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José Tavares and Pierluigi Sacco

This is an informed but personal perspective on the contributions to and the discussion at the STARTS symposium, held at BOZAR, Brussels, the 22 and 23 June 2015.

Opening Session
Michel Magnier, Paul Dujardin

Art no longer seen as **something detached**, what Théophile Gautier dubbed "l´Art pour l´Art", art for arts´ sake, no longer true that "the only truly beautiful things are those that are useless". The European Union ever more aware that culture means business, and output, and jobs, art as a cross-fertilizer, a catalyst that has to be taken into account in all EU policies.

The 21st century is about trans-disciplinarity between culture and technology, away from the pure engineering and standardization of the 20th century. But the variety of artistic practices in contemporary art is yet to be acknowledged and fully incorporated.

Keynotes
Gerfried Stocker, Nick Ervink and Fried Vancraen, Laura Beloff, Mehdi Tayoubi, Hugues Vinet, Roger Malina

Organizations **connect arts and technology in search of** encouragement, empowerment, innovative products and directions, new forms of communication and cultural experiences, the formation of innovative communities.

The **arts help define the question**, when the question is not yet clear. In particular, art can help enlighten issues from viewpoints that may be ignored by engineering conventional wisdom. **Take the example** of the self-driving car. One could think that the main problem is how to engineer the car so that its self-driving skills are safe enough. But if you see the problem from the point of view of the artist, the 'natural' way you could think of it is not in terms of the point of view of the competences of the machine, but rather of the humans. A machine can quickly learn how to interact with humans in a safe way, but can the same be said of humans? How can human pedestrians 'trust' a machine when they have to cross the road? Normally, what humans do is to make "eye contact" with the human driver so that they recognize whether they have been seen by the driver, whether s/he has the intention to stop or not, etcetera. But in the case of the self-driven car, what is really important for technological development is not just the self-driving technology per se – this is paradoxically the relatively easy part – but rather the technology that allows the car to signal to humans so that they can trust the car's reaction. This is an example of how artistic thinking can make the difference in developing a technology whose social impact and emerging psycho-social issues are still partly unknown or ill-understood.

The **challenges are wider than the range of any particular field** of expertise, but bringing art, science, design and science together may not be enough. A catalyst is needed, be it a person, incentives... Art-thinking as a combination of design-thinking and artistic prototyping. We can therefore regard 'art thinking' as an additional resource with respect to 'design thinking'. The latter

works when we have to find a solution to a well-posed problem. The former especially helps when the problem has not been yet well defined in the first place.

Art can often pose apparently 'silly' challenges that prove to be extremely fruitful for new conceptual and technical developments. The example of a sculpture with no interior, a "hollow sculpture", that is simultaneously a **technological challenge and a conceptual advance in art**, a new approach to sculpture, pushing a company working in 3D printing to constantly go beyond its technological limits to help the artist pursue his imagination but at the same time developing new powerful production skills that have a value on the commercial market.

Curiosity is a starting point for scientific activity... and also for the arts, stemming from the desire to speculate and develop future scenarios. The shared ground need not be on a discipline, but on a common interest. Artists are professional risk-takers, scientists and technologists as "risk-averse". Artists should not be limited to "illustrate" science, they should build their own tools and instruments. The artistic attitude is not ancillary to the scientific one, but complementary to it and standing on an equal dignity basis.

Many good things happen by chance, and are then ex-post rationalized. How do you choose a project? Intuition is important, and a visionary CEO, since it is hard to know where to place special projects. Artists can bring sense of purpose to what engineers do. Be provocative, be where people do not expect you to be and generate innovation with a purpose, a "story" that can be pitched to our mothers, our children, and at the same time be innovative. At the same time, you have to give up some part of the control, in order to be surprised by the unexpected turns that artistic practice invites you to take. You have to learn to work with artists, as they constantly challenge your convictions and your frames of mind. But once you learn to do that, it can be very rewarding on many levels and the occasions for fruitful collaboration multiply.

An innovative, visionary project as IRCAM has been generated by the intuition of great musicians but has never regarded itself as a self-referential playground for musicians. The dialogue between music and technology can be immensely fruitful but it calls for giving up prejudices and preconceptions on both sides. Technology has the ability to renew the music industry, technology first used by artists and then transferred to industry. Each artistic project has a composer and a technologist working side by side. Composers are not only commissioned, but also selected by open call and enter research teams. The artist is a sensitive specialist with specific knowledge, able to pass it on in small work groups. Complex activities, in which technologies are tested, then spill over to simpler activities. **The artistic experience becomes user experience**.

There is **a growing international community** bridging technology and the arts. It has lived through the internationalization of science, the interaction of government and science, even the utopian view of science as the way for full employment and unending abundance. There are new and evolving rationales, a great variety of stakeholders, a changing landscape in education.

We cannot just put artists and techies in a bag, we need a joint approach to problem solving, which comes from a long and difficult work of exploration and experimentation. A hard thing when people from different backgrounds work together. Creativity and innovation are different things. **Teams need to evolve flexibly**, often start within one discipline, become inter, multidisciplinary or even, in best cases, trans-disciplinary. The importance of place as a catalyst for art-technology innovations, "safe places" where developments can emerge on the basis of a shared commitment to make it happen and of a firm acknowledge of the importance of such an experimentation. This is why certain places have been so important in the historical development of the art-science relationship; in some places, making this happen was just more possible than in others, and this is a lesson that we have to treasure the expand the possibility of creation and development of new favorable

venues.

There is a need to move away from "niches", and rather bring artists to all "locations". A record of innovation products that ended in "nothing", but very difficult to identify those in advance. Sometimes there are large, positive surprises. Experts often "hostile" to new collaborations with artists they have not felt the need to work with in the first place. Forcing things is then never a good move, and there is also sometimes a problem of poor and reductive understanding on artistic practices on the scientific side. Scientists and technologists tend to see artists as "disseminators", a poor and limiting approach, when artists are no more than "performing scientists", or "performing technologists". These interactions, to be fruitful, take time, substantial time, and continuity is a requirement. Institutions need to be both agile and robust.

The Internet of Things

Rob van Kranenburg, Bruno Apollini, Carmen Mac Williams, Eric Joris, Pedro Omedas, Pavel Smetana and Pedro Arbadillo, Simona Maschi, Vittorio Loreto

The **"internet of things"** is a term that moves away from company-specific names that echo too much specific businesses. Technology and interaction are finding new meeting places.

Think of **social appliances**. Appliances that help a person optimize cooking to personal taste. Can cooking a cake become a poem? And doing the laundry? Appliances controlled from afar, but responding to each single user and her local and contingent information.

The example of the Fallas in Valencia: people **experiencing different events in one place**, a grassroots experiment, relying on locals and tourists. It is about learning how to involve the people, in ever greater circles so as to learn new applications and new ways to experience things.

Exploring **several incarnations of 3D imaging**. No need to wait for industry, doing it "bottom up", exploring ideas and being "stubborn" about what we think will work.

Understanding the brain by building technologies that simulate its functioning. If we know how to build something, we know how it works. Technologies should support and promote creativity and innovation. Preparation, incubation, insight or illumination, verification and evaluation: four phases. Take as example the experience induction machine, an immersive room, first suggested by an artistic installation, used for behavioral research, creating loops between data and the user. A machine that "understands" the user, what it tries to do, as well as the unconscious process, a heartbeat that is changing, the focus of an eye, etc.

How can creativity emerge? Designing interactive situations where people explore ways to find solutions to problems. The **adjacent possible**: how does accessing a new thing open new possibilities that were not foreseen before?

A **community based movie theatre**, exploring art house cinema in the digital age. Can act as a media laboratory for the big screen, exploring how to enhance the cinema experience. People interacting with the screen, maybe bringing personal stories to the big screen. Combining neuroscience, research on audiences, and gaming. Big data applied to the big screen.

Creating a room of desires, a connection between the brain of the spectator and the scenes that are in accordance with the person´s mental state. **Brain communication** is not between man and

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machine, but between individuals, between persons and animals, between artists.

Learning by doing, that is, learning by prototyping. **Prototyping is a "common language"** across disciplines. An example, a technological device that helps foreigners pronounce street names. How can the experience of building the prototype be incorporated into the language learning process?

Creative Cities and ICT

Mike Phillips, Andrzej Novak, Annemie Maes, David Crombie, Manuel Abendroth, Teresa Dillon, Tim Brooke

Cities are building control centers, right out of the top down model cities of the past, exploring the possibility of all people being monitored, radioed, etc., continuously One thing **hard measuring** is **social impact**, or cultural impact, for that matter. But there are new metrics, available, relying on information.

How can we build **new narratives for Europe**, now that enlargement and crises have made previous narratives old, no longer "functional". Can we invite people to share "shadow" narratives? Use ICT and online questionnaires to collect them, interpret through network analysis and disseminate the new narratives. Europe as a coalition of diverse cultures, a cultural bazar.

Creating **intelligent beehives**, interconnected and networked. By monitoring the wellbeing of the bee colony, we can learn about the environment of cities.

The game industry is not very interested in **educational games**, there is a dichotomy between games designed in universities and in the entertainment industry. Organize game jams across Europe, around educational games.

Creating evolving **public spaces** using light and shade in changeable patterns.

A new way to **create content and place it in the internet**, off the world wide web.

Place an object in several locations **and then observe**, find out what people will use it for. An example: a printer placed in every shop, used to send greetings, messages, vouchers. Build communities through common creative dynamics. Objects, especially unfinished objects, induce creativity.

Data and Society

Jaromil Roio, Domenico Vicinanza, Filippo Giannetta, Oriana Persico & Salvatore Iaconesi, Roel Roscam Abbing, Teresa Dillon

The relationship between data and society has a **strong activist component** from the artistic viewpoint, as artists are mainly interested in understanding what are the **conditions under which technology can truly empower people rather than facilitate their control** by incumbent economic powers and stakeholders.

Data sonification is a perspective of great interest because it allows to turn scientific and technological measurements into music data – a transformation that has not a pure aesthetic and sensory value, but can on the contrary deeply affect **the cognitive schemes that we apply to find patterns in data and to interpret them fruitfully**. For example, regularities in movement in the observation of a certain phenomena can translate into specific sonic properties whose patterns can

be better known than those of the original data and can therefore illuminate their analysis under a new light. The Higgs boson data sonification is an outstanding example of a case that has a vast potential both in terms of analysis and communication. Likewise for clinical data, where the onset of pathological conditions can deeply affect the musical structure of the sonified data, signaling the emergence of a possible anomaly worth of attention.

The relation between art and technology has complex social implications, that require critical thinking. Long-lasting platforms like Transmediale in Berlin have gradually because 'the' venue for such critical thinking, inspiring other initiatives elsewhere and at the same time convening together the most interesting thinkers and practitioners in the field, in order to stimulate closer interaction and exchange among them. **Critical thinking is not just about criticizing, but about questioning received wisdom to elicit new possibilities and alternatives**. The issue of data production, dissemination, storing, etc. is acquiring paramount relevance in this debate, and not incidentally the last edition of Transmediale chose data as the main topic.

Artistic research on data, and even **formalized artworks may turn into scientific research or business opportunities if one follows the thread they trace**. The example of Incautious porn, tracking the sexual behavior of people online, leading to the creation of a company producing generative paintings on the basis of such data and selling them online. Another example is that of One Million Dreams, tracking the narration of dreams in social network and consequently leading to useful analyses of dreaming patterns across sociological conditions, locations and so on, with interesting implications for different scientific fields. Or Human Ecosystems, examining User Generated Content in 8 major cities across the world, expressing the implicit relational ecosystem that they define. And finally, **the Ubiquitous Commons approach, which is designed to enable people to decide how they wish their data to be used**, giving back to them not only some margin of control on their data, but also the awareness of the possible uses and misuses that can be made of them.

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Once seen from the artistic viewpoint, Internet can easily appear as a technology we increasingly rely upon, but of which we know way too little of. **Nobody ever wonders – often let alone understand – how one's data navigate across the world when surfing the web**. A project like Border Check is explicitly designed to make this knowledge accessible. With it, a deeper understanding of the web's actual functioning becomes possible – for example, realizing that surfing from different locations, via the routing geometry that it makes use of, produces different routing paths across the web. **Unveiling this aspect easily leads to pointing attention towards mass surveillance and data retention issues**, reconnecting to the strong activist component of Internet art. Making the complex routing paths visible and understandable also elicits the development of innovative visualization techniques.

Another aspect that artistic approaches consider as highly relevant is **providing people with authoring tools that allow them to maintain full control of content exposure and circulation, while at the same time leaving full possibility of shared access and use**. Projects like Superglue transform home computers in mini-servers that allow for independent, unmonitored navigation with a fluid online/offline switching mode according to needs and circumstances. In this way, users' choice is safeguarded and promoted while at the same time stimulating a do-it-yourself approach that enhances autonomy and awareness about technological monitoring and control on the net. This increased autonomy also has an ethical side, by **recovering the original spirit of the net as a full peer-ignited platform** where all sharing activities had non-instrumental and non-commercial purposes, and where users were mainly able to manipulate and shape the technology in order to profile their content production in the desired way.

The discussion has pointed out that the main common asset that practically all projects attempt at

building is trust, and that **the data-society issue today is mainly about the production of trust** also in more general terms. This has to do with regaining control and reliability about one's own data production, dissemination, and storing. The policy challenges that come with this are, primarily, **building a sufficient basis of capabilities for people to get real awareness of the nature and critical aspects of the issues at stake, and to behave proactively as a consequence**. The contradiction of the actual status quo is that **the sharing economy attitude of most users, who are happy to give away their data and contents for free, is matched by an economy whose main companies are classic 19-cebtury like profit maximizers that strive to extract as much value as they can** from the sharing platforms, without openly recognizing this with users and concealing as much as possible the ways in which they track, extract and re-use the contents that they produce. This mimetic nature of technology is a concern of particular urgency – there is an explicit effort to keep people unaware of the borders they cross as they use digital platforms and as they think there are using 'for free' all sorts on new, exciting services and tools for data production, editing, and circulation.

However, we should not exaggerate fears and to assume an unconditionally negative and defensive attitude toward the new technologies – **all new technologies at the time of their inception have raised fear that lacked real foundation** after actual scrutiny and a direct experience of them (think e.g. of cinema or photography). On the other hand, the level of market power and data control that the current incumbents in the new technological content platforms enjoy is much bigger if compared to what happened in the emerging cultural industries at the beginning of the 20th century, and as a consequence possible issues are probably more complex and with bigger long-term impact.

In the end, the only viable solution seems to be truly investing in people's capability building to facilitate their expert, knowledgeable use of new possibilities while at the same time helping them to appreciate the socio-economic consequences. Technologies are far from neutral in this respect, as they can be modeled to amplify intention, attract attention, and create distraction according to the interests of the big stakeholders. **The increasing level of networking with respect to 20th century technologies allows for much more emergent properties at the social level** of which we still know too little. Market power is consequently much more difficult to debunk compared to what it was for cultural markets throughout most of the 20th century.

On the other hand, this new landscape is also **an ideal turf for the development of flexible, trans-disciplinary talents and intelligences**, and we need to develop new educational strategies to allow people with multiple talents and propensities to pursue their interests freely enough without trapping them in obsolete classifications of scientific and artistic fields as in the past century.

How music stimulates technological innovation

Francois Pachet, Beatrice de Gelder, Claudio Allocchio, Cynthia Liem, David Worrall, Mike Thompson & Susana Camara, Philippe Franck & Jacques Urbanska, Stefano delle Monache

Holbrook's book "Playing the changes in the jazz metaphor" provides good examples of **what good artists can bring to innovation**. The jazz jam session spirit is very representative of the social and cognitive processes going on in innovative environments. This goes much beyond improvisation and has to do with mutual phasing of creative frequencies, styles of thoughts, and rhythms of discourse.

If we want to seriously involve people in technological co-creation in the musical field, we have to design simple to use, non invasive systems that expand the possibilities for musicians on stage rather than constraining them with bulky or unnatural interfaces. Musicians are not customers for

these systems, they are developers who participate in the innovation process. An ideal interface entails no computers in the middle of the scene, and more generally **a completely hidden technology, tailored to the artists' needs, and not vice versa**. The LOLA platform is able to implement spatially distributed performances, making musicians play together with real time synchronization as if spatially co-existing.

The music-technology link has also to take into account the social dimension: people go to concerts to feel the environment, to enjoy the atmosphere. Use of multi-camera videos also in classical music concerts setting may be transformational, leading to a user-centered methodology in a complex- multi-perspective setting, and reaching out new audiences and not just peers and colleagues.

Data sonification can be a major theme also from the music-making point of view, leading to an understanding of how the psycho-perceptual and psycho-physical bases of sonification design influence our conceptualization and understanding of phenomena. Sonification makes it possible to approach complex multivariate data from earthquakes, epidemics, or trading, in wholly new ways. An especially developed field is the sonification of medical data for diagnostic purposes: the sonic translation of body pulsations in real time. Donating personal medical data to research at this stage is of great importance. **New research questions arise: how sonic data relate to metabolic processes?** On the other hand, music itself has an important impact on bodily functions: for example, music modulates cardiac and neurological functions, so there is a feedback loop: **physiology generates information that can be sonified, but sonification itself impacts body response**.

The music composers-technologists dialogue offers new avenues in computational support to the sound design phase, keeping in mind that **sound design is pervasively spreading in all aspects of human experience**, giving big help in improving ergonomics, security, social cognition, etcetera.

Sound design may be also useful in overcoming sensory barriers, e.g. in enabling blind people to perceive actual choreographic movement – this is opening new scenarios of cooperation between art, technology and neuroscience. One can thus sonify movement to generate distinctive sonic patterns that convey artistic expression. Moreover, this create a further layer for creativity as outputs of the data capturing system may be handed over to the composer to orchestrate them into a musically effective and conspicuous sonification.

Opening
Carlos Zorrinho, Zoran Stančič

We live in an era of disruption. The idea of disruption can lure us as a mere spectacle but we need to go further, we need to bring our values to the fore and change things. Cultural diversity as a human right: we can reinforce diversity and identity simultaneously, enhancing human rights.

Art can show scientists things they alone cannot see. Technology together with arts as a way to deal with complexity and improve livelihoods. This requires a new effort and commitment in bringing these pilot actions into EU programming and in fostering collaborative networks of experimentation across Europe.

Analysis of Projects Linking to the Arts
Pier Luigi Sacco

There are very few systematic studies on the relationship between ICT and arts. A sample of very heterogeneous examples and success stories suggests the urgency of a systemic approach. Think in terms of endogenous growth, namely assets like physical and technological capital, human capital, social capital, informational capital, and cultural capital. Capital is anything of value that can be accumulated, even if not physical, even if not easily measurable. Different ICT and arts connections affect different forms of capital. Research (TC, SC, IC), platforms and content distribution (TC, SC, IC), open technological development (TC, SC, IC), production of hybrid artwork (CC), formal and informal learning (HC). If systematically tackled, **the arts-science connection might become the basis of a new source of endogenous growth** in systematically modifying the nature of innovation processes.

In narratives about success, however, artistic excellence is not very preeminent, maybe because it is hard to evaluate this by means of universal criteria, and therefore the success factors have mainly a scientific and technological nature. This is a real weakness that can seriously impede the legitimization of the art-science nexus. The bases of the community of practice that works on these projects has a very strong social networking and is **mainly moved by the social benefit of sharing rather than by expectations of profit in the short-medium run**, and this is another aspect that should not be disregarded in evaluation the social sustainability of these processes, where 'forced' engineering and industrialization might not be the better option strategically. It is also mainly about very small groups, working in non-profit environments, often with some sort of artistic background also from the scientific/technological side. Multi-disciplinarity and trans-disciplinarity is another key hallmark. The perspective is now to **make the art-science nexus respond to specific, relevant societal challenges**, and ingraining it deeper in the ICT and technological value chains.

Institutional Testimonials
Simona Maschi, Cristian Beza, James Davis

At the end of the day innovation is about people, about changing the way people live. Think socioeconomic effects. Go from inspiration to impact. Innovation can be creativity driven or science driven. Together, we become **creative technologists**. The employability of contributors is an important gauge of success.

Massive people analytics, a methodology to score personal traits. Emotions, which change, and personality, which does not change across life.

An internet giant straddling different areas of art and culture, and aware of its weight and influence. The want to **make its expertise in technology useful** to others´ abilities and creativity. It is interesting that developments such as the Google Art Institute came out of the "20% time" program, and was subsequently picked by the company to become a strategic project.

How Can the Arts Stimulate Innovation in Technology?
Vladimir Sucha, Egbert Lox, Gerfried Stocker, Jaromil Rojo, Joachim Quantz, Lucía García, Peter Friess, Simona Maschi

We don´t understand what innovation is, but we can bring some light to it. We can think of the impact of innovation in a holistic way: quality of life, egalitarianism, growth, etc., all fundamental in an open and tolerant society. The arts as liberation and redemption, something arts do well.

New forms of art that result from the abuse of technology. Explore the idea of an artist and a businessman, both in residence. Start with something that captivates and fascinates and then use the technology to move ahead. **Make space for artists in residence even in situations and environments that are not conventionally thought of as appropriate**, and create the conditions for real experimentation.

Inspiration as a starting point. **Innovation has always been a mix of technology and artistic approaches. We are not starting from scratch**. Maybe in the past projects were technology driven but now it is different. We can have important projects which are artistically driven instead.

Innovation in science and engineering as a very structured process. The first part, creativity, is the hard part for engineers, and that is where artists can bring in major contribution. Adding art to materials. Use materials for a better life: clean the environment, produce energy, recycle. **One of the keys to creativity is to pose 'strange' but very generative questions**, and this is where art is very good at.

Prototyping as a method to incorporate creativity in a systematic way. Different agents are in presence. **Many engineers are artists, many artists can understand science**. Many individuals have hybrid interests and talents and it is difficult to combine these talents as a professional. This kind of trans-disciplinary dialogue should be further encouraged to make people feel this is important rather than their personal hobby.

Take innovation seriously. Have people committed and responsible to drive creativity and artistry into the innovation process. **Take artists with professionalism, just as any other professional**. Accreditation of professions may be a way to curtail inspiration and innovation. To professionalize artistry may be problematic, but having criteria is important. Need the metrics, need to professionalize the discussion. Developing specific evaluation metrics for artistic practice may become important to make the dialogue progress further and to find more space in funded programmes.

The word art and the word creativity are difficult words. Powerful organizations are using the label creativity, between freedom and novelty, on the one hand, and relevance and results, on the other.

How Can the Arts Stimulate Innovation in Business

Arnost Marks, Catherine Magnant, Cristian Beza, Francesco Monico, James Davis, Jo Libeer, Pier Luigi Sacco, Laura Beloff, Valentina Montalto,

There are examples of very able and productively innovative centers that, nonetheless, are not sufficiently studied to be eventually replicated.

We need more figures, and more robust figures. Build evidence as a way to the hearts and minds of policy-makers. The European Capitals of Culture initiative has arguably managed to change the image, the reputation, eventually the economic attractiveness of different cities in Europe, although not all experiences are equally successful and relevant. **There is a strong demand from cities as a locus of creative collaborations**. Three instruments: capacity building actions, understand the creative resources; incentives, financial and other. Incorporate creative directors, to work in tandem

with other decision makers. Creative mediators are also important, building bridges between artists and others. Enable collaborations in dedicated places.

The importance of people in decision-making positions having a vision. Be it in the business sector, in municipalities, in governments. The importance of systematic, common narratives for societies to acknowledge the power of arts and creativity for business.

The idea of people meeting together to resolve tensions, not as hierarchies but as *holocracies*. Each has a role to jointly solve the tension. Tension is something akin to culture. **Conflict is itself a dynamic force, and should be explicitly tackled rather than concealed or removed** – and culture has become very good at that.

The need for small actions, projects, that work and are flexibly changed as things progress. Not just taking time to understand problems and then trying to address them wholesale and comprehensively. Start and then go on, adapt.