

ParticipArt: Exploring Participation in Interactive Art Installations

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ABSTRACT

ParticipART is an initiative aimed at exploring participation in interactive works using ubiquitous computing and mixed reality. It supports and analyses work of artists and creative practitioners incorporating or reflecting on participatory processes to support new roles and forms of engagement for art participants. We aim at proposing a space for discussion that can enliven and enrich the dialogue between human-computer interaction and the creative practices. We present several works that have been exhibited and experienced. The works are used to reflect on the different participative strategies and the role of interaction technologies: enabling authorship, affording connectivity, interacting with artificial beings, reinterpreting the visitor world, and engaging in performative acts.

KEYWORDS: Participation, interactive art, performative interaction.

INDEX TERMS: H5.m. Information interfaces and presentation (e.g., HCI); Miscellaneous.

1 INTRODUCTION

While human-computer interaction has among other things reflected on the role of users and systems and on the application of interface technologies, Participatory Design has traditionally focused on the design and development of computing and information technologies with the active engagement of the people who use or are affected by these systems. An interesting analogy can be conceived where human-computer interaction HCI and Participatory Design PD talk about the designer and user dichotomy to the situation in art works between users and artists.

Over the years, the efforts of artists, musicians, architects and designers working across a wide range of disciplines have contributed to invigorate the discussion on the design boundaries of such engagement, and in recent years HCI and the PD fields have actively sought submissions from artists and designers that exemplify the principles of participatory design.

ParticipArt [4][6][5][25] is a series of initiatives such as exhibitions, installations and research that takes inspiration from artists and creative practitioners who incorporate ubiquitous computing and mixed reality to stage participatory processes that can expand the boundaries of audience engagement in either

experiencing or engendering the work. The work presented in this paper was curated as part of PDC 2006 in Trento, Italy, and exhibited in the Contemporary and Modern Art Museum in Rovereto.

Artistic work based on emergent media and technologies is a particularly fertile domain for the development of tools and environments that both supplement creative practices and contribute valuable research and design methodologies for other disciplines [7]. By promoting divergent thinking and creative visions, new media art practices offer a platform that emphasizes creative engagement as a locus for innovative design and evaluation methods [8], thus encouraging fresh and critical perspectives [9].

Our objectives in this paper can be summarized as follows: (1) explore novel relationships and multiple participatory processes enabled by emergent media and interaction technologies; (2) promote exchange and integration between technical and creative communities that adopt participatory approaches for distinct but potentially interweaving purposes; (3) identify different approaches and strategies in using ubiquitous computing and mixed reality to achieve participation in interactive works.

2 SETTING THE STAGE

2.1 Installations

Art installations are increasingly seen as carrying performative features. In [16] *Performative Installations* are defined as being a “synthesis of art event and art work, of presence and representation, of immateriality and materiality” (p. 4) in which artists work, intertwining different levels of presence, temporality, space and experience. An installation is a process of arranging and placing; it is three-dimensional and relates to the space surrounding it evoking a spatial experience. The space-invading quality and experience elements of an installation has the potential of creating an original and individual context. Its performative elements embrace live elements of the external context and “thereby incorporate categories from everyday routine and life”. Artists create a link between the event aspects of the performativity with the materiality of the installation. The simultaneousness of action and experience in a *Performative installation* results in a fusion of presence and representation, ephemeral and static elements, events and duration, and immateriality and materiality.

Vito Acconci is among the most important pioneers of performance and video art. While his early work was characterized by bodily performance, he soon turned to performative architecture. Acconci showed how architecture could become performative through its use (Acconci in [16]):

“Can a museum be opened towards the outside? Can its outside literally be brought into the inside of the museum ...? ...can a new museum bring beholders so close to the objects in the museum that they can no longer see them but have to feel their way towards them? Can objects in a museum be in constant movements?”

One of Acconci's works that marked a turning point is *The Peoplemobile* (1979), a flatbed truck with a face-like mask that was driven in public places, where a crew off-loaded steel panels and configured it into a different arrangement each day: the first day forming a wall and a staircase, the second day a three part shelter, the final day a table with two benches, while a loudspeaker on top of the truck was used to address the public. In art pieces like *The Peoplemobile*, artifacts and architectures are provided in public spaces for public viewers. Acconci appoints at the performative feature of his work [17]:

“The viewer activates (operates) an instrument (what the viewer has at hand) that in turn activates (builds) an architecture (what the viewer is in) that in turn activates (car-ries) a sign (what the viewer shows off): the viewer becomes the victim of a cultural sign which, however, stays in existence only as long as the viewer works to keep the instrument going.”

Several of Acconci's performative architectures include dynamics of actions, that can be performed by viewers, or that are inbuilt as tensions, as in *TV Must Die* (1979), where catapults or oversized slingshots are mounted on the columns of the gallery with a bowling ball aiming at a TV by the window. At other times, architecture has an explicit re-configurable character as in *Adjustable Wall Bra* (1991), where “the bra is a multifunctional fixture for the home; it functions as lighting, audio speakers, and furniture.” (Acconci in Sobel et al. 2001, p. 33) The bra can be used to create different spaces and sitting arrangements according to how the two cups are positioned. Acconci explains different approaches to creating a space (Acconci in [18], p. 18):

“If the space presented is complete, what's left for the viewer is to relive the space – this is the domain of fiction, the impulse is preservation (conservative); if the space presented is not yet complete, what's left for the viewer is to try out the space – this is the domain of essay, the impulse is change (radical).”

2.2 Participation

The ParticipART initiative included work of artists and creative practitioners incorporating or reflecting on participatory processes to support new roles and forms of engagement for the audience in the experience of the work or its iteration over time through a process of continuous changes and development.

Broadly speaking, participatory design in the context of digital arts and media ranges along a spectrum of forms and approaches. As highlighted in a round-table discussion on participation in arts and design at PDC 2006, which was organized by two of the present authors, some artists create conceptual frameworks or digital environments and then invite others to contribute or act within them. Others organize environments or events that are subsequently created and extended by the joint action of participants and designers alike. Some of these environments exist exclusively in the virtual world while others represent augmentations of natural settings and public spaces.

Creative work and practices based on interactive media and technologies inherit concepts and forms that were elaborated in art decades earlier. From a participatory design perspective, an interesting aspect of this inheritance is the focus on media and technologies supporting creative and open-ended activities in relation to which the artist is more of a “meta-designer” than a conventional author [10].

Few studies have explored in detail the participatory dynamics unfolding around and with a piece of art. For example, Heath et al. [15] examined how people in and through interaction with others, explored, and experienced a mixed-media installation in a museum. They analyzed how the artwork draws spectators into active engagement with the piece; how spectators ‘display a sensitivity to how others are viewing and orienting to the piece’ (p. 28); how the ‘installation provides participants with ways of making sense of ‘reading’ the conduct of others’ (p. 29); and how the immediate ecology of the space is ‘a critical part of the production and coordination of conduct’ (p. 29). “...through interaction participants discover and reflexively create the sense and significance of the installation and its various components, their playful actions and activities giving a flavour or character to the piece and the surrounding artefacts.” (p. 28)

These activities expand the boundaries of audience engagement in the unfolding of the work and the correlated process of sense-making, thus promoting new participatory roles and practices.

The participatory works in this paper challenge us to consider these new roles and practices through the innovative use of interaction methods and techniques ranging from image processing to motion tracking systems, often originally combined with novel and configurable architectures in the physical space.

2.3 Performance

Recently, several researchers have applied different performative or theatrical metaphors in describing the emergence of novel interaction formats and experiences that are related to interactive installations.

Dalsgaard and Koefoed Hansen [11] observe how the user is simultaneously operator, performer, and spectator. A central facet of the “aesthetics of interaction” is rooted in, as they put it, the user's experience of herself “performing her perception.” They argue that this three-in-one situation is always shaping the user's understanding and perception of the interaction, and they address the notion of the performative spectator and the spectating performer. The concept of Spect-actor is also rooted in theatrical practice. Boal has developed *Theatre of the Oppressed* tailored to situations of political or social oppression. The techniques proposed by Boal are aimed among other things at turning the audience from passive to active participant hence the concept of spect-actors [1].

Reeves et al. [12] present a taxonomy with four broad design strategies for the performer's manipulations of an interface and their resulting effects on spectators: the “secretive”, wherein manipulations and effects are largely hidden; the “expressive,” in which they tend to be revealed, enabling the spectator to fully appreciate the performer's interaction; the “magical”, where effects are revealed but the manipulations that caused them are hidden; and, finally, the “suspenseful”, wherein manipulations are apparent but effects are revealed only as the spectator takes his or her turn.

Benford et al. [13] extend the above framework for designing spectator interfaces with the concept of performance frames, enabling one to distinguish audience from bystanders. They conclude that ambiguity to blur the frame can be a powerful design tactic, empowering players to willingly suspend their disbelief.

Also central to the discussion is the framework of *Interaction as Performance* [9][14]. This framework is based on anthropological studies of performance that have roots in a pragmatic view of experience. The framework proposes a variety of principles that characterize performative interactions. One of the principle is that of accomplishment and intervention. Already the etymology of the term “performance” shows that it does not have the structuralist implication of manifesting form but, rather, a

processual sense of bringing to completion or accomplishing. The concept of event and processual character is also key: performances are not generally amorphous or open-ended; they have diachronic structure, a beginning, a sequence of overlapping but isolable phases, and an end. Expression and experience is another element of import. According to pragmatist views, an experience is never completed until it is expressed. Also, in an experience there is a structural relationship between doing and undergoing.

These novel frameworks originate from concurrent trends in HCI, including the emergence of installations as a delivery platform for interactive experiences [28] [26]. Installations as also tangible interfaces have the property of providing a stage on which the user becomes at times a performer. Other trends include attention to the fact that performers in general have more and more technology to mediate their interaction with spectators.

3 CASES OF PARTICIPATIVE INSTALLATIONS

The works selected for this paper from altogether 14 interactive installations span a wide range of artistic practices, interaction techniques, and production methods to address the issues related to the paper theme. They were chosen to highlight different strategies of technology use and instances of participation. Our method of analysis as curators and as artists of the works is grounded in several open sessions and discussions, ethnographic participant observation of how visitors interacted with the artwork, as well the direct experience of setting up the work that exposed to us the working of the technology.

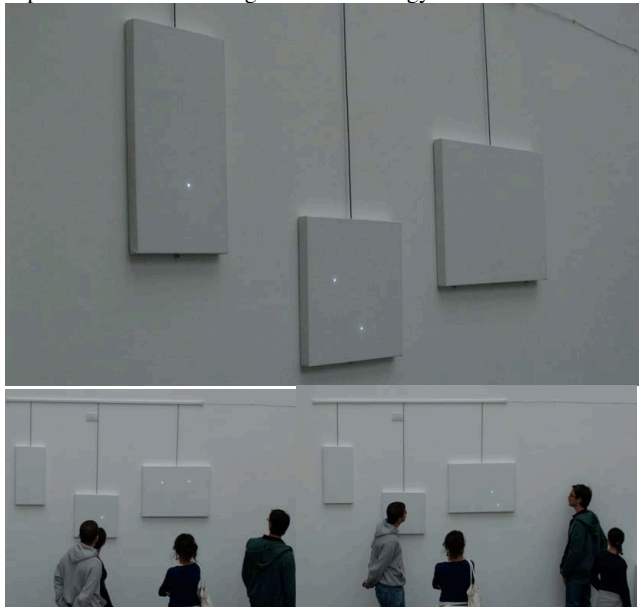


Figure 1. Still Life II spectators interact with the Canvases generating light-spots

3.1 Still Life II, Stijn Ossevoort

Most paintings (either figurative or non-figurative) are restricted to represent a certain moment or sequence in time of the artists' interpretation on the canvas. *Still Life II* is a series of paintings, which will take a very different approach: the piece conveys a reality behind the canvas that can be manipulated by the spectators. This changes the traditional role of the artist and spectator dramatically: in this installation the artist creates an artificial reality, which includes a pre-defined set of behaviors open to be manipulated by the spectators and the environment.

Still Life is a response to both visible and non-visible space. It contains three blank canvasses, which respond to external stimuli. As a spectator walks past, lights appear from behind the canvasses which follow the spectators movements; in addition if you are using a mobile phone the lights start to pulsate indicating the perceived change in the electromagnetic spectrum. This way the pieces react to both visible and invisible stimuli generating a light movement, which is continued from one to the next canvas.

The installation contains not only movement sensors but can also be aware of sound and gusts of air, such as spectators blowing against the pieces. This enables spectators to become a true spect-actors and co-authors of the installation.

3.2 One's Walk, Experientiae-Electricae, Natacha Roussel



Figure 2. The One's Walk on display and while walking with a participant.

One's Walk is an environmental garment; modifying our relationship to our urban environment. It lets us create a personal sonic cocoon that displays our own rhythm. The wearer uses this sonic surrounding to dissociate him/herself from the outside urban world. It integrates seamless technology; the suit is washable and still fully sensitive. Our artistic interest in creating technically enhanced garments is to explore new sensitive links using clothing, our second skin. By this the artist addresses poetically the user and refer him/her meditatively back to him/herself. This goal differs from research aiming at technically enhance the body with a variety of controls, sensors or medication *One's walk*, our first prototype, rehabilitates walking as source of inspiration and introspection in a urban context. It transforms the sound of our legs passing one another in a electronic rhythm. By replacing the sounds of the city by our own corporal rhythm *One's walk* erases the distractions of the urban environment while keeping its context; it is a support for the *Urban Flâneur* that can be activated upon request.

Experientiae electricae is a group of artist and designer and programmer working on various physical, interactive supports. The artist integrates technology based on rudimentary electrical principles and leading to multimedia works. Our realisations tend to maximise the potential of the interactive relationship between the user and the piece or between a group of users by focusing on the specific link between the interface and the content, often using a minimalist multimedia feedback. This concern led us to manipulate sculptural haptic installation low resolution modulable displays and the closest to our body: clothing. Clothes are an excellent source for daily interaction directly connected to our body as a second skin. Clothes have been modifying our posture and gesture through history, from high heels to corsets or Padaung women [21]. Miniaturisation of technologies allows implementation in every aspects of our life. After the proliferation

of portability, the migration of interaction towards the body seems possible. Research questions posed are: does this form of interactivity modify our relation to our body do the physical qualities of those elements transform our movements, our rhythm and the perception of our immediate environment to what could be an "augmented physicality" - an augmented sensing of our body? When integrated with our physicality the interface can become a source of content in itself. For *Experientiae Electricae* this is a source of inspiration for the production of interactive art pieces.

One's Walk deals with this idea of an interactive body producing its own content. *One's Walk* prototype is fully made of fabric and conductive yarns, all conductive materials are blended with fibers, some taken from traditional materials, such as silver organza made for centuries in India. The choice of those materials follows principles developed by Joanna Berzowska [22] that she calls *soft technologies*. Soft technologies allow the integration to the fabric of versatile captation zones while response occurs through sound light or color. The sensitive parts are made out from those same fibers, weaved and sewn in ways that lets them become sensing parts. For *One's Walk*, the only solid part, the electronic control is embedded in the collar and can be taken out for washing.

The artist chose not to emphasise technology as a visual identity of this project. This choice was made, in order to preserve the intimacy of the wearer. The outfit is neither an expression of identity nor an adhesion to any techno style; everything happens discretely inside. Following the same idea, preference has gone to natural materials such as wool, for it's feeling and intimate contact. The aesthetics focuses more on comfort for everyday use while conforming to city style and the possibility of being worn in a variety of contexts from going to the office to walking to a private appointment in a coffee place or at a regular event.

The user in this was defined as an outsider utopian urban human of any age surrounded by the urban noise with a rich interior life. User needs are defined as isolation meditation and daydream as well as a need for noise an urban stimulation. *One's walk* has been conceived as an art piece but it refers directly to reality as a dreamed extension of our world. We talk about walking on two feet, this rhythm that rocks us since before we were born this human characteristic fulfilling our daily life.

Several artists have conceived body extensions for the walk. In the series of his prototypes for functioning objects Fabrice Hybert has conceived two tools for the pedestrian, one being a crutch with a mirror at the bottom that lets you see what you shouldn't but also centers you on the floor you are stepping on.

Our work also evoked a rich philosophical and artistic background. Walking has always been addressed as a source of inspiration concentration and meditation; Aristotle professed and conversed walking, while in the 18th century Rousseau talks about strolling as his source of inspiration, and Kierkegaard describes walking as a therapy as well as essential philosophic tool; Nietzsche conceived Zarathoustra while walking. But as the 19th century artists promoted the walk as 'wandern', contemporary artists like Beckett or Richard Long prefer to deal with a more structured walk: Richard Long Walking a line in Peru, Bruce Nauman's Angle Walk, Samuel Beckett Arena Quad I-II And finally, many contemporary performers propose to discover step by step a urban path that the pedestrian appropriates while he invents it and which function is to produce a travel like sensation at the heart of the city. *One's walk* is at the crossroad of those two concerns while it intervenes on our relation to the city it also uses the rhythmic structure of the walk as a support for content.

One's walk is at the plays of a variety of disciplines as most of *Experientiae Electricae's* projects, it integrate concerns from art

interactivity and design. The artist chose to develop this project within the art scene where the next question is how to show it as an art piece. The current development of *One's walk* is guided by the implications that come out when developing an interaction with the public in exhibition contexts. What happens when you ask people to try out a garment does it become a costume? On another point of view it could be seen as a uniform. Does the user become part of a group? And in this case the path's rhythm has other connotation, does it becomes an anti-march where each user develops his own path along his parcours. The pieces in use at the same time can be amplified and diffused at distance within an exhibition; then each user becomes a part of a collective sound piece, that can be archived as a sonic parcours.

3.3 Time Translations, Nell Breyer

This installation places cameras next to "human traffic" to capture movements of passers-by. The live video footage is processed and juxtaposed with pedestrian movement recorded seconds, minutes or days before, and finally projected back next to the flow of human traffic. *Time Translations* is an interactive video installation originally designed for the World Financial Center's Southern Pedestrian Bridge in New York, beside Ground Zero. The installation was commissioned and produced by the World Financial Center Arts & Events and ran continually from May through October of 2005. The work uses multiple cameras and computers to stream pedestrian movements to video projectors and plasma monitors spanning two portions of a 200+ foot long bridge. The resulting real time visualizations capture specific patterns of the daily urban commute through the World Financial Center (WFC). The artwork experiments with folding live motion into architectural surroundings - drawing a kinetic history for a unique site.



Figure 3. Time translations installed first in the foyer next to a passage left. Then right on top of the main reception in the museum.

3.4 THE SINE WAVE ORCHESTRA

The Sine Wave Orchestra [23] (Furudate Ken, Jo Kazuhiro, Ishida Daisuke, Noguchi Mizuki) is a participatory sound project by crowds of visitors. Each participant plays a sine wave with a device equipped with an individual speaker creating a collective sound performance in a public open space. Participants may bring any kinds of device that can produce a sine wave, such as laptop PCs, synthesizers, analog oscillators, loudspeaker equipped iPods, PDAs or mobile phones. The volume of a sine wave should be the same grade as people's voice. The frequency of a sine wave has no limitation. Those devices must work with battery.



Figure 4. The installation was performed preparing devices that could produce a sine wave for those who do not have these kinds of device. The number of the devices that was prepared was about 50.

3.5 Reaction Machine, Jonas Hansen and Klaas Jan Mollema

In the installation *Reaction Machine* by Jonas Hansen and Klaas Jan Mollema visitors see themselves looking at another person on a television screen, they are able to record a video of themselves by turning a handle. The video is mirrored and used for subsequent visitors. In the *Reaction Machine* different kinds of technologies are combined in one object, a television screen is combined with a old rusty gear wheel and a handle, all together connected to a computer with a web cam, microphone and speakers. The object looks unfamiliar, but the interface is clear: a chair in front of it to sit, a television screen to watch and a handle to turn. When a curious visitor sits down and starts to explore the use of the machine, s/he will discover that the machine is not about the wired use of its technologies. It's about people that are using it and all used technologies and materials are only there to enable this interaction. So when a visitor sits down, s/he will see him/herself and somebody else looking at each other on the television screen. His/her head is filmed live by a web cam and combined with a recording of somebody else. As soon as s/he starts to turn the handle the video recording of the other person starts to be plaid. After watching the video the visitor is asked to record him/herself. If s/he now keeps turning the wheel, s/he will be recorded. In the end of his recording his/her movie will be mirrored and the next visitor can watch and react on his recording.

In the installation, participation means to create an open system, that a user can easily discover and learn, in order to express him/herself playfully and interact with others. In this way the installation promotes interaction to the fearless confrontation and contact with strangers and create a reflective view on one self, others and technology.

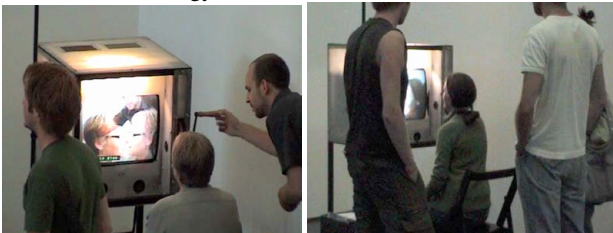


Figure 5. Reaction Machine in use attracting several participants.

3.6 Frequent Traveller, Susanne Schuricht

Frequent traveller (sushu.de/free) is an interactive installation by the Berlin based artist Susanne Schuricht. The interface consists of a hammock, whose movement is tracked by a custom-made hardware interface. While relaxing in the hammock, you animate

text on a projection sail by your motion. The dynamics of these visuals depend on the motion of the hammock. The texts are about mobility, home and identity. This project was developed in collaboration with Tobias Schmidt as programmer.

In the exhibition as a particular participative feature the artist also collected text from the visitors thereby enriching the content of the installation with local content.

The content consists of statements from people from all over the world about mobility, home and identity and is intended to raise global awareness to a certain extent. The animated text is prewritten, not dynamically generated nor pulled from the web nor pushed from a content-provider. The text passages are contemplations by the artist and excerpts from collected interviews and conversations with the audience of this travelling installation. Thus the content is permanently updated.

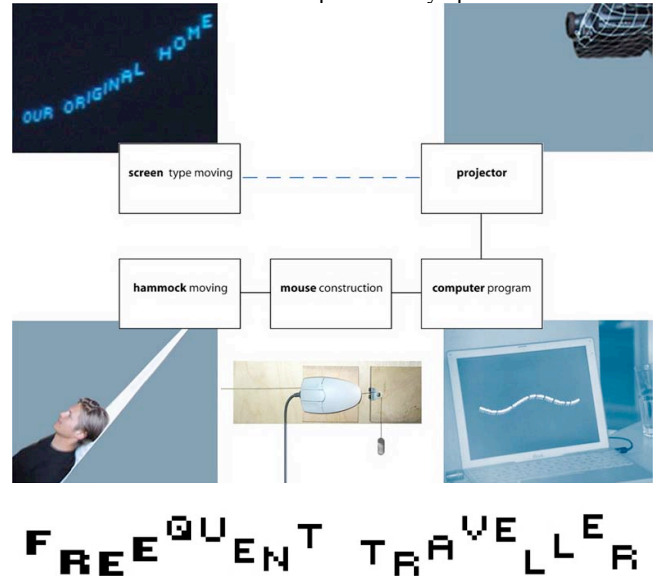


Figure 6. Frequent Traveller diagram and example text.

The hammock has been chosen purposeful as it creates a situation of peace and contemplation, though one is passive and active at the same time. Analogous to the pendulum like movements of the hammock itself, the animations are based on sine waves. The movements of the hammock control amplitude, frequency and density. The hardware components are simple. No bitmap-tracking, just plain mechanics. The visibility of this simplicity is part of the aesthetics of the installation. The piece does not conceal its interface but reveals it as part of its appearance; its transparency often creates a surprising effect of becoming aware of the own action in relation to the construction. In *Frequent Traveller* bodily motion and technology, the analogue and the digital coalesce.

Frequent Traveller is explorative, sensuous and playful. Its use is intuitive. Interactions are continuous and not in discreet steps; it is unencumbered, poetic, involving, engaging, has cognitive (visual/texty) as well as sensuous (feely) qualities.

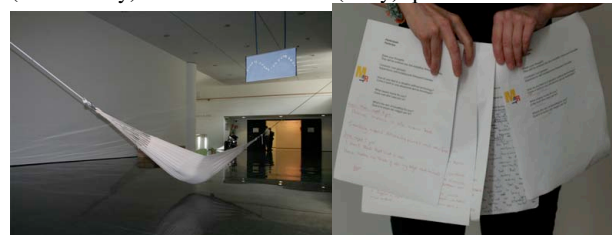


Figure 7. Frequent Traveller, left in action, right the artists shows a selection of filled papers with the visitors text that was added in the content of the installation during the exhibition .

3.7 Pegaso³, Gruppo Làbun

Gruppo Làbun, Italian collective (at the time of the creation of this work it was made up of Vincenzo D'Angelo, Stefano Fumagalli and Alessandro Perini) interested in research in the field of electronic and contemporary music, especially in establishing relationships between music and other artistic disciplines. *Pegaso³* is an interactive multimedia installation by Gruppo Làbun, based on the sculpture *Pegaso* by Paolo Minoli. The installation makes use of sound and colored lights in order to define an artificial environment that can be modified by visitors using gestures. As a matter of fact, people can navigate the boundaries between space and light and sound simply by interacting with three *theremins* (i. e. antennas used as musical instruments, invented in the beginning of the 20th century). The environment defined by users' interaction surrounds both the audience and the sculpture, with coherent reference to Minoli's idea about the interaction of sculptural works with the landscape, expanding the potentials of this relationship.



Figure 8. Pegaso 3 attracts participants that animate the space collectively using gestures and creating an audiovisual aura to the sculpture.

Pegaso3 narrows the boundary between two different approaches to chromatic research: the first concerns variations of black/white/grey light, typical of Minoli's sculpture; the second involves the phases of primary color combination, typical of his pictorial works. Indeed, *Pegaso* mirrors the paradigm of a sculpture that establishes relationships with the landscape: the light stream of the environment interacts with its reflecting surfaces, generating different grey tones [1]. The *Pegaso3* installation overcomes the limits of a natural and static landscape while favoring a new, dynamic, abstract and artificial landscape reconstructed by the visitors. What are the boundaries of this new landscape? On the one hand, the absence of interaction results in half-light and silence. On the other hand, the simultaneous and protracted interaction through the three terminals corresponds to a continuous accumulation and intensification of light and sounds, making possible an ideal approach to the concept of "white".

White means both white light and white noise, the sum of all the possible frequencies (both acoustic and visual). But it also means unlimited-infinite (the number of frequencies of the light and sound continuum) sealed in a finite limit, the limit of our perception. *Pegaso3* can be thought of as a route that develops within the limits of a tridimensional space, the axes of which are the three basic colors, and allowing combinations between the segmentations of the chromatic and the sonic continua,

3.8 E-Sparks

This installation creates an environment where apparently living artificial beings develops behavior and absorbs language from the people visiting the installation and try to dialog with them. In the installation, three-dimensional "digital creatures" move inside a "real-virtual hybrid world" projected on a wall screen. In front of the screen, the visitors can interact through gestures and voice. The creatures, modeled as a real existing specie of plankton, appear as three-dimensional shapes pulsating and fluctuating with movements similar to the real plankton, animated by social behavior visually similar to swarm formations.



Figure 9. Visitors interacting with E-sparks virtual beings

The basic idea of *E-Sparks* is the creation of a environment where unidentified artificial entities develop behavior and absorb language from the people visiting the installation. The focus is a sort of participatory play of the visitors to interact with an intelligent environment characterized by a degree of autonomy and ability to share symbols with the human contacts. In this sense *E-Sparks* explores communication between the human being and the alien. The contact is revisited at the first step to assume common symbols, to qualify behaviors, to recognize part of ourselves in the alien. Our underlying goal is to solicit of visitors a dramatic question: who am I interacting with - artificial creatures, people or myself ?

In front of the screen, the visitors can interact through gestures and voice (Figure 9). The creatures are equipped with an artificial brain and sensors that make them able to see and listen to the visitors. The "eye" is attached to a video camera looking at the shadow of the visitors on the screen and the "ear" is attached to a microphone into which the visitor can speak. The "brain", built using memory and neural networks, allows process visual and sound information, control the movements, learn words spoken by the visitors, and produce vocalizations. The entities can learn two basic ways of interaction. The first kind is to follow the visitor's shadow projected on the screen. At the beginning the creatures have no idea how to manage the data from the sensors, but after a while they realize that it is convenient to move towards the visitors in order to gain energy. The learning process is based over

a behavior partial emulation: the creatures with lower energy try to partially emulate the behavior of the best creatures.

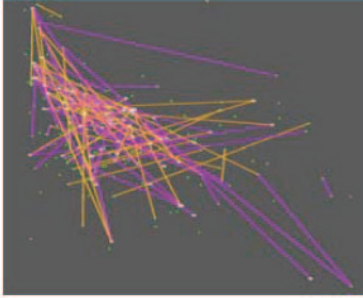


Figure 10. The language network

The other way of interaction is realized through spoken sentences exchanged between creatures and humans. The creatures are able to self-organize a sort of free association of semantic units. After a voice stimulus, the creatures try to recognize the sentence searching for eventual semantic associations with the already memorized units. The semantic language network (Figure 10) is progressively reconstructed through a statistically reinforced procedure based on the answers the visitors. The answer is a mosaic of sentences learned from other previous visitors.

4 DISCUSSION AND CONCLUSION

4.1 Technology Tools

The works in the exhibition touch diverse aspects relevant to participative and interaction technologies. We highlight a few important issues.

Language technologies are applied to sense and process visitors' speech and support a more natural interaction (for example with novel forms of artificial life) (*E-Sparks*). Sensors, motion tracking systems, haptic interfaces, and RFID tags enhance visitors' interaction with both the public and the social space (e.g. *Pegasus3*, *One's Walk*).

Novel architectures create immersive and configurable spaces. Video feeds are used to mirror and shape visitors' perception and experience of the world, by bridging visible and invisible, private and public, local and remote, past and present (*Time Translations*, *Reaction Machine*).

Image processing and display is used to filter and interpret visitors' views and perspectives (*Time Translations*). Internet technologies are used to connect and support collective practices. Finally, natural phenomena, forms and materials (from electromagnetic waves to liquids) are used to drive the interaction process (*Still Life II*). Some of the works could fit in several of the areas we have identified.

4.2 Participative strategies

4.2.1 Enabling Authorship

Several of the works incorporate participatory processes to enable novel forms of authorship (from collective to hybrid to collaborative). In *E-Sparks* the dialogue of the entities are based on utterances captured by previous spectators. *E-Sparks* experiments with mixtures of 'reality' – abstract/real, physical/projected – asking how do these affect the participant thing experience. A collaborative authorship can be found in the *Reaction Machine*. People can record them self, while being juxtaposed with a video feed of a recording of a previous visitor.

The created material reminds one of a sequential narrative [24]. This derives from the fact that the visual elements of each participant are temporally connected and influencing each other. The participant him/herself can however experience a causal or dramatic relationship with the imagery of the previous participant as well. The materials appear as a shared diary with previous and current participants sharing their imageries. The imageries are temporally connected, but the participant does not have access to the whole history of the diary, only to previous imagery. Co-authorship [27][9] is also supported in *Frequent Traveller* where visitors can add text to the installation. A common strand here is the question: does the artwork allow participants identify and 'project' themselves into a space or scene, to create a proposition?

4.2.2 Affording Connectivity

Another group of works focuses on the sense of connectivity afforded by interactive technologies. Gruppo Låbun's *Pegaso3*, based on the sculpture "Pegaso" by Paolo Minoli, is an installation that makes use of sounds and colored lights to create an artificial environment that can be collaboratively modified by visitors' gestures.

4.2.3 Interacting with Artificial Beings

Works in this group create environments where visitors can interact with artificial creatures and pseudo-life forms at various levels. Mauro Annunziato's and Piero Pierucci's *Esparks* creates an environment where living artificial beings develop language and behavior by interacting with the installation visitors that try to dialog with them. Answers of the entities are generally incoherent, especially during the first phases of the evolution, but after some days of interaction, due to the learning features, the ability of the creatures to give inherent answers increases, and the play is still more stimulating for attending audience. The play is unconsciously driven by the visitor, which uses often irony and personification of the digital creatures.

4.2.4 Reinterpreting the Visitor World

These works use live video footage as a means to mirror, reinterpret, and shape the visitors' relationship with both the private and the public space. In Jonas Hansen's and Klaas Jan Mollema's *Reaction Machine*, visitors see themselves looking at another person on a television screen. By recording a video of themselves, the act of looking is mirrored ad infinitum for subsequent visitors. Nell Breyer's *Time Translations* uses cameras to capture movements of passers-by in public spaces and visualize the choreography of daily activities. The live video footage is processed and juxtaposed with the pedestrian movement recorded seconds, minutes or days before, and finally projected back in the public space as an ephemeral drawing.

4.2.5 Engaging in Performative Acts

Other works place a special focus on engaging the visitors in collective performances and social processes [26][6]. THE SINE WAVE ORCHESTRA is a participatory sound project for large audiences. Equipped with a mobile device and an individual speaker, participants can play a sine wave and thus create a collective sound performance in the public space.

4.2.6 Use of space

From analyzing the artworks we also learn about how to strategically play with the different elements that strengthen the performative and participative aspects of an installation. The artworks make deliberate *use of space*, leading to question such as: which configurations of multiple participants do the space and the position of the artwork within it allow and how are these

appropriated by participants; how does this influence their relationship to each other and to the artwork? These are questions that are in particular addressed by *Pegasus3*, in which visitors co-create light sculptures thereby explore the sculptural qualities of space.

4.2.7 Playing with materiality

We can also see how mixtures of material and immaterial affect the participant experience, asking ourselves: how do the different material features of an interactive artwork invite engagement and dialogue and what is the specific effect of particular affordances; how do tangible interactions, gesture, and gaze 'cooperate' in shaping body-world relationships? The first is a dominant theme in *One's Walk*, where garment is used to alter the bodily experience of walking; the second aspect has been taken up in the *Reaction Machine*.

4.3 Epilogue

Technology in these works is not just facilitating participation but a key feature in creating engagement [28]. Overall, it seems to be augmenting our sensory experience by tapping into not just our sensations and perceptions but our knowledge and understanding of how the world works as well. The tools bring in our conscious understanding into an otherwise purely experiential situation. Also a number of technologies that are used in daily life (cameras, tags, motion and other sensors) are here used in artworks to bring us out of the mind set that we just "do" in a daily, unthinking way, and bring us into the mind set that we "do, observe, think about and re-do" in a non-daily context, reflecting on our daily actions through this re-performance. Additional themes span across these areas, questioning artist's and visitor's roles and expanding the boundaries between real and virtual, artificial and natural, action and representation, performance and outcome, interface and content. The exhibited works, with their the correlated themes and inquiries, constitute creative laboratories to explore new participatory roles and new forms of engagement that can inform and enliven our understanding of participatory design and the critical role technology can play in support of participative practices.

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