IN RESEARCH**  
The recent discovery of the oldest cave paintings in the world allowed us to better understand the importance of practices of art in development of the capability of abstraction of human beings. Abstraction is considered to be the main enabler for innovation in science and technology.

**NEW ORGANISMS FOR EDUCATION**  
Artists have been developing new methods of education, to which they prefer to refer to as learning, that allow for a better implementation of ideas such as transdisciplinarity, hybridity of competences and holistic approaches. By implementing this actions at master's level they contribute to a better knowledge transfer from academia to industry, such is the case of the Aalto University. Implementations at PhD level, such as the Planetary Collegium, contribute to what was coined by another study as the Third Industrial Revolution that positions the EU as the place for highly qualified competences.

**COLLABORATIVE CONTEXTS**  
Introducing artistic practices in companies or research departments in the field of ICT stimulates a context in which employees or researchers are urged to experiment with new ideas, technologies and materials. This has multiple advantages; it leads to unforeseen innovations on a short or longer term (serendipity), develops social and communicative skills of the participants and results in a stronger team spirit and better productivity.

# ART IN R&I SOCIAL AND ECONOMIC IMPACT

The analysis of successful project stories focussed on cases where interaction between artists-researchers and other IT experts was especially enhanced and had concrete impact on innovation and creativity in Europe and worldwide. These cases form good practice-based evidence of how integration of the arts in research, development and innovation can lead to real progress in the field of ICT. This points at the sound reasoning behind some of the main worldwide references in engaging with the arts and design for social and economic innovation processes based on ICT, such as the National Endowment for the Arts, the agency of the US Government responsible for innovation in the arts, and the STEAM strategy for successful innovation in the US – Science, Technology, Engineering, Arts and Mathematics.

From a methodological point of view, the concept of best practices, foreseen in the study's proposal and work plan was, after input from the Advisory Group, transferred to the concept of successful project stories. As the field is vast and wide, the mapping of successful stories resulted in interesting views of the community towards the process of creation and their own understanding of success. Facing questions on what success means to the community and why projects were considered to be successful, the outcome generated a comprehensive framework upon which a model of Best Practices can be devised. Through custom-made software, correlations between aspects of the stories were established to define common grounds. In itself, the approach is an example of the integration of the artistic methods in research: an interactive graphics program was used to systematize the data in analysis, in opposition to being simply used to illustrate or visualize analytics.

ARTISTS SHOULD BE  
INCORPORATED AS  
CATALYSTS FOR NEW  
WAYS OF THINKING  
NOT ONLY ABOUT  
ART BUT ABOUT THE  
WORLD WE LIVE IN,  
TO CHANGE THE  
WAY THINGS ARE  
DONE MADE, AND  
DEVELOPED IN THE  
WORLD.

Quote from the FET-Art project, suggested by boardmember Camille Baker,  
Media Artist/Researcher/Curator/

ARTISTIC EXPRESSION  
BRINGS TO ICT KEY  
DIMENSIONS FOR  
INNOVATION,  
SENSITIVITY, CONTEXT  
AWARENESS,  
TRANSDISCIPLINARY  
INTEGRATION AND  
FREEDOM OF DESIGN.

Quote from boardmember Hugues Vinet, R&D Director, Ircam.

ICT ART CONNECT .study

## THE EMERGING HYBRID FIELD OF ICT AND THE ARTS

The study involved intensive stakeholder consultations in reaching the different objectives, by engaging the advisory group as well as by integrating community crowd-sourcing aspects in its web presence, for example by a qualitative in-depth survey. An interactive map application was integrated with the survey approach and as such shows some of the main inputs of relevant stakeholders, crowdsourced from the community itself. The community was asked to participate through peer-to-peer contacts, interviews and open calls on social media platforms and mailing lists. The emerging community of practitioners in the mixed field of arts and technology can be described as hybrid and nomadic. While the respondents to the survey describe themselves more as artists than ICT-orientated scientists and engineers, it is clear that there is a subset of respondents with specific technical skills that may enable them to expertly and fluently navigate the specificities of the fields or ICT as well as arts. This specific community can be interesting to look at in terms of strategic support for development, as concrete results may emerge easily from these 'hybrid creatives'. However, as the example of

STEM to STEAM\* in the US illustrates, innovation does not only emerge from ICT and STEM related skills, but also from arts and design in itself. Only integrating arts in ICT related research when arts are ICT-based in themselves would not sufficiently open up traditional STEM methodologies for fostering creativity and innovation. In this respect, a warning against instrumentalism emerges from the community consultation. The survey characterising this emerging hybrid field contains quotes pointing out the need for 'the focus on invention and experimentation without being trapped by the economic outcomes', the risk of art being 'used as a poor justification of purely scientific projects', or only used 'to generate new commercial products and services'. Any successful strategy or implementing artistic approaches in ICT R&D funding will have to take this into account as a crucial minefield of sensitivity in the artistic field. The call for openness emerging from the field – open structures, open platforms, inclusivity and open definitions – echoes the ongoing discourse of open innovation in the specific light of including arts as an engine for innovation.

\* STE[A]M - science, technology, engineering

From the analysis, recommendations can be drawn for a DG CONNECT strategy to engage more broadly with the arts in H2020. Aside from the instrumentalism risk, a main need of the communities is to be made aware of the role of the European Union both in policy making and funding mechanisms. The survey responses hint at the fact that, even though the community is highly used to collaborative and project-based work, potential key players are often not aware of the available opportunities. A main aim of the website that will outlive the end of the study can therefore be to inform the communities about developments in the area of opportunities. Related to this, we can also expect that training will be needed in order to prepare relevant agents from the art field to face the bureaucratic level of funding application processes in the ICT domain. An umbrella meta-project to promote smaller projects could be instrumental in this initial phase, in analogy with recently launched sector-specific programmes coordinated by intermediate organisations in the context of Future Internet technologies.

A main challenge will be to combine artistic creative freedom with technology transfer processes. The survey points out tensions between the need to be cutting-edge versus the risk to be too new; the need for being open and flexible versus standard project needs of having well-defined targets. Balancing these tensions as well as foreseeing financial support will be instrumental to build a sustainable field of practice.

In light of this, a number of strategic scenarios are possible. These scenarios are not necessarily exhaustive and could be implemented at the same time. One approach is to fund artistic activities in the context of ICT research projects with a fixed percentage of the overall project cost. This is similar to what is put in practice, for instance, in public building in some countries like the UK: 2% of the overall cost of the building is invested in public art. This could be a good transition option, but it runs the risk of, as quoted in the survey, art being ‘used as a poor justification of purely scientific projects’. As such, it may not be sustainable and it may also not sufficiently foster the significance of concrete inputs to innovation from artists-

## POLICY OPTIONS AND RECOMMENDATIONS IN THE CONTEXT OF HORIZON

researchers. A second strategic approach could be to allow for the recognition of artistic research as a valid practice in the production of knowledge, i.e. on the same level as recognised scientific and engineering practices. In this case, artists-researchers, or teams of artists and technologists/ ICT specialists, could for example be evaluated on their technological capacity and potential towards innovation, similarly to current practice with other experts in ICT proposal evaluation. Combining both options could for example lead to a scheme whereby as an initial incentive, the inclusion of artists-researchers in project teams could count as a (small) positive factor in evaluation. A third option is to ensure that the EU level standardization of works of art and exhibitions could be accepted as research outcomes, i.e. generalising this practice as it happens in some EU countries to the context of STOA. A well-considered implementation of options such as these could be instrumental for the nourishing of the emerging field of ICT and arts in the European Union.



“Art works can put meaning and values into physical form”  
Studio visit and second Board meeting at Studio Olafur Eliasson, June 2014

## FURTHER METHODOLOGICAL NOTES AND PARALLEL ACTIVITIES

Full methodological elaborations as well as further findings and recommendations will be published in the study's final report. It is, however, worth pointing out that the study was represented at 8 events, including round-tables and exhibitions, mostly but not exclusively in Europe. The round-tables were used as both consultation and promotion mechanisms. All parallel activities were integrated in already existing events in order for the study to make a bidirectional direct translation between concrete action grounds and policy-making environments, further underlining the hybrid methodology used in the study with stakeholder consultation by means of the online map and survey, advisory group as well as open discussions at events such as these.

→ [www.ictartconnect.eu](http://www.ictartconnect.eu)

A key example was the event at Ars Electronica, in Linz, Austria, the renowned festival that congregates one of the biggest communities in the field. The study also organised its own symposium in the context of the Bozar Electronic Arts Festival. The event included an exhibition of an open call for project stories that was specifically launched for the occasion, and results from the Art&D program of iMinds were also presented in the symposium and in an exhibition.

IT IS COMMON  
KNOWLEDGE THAT  
THE FUTURE IS  
UNPREDICTABLE,  
HOWEVER IF  
YOU INTEND TO  
CONTRIBUTE TO THE  
EMERGENCE OF OUR  
FUTURE THEN ART  
WILL SERVE YOU AS  
A VITAL BEACON.

Quote from boardmember Alexander Mankowsky,  
Futurologist & Trend Researcher at Daimler AG, Stuttgart.



Davide Quayola [IT], Video Installation Strata # 1, 2014, BOZAR Electronic Art Festival

Davide Quayola [IT], Iconographies / Tiger Hunt, 2014, BOZAR Electronic Art Festival



Jean-Michel Albert [FR] & Ashley Fure [USA], installation Tripwire, 2014, BOZAR Electronic Art Festival

Cod.Act, | Michel & André Décosterd - Pendulum Choir [CH], 2014, BOZAR Electronic Art Festival

## SUCCESS STORIES

# ICT ART CONNECT SYMPOSIUM AT THE BOZAR ELECTRONIC ART FESTIVAL

25.09.14 Brussels, Belgium



### Presentation of success stories in the field of Art & ICT

“After just three editions, the BOZAR Electronic Arts Festival (BEAF) is already a reference for lovers of the electronic arts. BEAF attracts both specialists and the general public with artists who exploit the lightning pace of technological developments in order to express their ideas. In the unique setting of the Centre for Fine Arts, we mix music, performances, installations, workshops and conferences into a fascinating whole. The festival team collaborated with the study ICT ART CONNECT for the presentation of success stories in the field of Art & ICT and for the organization of the symposium: Tools for Unknown Futures.”

# SUCCESS STORIES

Technological projects driven by artists

S 1 BERLIN, GERMANY



## Critique Of Technology: Transmediale

“Transmediale is a Berlin-based festival and year-round project that draws out new connections between art, culture and technology. All activities of transmediale aim at fostering a critical understanding of contemporary culture and politics as saturated by media technologies. In the course of its 28 year history, the annual transmediale festival has turned into an essential event in the calendar of media art professionals, artists, activists and students from all over the world. Since 2011, transmediale also has an all-year ongoing activity, including a residency programme. These activities provide a sustainable structure of feedback, research and reflection that interacts with the yearly festival.”

→ [www.transmediale.de](http://www.transmediale.de)

S 2 LINZ, AUSTRIA



## New Services: Ars Electronica Solutions

“Art, technology, society. Since 1979, Ars Electronica has sought out interlinkages and congruities, causes and effects. The ideas circulating here are innovative, radical, eccentric in the best sense of that term. They influence our everyday life—our lifestyle, our way of life, every single day.” Recently and in addition to the Festival, the Museum, the Prix and the Future lab: “Ars Electronica Solutions creates customized interactive products and services in four areas: shop experience, event & show design, urban media development and brandlands & exhibitions. Products and services are precisely adapted to the needs of a highly diversified list of international clients, and we make them available flexibly on both a short-term lease or outright purchase basis.”

→ [www.aec.at/solutions/en/](http://www.aec.at/solutions/en/)

# SUCCESS STORIES

S 3 PLYMOUTH, UK

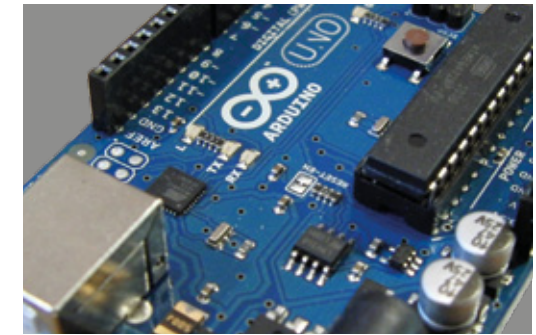


## New Technology: Musical Bio-Computer

“Researchers at Plymouth University have built a musical bio-computer. It contains an analogue computing circuit with components grown from a slime mould. When electrical impulses are sent to the mould, its response is measured in current and translated back to a piano using electromagnets.”

→ [www.bbc.com/news/technology-30182600](http://www.bbc.com/news/technology-30182600)

S 4 LINZ, AUSTRIA



## Internet Of Things: Arduino

“Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects”

→ [arduino.cc](http://arduino.cc)

# SUCCESS STORIES

Technological projects driven by artists

S 5

BERLIN, GERMANY



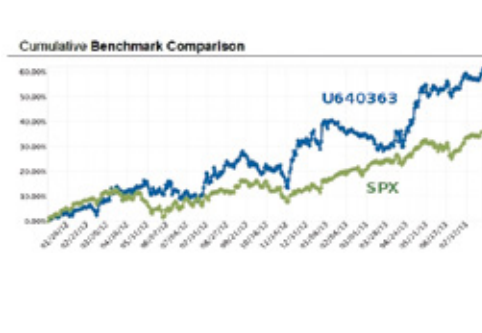
## New Products: Terravision

“Terravision, [1994] was the first system to provide a seamless navigation and visualisation in a massively large spatial data environment. Terravision is a networked virtual representation of the earth based on satellite images, aerial shots, altitude data and architectural data. Terravision is an isochronous realisation of Neal Stephenson’s literary idea in the novel “Snow Crash” as well as a prequel to Google Earth.”

→ [artcom.de](http://artcom.de)

S 6

HELSINKI, FINLAND



## New Business Models: Robin Hood Minor Asset Management

“Robin Hood looks like a financial operation, but in a strange way. It creates a foreign language inside the technological automatism of financial control, it hollows them from inside, it escapes and exceeds the established meanings and identities, makes them stutter and mutate. It releases minor finance from major finance, it turns major assets into minor assets. It is minor asset management. Which corresponds to our subjectivity.”

→ [www.robinhoodcoop.org](http://www.robinhoodcoop.org)

# SUCCESS STORIES

S 7

BERLIN, GERMANY



## Social Innovation: Superglue

“Make and host your webpages at home. Superglue provides you with an independent, end-to-end solution for creating and hosting your webpages at home. In this way, it promotes the original Do-It-Yourself ethos of the Internet.”

→ [www.superglue.it](http://www.superglue.it)

S 8

AMSTERDAM, NETHERLANDS



## Internet Security: Tomb

“The Crypto Undertaker, Tomb is an 100% free and open source system for file encryption on Linux, facilitating the backup of secret files. Tomb is written in code that is easy to review and links commonly shared components. Tomb generates encrypted storage folders to be opened and closed using their associated keyfiles, which are also protected with a password chosen by the user.”

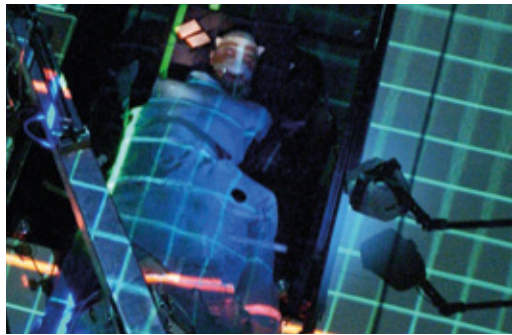
→ [www.dyne.org/software/tomb/](http://www.dyne.org/software/tomb/)

# SUCCESS STORIES

Technological projects driven by artists

S 9

BRUSSELS, BELGIUM



## Applied Research: Camargus

"In 2002 Eric Joris with his theatre company CREW wanted to create a medium 'like a prosthesis' based upon his work with a paraplegic actor. He sought to combine 360° video with a Head Mounted Display and a tracking system instead of using computer graphics or 'virtual reality' tools (as in Computer Caves) EDM/UHasselt developed not only the camera but the whole system and software around. Together they pioneered the first immersive performances with 'Crash', 'U', 'EUX', Terra Nova,..."

→ [www.crewonline.org](http://www.crewonline.org)



Their system proved to be ahead of its time and led to many new applications. In the meanwhile 360° video grew popular and the University made a first spin-off, centering around a 16head camera-system for sports events. A second spin-off is being considered at this moment. CREW and UHasselt are collaborating inside of the EU FP7 project Dreamspace."

# SUCCESS STORIES

S 10

ESPOO, FINLAND

A?

**Aalto University**  
- Where *Science* and  
**Art** meet **Technology**  
and *Business*

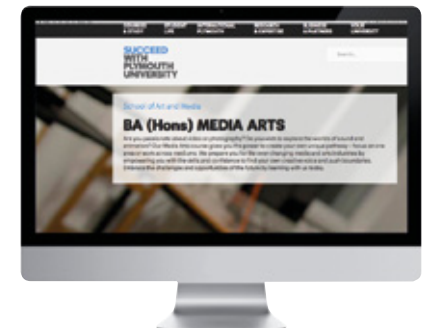
## Knowledge Transfer: Aalto University

On the School of Arts, Design and Architecture: "The school's unique character is a result of its ability to combine experience stemming from a long tradition with new thinking in a way that enables new, creative solutions. The key areas of research are design, digital media, audiovisual representation, art, visual culture, well-being architecture and emerging technologies, and urban planning and design. The school produces specialists and innovators of art, design and architecture with strong artistic and technical skills."

→ [www.aalto.fi/en/](http://www.aalto.fi/en/)

S 11

PLYMOUTH, UK



## New Learning Models: Planetary Collegium

"Within a transcultural, transdisciplinary perspective, the Planetary Collegium is concerned with the advancement of emergent forms of art and architecture, in the context of telematic, interactive and technoetic media, and their integration with science, technology, and consciousness research. The Collegium's hub (CAiiA-Hub) is located in the School of Art and Media of Plymouth University, with nodes in Zurich, Milan and Kefalonia."

→ [www.plymouth.ac.uk](http://www.plymouth.ac.uk)

# A NEW INITIATIVE IN BELGIUM

→ [www.gluon.be](http://www.gluon.be)

Gluon is a platform that realizes projects on the crossing borders of media arts, technology and science. For the realization of its programme Gluon is supported by an ab initio network of Belgian research departments, cultural institutions, governments and enterprises. Gluon was founded during the ICT & Art Connect study, and this with the support of the CEO of the Flemish research department iMinds (Wim De Waele) and the director of the Center for Fine Arts in Brussels (Paul Dujardin).

Cities, cultural institutions, governments or private persons can launch an open call via the site of Gluon. This open call should formulate a challenge that needs the involvement of a multidisciplinary team for its solution, requires the creative input of an artist and stimulates experiments in the field of technology and science. A city could for example commission a multimedia installation for its public space or a company can invite a multidisciplinary team to develop a new and inspiring idea that relates to its products or services.



On the basis of this open call national and international artists, whether or not in dialogue with researchers, are invited to send exciting proposals online. These proposals will be reviewed by an independent jury. Once the best proposal is selected, Gluon will establish a multidisciplinary team that develops the ideas and translates them in prototypes or concrete realizations, this in collaboration with local or international experts and companies.

## ICT ART CONNECT team

### Luis Miguel Girão (PT)

Luis is a transdisciplinary artist and researcher in the application of technology as a tool for artistic expression. He is a PhD Candidate at the Planetary Collegium and Master of Fine Arts in Design and Digital Media. He is member of the Centre for Sociology and Music Studies of Faculty of Social Sciences and Humanities of the New University of Lisbon, Portugal. In 2007, he was awarded the Bolsa Ernesto de Sousa prize that allowed him to do research and present results at the Experimental Intermedia Foundation, in New York City. He is expert in New Media for the Secretary of State of Culture, Portugal, as well as for the European Commission. He was coordinator of ICT ART CONNECT 2013 of the European Commission, that happened in several venues in Brussels including the European Parliament.

### Pieter Jan Valgaeren (BE)

A happy schizophrenic researcher linking his love for art, law and ICT in diverse programs and projects: from hardcore legal research to soft metaphysical legal thinking, over cultural consultancy and exhibitions to social media research. He joined iMinds-SMIT, Vrije Universiteit Brussel in 2012. As a guest lecturer on the legal protection of TV formats and Legal Issues related to Social Media he taught at Universities in Potsdam, Berlin, Valetta and Madrid and the Thomas Moore Institut in Mechelen. Since 2014, he became artistic director of the Triennale Hasselt, focussing on design, fashion and art in contemporary society.

### Eva Van Passel (BE)

Eva Van Passel joined iMinds-SMIT, Vrije Universiteit Brussel in 2007. Her research has focused on the challenges of providing access to cultural content. She has worked closely with local cultural stakeholders, including artists, as well as with the wider EU museum community in Europeana-related project work. Themes include strategic roadmaps for cultural institutions, digital cultural policy, audience strategies and business and financing models."

### Wouter van den Bosch (BE)

Wouter is passionate about technology, how it affects us and how it can be shaped into exactly the right form. He has a degree in business studies and over ten years of experience working in IT related jobs. In 2006 Wouter made the move towards more research focused activities at the Thomas More University College of Mechelen, where he worked as a new media researcher and teacher. He is the co-founder of Dough, a startup focused on developing social and geolocate software. In 2011 he joined the iMinds-iLab.o prototyping crew, where he helps to design, create, implement and evaluate innovative prototypes within the scope of iMinds' research activities. Wouter is also highly involved in creating new tools to support our Living Labs research.

### David Vermeir (BE)

David holds a degree in Interactive Multimedia Design from Thomas More University College (Mechelen). He started his working career at Cronos in 2008, where he worked on large-scale IT projects for some of the largest companies in Belgium (NMBS, VMM, ...). He has also designed and given gamification implementations and workshops. In 2014, David joined iMinds - iLab.o as a Prototype Developer to put his passion for innovation and technology to good use. David helps to design and develop innovative prototypes.

### Christophe De Jaeger (BE)

Christophe runs the department of photography and media arts in the Center for Fine Arts. This department is responsible for the exhibitions in the Center for Fine Arts and for the organization of the biennale for photography and media arts in Brussels: 'The Summer of Photography'. On a freelance basis he curated exhibitions in Belgium and abroad (USA, China) with international media artists.. Currently Christophe is working on a phd at King's College London where he researches the history of early computer art in the 1960s and 1970s.

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