CELEBRA

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Abstract

In this paper we present *Celebra*, a massive, site-specific, interactive installation comprising two hundred balloons, LEDs, custom electronics, and custom software. The artwork allows for different interaction modes: visitors can interact with the piece locally via sound and movements, and remotely via smartphone apps and a dedicated website. The piece can also become an audio-visual performance instrument, allowing its users both direct and high-level control. We will discuss the motivation behind *Celebra*, its implementation, and technical details.

Keywords

new media art, interactive art, balloon, LED, media appropriation, remote interaction

Introduction

In this paper we present *Celebra*, a massive, interactive, site-specific and remote installation and performance tool. *Celebra* comprises a suspended network of two hundred balloons. The balloons have a diameter of one-meter and are lit from the inside by LEDs. The installation presents an organic aesthetic that combines the grunginess and DIY style of the underlying electronics with an elaborate visual output and interaction scheme.

Our work, in *Celebra*, is framed within three main axes: media appropriation, explicitness of interaction, and the geographical and socio-political contexts of the piece.

1) Media appropriation: technology has always played a defining role in art [1], but in *new media art* it is possible to identify a different relationship with technology which arises from its appropriation. In this case, technology becomes a raw medium of artistic expression. This appropriation effectively expands the artistic possibilities, allowing for the search for new solutions, and for the incorporation of technology production to art practice.

2) The explicitness of interaction: Marcel Duchamp once wrote: "The creative act is not performed by the artist alone; the spectator brings the work in contact with the external world by deciphering and interpreting its inner qualifications and thus adds his contribution to the creative act." [2]

Fig. 1. *Celebra* as installed at EAC, Montevideo, Uruguay. Photo © 2011 Guillermo Berta),

We can state that all art is interactive; however, this should not hide the fact that 'explicitly' interactive artworks, ones that actively react to human input, conform to a distinct genre of art production. With an explicitly interactive work, the aesthetic characteristics of the interaction become a relevant part of the work's proposal.

As American computer artist Myron Krueger said [3], *"I have been trying to raise interactivity to the level of an art form as opposed to making art work that happened to be interactive."* In *Celebra*, the different modes and the discovery of the work's possibilities by the audience are integral components of the artwork.

3) The geographical and socio-political contexts: In Uruguayan engineer Eladio Dieste's words [4], "Each problem [...] should be faced with a sort of ingenuity, [...] with an attitude humble and vigilant. It should be thought again, with the basic body of knowledge that is now the heritage of all men." From our perspective, Dieste's assertion implies a radical change of attitude towards art and technology production. Media appropriation permits the creation of art which both reflects its context, and also reflects *on* its context.

Prior, related work does exist; lanterns have been used for almost three thousand years, while artificially illuminated balloons can be traced back to the Chinese Kongming lanterns (sky lanterns) from

Fig. 2. Detail of *Celebra* as installed at ISEA in 2013. Photo © 2013 Tatjana Kudinova)

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around 200 AD.
In addition, LED-lit balloons have been used in a number of artworks, perhaps the most wellknown being *Open Burble*, created by Haque et al. for the Singapore Biennale in 2006 [6]. There are also a number of commercially produced LED-lit balloons for sale, together with many tutorials on how to assemble your own.

Celebra

Celebra consists of a network of two hundred balloons, each one metre in diameter, lit by LEDs, cables, LED-controlling boards, computer power sources, computers and software.

According to the definition suggested in the previous section, *Celebra* is both implicitly and explicitly interactive, and any analysis of its artistic proposal must consider this. Its aesthetic characteristics unfold over two dimensions: its physical appearance and its behaviour.

Grunginess and explicitness

Celebra embraces two aesthetics that are frequently seen as contradictory: on one hand, much effort has been put into the design and construction of its very refined control interfaces, interaction schemes, and visual output; on the other, it embraces a rough aspect that arises from its components and their interconnection, and lends it the *grunge* appearance of many DIY projects.

All the physical, functional components of *Celebra* are visible, and spectators can trace the flow of data from the computers to the balloons, following the cables and seeing how the controllers group sets of balloons. When necessary, the circuit boards are covered with transparent protection (made out of recycled plastic bottles), maintaining the visibility of all parts.

The inclusion of technology in the aesthetic proposal is intentional, and this intentionality is based on two aspects: first, in the traditional style of the 'readymade', by recontextualizing the object its aesthetic qualities are reclaimed; second, and more important, these objects are functional components created by the artists. By incorporating them into the piece, technological production is inscribed into the art production; *Celebra* attempts to re-state that technology creation is part of the new media art discourse.

The piece does not only involve a substantial amount of original technology, but also exposes it and makes it immediately perceivable, in an overt attempt to reaffirm that it is not only pertinent, but intrinsic, to the aesthetic proposal.

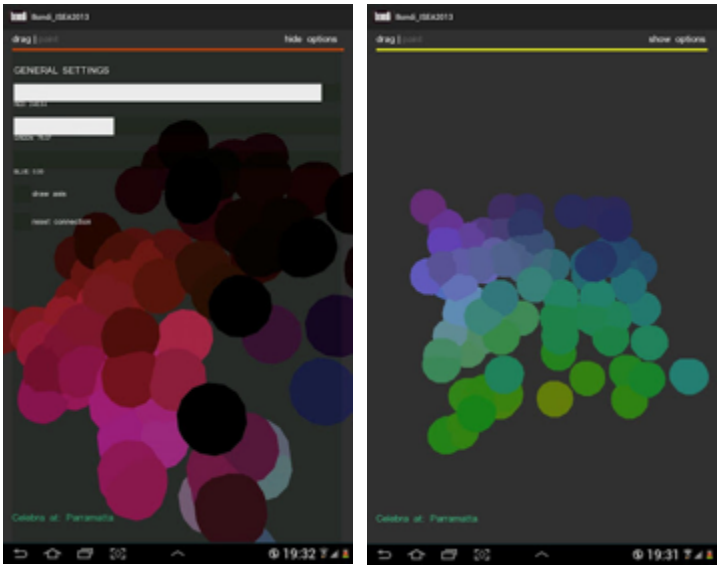


Fig. 3. Smartphone application screenshots

Media appropriation occurs not only in the expansion of the functional spectrum, but also at a pure aesthetic level: by showing these functional components, the appropriation becomes evident.

Celebra's elaborated visual behaviour somewhat collides with the aforementioned 'grunginess' of the installation, creating a tension that is left for the public to resolve, and which becomes central to the artistic proposal.

Interaction and explicitness

As mentioned in the introduction, *Celebra*, like all artworks, is implicitly interactive: its audience can walk into the network of balloons, touching, moving and perceiving them.

However, the piece is also explicitly interactive, admitting several forms of interaction. As a stand-alone installation, it reacts to participants (both present and remote), and to ambient sound or music.

These two interaction modes are both local: some balloons react to stimuli close to them; and global: the behaviour of the installation as a whole is also reactive.

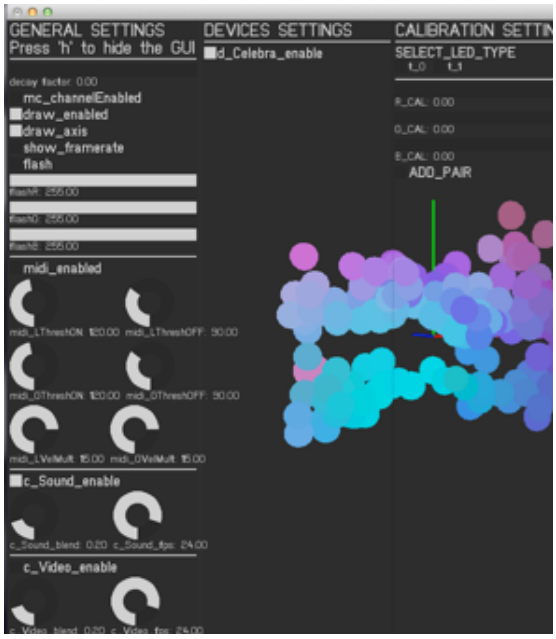
The local interaction channels are aural and visual. We use depth cameras and microphones distributed throughout the installation, and each sensor's data affects only the balloons in its surroundings.

In addition to this local response, the whole installation reacts to ambient sound, creating different visual styles or 'moods'.

The piece also allows for remote interaction via both web and smartphone apps (for Apple's iOS and Google's Android) that reproduce in real-time the light patterns of the piece, and allow users to interact with it. Currently, the only interaction implemented allows ®s to 'paint' the balloons using a colour palette, but other interaction schemes may be added for any particular installation of *Celebra*.

Facilitating remote interaction uncouples the experiencing of the artwork from its physical immediacy; by reaching beyond the geographical borders of the installation, we propose to reflect on modes of artistic consumption, and on the role that participants play in the completion of an artwork.

Simultaneous interaction with an artwork by two or more individuals transforms it into a form of interpersonal communication tool. Exhibition spaces exist not only to facilitate art consump-



tion, but also to favour art-mediated human interaction; allowing remote interaction extends and interpellates these spaces and their relation to art production.

This interweaving of local and remote control also adds an interesting element of playful uncertainty, as participants perhaps wonder how the installation is

Fig. 4. Screenshot of the server

controlled, why certain patterns are appearing, and how many people are interacting (locally or remotely) with the work. The work's responses to their movements and sounds can be perceived not only by those interacting locally with the work, but also by remote participants; thus, again, the reach of *Celebra* extends beyond its immediate perception.

Celebra as instrument

Celebra also functions as a multi user visual instrument, supporting an arbitrary number of concurrent performers.

One performer controls the server (the central computer that handles most of the computing requirements), which blends the input from an arbitrary number of clients (devices, computers, or pieces of software that connect to the server).

Celebra's architecture allows for different configuration involving many clients, computers, and devices. These clients can be operated by one or more simultaneous performers, sharing the physical space or performing remotely.

The clients are stand-alone pieces of software that communicate with the server via the Internet (or a LAN). They all offer interaction via the computer's peripherals (keyboard and mouse), and accept MIDI input. Performers can choose their preferred MIDI controller and map it onto each client's parameters and controls.

Every client allows for real-time control of their parameters, triggering real-time responses from the server, and therefore, from the installation.

As of June 2013, the implemented clients are:

Video. Video (both live and pre-recorded) is mapped onto the balloon cloud, turning it into a low-res deconstructed screen. Each video client supports up to three simultaneous alpha-blended videos, selected from a large arbitrary video library. The client offers the performer some traditional tools of VJing, such as scratching, mixing, pausing, and controlling the reproduction speed.

Sound. A number of virtual illuminators orbit the installation and react to different frequencies. The performer can modify the number of illuminators in real-time, and how they react to the sounds.

Noise. The client maps Perlin noise onto the cloud. The performer can assign different noise generators to different global parameters.

Local sound. The balloons near a microphone react to the sound. Different patterns can be triggered, and different frequencies can be mapped onto different parameters.

Kinect. Each client tracks users' locations and their skeletons. This information is mapped onto different behaviours that can be changed in real-time. By default, users can trigger patterns by waving and shaking their hands. This client can also be used to allow one or more performers to manipulate global parameters using hand gestures and movements.

Direct control. The performer can change any set of balloons to a given colour, cause it to oscillate between several colours, assign pre-stored animations, and other simple behaviours.

Web and smartphone. These two clients implement remote interaction; they obtain commands from a queue managed by a web server. This server publishes a web application that performers can interact with, and listens to the commands sent by smartphone apps (see section four for more details).

Celebra allows for both direct control of the balloons' colours (via the 'direct control' and 'video' clients), and a higher-level control in which the performers affect the parameters of a more autonomous behaviour.

The two modes, interactive and performative, are not exclusive: local and remote spectators can experience the piece and interact with it while one or several performers play it. The piece creates a joint performance in which, again, the roles of performer and spectator are blurred and challenged.

Site specificity

Celebra was originally created under a commission by the Uruguayan Government as part of the celebrations of Uruguay's bicentenary. We chose to use two hundred balloons as a direct reference to the country's age.

The piece is conceived as a communication and connection tool. It brings together the participants, both local and remote, spectators and performers. The work's potential is highlighted and enhanced when the work is experienced by several persons at the same time; they collaborate with it both implicitly and explicitly, and the piece exists in this real-time collaboration.

In its first installation, within the bicentenary celebrations, *Celebra* was shown at *Espacio de Arte Contemporáneo*, a public museum in Montevideo, Uruguay, located in a converted prison. The piece was installed on the former prison's patio, and by installing this playful artwork, the space of the prison is again reclaimed, and a reflection on the country's recent history is proposed. By allowing interaction with the remote audience, the prison walls are perforated; the artwork is expanded, and transcends its physical immediacy.

Subsequent installations have allowed us to focus more on the relationship between work and the space where it is shown. As a blunt example, indoor and outdoor installations differ significantly: outdoors, for example, the wind becomes a feature of the experience.

In a parallel and consonant way with the electronic setup, *Celebra*'s structural solution is also explicit, and easy for its spectators to follow and understand. Its rooting into the physical space is evident, and becomes part of the work.

Technical details

Architecture

Celebra implements a client–server architecture, in which one computer – the server – controls the work's hardware by following the commands of several clients.

Each client runs at an independent speed (frame rate), and sends frames – that is, complete specifications of all the balloons' colours – to the server. The server, in turn, mixes all the inputs to determine the final balloon colour configuration.

The parameters that govern how the server mixes the different sources is controllable in real-time, and is one of the main parameters manipulated by performers.

The piece uses Macetech's Octobar boards as LED drivers, each controlling, by means of eight A6281 chips, eight RGB LED modules. Octobars can be daisy chained (power and data) and thus they can control a very high number of LEDs. The server and all the clients are constructed so that new instances of Celebra can involve an arbitrary number of

balloons.
Connected to the server is an mBed board, a multi-purpose programmable 32-bit micro-controller with a built-in Ethernet interface and an implementation of the UDP stack protocol. The mBed is a relatively cheap microcontroller using an ARM microprocessor. It has the unusual (and annoying) feature of having its development environment on the web.

We run our custom code on this device, which makes it behave as a standard DMX512-A controller, fully implementing the Art-Net protocol [5].

In *Celebra*, the mBed acts as an interface between the low-level light system and the interaction software, receiving Art-Net packets from the interaction software and translating them into TTL signalling, which is understood by the A6281 chips of the Octobar.

We use 3W RGB LED modules and standard PC power supplies that power the Octobars and mBed.

Software

As previously mentioned, Celebra implements a client-sever architecture. One central computer (the server) is fed by multiple clients that instruct the server on how to light the balloons. The server performs all the communication with *Celebra*'s hardware. At any given time, an arbitrary number of clients can be running. Clients can be added and removed as a function of the installation requirements.

The communication between clients and the server uses an ad hoc application network protocol over two communication channels: a TCP channel for control, and a UDP channel for transmitting frames to the server.

During the handshake, the server informs the new client on all aspects of the current installation (number of balloons, their three-dimensional locations and identification numbers, location of some sensors, UDP port and so on), and starts listening on a per-client UDP port. The protocol allows for binary and XML based communication, and the communication speed is negotiated and renegotiated in real-time by the server and its clients.

The server was developed using openFrameworks, an open source framework for creative computing.

Celebra implements different clients; some of them (sound; Kinect) were created using Java and Processing, while the video client was created using C++ (openFrameworks), and the web client using Java and Python.

Web and smartphone clients

To enable web interaction, two-way communication is needed between the server and the devices, as the server must send the smartphones the installation data and frame colouring information, while *Celebra* needs to receive commands sent by the devices.

In our setup, smartphones communicate with a web application using standard HTTP messaging, and obtain all the setup information (balloon positions, identification numbers and communication parameters). This web application is hosted on the cloud (using Amazon's services), and not at the installation site.

After obtaining the parameters of the data feed, the smartphone either starts listening for data on a specified UDP port (which works extremely fast, but has the disadvantage of not performing well on some Internet connections), or opens a WebSocket connection to a web server on the cloud.

This data stream is established on a per client basis, and is generated by *Celebra*'s server, which, in addition to feeding data to the actual hardware LED components, also uploads a single data stream containing the current frame colour information to a Stream Server hosted on the cloud.

The Stream Server, which has a high-speed uplink connection, replicates the single data stream into multiple point-to-point streams, one per connected smartphone. As all the data transmission is delegated to the Stream Server, this allows *Celebra* to use a standard ADSL Internet connection.

The smartphones also need to send data to the server. This consists of simple lightweight colouring commands, which are sent, using HTTP messaging, to another web server: the 'Command Server'. This Command Server is set up in the same LAN as the server, and exposes the message queue to the clients.

Finally, the two-way connection is completed by a standard *Celebra* client that translates commands from the message queue into coloured frames.

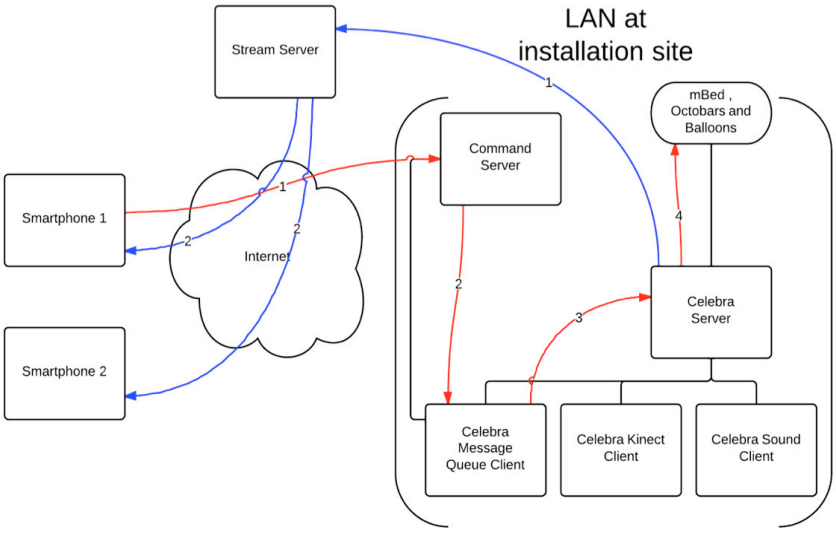


Fig. 5. Network scheme and data paths. In red: connections from the smartphones to the server. In blue: from the server to the smartphones.

Conclusions

With *Celebra*, we found a new solution to a previously tackled technical problem: using LEDs and balloons in a massive interactive installation. This could have amounted to little more than a technological anecdote or an engineering exercise; however, we conclude that it has become something much richer, an artwork in which the artists appropriate the work's medium to build a new relationship with technology. This allows a search for new aesthetics, and the proposition of new dialogues and new solutions. Site specificity, for example, becomes relevant not only in the layout of the work, but also in the lower level aspects, and also the purely technical decisions.

In this way, the artists are concerned not only with the general aesthetics, but with all components of the work.

Media appropriation offers a new sensation of freedom, a widening of the spectrum in the search for solutions, and new aesthetic and technological alternatives.

With *Celebra*, we found, this also had an impact on the appearance of the artwork: we decided that the functional

components (boards, cables, controllers, computers, switches, power sources) should collaborate in *Celebra*'s appearance, and assisting our claim that the underlying process of design and construction of the piece, and its context, are integral parts of the work.

Or, at least, we intended *Celebra* to suggest that there may be a reason behind its appearance. Even if it is obvious that there is an aesthetic reason behind the avoidance of a sterile refinement, we present the installation to suggest that there is also a narrative that we believe relevant.

Celebra is intended as both a dialogue with its environment, and a proposal for dialogue with its public, with other artists and with ourselves; a humble tool for discussion - one with lights, interaction, music and balloons.

Acknowledgements

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