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Design wearables for interactive art based on Brazilian tropicalism.

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Abstract

"Design wearable for interactive art based on Brazilian tropicalism" is a research about the development and use of intelligent clothes in the interactive art field especially in performing arts. This research consists of practical work that uses ideas of tropicalism as a base.

"Tropicalism" or "*Tropicália*" was an art movement that occurred in Brazil in the late 60's that has incorporated many different aspects of the global culture in order to shape the Brazilian culture. Its main essence was the mixing of cultures and expressions to create something new.

One of the structural concepts of this art movement was a plastic happening called Parangolé, an installation proposed by Hélio Oiticica, an artist flamed by the very spirit of his time and full of energy that led him to the anti-art concept breaking away from the traditional concept of art and establishing new relations between the artwork, the viewer and the environment.

Based on Hélio Oiticica's "*Parangolé*" I created a work called "*Parangonet 1.0: sonic dimension*". The work is a group of two wireless electronic wearable garments that refer to Oiticica's work and act as experimental interface to create and modify the surround sound landscape in a collaborative environment.

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1.Motivation and Overview

Everyday we choose what we are going to wear. These decisions are made at a conscious level and they try to reflect on how we feel or how we want to appear to people or, in other words, our feelings, wishes and emotions. Clothes are used to express something about the wearer.

As a Brazilian, I was always fascinated by the multiplicity of colours and patterns that is commonly found in Brazilian popular clothes and objects. Those characteristics are nothing more that the mixture of many cultural expressions, such as African and European for instance. And nowhere other than in a country with such characteristics could a movement as "*Tropicalia*" take place. This movement that began with the music and soon spread its concepts throughout other creative areas was responsible for a big and definitive change in the Brazilian art and culture. From that very moment people stopped seeking a pure Brazilian art and assumed what is our strongest characteristic: the mixture.

This vision was expressed also through clothes. Colourful patterns, extravagant modelling and exaggerated looks were the tools used to convey the idea that the assimilation of the different was what was needed.

In visual arts, Hélio Oticica took this idea to extreme levels. He created his "*Parangolés*" as a tool for the creation of new syntaxes based on colour and movement. This work had great influence in my personal production once the concepts it embraces became the basis for my work such as: interaction, construction of meanings and, most important, the connexion of art with the real world.

Today, with the use of electronics and other smart components, clothes have become intelligent. They start to respond to their environment and establish communication at many different levels.

This thesis attempts to look upon Tropicalism and its production with today´s eyes when technology is being used in a profound way. How could a tropicalist work be done today? How to address the basic tropicalist questions through wearable computing? Would it be possible to transpose its concepts to current days? These are the questions I address through my research.

This thesis provides a brief clarification of different concepts of interactivity with emphasis on performative art and wearable art. Also it provides a broad view on the Brazilian Tropicalist movement and its consequences in the field of visual arts. Several wearable art projects and research experiments exploring issues related to body and communication are presented and situated in the context of performance and tropicalism.

More specifically, the accomplishments of this thesis are:

- An analysis of different views regarding interactivity.
- The enumeration of specific design parameters and principles inherent to the field of wearable computing.
- A set of design and art experiments that explore body concepts and its relationships.
- The development of a practical artwork based on denoted axes/principles.

2.Theoretical Background

2.1 Tropicalism or Tropicália

Tropicalism or Tropicália[1] was a movement of rupture that shook Brazilian popular music and culture between 1967 and 1968. It emerged out of the "anthropophagic manifesto", a concept and/or movement based on Oswald de Andrade's theory of "*antropofagia*" or cannibalism, in which the defining purpose of Brazilian culture was recognized as being the ingestion of various foreign cultures.

The Tropicalist artists took a historic step forward in the Brazilian cultural scene, especially in music and visual arts. Brazilian music post-*Bossa Nova* and the definition of musical quality in the country were increasingly dominated by the traditional or nationalist positions of movements linked to the left. Against these trends, some artists from the state of Bahia and its collaborators aimed at universalizing the language of Brazilian Popular Music (MPB), incorporating elements from world youth culture, such as rock, psychedelia and the electric guitar. At the same time, they merged electricity with information from the erudite avant-garde by uniting the popular and pop with esthetic experimentalism. Tropicalist ideas came to be the driving force behind the modernization of not only music, but also the country's national culture.

In the realm of visual arts some artists such as Hélio Oiticica[2] and Lygia Clark[3] started to experiment the interaction between the artwork and the audience, inaugurating a new form of art more connected with daily life and away from the galleries and museums. I will talk more about this aspect of their work later in the text.

[1] Tropicália is the official name in Portuguese of the movement.
[2] Hélio Oiticica (1937 - 1980): Brazilian artist who coined the term tropicália. (see 2.1.6).
[3] Lygia Clark (1920 - 1988): Brazilian artist that along other artists founded the neo-concrete movement in Brazil. She also started experiments with the audience drawing them into a more active role inside the artistic experience.

Dialogs with literary works such as those of Oswald de Andrade and the Concretist[4] poets raised some Tropicalist musical compositions to the status of poetry. Their songs formed a critical and complex picture of the country – a conjunction of the archaic Brazil of traditions and the modern Brazil of mass culture, and even a futurist Brazil, with astronauts and flying saucers. They made the repertoire of Brazilian popular music more sophisticated incorporating in commercial records procedures and matters until then only associated with conceptual avant-garde.

With its irreverence, *Tropicália* transformed the reigning criteria of taste, not only in music and politics, but also in morality and behaviour, the body, sex and clothing. The hippie counterculture was assimilated with the adoption of long curly hair and stridently colourful clothing.

Tropicália, as Oiticica says, was the very first conscious, objective attempt to impose an obviously Brazilian image upon the current context of the avant-garde and national art manifestations in general. (OITICICA, 1984)

[4] Concretist was an avant-garde literary movement in Brazil that aimed at a new form of expression based on experimental principles. For them the visual graphic is much appreciated.

Figure 1: Cover album of Tropicália. The music album that officially started the movement. by Rubens Gerchman, 1968.

Figure 2: Dresses with colourful patterns for Cia Rodia Brasileira by Alceu Pena[5].[6]

2.2 Social and artistic background of Topicália

To understand how this movement originated, it is important to be aware of the political scenery Brazil was facing in the mid-60s. In 1964, Brazil found itself in the eye of the storm. The Cold War – between the United States and the Soviet Union superpowers – fanned the flames of conflict in Latin America and also in Brazil. In 1959, the Cuban Revolution had made Fidel Castro and Che Guevara international heroes and increased the capitalist bloc's pressure on countries in the Third World. (MARTINHO, 2006)

In Brazil, President João Goulart put forward a series of basic reforms to relieve both the serious problem of social disparity and the political pressures exerted by left-wing

[5] Alceu Pena (1915 - 1980): Brazilian fashion designer and illustrator. He worked with the tropicalists in fashion shows promoted by Cia Rhodia Brasileira.

[6] Source: http://www.fashionbubbles2.com

movements. Against these reforms – accused of being communist-inspired – a right-wing political movement was formed with part of the society preaching a conservative modernization. Backed by Congress and the middle and upper classes, this faction overcame by staging a military coup on March 31st. The army and its civilian allies deposed President Jango and handed over power to the military. The U.S. backed coup destroyed the yet fragile Brazilian democratic process. Concentration of income rose as a form of capitalist expansion. Castelo Branco became the first of a series of dictatorial president-generals. His substitute, Costa e Silva, governed the country from 1967 to 1969 with an ever-greater concentration of powers.

Culturally, the country was in turmoil. Up until 1968, intellectuals and left-wing movements could act freely having only slight problems with the censors. This intense production ranged from the plays of the Theater Oficina[7] to the Opinião and Arena groups; from protest songs to the *Jovem Guarda*[8] pop music and included the Cinema Novo[9] movies as well as the visual arts. Politics made its presence felt in all areas, keeping alight in the field of arts a polemic that placed experimentalism in opposition to engagement, participation to alienation.

After 1967, the antagonisms became more radical. In music, there was confrontation between nationalist artists and the avant-garde of Tropicalism. The latter were opposed to authoritarianism and social disparity while proposing an internationalization of culture and a new aesthetic expression, though, not limited to political discourse. For the Tropicalists, understanding mass culture was as important as understanding the revolutionary masses.

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[7] Founded in 1958 in São Paulo (Brazil) the Theater Oficina absorbed the international scenic experience. There, a play by Oswald de Andrade called "*O rei da vela*" was presented in 1957 and had great influence over Tropicalism. In this piece Oswald spoke about Brazil in an anthropophagic way, eating what Brazilian people had in its goodness and badness.

[8] *Jovem Guarda* was a movement in the late 60s that mixed music, behaviour and fashion. It appeared as a TV music show. On the contrary of other movements of the time the *Jovem Guarda* had no political content. The main artists were: Roberto Carlos, Erasmos Carlos and Wanderléia.

[9] Cinema Novo was a cinematic style practiced by Brazilian filmmakers in the 50s and 60s. Its main characteristics were, as with a low budget production cost, to present Brazil the way it was in its poverty and diversity and a thematic strongly connected with the underdevelopment status of those days Brazil. The motto was *"uma camera na mão e uma idéia na cabeça"* or, in English "a camera in hand and an idea on the mind" (free translation).

Still in the political area, 1968 was the year in which tensions reached a climax in the country. Industrial strikes and student demonstrations resulting in police repression intensified. Guerrillas in both cities and countryside increased their activity. Faced with growing opposition and pressured by the far right, Costa e Silva responded with more political repression. On December 13th, Institutional Act Nº 5 was decreed ending civil liberties and freedom of expression and legalizing arbitrariness. The decree stood until 1984 when João Figueiredo, last of the president generals, left office.

Figure 3: People protesting against the government in Brazil after the AI- 5. © Agência Estado.

Tropicalism was born in this extreme censored environment that ended up with the deportation to London in 1967 of its two main figures: Caetano Veloso and Gilberto Gil. However, its bases came from a bit earlier with the anthropophagic manifest by Oswald de Andrade and later with Cinema Novo and the Brazilian concrete poetry.

2.3 Antropofagia or how to eat cultures

Published in "Revista de Antropofagia" in 1928, the Anthropophagic Manifest proposed: feed on all of that that the foreigners bring to Brazil, suck all the ideas and pair with the Brazilian ones (Revista de Antropofagia, 1971). This cannibalism was their tool that provided a rich, vivid and authentic artistic production. The name of the manifest recovered an Indian belief: the anthropophagus Indians ate their enemies believing that by doing so they would assimilate their qualities. The idea of the manifest rose when Tarsila do Amaral, an outstanding brazilian painter at that time, presented her husband Oswald de Andrade with one of her pictures called Abaporu (aba = man; poru = who eats).

Figure 4: Abapuru (1928) oil on canvas 85 x 73cm by Tarsila Amaral.

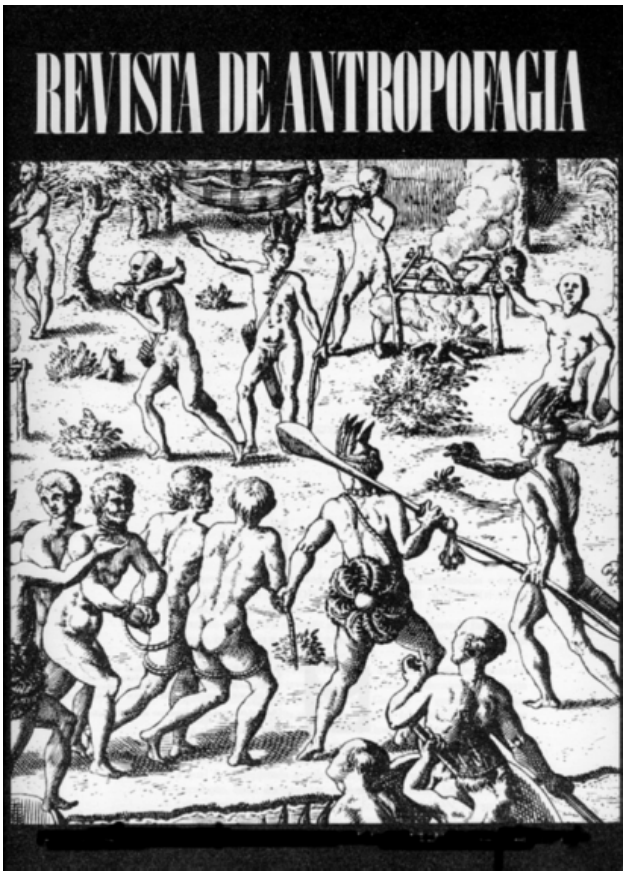

Figure 5: Facsimile of the cover of "Revista de Antropofagia". © Diário de São Paulo

Written by Oswald de Andrade with the help of Mário de Andrade and Raul Bopp, the proposal was to devour the foreign culture and techniques or even vomit them if considered unappropriated or undesirable.

Oswald de Andrade refers ironically to an episode of the Brazilian history: the shipwreck on which a Portuguese bishop had travelled, followed by the death of the bishop who had been eaten by anthropophagus Indians in Brazil.

Many theoretical influences may be identified in the Manifesto: the revolutionary thoughts of Karl Marx (1818-1883), the discovery of the subconscious by psychoanalysis and the study, Totem and Taboo, by Sigmund Freud (1856 - 1939), the liberation of the primitive element in man, suggested by some Surrealist writers such as André Breton (1896 - 1966), the Manifeste Cannibale, written by Francis Picabia (1879 - 1953) in 1920, the issues surrounding the savage discussed by philosophers Jean-Jacques Rousseau (1712 - 1778) and Michel de Montaigne (1533 - 1592) and Hermann Keyserling´s (1880 – 1946) idea of technical barbarism. When

cross-fertilised through Oswald de Andrade´s pen, these influences gained a new life through the amalgamation under the banner of an unprecedented concept rooted in the history of Brazilian civilisation: Anthropophagy or Cannibalism. The cannibalist stage highlighted the violent contradiction between two cultures, the primitive (Amerindian and African) and the Latin (of a European cultural heritage), which form the basis of Brazilian culture through the transformation of the savage element into an aggressive tool.

As followed below, the entire Anthropophagic Manifest:

> Cannibalism alone unites us. Socially. Economically. Philosophically.
>
> Only law of the world. Masked expression of all individualisms, of all collectivisms. Of all religions. Of all peace treaties.
>
> Tupi or not tupi that is the question.
>
> Against all catechisms. And against the mother of the Gracchi.
>
> I am interested only in what is not mine. Law of man. Law of the cannibal.
>
> We are weary of all the suspicious Catholic husbands in drama. Freud finished off the enigma of woman and other frights of printed psychology.
>
> It was clothing that got in the way of truth, the impermeable coat that stood between the interior world and the exterior world. The reaction against clothed men. American movies will elucidate.
>
> Sons of the sun, mother of the living. Found and fiercely loved, with all the hypocrisy of nostalgia, by the immigrants, by those who were trafficked, and by the tourists. In the land of the big snake.
>
> Because we never had grammars, nor collections of old vegetables. And we never knew what was urban, suburban, frontier, and continental. Lazy on the world map of Brazil.
>
> A participant consciousness, a religious rhythm.
>
> Against all importers of canned consciousness. The palpable existence of life. And pre-logical mentality for M. Levy-Bruhl to study.
>
> We want the Caraiba revolution. Greater than the French Revolution. The unification of all man's efficient uprisings. Without us Europe would not have had even its sorry declaration of the rights of man. The golden age, as announced by America. The golden age. And all the girls.

Filiations. Contact with Caraiba Brazil. Or Villegaignon print terre. Montaigne. Natural man. Rousseau. From dead French revolution to Romanticism, to the Bolshevik revolution, to the Surrealist revolution and Keyserling's technicised barbarian. We walk.

We were never catechised. We live by somnambulistic right. We brought about the birth of Christ in Bahia. Or in Belem do Para.

But we never owned up to the birth of logic in our midst.

Against Padre Vieira. The author of our first loan, to gain a commission. The illiterate king had said to him: "Put it down on paper, but go easy on the smooth talk." There the loan was. Brazilian sugar was taxed. Vieira left the money in Portugal and brought us the smooth talk.

We can only answer to the oracular world.

We had justice, the codification of revenge. Science, the codification of Magic. Cannibalism. The permanent transformation of totem into Taboo.

Against the reversible world and objectified ideas. Cadaverised. A stop to dynamic thought. The individual victim of the system. The source of classic injustice. Of romantic injustice. And the oblivion of interior conquests.

Routes. Routes. Routes. Routes. Routes. Routes. Routes.

The Caraiba instinct.

The life and death of hypotheses. From the I equation which is part of the Kosmos to the Kosmos equation which is part of the /. Subsistence. Knowledge. Cannibalism.

Against the vegetable elites. In communication with the soil.

We were never catechised. What we did was Carnival. The Indian dressed up as a senator of the Empire. Dressed up as Pitt. Or as he appears in Alencar's operas, brimming with decent Portuguese sentiment.

We already had communism. We already had the Surrealist language. The golden age.

Catiti Catiti Imara Notia. Notia Imara Ipeju

Magic and life. We had the list and the distribution of physical goods, of moral goods, of dignitary goods. And, with the aid of a few grammatical forms, we knew how to transpose mystery and death .

I asked a man what the Law was. He replied that it was a guarantee for the exercise of possibility. This man's name was Galli Mathias. I ate him.

Where there is mystery there is no determinism. But what's that to us?

Against histories of men which begin at Cape Finisterra. The undated world. Uninitialed. Without Napoleon. Without Caesar.

Fixing progress by means of catalogues and television sets. Only machinery. And the blood transfusors.

Against antagonistic sublimation. Brought over on the caravels.

Against the truth of missionary peoples, defined by the sagaciousness of a cannibal, the Viscount of Cairu: "It is an oft-repeated lie."

But it wasn't crusaders who came. It was fugitives from a civilisation we are now eating, for we are strong and vengeful like the Jabuti.

If God is the conscience of the Uncreated Universe, Guaraci is the mother of the living. Jaci is the mother of vegetables.

We didn't have speculation. But we had guesswork. We had Politics, which is the science of distribution. And a worldwide social system.

Migrations. The flight from states of boredom. Against urban scleroses. Against Conservatories and speculative boredom.

From William James to Voronoff. The transfiguration of Taboo into totem. Cannibalism.

The paterfamilias and the creation of Stork Morality: True ignorance of things + lack of imagination + a sense of authority in the presence of the curious brood.

To arrive at the idea of God, one must start from a profound atheism. But the Caraiba didn't need this. Because he had Guaraci.

The created objective reacts like the Angels of the Fall. Later, Moses rambles on. What's it to us?

Before the Portuguese discovered Brazil, Brazil had discovered happiness.

Against the Indian as torch holder. The Indian son of Mary, godson of Catherine de Medici and son-in-law of Don Antonio de Mariz.

The acid test is joy.

In the matriarchy of Pindorama.

Against Memory as source of habit. Personal experience renewed.

We are concretists. Ideas take over, react, burn people in public squares. Let us suppress ideas and other paralyses. Through itineraries. To believe in signals, to believe in the instruments and the stars.

Against Goethe, the mother of the Gracchi, and the court of Don Joao VI.

The acid test is joy.

> The struggle between what would be called the Uncreated and the Creature — illustrated by the permanent contradiction of man and his Taboo. Everyday love and the capitalist modus vivendi. Cannibalism. Absorption of the sacred enemy. That he may be transformed into a totem. The human adventure. Earthly finality. Only the pure elites, however, succeeded in cannibalising the flesh, which bears with it the highest meaning of life and avoids all of the catechistic evils identified by Freud. What takes place is not a sublimation of sexual instinct. It is the thermometric scale of the cannibal instinct. Which moves from carnal to elective and creates friendship. Affective, love. Speculative, science. It turns away and transfers itself. We arrive at ignominy. Low cannibalism packed in with the sins of the catechism — envy, usury, calumny, murder. It is against the plague of the so-called educated Christian peoples that we act. Cannibals.
>
> Against Anchieta singing the eleven thousand virgins of heaven, in the land of Iracema, — patriarch Joao Ramalho, founder of Sao Paulo.
>
> Our independence has not yet been proclaimed. The typical words of Don Joao VI: "My son, put that crown on your own head before some adventurer does!" We cast out the dynasty. We must cast out the Bragantine spirit, ordinations, and Maria da Fonte's snuff.
>
> Against clothed, oppressive social reality, as recorded by Freud — reality without complexes, without madness, without prostitution and without penitentiaries in the matriarchy of Pindorama.
>
> Oswald de Andrade In Piratininga 374th year of the deglutition of Bishop Sardinha. (LAGNADO, 1999)

This text/manifest was the greatest source for the tropicalist ideas. Its vision about how Brazilian culture has been shaped and the impact of this process on the Brazilian people and behaviour was the basis of the construction of a genuine Brazilian culture. Through the text one can understand the reflex of the Portuguese colonization on Brazilian culture and also the dependency of American and European culture.

The sentence, "tupi or not tupi, that is the question[10]" alludes to what is perceived as a characteristic of the Brazilian national identity — the appropriation of difference, its maintenance, and re-contextualization. In this Manifesto, the contact between the local and the global, and the national and the foreign, is brought to the foreground and challenged in its cultural and economic implications. The Manifesto casts a light of

[10] "Tupi" is a Brazilian indigenous language.

ambivalence — in a positive way — on intercultural, temporal, and spatial relations between Brazil and other countries, cultures, and economies. (JORDÃO, 2008)

2.4 Influence of Cinema on tropicalism

Other forms of art also were used as inspiration for the tropicalists. The Cinema Novo (New Cinema) - movement that emerged in the early sixties of which the cineaste Glauber Rocha[11] was always the leader in both theory and practice - was essential for the solidification of the tropicalism ideas.

Glauber's Revisão Crítica do Cinema Brasileiro (Critical Revision of Brazilian Cinema) advocated a cinema born out of Brazilian poverty in the same way that neo-realism was born out of the destitution of Italian cities immediately after the war (ROCHA, 2003). A call to arms for the young intellectual of the Left, Glauber's revision inspired the tropicalist's artists interest in cinema and drew their attention to films such as "Rio, 40 Degrees" by Nelson Pereira dos Santos, perhaps Brazil's most influential filmmaker.

The movie "Terra em transe" by Glauber Rocha was one of the main influences for the tropicalism. The novelty way that the Bahian filmmaker represented the country, symbolic and violent, produced an effect of interior illumination. In Glaube's movie, Caetano found the key to start facing aesthetics ideas and questions that had annoyed him for a long time. (CALADO, 1997)

2.5 Influence of Literature and Poetry on tropicalism

Literature also had an enormous influence on the tropicalist works. Augusto and his brother Haroldo, together with Décio Pignatari, formed the nucleus of a group of poets who, in the mid-fifties, launched the concrete poetry movement, a radical renewal of the modernist spirit of the twenties. These poets took a stand against the propriety of the antimodernists and anti-avant-gardists who had taken hold of

[11] Glauber Rocha (1939 - 1981): Brazilian film director, writer and actor who started the so-called "cinema novo". His most famous movie is "*Deus e o diabo na terra do sol*" (1964) which had great influence on the tropicalism.

Brazilian literature.

The concrete poets felt they were in synch with European musicians like Boulez and Stockhausen who in the fifties had revived the rationalism of the Vienna school (especially Webern), and with the painters who were following the path of Mondrian and Malevich. They valued the physical aspect of the word, creating poems to be sensed as sculptures would and studied in its typography, color, and blank spaces. Form was to them as important as the meaning of words.

Figure 6: “beba coca cola” by Déecio Pignatari.

The appearance of the concretists provoked a scandal. Though they had the support of Brazilian poetry giant Manuel Bandeira (who, older than the modernists, was their precursor and a master for all time), they found strong resistance among poets, literati,

and scholars. But the level of the arguments they sustained was so high, their determination so unshakable that they became tough cookies of contention in the Brazilian intellectual milieu, commanding respect even where there was no receptivity.

It was this feeling of initial rejection that led the concretes to support the tropicalism. Augusto, his brother Haroldo and Décio Pignatari had suffered attacks and similar reactions that Caetano and Gil were to suffer at the time (beginning of tropicalism). It was the empathy for a project of artistic renewal quite similar to that that led Augusto de Campos to write articles about the musical contribution of Caetano and Gil. (CALADO, 1997)

The influence of the concrete poetry is also detectable in the aesthetic of the tropicalist lyrics. The main example might be the lyrics of the song “Bate Macumba” by Gilberto Gil and “Os mutantes” that follow below.

Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba oh
Bat Macumba ê ê, Bat Macumba
Bat Macumba ê ê, Bat Macum
Bat Macumba ê ê, Batman
Bat Macumba ê ê, Bat
Bat Macumba ê ê, Ba
Bat Macumba ê ê
Bat Macumba ê
Bat Macumba
Bat Macum
Batman
Bat
Ba
Bat
Bat Ma
Bat Macum
Bat Macumba
Bat Macumba ê
Bat Macumba ê ê
Bat Macumba ê ê, Ba
Bat Macumba ê ê, Bat
Bat Macumba ê ê, Batman
Bat Macumba ê ê, Bat Macum
Bat Macumba ê ê, Bat Macumba
Bat Macumba ê ê, Bat Macumba oh
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá
Bat Macumba ê ê, Bat Macumba obá!

Figure 7: Lyrics of the song “Bate macumba” by Gilberto Gil and “Os mutantes”

2.6 Tropicalism in visual arts

The Tropicalista movement had its upmost manifestation in music. Its brains were essentially musicians Caetano Veloso and Gilberto Gil. However, it is undeniable that the *tropicalista* ideas were aligned with ideas of other artists from other fields of art such as visual arts, literature, theatre and cinema. Despite the fact that some of the presented artists did not consider themselves as part of the tropicalist movement, their production was strongly connected with the movement and was essential to shape the aesthetic of *Tropicália*. As the focus of this research is visual arts I will leave music aside and go straight to the target. I wish to point out here a few works from probably some of the most representative Brazilian plastic artists who carried out and/or were inspired by ideas of tropicalism: Lygia Clark, Beatriz Milhazes, Lygia Pape, Flávio Império and Helio Eichbauer. It is interesting to perceive in all of these pieces the idea of auditory participation. Such works were also source of inspiration for my own project that I will further describe.

2.6.1 Lygia Clark

Lygia Clark (Belo Horizonte, 1920 – Rio de Janeiro, 1988) starts her artistic training in 1947 in Rio de Janeiro with Roberto Burle Marx and Zélia Salgado. In 1950 Clark travels to Paris, where she studies with Arpad Szènes, Dobrinsky and Léger. After her first solo exhibition at Institut Endoplastique in Paris, in 1952, the artist returns to Rio de Janeiro.

In 1954 Lygia Clark is co-founder with other artists of Grupo Frente (Frente Group). With her oeuvre Clark proposes that painting is not limited by the picture frame. Indeed, new horizons are sought.

In "*Unidades*, 1959" (Units) the picture frame and "pictorial form" are confounded when one invades the other, and Clark uses the same color to blur the line between frame and canvas. Clark called it "*linha orgânica*" (organic line), in 1954: it is not a painting closed in itself; the surface outspreads equally on the canvas, by separating a space and then, gathering on it, coming back as a whole.

Painting results in the construction of a new support to the object. Based on these propositions "*Casulos*, 1959" (Cocoons) are produced. Using metal, which allows folding the plane, it assumes the search for three-dimensional space by putting them closer to the space in the world. In 1960 Lygia develops the series "*Bichos*" (Animals): hinged aluminum sculptures making the parts of their "body" articulated. The spectator, encouraged to be participative, is invited to interact with the countless forms provided by the open structure. With this series, Clark becomes one of the pioneers in participative art in the world. With "*Bichos*" (Animals) she was awarded the Prize for the Best National Sculpture at the São Paulo Bienale in 1961.

Figure 8: Bicho/Animal (caranguejo duplo), 1961. Aluminium, 53 x 59 x 53cm. Pinacoteca do Estado de São Paulo Colection. Potograph: Rômulo Fialdini.

The experience with malleability of hard materials converts into flexible material. Lygia Clark succeeds in reaching the soft material: hard material (wood) is put aside, going through flexible metal in "*Bichos*" (Animals) and reaching the rubber in "Obra Mole, 1964" (Soft Work). The displacement of power from artist to spectator gets a new limit in "*Caminhando*, 1963" (Walking). Such twisted strip shown in "Obra Mole" (Soft Work) is now cut in "*Caminhando*" (Walking). It was a boundary situation and a clear beginning of a new paradigm in the Brazilian Visual Arts. The object was not out of the body, but it was the "body" itself, which was of Lygia's

interest.

Figure 9: Caminhando, 1964. Photograph: Beto Felício.

Lygia Clark's trajectory made her an atemporal artist with no well defined place within the Art History. She and her works do not frame into categories or situations that can be easily packed; Lygia establishes a link with the life, and this new stage can be noticed in her "*Objetos sensoriais*, 1966-68" (Sensorial Objects): the proposition of using simple everyday objects (water, shells, rubber, seeds) indicated in Lygia's work her intention to displace the spectator's position in the art institution, and take him/her to a state in which the world shapes itself, under constant change. In 1968 Lygia returns to Paris. The desexualized body is shown in the series "*roupa-corpo-roupa: O Eu e o Tu,* 1967" (clothe-body-clothe series: The I and the You). A man and a woman entered heavy suits in plastified clothes: the man enters the woman's suit, and she enters the man's. Cavities are found by touching each other's pockets in the

suits. The zippered pockets allow tactile discovery and recognition of the body. The experience is totally sensorial. In this work the body is the highlight; she uses clothing only to denude the body.

Figure 10: Wearable art by Lygia Clark. Potograph: Rômulo Fialdini.

"If the person, after doing the series of stuff I give, if she accomplishes to live a more free way of live, uses the body more sensually, expresses herself better, loves better, eats better, all of this is of my interest even more as a result than the thing itself I have been proposed to you"

(Cf. "The World of Lygia Clark" 1973, video documentary directed by Eduardo Clark, PLUG Produções).

2.6.2 Beatriz Milhazes

Beatriz Milhazes (1960) was born in Rio de Janeiro and started her artistic life studying at the School of Visual Arts, Parque Lage in Rio de Janeiro, Brazil.

She has attracted international attention with her colorful compositions since the 1990s. Her art features elements of both Brazilian pop culture and modern visual languages. Overlapping floral motifs, ornamental arabesques, and abstract patterns convey an excessive, sensuous energy.

Figure 11: Avenida Brazil, 2003-2004. Acrylic on canvas 300 x 400cm by Beatriz Milhazes. © Courtesy Galeria Fortes Vilaça, São Paulo, and Stephen Friedman Gallery, London.

With an emphasis on materials and process, Milhazes's paintings and prints incorporate decorative motifs adapted from a variety of sources into intensely colorful works. Visual reflections of the vibrant culture and traditions of Brazil, her work revisits the notion of décor in painting as seen through the eyes of a female artist in contemporary Latin American culture.

Milhazes emerged around the time of the Brazilian movement *Geração Oitenta* (the 1980s Generation), which, as in Europe and the US, proclaimed a return to painting after the rather austere art of the 1970s. The new spirit of hedonism, with pleasure as its liberating motto, was largely expressed in vivid brushstrokes and rich colours. Whatever aspects she may share with this group, she also has something in common with the ideas of Oswald de Andrade (1890–1954), the Brazilian poet and novelist. His *Manifesto Antropófago*, or Cannibalistic Manifest, published in 1928 (see chapter 2.3), was a key text of early Brazilian Modernism. It was a profound reflection on the dilemma of the Modernist intellectual caught between high European literary and artistic references and his/her own native sources.

Figure 12: Panamerican, 2004. Acrylic on canvas 198 x 4179cm by Beatriz Milhazes.

2.6.3 Lygia Pape

Lygia Pape (1927 - 2004) worked at challenging formal and conceptual limits in many different media, including painting, printmaking, sculpture, dance, film, performance and installation. In the 1950's Lygia Pape was involved in Concretism, which was based on severe abstract styles of European painters like Piet Mondrian and Kasimir Malevich.

In 1954 she co-founded Grupo Frente, whose members included Ivan Serpa, Hélio Oiticica, Lygia Clark, Franz Weissman, and others, which rejected the formal remove of Concretist art but retained its insistence on the concrete reality of the artwork as opposed to more representational imagery.

Figure 13: Roda dos prazeres, 1967. Porcelain, paint, flavours, dropper. Dimension variable by Lygia Pape. © Courtesy Lygia Pape Project

Favoring more interactive relations between art and viewers, the Neo-Concretists sought to expand the formal, expressive and social dimensions of art. Lygia was a

pioneer in dealing with sensorial questions, requiring/suggesting the participation of the viewer in the artwork through the manipulation of some *Livros-Poema* [Poem Books], as early as 1956. These sensorial body/artwork-viewer/artwork issues were later taken up by some of her neoconcrete colleagues.

Figure 14: Divisor, 1968. White cotton square cloth with slids by Lygia Pape. © Courtesy Lygia Pape Project

In the 60's Lygia Pape worked together with the film movement group *Cinema Novo* (see chapter 2.4), for which she designed lettering and posters. She also made short experimental films of her own, some only seconds long. In later decades she created large-scale and often surrealistically dramatic installations using lights, plants, food, flowing liquids, fabric and other materials.

2.6.4 Flávio Império

Flávio Império (1935 - 1985) was a stage designer, art director and visual artist. In 1961 he graduated from the Faculty or Architecture and Urbanism at São Paulo University. From 1960 on he started to work together with various theatre companies. In 1962 Império started to collaborate with *Teatro Oficina* (see chapter 2.2) and received many awards for his works. Inspired by the irreverence of director José Celso Martinez Correa (see chapter 2.2) Império explores the architecture of the space and enhances the audience's perception.

The artist uses colourful textiles and traditional patterns to compose his works. He also often uses low budget materials to develop his creations.

Império was considered one of the best stage designers that the Brazilian theatre had ever known. He shocked the conservative society when in 1968 he designed provocative spaces and costumes for the show "*Roda Viva*". Flávio was committed with the new and with the politic activism and because of this behaviour he was arrested by the military dictatorship during the 60's. He also had an outstanding participation as professor at the Faculty or Architecture and Urbanism at São Paulo University between 1962 and 1977. His ideas as works were important for the development of the tropicalist ideas and aesthetics.

Figure 15: Detail of the exhibition with works of Flávio Império at SESC Pompéia, São Paulo, Brazil,1997. Photograph: Sit Kong Sang.

Figure 16: Flávio Império's lecture at Faculty of Architecture and Urbanism during 1973-75. He conducted relaxing practice and intervention on the space. © Sociedade Cultural Flávio Império (SCFI).

2.6.5 Helio Eichbauer

Helio Eichbauer (1941) was one the main characters of the modern Brazilian Scenography with his “arrojadas” (bold) ideas for several theater productions. He proposes the use of metaphor, free interpretation and the authorial aspect of the scenery on the artistic conception of the show.

From 1962 to 1966 he studies scenography and architecture in Prague, Czech Republic. His advisor was Josef Svoboda, considered in the 70’s one of the best stage designers of the world. He works at the Berliner Ensemble and at the Berlin Opera House in former East Germany. After that he works in several countries such as France, Italy and Cuba.

From his first master, Josef Svoboda, he gets the taste for the exploration of the space. According to Sábato Magaldi, a theater critic, Eichbauer works “do not just create an ambience, but act as a living organism that projects, illustrates and sometimes even disagrees with the dramatic acting” (MAGALDI, 1972). However the artist does not override the scenery for the show: his work translated into visual language the profound meaning of the work, in an unconventional and authorial way.

Figure 17: Detail of the scenery for the show “Oceano de Luz, Mar do Espaço: Surfando Ondas Quânticas”, 2008 designed by Hélio Eichbauer. Photograph Luis Saguar.

Figure 18: Stage design for "*O rei da vela*" of Oswald de Andrade. São Paulo, Oficina Teather, 1967 by Hélio Echbauer. © Hélio Echbauer.

Figure 19: Cover of Caetano Veloso's album " *Estrangeiro*" (1989), where the panel designed for "*O rei da vela*" was reproduced. by Hélio Echbauer. © Polygram Records.

2.7 Hélio Oiticica: his importance and influence on Tropicalism

To comprehend the art within the tropicalism, it is essential to pass through the work and ideas of Hélio Oiticica (July 26, 1937 – March 22, 1980). He was a Brazilian painter, sculptor and performance artist.

His reflections turned into engaged works formed by rational concepts and extreme sensibility, which arose from his observations and critics over the modern human being whose life is shaped by rules giving the society's rhythm.

The propositions[12] made by Oiticica could be seen as social interventions. Grandson of the famous anarchist leader José Oiticica and son of photographer José Oiticica Filho, Hélio not only criticized the system but also proposed new paths and languages that would disrupt the status quo. The artist begins a research where interactive speeches are the bases for the raise of a critical conscience.

It is clear that Oitica´s interest in interactive speeches was not the persecution of technical accuracy but much more a concern with man and technology's return back to their historical place: attend the human's demand rather than impose the institutional world to society.

Author of an inaugural artwork conception, he believed an artwork only existed as being also anti-art[13], in contrast with the art performed in a world detached from its daily values he considered superficial.

His works break the classical structures that have come with art since remote times. The contact – mainly through the Paragolés – is established in a direct way with the audience thus dispensable of art galleries, museums, critics or historians.

[12] Oiticica always called his works propositions. He claimed that what was important was the experience of the user. Materiality is only a trigger to deeper senses and experiences that only could happen with the user's act. (Ramírez, 2007)

[13] We could consider the anti-art as an enlargement of the art in its traditional sense. It tries to eliminate the distance between art and daily life assumed as non-artistic experiences.

2.8 Hélio Oiticica and interactive artworks

Hélio Oiticica (1937 - 1980) was a member of the Brazilian constructivist "*Grupo Frente*" in 1955. After they disbanded, Oiticica joined the successor movement "*Grupo Neoconcreto*" in 1959. He participated in the 1957 and 1959 São Paulo Biennial. Around this time, Oiticica moved away from painting and began to investigate three-dimensional work through colour, form and structure. He created the series *Bilateral*, *Relevo Espacial* (Spatial Reliefs) and *Núcleo* between 1959 and 1964. Oiticica created his first environment, Hunting Dogs Project, in 1961. It combined a walk-in labyrinth by Oiticica and two rooms, Burried Poem by Ferreira Gullar and Integral Theatre by Reynaldo Jardim. Oiticica developed his *Bólides*, containers filled with pigments and earth in 1963. Shortly after came the *Parangolés* (see chapter 2.9); clothes made from banners, flags, plastic bags, pillows, etc. which were meant to be worn. Movement and observation were essential elements for Oiticica. He began to professionally study dance at the Mangueira Samba School in Rio de Janeiro in 1964. For the exhibition "*Nova Objetividade Brasileira*" at Museum of Modern Art in Rio de Janeiro - Brazil, he designed the installation *Tropicália*, a labyrinth environment with two hut-like structures, sand, pebbles, parrots, poems and a television set. The installation served as an example of Brazil's specific, anthropophagous culture. In the so-called "Whitechapel experiment", as he described in his exhibition at the Whitechapel Gallery in London in 1969, he realized Eden. The installation spread out across the entire first floor of the Gallery and consisted of several rooms that could be entered, in which, among other things, several *Bólides* were integrated.

Oticica's thoughts related to interactivity[14] took shape between 1961 – 1965 when he achieved a break and established new possibilities for the visual arts with his "*Penetráveis*"[15], "*Bólides*" and "*Parangolés*". The *Bólides* incorporated the sensorial while the *Penetráveis* the participation and the *Parangolés*, started in 1964, attained the junction of the previous experiences with the time issue.

[14] The term interactivity will be discussed in chapter 3.
[15] Penetrables in English.

Figure 20: Detailes of Tropicália installation (Top) and dancers performing the Parangolé (Bottom).
© Generali Foundation

The interactivity of art is a central ingredient in Oiticica's Penetráveis. These are works of art to be inhabited (penetrated) just as the Parangolés are to be worn. While moving inside a Penetrável from one enclosure to the next, the participants experience different sensations and feelings. Often, the constructions resemble improvised dwellings of favelas (slums) where curtains or straw mats often take the place of walls and bedrooms are often little more than boxes. Oiticica invited viewers to take off their shoes and inhabit these spaces through leisure activities such as lying down. The

first of these environmental works, "*Tropicália*" (1966-1967) was mounted at the Museum of Modern Art in Rio de Janeiro in 1967. It became a seminal work that gave rise in Brazil to the Tropicalist movement in all the arts: theater, cinema, poetry, visual arts and popular music.

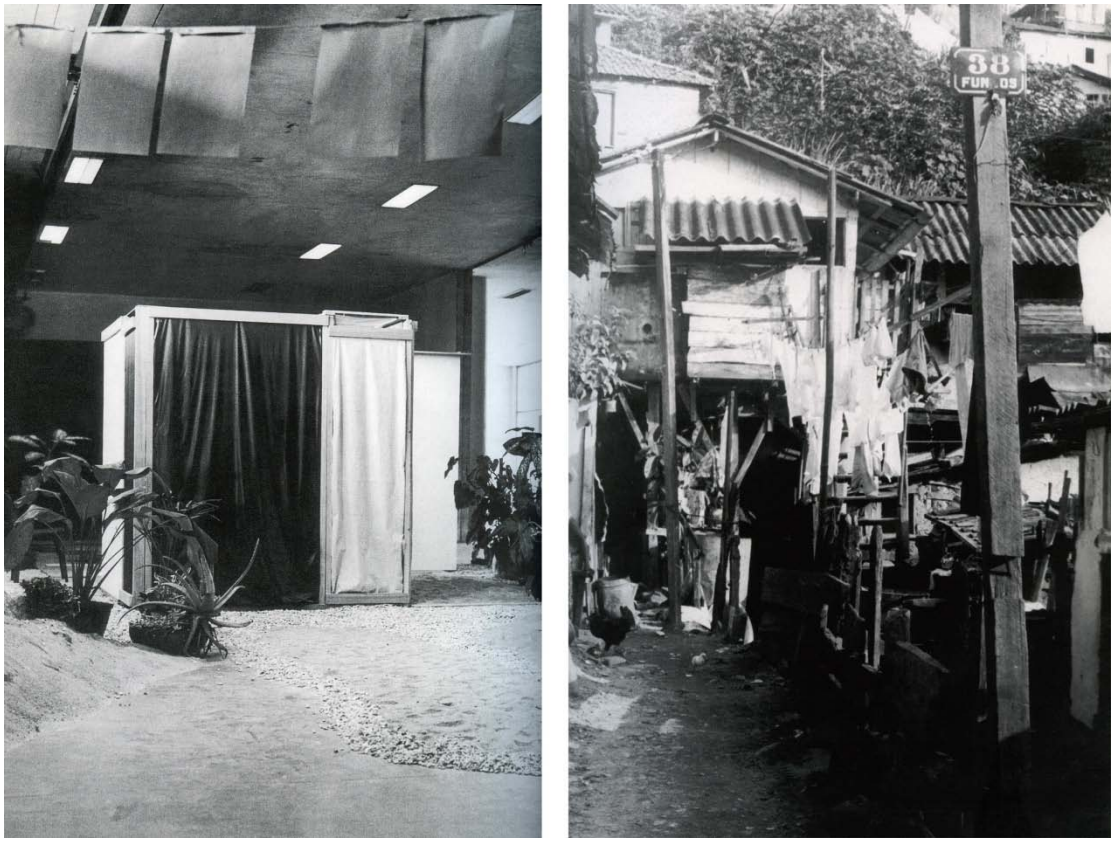

Figure 21: *Tropicália* installation at Museum of Modern art in Rio de Janeiro (left) and a slum in Brazil (right). © MAM-RJ

"Tropicália" was a combination of heaped-up sand and pebbles, tropical plants, two live parrots and two *Penetráveis* – hut-like edifices reminiscent of slum-dwellings. These were to be entered and experienced with all one´s senses. Sabine Breitwieser points out the risk the concept runs of being understood as a type of Brazilian neo-folklore or even as a poetic mystification of the tropics and poverty. Oiticica, however, understood this 'scenario' as an invitation to experience the "fantastic architecture of the favelas[16]" and to share another experience of life. (BREITWIESER, 2000)

[16] Slums in English.

Figure 22: "*Tropicália*" installation mounted in Generalli Foundation in Vienna, 2000. © Generalli Foundation.

"I wanted", he wrote, "to institute and characterize a state of Brazilian avant-garde art, confronting it with the major movements of world art (Op and POP), and aiming at a Brazilian state of art, or of manifestations related to this […] For this I created a tropical scenario, as it were, with plants, parrots, sand, pebbles, like a back-yard […] Entering the main Penetrabel, undergoing several tactile-sensorial experiences addressed to the participant who, through them, cerates their imagistic meaning there, one arrives at the end of the labyrinth, in the dark, where a TV set is permanently switched on: it is the image that devours the participant, because it is more active than his sensory creating. Actually this Penetrable gave me the powerful sensation of being devoured." (OITICICA, 1968)

Figure 23: Detail of "Tropicália" installation mounted in Generalli Foundation in Vienna, 2000. © Generalli Foundation.

2.9 The "Parangolé" experience

One of the most important works of Oiticica and also of the Brazilian modern art is the "*Parangolés*". In November 1964, Oiticica, to explain wrote about "*Parangolé*": "The discovery of that that I call "*Parangolé*" (slang for a situation of sudden confusion or excitement among people) marks a decisive point and defines a specific position in the theoretical development of my entire experience with the question of three dimensional color constructions." (SULLIVAN, 1993) This especially relates to a new definition of what "the object" or better, "the artwork" is seen as. One could see the phenomenon of "*Parangolé*" as an art form related to Body Art, Happening, or Performance. One of the most well known examples was the "*Parangolé*" cape,

worn by friends of the artist. A wide variety of other objects - such as banners and tents - add to the "*Parangolé*" experience as a whole. Central to the "*Parangolé*" are interaction, movement, and altering of peoples´ sense of reality.

Figure 24: Stills from HO, a film by Ivan Cardoso, 1979. Collection of Ivan Cardoso, Rio de Janeiro. © Ivan Cardoso.

The "*Parangolé*" is a kind of cape, banner or even tent made of fabric, paper, plastic, straw, and/or rope sewn together and painted or drawn on. They were inspired by the capes worn by the dancers of the Mangueira samba school to which Oiticica belonged. The most important conceptual aspect of these works is that they are art to be worn, a novelty at that time. It is the viewer´s participation that creates these moving sculptures and, by wearing them, the wearer becomes an active part of the work.

The "*Parangolé*" series is strongly related to the idea of liberty and issues such as free participation, dialog with uncertainty and with the undefined, through a precarious structure in a sense of no-completeness that are built together with the user. By doing so, the result of the experience goes beyond the artist's intention.

For Oiticica the "*Parangolés*" were not an artwork but an environmental program: "My environmental program, also called "*Parangolé*", does not intend to establish a new moral or anything like that. But, to drop all the morals that create stereotype opinions and also non-creative concepts […] The "*Parangolés*" are programs created to open the individual behaviour towards the collective and enhance the experience of life." (JUSTINO, 1998)

The "*Parangolé*" are commonly made out of fabric or plastic and are presented as wearable capes acting as support to visual and verbal elements. It is from the experience of dressing the "*Parangolé*" and starting to perform that Oiticica allows experimentations of new sensations. Due to the performance the user becomes a co-author, thus, recreating the work every time it is performed. The concepts as co-author and performance will be further discussed.

The point is the appropriation: of time, space, experiences and sensations of the collective creating new spaces, time, experiences and sensations moreover at an individual level. Through these appropriations, the "*Paragolés*" create exchanges between languages and through these exchanges a new semiotic dimension is created. Oticica understands the music and dance as elements that allow communion with the environment.

The "*Parangolés*" also allow the deprogramming of environments because they establish connexions among dance, music, environment, experimentation and fantasy. Unexpected behaviour patterns emerge through the interaction with the capes. According to Oiticica, the act of dressing the "*Parangolé*" triggers newness in the environment and in the sensations because the pure gaze of the viewer is abolished through the physical contact, the planning of the cape over the body.

Oiticica invented the neologism "creleizure" which meant, "to believe in leisure." For him "creleizure" was based on joy and phenomenological knowledge and this condition is a precondition for creativity. Not unlike Aldous Huxley[17] and Timothy Leary[18], Oiticica also believed that expanding perception could unleash the creative being; he called it the "Supra-sensorial." The Super-sensing could be achieved by hallucinogenic states, religious trance and the kind of delirium reached during samba dance for instance. In his own words, "This entire experience into which art flows, the issue of liberty itself, of the expansion of the individual's consciousness, of the return to myth, the rediscovery of rhythm, dance, the body, the senses, which finally are what we have as weapons of direct, perceptual, participatory knowledge... is

[17] Aldous Huxley (1894 - 1963): English writer best know for his novels and advocating and taking hallucinogens.
[18] Timothy Leary (1920 - 1996): American writer famous for his connection with psychodelic drugs. He was an icon of the 1960s counterculture.

revolutionary in the total sense of behavior." (OTICICA, 1992)

Figure 25: People celebrating the carnival in Trinidad and Tobago. Photograph: John Langman

Figure 26: Ritual of Candomblé, an afro-Brazilian belief. © SESC Pompéia

Inside the speech's dynamic proposed by Oitica, music represents a fundamental role, especially samba. This process creates interesting parallels with other forms of expression that also use common elements of the "*Parangolé*" in order to allow the users to reach modified states of mind. One example could be the afro-Brazilian beliefs in which one believes to be in contact with supernatural entities.

However, despite sharing elements – the appropriation of the primitive for instance – the goals of each experience are diverse. It is important to clarify this distinction to stress that the consciousness of the language is a condition sine qua non for the creation of conceptual structures with specific purposes. While Oiticica sought the evolution of his reflections through structures of knowledge that he called "software on progress", participants of religious rituals do not have this code domain; they cannot create Meta linguistics functions with those experiments.

The "*Parangolé*" is characterized as a verbal and visual experience within a defined time and space. However, it promotes an alteration of the collective time and space relation through the user's interaction and this creates an individual experience. And because it is an individual unique experience, time reflects the individual background of each person. Through this dynamic occurs what could be described as what Huizinga called "magic circle", a space where the receptor is seduced by the presented proposal and is conducted to a syncretic world made from combinations of images, sounds and gestures. (Huizinga, 1955)

The propose is clear: what the "*Parangolés*" allow is the access to a new spatial and time perception in which the receiver can act as he likes realizing movements, actions, gestures, performances, noises or, in other words, creating languages by just wearing, incorporating and completing the "*Parangolé*". Those characteristics will be the starting point of my personal work that I will further explain.

The process of co-author finds a huge field to be explored, a field that depends on the repertoire of the user who starts to act as scriptwriter. The "*Parangolés*" open the space; it is the user's role to fill it with his colours, images, sounds and words. This

work is strongly related to the idea of interactivity that I will present in the next chapter and was the basis of the development of the practical part of this thesis.

3. Interactive art and performance based on the usage of wearables

The term interactivity in art has many diverse definitions and approaches. Some writers such as Andrew Benjamin argue that all artworks are interactive in a way that what realizes them is the relation between the viewer and the artwork. (BENJAMIN, 1995)

However, this view seems to embrace a very broad idea about interactivity in art and maybe so large that it does not really define its characteristics and differences. Other theoreticians suggest some classification of the phenomenon of interactivity, which is more useful for the understanding of its applications.

3.1 Interactivity in art

One author that presents an interesting and quite clear view on this issue is Katja Kwastek. She argues that the general usage of the term "interaction" denotes 'mutual or reciprocal action or influence'. This interaction can be realized in different ways and focus on different aspects such as: Social psychology – focus on interpersonal relationships, cybernetics – focus on interaction as a process of feedback and human computer interaction (HCI) – focus on interaction as a man-machine communication. (KWASTEK, 2008)

Dieter Daniels goes further and argues that in a work that involves interaction according to John Cage's point of view, the purpose of the composition was not to deliver an "optimum system", but to initiate an individual and social process that successively detaches itself from the author". He says that "Cage's concept of interactivity stems from an aesthetic and ideology leading to the dissolution of the boundary between author, performance and audience. (DANIELS, 2000)

Arjen Mulder also presents us with a definition of interactive art that reaffirms the importance of the audience. According to her, interactive art is not made up of final

products that have the ability to influence their viewers, as good paintings or statues do; it seeks to continue the process of mutual change between the creator and the work by which painting and statues come into being – but this time not with the artist but with the viewer. Interactive art refuses to uphold the forced splits between an art world in which real artists are productive on the one hand and an outside world where regular people consume art on the other. The visitor continues the creative process and experiences it personally. The visitor does not complete an interactive work, as he often claims. It is never finished; it can always start over and lead to totally different results. (MULDER, 2007)

Interactivity, as we may conclude from all those definitions, should involve some kind of dialogue among the actors involved in the system. If one just turns on a switch it does not make the process interactive, maybe "reactive" would be a better term. This observation leads to different levels of interactivity in an artwork, going from navigation or multiple-choice until collaboration.

Collaborative works, and this definition is important to understand the practical work presented by this thesis, need the audience to help one another in order to make the art happen. Collective behaviour is what is asked and what is needed from the audience. In this case, the interaction of the viewer could make and transform the artwork at some level. However, for the artwork to be realized in its full power more than one person is necessary and moreover those people are supposed to work as in a group, each one taking a small part in the interactive experience. Thus, the collective experience is the base of the work.

Despite the different definitions of interactivity they share one main characteristic: the idea that the work is only completed with the interference of the user or, as in Umberto Eco´s words, an "open work". Eco presents a theoretical model called "open work". (ECO, 1989) This model has not the intention to be a structural text about a hypothetical model of artistic thinking that could produce participative artworks but a study about the representation of the structure of the relation presented in all artistic manifestations.

In his study, Eco analyzes the relations involved in the fruition of art, the process that

controls the artistic creation and the probabilities that embrace the process of creation. He points out that probability is one of the main aspects of an open discourse, typical from art. Other important aspect is the ambiguity. The artwork is, therefore, the ambiguous manifestation of a discourse where borders are fixed by probability laws. The result of an artistic intentionality is always open and needs the action of the receptor to realize it.

When the artist decides that his work is ready, in its formal aspect, it becomes a starting point where the receptor starts a process of accomplishment, bringing the work to life through different readings and different perspectives, quite often completely different from the author´s original proposal. This "new" interpretation is fully based on the receptor´s knowledge and previous experiences and they are these that determine how much of the work´s aesthetic information is subject to interpretation.

The perception of the spectators over the artistic proposals is incorporated as a recreation of the discourse started by the artist, now much more a proponent than someone that presents something finished. "It is a movement away from the concept of the "author" and leading over the "author as producer". (ARNS, 2009)

Historically, the first movements in art toward active participation were taken by art movements as the Futurists[19] and Gutai[20] that systematically initiated performances that relied upon direct interaction from their audiences. Artists such as John Cage[21], with his piece "Imaginary Ladscape n. 4" (1951) created an exciting example about

[19] Futurism was an art movement that originated in Italy in the early 20th century. Founded by Filippo Tommaso Marineti who wrote the Futurist manifest in 1909 in which he expressed a passionate loathing of everything old. The artists were passionate about technology and were very nationalistic. This movement passed through many fields such as: painting, sculpture, ceramics, fashion and literature. The main artists among others were: Giacomo Balla, Gino Severini and Carlo Carrá.

[20] The Gutai group was a movement started by Jiro Yoshiha in Japan in 1954. Yoshiha wrote the Gutai manifest where he points the fascination with the beauty that arises when things become damaged or decayed. The main artists were: Jiro Yoshihara, Shozo Shimamoto and Atsuko Tanaka.

[21] John Cage (1912-92): American composer and music theorist whose interests spanned using indeterminacy to make art, Zen Buddhism, and mushrooms. Author of Silence: Selected lectures and Writings (1961) and A year from Monday (1967). His many musical compositions include Fontana Mix (1960) and Roaratorio (1982).

how an art piece can be shaped by the audience; Allan Kaprow[22], who established the Happening as an art form and had the spectators themselves be participants, executors and performers of the artistic process (KIRBY, 1964) and Lygia Clark who started to use the audience´s input as an important piece of the work.

From these firsts experiments the user/viewer starts to assume a new position, much more participative and active. Not only using his mind but also his body. Lev Manovich says that interactive art acts requiring a viewer to fill in missing information as well as to move his/her eyes or the whole body. (MANOVICH, 2009)

3.2 The role of the body in performance and in interactive art

The body starts to occupy a central position in this art conception, once it is no longer only the audience's gaze that acts in the piece. With art installations occupying the place of the frames, the spectator's body is commonly the materiality of the artistic discourse. In this kind of work it is "the entire viewer's body and not only his contemplation that is engraved on the work. So we can talk about real participation and no longer only just mental". (COUCHOT, 1997) Putting the spectators as the central part of his work, the artist invites them to perform with a new behavior and attitude toward the artwork. This discourse makes the spectator share the time of creation of the work. The work becomes sensitive to the demands and manipulations of the observers and the environment.

According to this vision, the importance of the body goes beyond the simple interaction with the artwork and also performs important symbolic aspects. Our bodies (whether individual, social or collective) are capable of being experienced because they are symbolic systems that participate in a political struggle over identity and legitimation and derive their authority from the symbolic which, politically speaking, is a mechanism of dominance. (SCHMALE, 1996)

[22] Allan Kaprow (1927 - 2006): American artist who coined the term "Happening" to describe his 1959 installation/performance 18 Happenings in 6 parts. Author of Assemblage, Environments and Happenings (1966), Essays on the Blurring of Art and Life (2003, with Jeff Kelley), and Childplay (2004, with Jeff Kelley).

The audiences become performers who answer the questions proposed by the interactive input. If this is true for interactive installations, the importance of the body increases in performative artworks.

Performance is related to doing and every time in a different way. Heraclitus of Ephesus (c. 535 – 475 BCE) is credited with the creation of the doctrine of fluidity, the theory of impermanence and change. He says that you cannot step into the same river twice because the flow of the river insures that new water continually replaces the old. (BAKALIS, 2005)

The uniqueness of an event does not depend on its materiality solely but also on its activity – and the interactivity is always in flux. Performances exist only as actions, interactions, and relationships. (Schechner, 2007) In this sense performance could be understood as an open work per se, where the notion of improvisation and unpredictable change are embedded in this art practice. To work inside a complex process – essentially what ensemble creativity is all about – implies uncertainty and working with change that is outside of your control. (Edwards, 2006) Barry Edwards and Ben Jarlett go further describing a situation where the unpredictable rose from the performers and changed the relation:

"A performer, Hannah, was repeating a run across the space. […] After repeating this action several times she started to laugh, and her laugh grew. […] She had no warning about this sudden intensity that erupted in laughter. Nor how long it might last. Physical sounds such as these coming from the actor's bodies, shrieks, laughter, breathing can be picked up by the live sound editing and woven into the sound pattern. […]As decisions are made live there is nothing that is predictable in their appearance or depth of feeling. In the language of new physics there are phenomena called instantons that are sudden and unpredictable eruptions of intense energy. They appear and disappear without warning. You could say that there are similar phenomena, similar 'instantons' of human experience, response and awareness in performance. Spectators are unavoidably (and necessarily) involved in these fluctuations." (SCHERCHNER, 2006)

When these moments happen they have the power to lead the performer into a new level of existence. They act as a ritual of transformation.

Ritual and play lead people into a “second reality”, separate from ordinary life. This reality is one where people can become selves other than their daily selves. Thus, ritual and play transform people, either permanently or temporarily.

Performances have plenty of symbolic aspects and elements that are expressed on the choices made by the artist, from the stage, clothes, sound to the use of technology and media. Those symbolic aspects of the performance are crucial. They function to provide an unusual, even abstract environment that is open to interpretation by the viewer. And so it is with technology and media in live performance. It cannot change the core, shared experiences of our lives, but it can serve to refresh the performance environment with new symbols and as yet unfamiliar codes that must be addressed by the audience. (CONIGLIO, 1999) It allows performers to control that environment in new ways that force them to reconsider their own role. In other words, it allows us to create mystery for both: audience and performer.

3.3 Wearable computing

As human beings we are always seeking an improvement of our bodies. To expand our powers, we have used and adapted things in our environment, found ways beyond our own physical bodies of doing all sorts of things more effectively. Following this evolution the logical consequence is the growing application of electronics in clothes, the so-called wearable computing.

Wearable computing describes a genre of cloth that functions at a whole new level – the electronic level. Capable of processing information on the moving body, this field stems from computing research begun in the late 1960s, but gained momentum with the miniaturization of components in the 1980s and 1990s. (LEE, 2005)

Ed Thorpe and Claude Shannon presented the first wearable computer in 1966. They developed a computer about a size of a cigarette pack and hidden in a shoe. The device was built for predicting gambling results using radio frequency. It was used in

secret in a casino in Las Vegas and was very successful, with an average profit of 44% for every dollar. (Thorpe, 1998)

Sabine Seymour (Seymour, 2007) in 2000 coined the term 'fashionable technologies' that refers to the electrical engineering physical computing, and wireless communication networks that make a fashionable functional. Through technology the function of clothing is enhanced and new ones are defined.

The computer embedded in a wearable device brought interesting, new and fresh possibilities. Clothes started to communicate with the surround and to feed interactive process between the human and the environment. As personal electronic devices became adapted to wear as jewellery or accessories, the scope to integrate them into fabric became apparent. Mobile phones, personal stereos, laptops, digital organizers and music players are being fully integrated into items of clothing to form part of wearable 'body area network' that can also surf the web, monitor vital signs and even administer medication through the wearer's skin. The systems are activated by sensors that respond to voice-recognition software and body movement, and are programmed to detect and respond to other networks in the home, office or urban environments.

Enhanced wearable – clothing that accommodates functions beyond the standard requirement of style - is impacting the industrial context. "The United States military is establishing projects to research further types of intelligent clothing for soldiers, to enhance the protective and communicative properties of their uniforms and combat gear. Soldier's uniforms could be engineered to change colour to match their surroundings[23], making camouflage patters redundant; sense the impact of a bullet and send a signal to the soldier's command base; and even administer medicine, and detect poisonous gases." (QUINN, 2002) Other areas are interested in wearable computing as well. Insurance Companies also have been putting lots of effort into developing a system able to transmit data at high speed.

[23] See http://www.darpa.mil/

Health care also seems to be one of the largest markets for this kind of innovation, with clothes remotely monitoring the patient´s condition and able to contact the health system in case something wrong should happen. This possibility would give a new dimension to the capabilities of a hospital gown or even create a special garment that would supersede it entirely. The gowns could be made of fabric woven throughout with copper strands, allowing a continuous flow of current powered by rechargeable batteries. Hospital administrations are devising methods to shorten hospital stays by initiating more home care, which has led to a growing need for remote diagnostic technology.

In sport as well the use of technological fabrics can improve the athlete's performance and can make the difference between the gold or silver medal. With the sports industry in the forefront of advanced textile developments, the new generation of sportswear includes new materials equipped with antibacterial and deodorizing agents, screens against ultraviolet rays and the self-medicating components. Textile manufacturers continue to research enhanced fabrics for all areas of sportswear, including outdoor and adventure gear, high-performance sports and Olympic uniforms.

"In future, clothing may incorporate alarm and GPS systems that can both call a designated person or emergency service and enable them to find the elderly person quickly. This function would be desirable for anyone at risk, whether medically or from external attack, such as the police and the military." (LEE, 2005) This kind of technology also has the potential to be used to address the personal protection of vulnerable individuals, such as woman at risk of domestic violence.

Fields such as biotechnology, nanotechnology[24] and chemistry[25] have also given enormous contribution to the development of innovative and intelligent materials that

[24] "Nanotechnology operates at a molecular level. Carbon nanotubes can provide thermal and electrical conductivity while allowing the textile to maintain the touch and feel of a typical textile. The microcapsules in microfibers can contain a variety of active agents such as medication, vitamins, antibacterial products, or moistures. Microencapsulated PCMs (Phase Changing Materials) can be applied as a finish on fabrics or infused into the fibers during the manufacturing process to provide a buffer against temperature swings." (SEYMOUR, 2007)

[25] The Spanish fashion designer Manel Torres carries out his PHD research at Imperia College in London about a chemical component that in contact with the body, transforms the spray into fabric. See www.fabricanltd.com.

are being used in a creative manner and are contributing to the creation of new materials that have been challenging scientists and artists around the globe.

The miniaturization of the electronic components allows the development of devices that can be worn on the body. Current technology and research have come a long way in making wearable computing a reality, with smaller and even flexible batteries, sophisticated sensing mechanisms, and powerful compact embedded systems.

On the user side a research held by the Philips research lab points out that the consumer associates miniaturisation with sophistication and progress, and demands smaller products with an increasing array of functionality. (VAN HEERDEN, 2000) The rapid technological advances taking place at the time meant that electronics industry was more than capable of providing such miniaturised devices.

Technology is inspiring a new generation of designers that work close to scientists to create pieces that communicate in a more effective way with the environment. This phenomenon is focusing the designer's attention more to electrical and biological discoveries than colour or style trends.

The recent circuit's miniaturization and the development of sensory technology have allowed this new form of computation. The computer are more integrated in everyday objects as furniture and clothes. In this way the computers are improving the capability of communicate with humans and the environment imitating sensory methods we use by nature such as: touch, speech and vision.

In this sense, clothes are not only useful to protect us from the weather or as a way of cultural expression; they interact with the environment and with the user, and also react according to external stimulation. Clothes are becoming a key interface for giving graphic and kinetic expression and form to our moods and feelings. They become intelligent.

The word "intelligent" is applied here as reference to a series of materials and electronic procedures that dramatically react to external stimulus, modifying its properties, structure, composition or function. Intelligent materials as shape

memory alloys (SMAs), magneto theological materials (MR), piezoeletric materials (PZT) and electroactive polymers (EAPs) are changed through the use of electricity, a hit, light, pressure or magnetic fields provoking a change in its format, color, size or molecular structure (from liquid to solid for instance).

The concept, in which computers tend to be embedded in everyday objects as walls, tabletops, furniture and even clothes, is called "Ubiquitous computing"[26].

> *"The most profound technologies are those that disappear. They weave themselves into fabric of everyday life until they are indistinguishable from it".* M. Weiser, "the computer for the Twenty First Century", Scientific American, September 1991.

The term "ubiquitous computing' was coined by Mark Weiser[27] in 1988. According to his concept a person might interact with hundreds of computers at a time, each invisibly embedded in the environment and wirelessly communicating with each other. (WEISER, 1996)

Bradley Quinn also pointed this trend when he said: "electronics would be embedded invisibly almost everywhere, so that sensors can exchange information about a number of systems they are programmed to detect." (QUINN, 2002)

In order to add new functionalities to the wearable devices the use of technical components becomes necessary. The main technical components could be divided, according Sabine Seymour, in 6 categories (SEYMOUR, 2007):

- Interfaces (connectors, wires, antennas…),
- Microprocessors,
- Sensors,
- Software,
- Energy (battery, solar panel…)

[26] In the late 1990s IBM coined the term 'pervasive computing', which is often used synonymously with ubiquitous computing. Also MIT has used the term 'calm technology' to express similar concepts.
[27] At that time chief of Computer Science Laboratory at Xerox PARC (Palo Alto Research Center).

- Special materials such as electronic fabric, microfibers and so on.

Steeve Mann, one of the pioneers in this field, defines a wearable computer as a computer that is subsumed into the personal space of the user, controlled by the user, and has both operational and international constancy, i.e. is always accessible. (MANN, 1998)

The technological advances have driven key developments in the story of wearables, and not only from the 80's with the miniaturization of electrical components. Ryan (RYAN, 2008) explain that for example the development of elastic thread in the 1930's, as a result of research in synthetics, led to rapid changes in women's undergarments and eventually in clothes themselves.

The potential of new technologies applied to wearable has shown deep implications in our experience with our own body and mind, our communication capabilities, care for health and life style. These aspects are perceived and interpreted by artists that use recent technology to create wearable artworks.

3.4 Artistic applications of wearable technology

For a long time artists have attached devices to clothes in order to modify their appearance or add some functions. Despite the recent developments in sensory technology, the union of electricity with light and fashion is not an exclusive fact of the twentieth-century.

Battery-powered 'flash jewellery' in the form of kinetic or illuminated hatpins, brooches and diadems became a fashion fad in France and England during the late 1870s and 1880s. Magazines like "La Nature" and "Scientific American" documented the designs of Monsieur Trouvé in Paris - labeled Electric Jewels - to be worn in the costumes of dancers and stage performers. They were powered by 2-4 volt hidden batteries and operated by a switch carried in a pocket. Glass gemstones placed over tiny bulbs accented the sparkling electric magic so that, as the Electric World commented, a dashing demimondaine can thus make a pennyworth of glass eclipse a duchess's diamonds or rubies. (LEE, 2005)

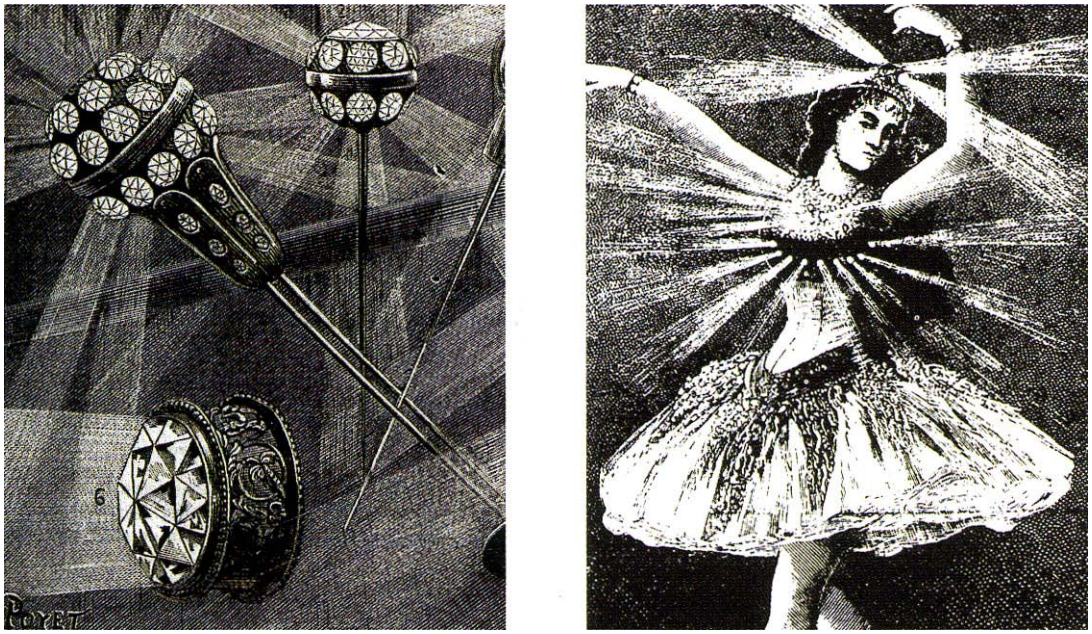

Figure 27: Design from Monsieur Trouvé. © La Nature

Another historical example of the intersection of technology and clothes are the drawings produced by the Italian futuristic movement in the beginning of the twentieth century. The Italian Futurist movement of the early twentieth century advocated clothing that escaped the fripperies of fashion, among other things proposing ‘dynamic’, ‘functional’ clothing that freed the wearer.

In 1914 Giacomo Balla suggested a series of dresses for a new mood at any instant. Similarly, in the 1935 manifesto ‘Latin Pleasures for the Mind’, Filippo Tomaso Marineti sought ‘ tactile resonant metaphorical dress tuned to the hour, the day, the season and the mood to convey sensations of dawn, noon, evening, spring, summer, winter, autumn, ambition, love, etc. (LEE, 2005)

LE VÊTEMENT MASCULIN FUTURISTE

Manifeste

L'humanité a toujours porté le deuil, ou l'armure pesante, ou la chape hiératique, ou le manteau traînant. Le corps de l'homme a toujours été attristé par le noir, ou emprisonné de ceintures ou écrasé par des draperies.

Durant le Moyen-Âge et la Renaissance l'habillement a presque toujours eu des couleurs et des formes statiques, pesantes, drapées ou bouffantes, solennelles, graves, sacerdotales, incommodes et encombrantes. C'étaient des expressions de mélancolie, d'esclavage ou de terreur. C'était la négation de la vie musculaire, qui étouffait dans un passéisme anti-hygiénique d'étoffes trop lourdes et de demi-teintes ennuyeuses efféminées ou décadentes.

C'est pourquoi aujourd'hui comme autrefois les rues pleines de foule, les théâtres, et les salons ont une tonalité et un rythme désolants, funéraires et déprimants.

Nous voulons donc abolir:

1. — Les vêtements de deuil que les croque-morts eux-mêmes devraient refuser.
2. — Toutes les couleurs fanées, jolies, neutres, fantaisie, foncées.
3. — Toutes les étoffes à raies, quadrillées et à petits pois.
4. — Les soi-disants bon goût et harmonie de teintes et de formes qui ramollissent les nerfs et ralentissent le pas.
5. — La symétrie dans la coupe, la ligne statique qui fatigue, déprime, contriste, enchaîne les muscles, l'uniformité des revers et toutes les bizarreries ornementales.

Costume gris
Dessins noirs
Modifiants rouge bleu
Gilet vert

Figure 28: Giacomo Balla. "Male Futuristic Dress: A Manifesto", 1913, 14. © DACS 2005

The artistic expression through wearables emerged in the 1950's and 1960's alongside art world interest in the body (body art) and performance. Artists like Atsuko Tanaka[28] (Electric Dress, 1959) created wearable works that could be worn. From

[28] Atsuko Tanaka, member of the famous Japanese avant-garde art group Gutai, whose work was most productive between 1950 and 1960. The artist created the "electric dress" from neon lamps connected by a mass of cables. The dress combines the traditional Kimono with the modern industrial technology. The dress was used in a performance during the 2nd Gutai art Exhibition in Ohara Kaikan Hall in Tokyo in October 1956.

that time, with the popularisation of the computer and the increased miniaturization, many wearable projects started to pop up.

Figure 29: Reconstructed Electric Dress by Atsuko Tanaka, 1986. Photograph: Shigemufi Kato © Takamatsu City Museum of Art

In the following part of the text I will describe my own wearable project based on what was discussed until here.

4. Practical Research: Parangonet 1.0: sonic dimension

This research has lead to an artist project which involves aspects of the tropicalist movement and the use of wearable device as interfaces to create and transform the sound landscape. This work was strongly inspired by the work *"Parangolé"* from Hélio Oticica (as described in chapter 2.8) and tries to make a review of this piece and to bring it to our time, using technology to enhance its function and turn the *"Parangolé"* into what I call "*Parangonet"*. It is in homage to this great artist who has influenced my work and still has an enormous influence on the Brazilian culture.

4.1 Previous work – Taiknam hat

However, my interest in wearable art and intelligent devices begun during my studies at Interface Cultures where I developed artworks in which the perception of the space is changed trough the usage of a wearable piece. Bellow, I will describe an early project developed under this concept: Taiknam hat.

Taiknam Hat (2008) was made in collaboration with Ebru Kurbak and Fabiana Shizue. It is a kinetic head-wear that reacts and animates in accordance with the changes in its surrounding radio frequencies. The intention of the project is to materialize the invisible and to contribute to the awareness of the increasing electromagnetic radiation.

The co-existence of all electromagnetic waves that radiate from physical devices creates an invisible landscape that interacts with physical space and its inhabitants. This landscape is transforming into a new form of pollution, the electrosmog, which might have biological effects on humans and animals.

Taiknam Hat is an attempt to materialize the electrosmog, especially with the contribution of immensely used cell-phones, by emulating horripilation, an automatic instinctive reaction of living creatures to sources of irritation and stress.

Horripilation, which can be defined as the erection of hairs or feathers in various species under certain emotional conditions (better known as goose bumps in human body) is a temporary and local change in the skin. It is usually referred to as being a part of the "fight-or-flight" reaction of animals. Animals respond to exterior threats with a reflex of their nervous system which results in either the animal fighting (anger emotion) or fleeing (fear emotion) and horripilation can be clearly observed in the moment of both reactions. In some animals, especially in birds, horripilation is also attached to another instinct, the instinct of self-display and signaling.

Taiknam Hat utilizes the biological fact of horripilation in birds as a metaphor to express our bodies' irritation towards electromagnetic radiation as well as to create a visual and tactile signage of their existence for other people. The headwear employs a number of movable actual feathers. These feathers become activated and move according to the existence and amount of radio frequencies at a certain location while the person who wears the hat strolls through space.

4.1.1 Fashion Design of Taiknam hat

A lady's hat is composed by black feathers and a top of a transparent fabric found in an old shop in Nagoya - Japan. The feathers were brought from Brazil and are typical from birds in South America and largely used in costumes during the carnival. The man's hat is a typical Austrian hat with also typical feathers.

The fashion design and the material were chosen taking in consideration cultural aspects of the place where it was produced and also the culture of the authors.
The circuits and sensors are in the inner top part of both hats where it does not disturb the wearer and the aesthetic of the outside.

Figure 30: Male Taiknam hat. Photograph: Fabiana Shizue

Figure 31: Female Taiknam hat. Photograph: Ricardo Nascimento

4.1.2 Technology of Taiknam hat

The *Taiknam Hat* is composed of fixed and movable actual feathers attached to a fabric base together with a detecting/motion-driving system. A radio frequency detector probe[29] constantly traces signals between 100 KHz and 1000 MHz and creates a DC power output. This live information is sent to the Arduino[30] board (see the code at appendix A), analysed and utilized as input data that activates a servo motor (see figure 32). The servo motor operates a mechanical structure that holds the feathers and results in the kinetic behaviour of the feathers.

Figure 32: Detail showing the servo motor used to move the feathers. Photograph: Ricardo Nascimento.

[29] Ramsey Electronics model n. RF1. This device is available at www.lessemf.com

[30] Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). www.arduino.cc

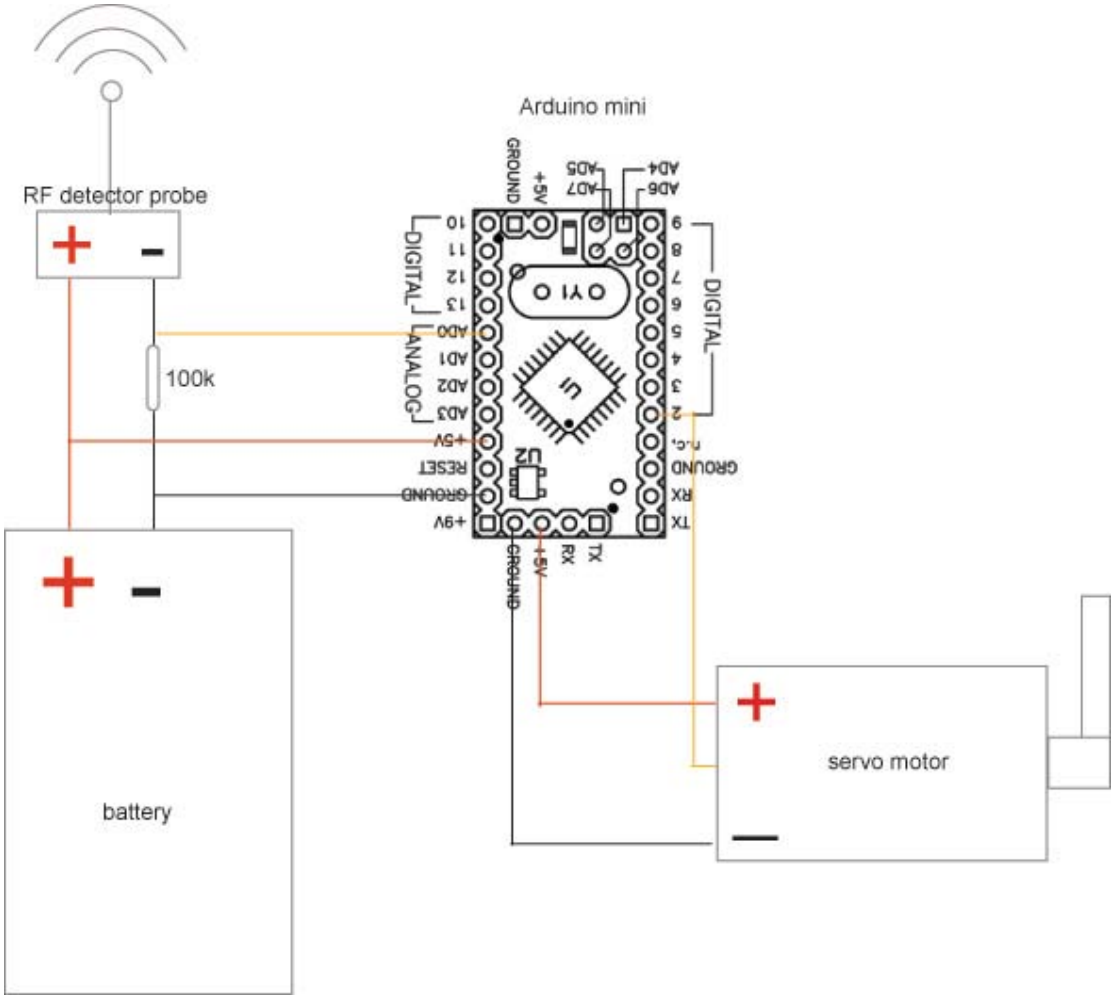

Figure 33: Circuit of Taiknam hat.

4.1.3 User Interaction of Taiknam hat

The hat is a visualization tool to alert people about the electronic pollution. For this purpose someone should wear the hat and walk around the space. When some electrical activity is detected the others can perceive the changes on the magnetic field through the hats movement. For the one who is wearing the hat it is possible to feel the vibration that comes out from the motor activity.

The hat reacts mainly according to cell phone frequency and this characteristic creates a funny situation when the wearer receives a phone call and the hat starts to move. Normally the audience perceives the movement of the feathers as the tail of a peacock trying to catch attention.

4.1.4 Summary and constrains

These two *Taiknam hat* prototypes where quite successful in their objectives and people perceive them as a funny interface that deals with a serious issue. The humour embedded in the pieces has revealed itself as a strong and effective way to reach people's attention. However, the piece is extremely delicate and the constant manipulation in an exhibition environment have damaged the feathers a bit, mainly by people wanting to look at the inner part. After some exhibitions, both hats needed repair and the feathers changed. Another issue is that the hat itself, due to the servo motor, creates an electronic field and goes somehow against what it is trying to aware. This work was a fabulous first contact with wearables and gave me tools to deepen into this realm and develop the next work of my master's thesis: "*Parangonet 1.0: sonic dimension*".

Before I start the "*Parangonet 1.0: sonic dimension*" I sought works that use wearable garments to specifically control and modify the environment. Such works were useful to research about technical issues and also gave me an overview about the wearable computing production that is somehow connected with my personal work.

4.2 Related works

In this chapter I introduce some works that deal with the relation between body and environment mediated by technology and/or point out new ways by which technology changes or creates new relationships involving the body. These works were selected due to their connection with my personal work and their creative approach of the theme on the technical and aesthetical aspects.

4.2.1 Audio Ballerina (1989) by Benoît Maubrey

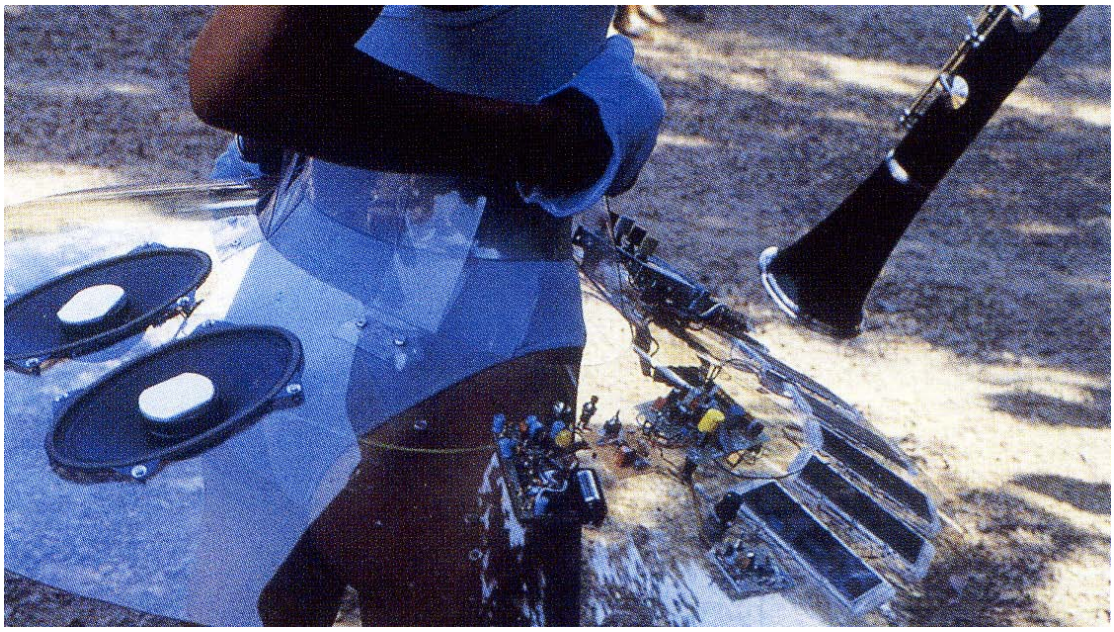

Figure 34: Audio Ballerina, 1989. Credits: Eke Wijngaard/Benoît Maubrey.

This project, one of the pioneer wearable works that deal with sound, creates a wearable synthesiser in a shape of a ballet dance costume. Totally analogue, the performer can record the surround environment and transform this sound through buttons and knobs placed on the costume and on the performer's hands. Via movement sensors the performer can also trigger electronic sounds that are subsequently choreography into musical compositions as an "audio ballet". The plexiglass surface is equipped with digital memories, radio-wave receivers, microphones, light sensors, amplifiers and speakers that enable the interaction with the environment. The system is powered by solar cells when performed outdoor and rechargeable batteries when indoor.

4.2.2 DIVAs (1994 - 2003) by Sidney Fels

Figure 35: DIVAs. © Sidney Fels

DIVAs is an easy-to-use portable, wearable gesture-to-speech system based on the Glove-TalkII (SIDNEY, 1995), GRASSP gesture-controlled speech systems and face synthesizer. This new version of the portable system is called a Digital Ventriloquized Actor (DIVAs). Using DIVAs, user can speak using hand gestures mapped to both synthetic sound and face using a mapping function that preserves gesture trajectories. By making DIVAs portable and self-contained, speakers can communicate with others in the community and perform in new music/theatre stage productions. DIVAs performers also allow the study of the relationship between visible gestures and speech/song production.

4.2.3 MIBURI (1995) by Yamaha

http://www.yamaha.co.jp/design/products/1990/miburi/

Figure 36: model performing the MIBURI for the Yamaha website. © Yamaha Corporation

MIBURI is a wearable instrument developed by Yamaha. Several wearable garments equipped with buttons, pressure and flex sensors compose the device. By moving the whole body the user triggers different sounds. MIBURI can be totally reprogrammed in order to play any instrument that can be synthesized by a sound module. MIBURI creates many performing possibilities and allows the musician to play freely, using the body as an instrument. Several videos spread over the Internet[31] show the impressive performance of this device. Unfortunately it was only released in Japanese market.

[31] http://www.youtube.com/results?search_query=MIBURI+Yamaha&search_type=

4.2.4 Musical Jacket (1997) by MIT

Figure 36: Musical Jacket from MIT lab. Credits: Maggie Orth

Another example of enhanced clothing is the visionary “Musical Jacket” from the MIT media lab. The Musical Jacket integrates a wearable MIDI synthesizer with an embroidered keypad. Sensing electronics place a small electrical charge on each number embroidered from conductive thread. When the wearer touches the number the body draws the charge to ground. Electronics sense the charge to trigger a musical event.

4.2.5 Ensemble (2004 - ongoing) by Kristina Andersen

http://ensemble.lockergirl.com/

Figure 38: Drawing showing the interaction with the clothes. © Kristina Andersen

“Ensemble” is a group of clothes designed for children´s plays. Many different pieces were created such as: trousers, skirts, hats, suits and shoes.

According to the artist “Ensemble” is a suitcase full of sounds and clothes. Each piece of clothing is a simple sensor that modifies a sound or a voice. The sensor is incorporated into a garment and together each set has its own possibilities for movement and control. (ANDERSEN, 2004)

Several sensors were used in this project such as: flex sensors, pressure sensors, light sensors and accelerometers. Children are allowed to dress the clothes and play around. By doing this they create several sounds that are transformed by their movement and the environment.

4.2.6 Visita: Delírio Corporal (2008) by pmdn + zero do Brasil

http://www.maiszero.org/blog/?p=692

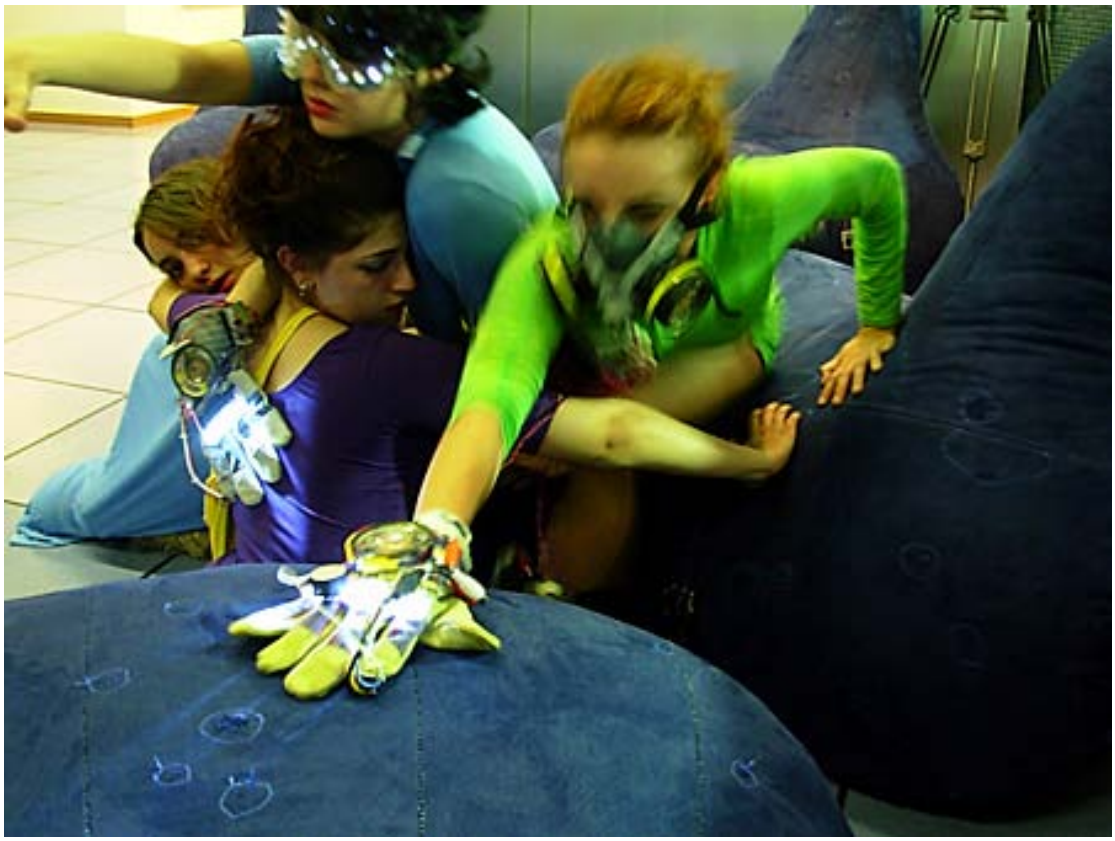

Figure 39: Detail of the performance of "Delirio corporal". © pmdn + zero do Brasil

"Visita: *Delirio Corporal*" is a performance-based artwork that uses a collaborative interaction situation to enhance the perception of the space. The garments, created by the Brazilian art collective, are called "*aparato planejante*". They are equipped with sensors, speakers, bips and LEDs. Performers should wear the clothes (five in total) and interact among themselves and with the audience. This interaction activates several audios and light outputs that transform the surround environment.

This work has some similar characteristics as "*Parangonet 1.0: sonic dimension*" as: performance based, garments with vibrant colours and output that changes the environment.

4.2.7 Sharewear (2008) by V2

http://sharewear.projects.v2.nl/

Figure 40: SHAREWEAR devices. © V2

Distorting the seam between home comfort and urban exposure, “SHAREWEAR” creates an in-between place amid private and shared space. The work comprises of a pair of reconfigurable, electronic dresses that physically slot together to activate atmospheric pools of light. Unleashing potential for intimate chance discoveries, they are worn as part of a performance, inviting both wearer and audience to get close, lean on one another, morph space, manipulate light and cast long shadows.

4.2.8 Perfect Human (2008) by Mika Satomi and Hannah Perner-Wilson

http://kobakant.at/index.php?menu=2&work=5

Figure 41: Performance of "Perfect human". © Mika Satomi and Hannah Perner Wilson.

"Perfect Human" is a performance inspired by Joergen Leth's 1967 short film "The Perfect Human" and Lars von Trier's "The Five Obstructions" (2003). The artists intend to create a sixth obstruction, by introducing the rule of performance and the rule of non-linear narration. In this work many stretch sensors were embedded in the clothes to trigger the performer's movement and send this information to the computer that changes the sound of the text according to this information.

This piece is an open source project. It presents all the technology involved (sensors and wireless communication) in a website[32] and was an amazing source of ideas and technical solutions for "*Parangonet 1.0" sonic dimension*".

[32] http://www.instructables.com/id/SG9FAGPFL9KQLDD/

4.2.9 Spin on the Waltz (2009) by Ambreen Hussain

Figure 42: Dancers performing "Spin on the Waltz". Picture by Ambreen Hussain.

"*Spin on the Waltz*" or "*Spin for short*", creates a new and interactive sound environment for Viennese waltz dancers through two wearable garments with embedded technologies that trigger an electronically generated melody. These two wearable outfits are constructed for professional-level male and female Viennese waltzers, and act as new media audio instruments allowing the dance and the two bodies to control music in an interactive manner.

Three sensors are placed on both the male and the female garment. Five encounters trigger a sensor that controls the output of a synthesized melody. In a sense, their bodies are reflecting the movements of the harmonic waveforms that produce the sound outputs, and vice versa. Spin is constructed through hard and software

technologies such as: Max/MSP[33], soft circuitry, and Lilypad Arduino[34] programming.

4.3 Parangonet 1.0: sonic dimension and the recreation of Hélio Oiticica works in the wearable field

The project *"Parangonet 1.0: sonic dimension"* aims to recreate the original concept of the artwork *Parangolé*, from the Brazilian artist Hélio Oiticica (see chapter 2.8), in our times, when technology plays an important role in society. The idea is to develop a series of "*Parangolés"* sensed by technology and to transform them into what I call *"Parangonet"*.

The *"Parangonet 1.0: sonic dimension"* is the first of a series of wearable garments that form a net of collaborative wearable sculptures that change and interfere in the surround environment, creating new languages and experiences.

This project is composed of two wearable sculptures that, through their movement in space, create and broadcast sound samples that refer to the Brazilian artistic movement called *"Tropicalismo"* or Tropicalism, in English (see chapter 2.1). Each garment is able to trigger and modify a different sound input (see chapter 4.3.5). When performed together they create a sonic atmosphere that represents the cultural agglutination at sound level as previously proposed by the tropicalists but transposed to our days.

[33] Max is a visual programming language for music and multimedia developed and maintained by San Francisco-based software company Cycling '74 (www.cycling74.com).

[34] The LilyPad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. The board is based on the ATmega168V (the low-power version of the ATmega168) or the ATmega328V. The LilyPad Arduino was designed and developed by Leah Buechley and SparkFun Electronics. Source: arduino.cc

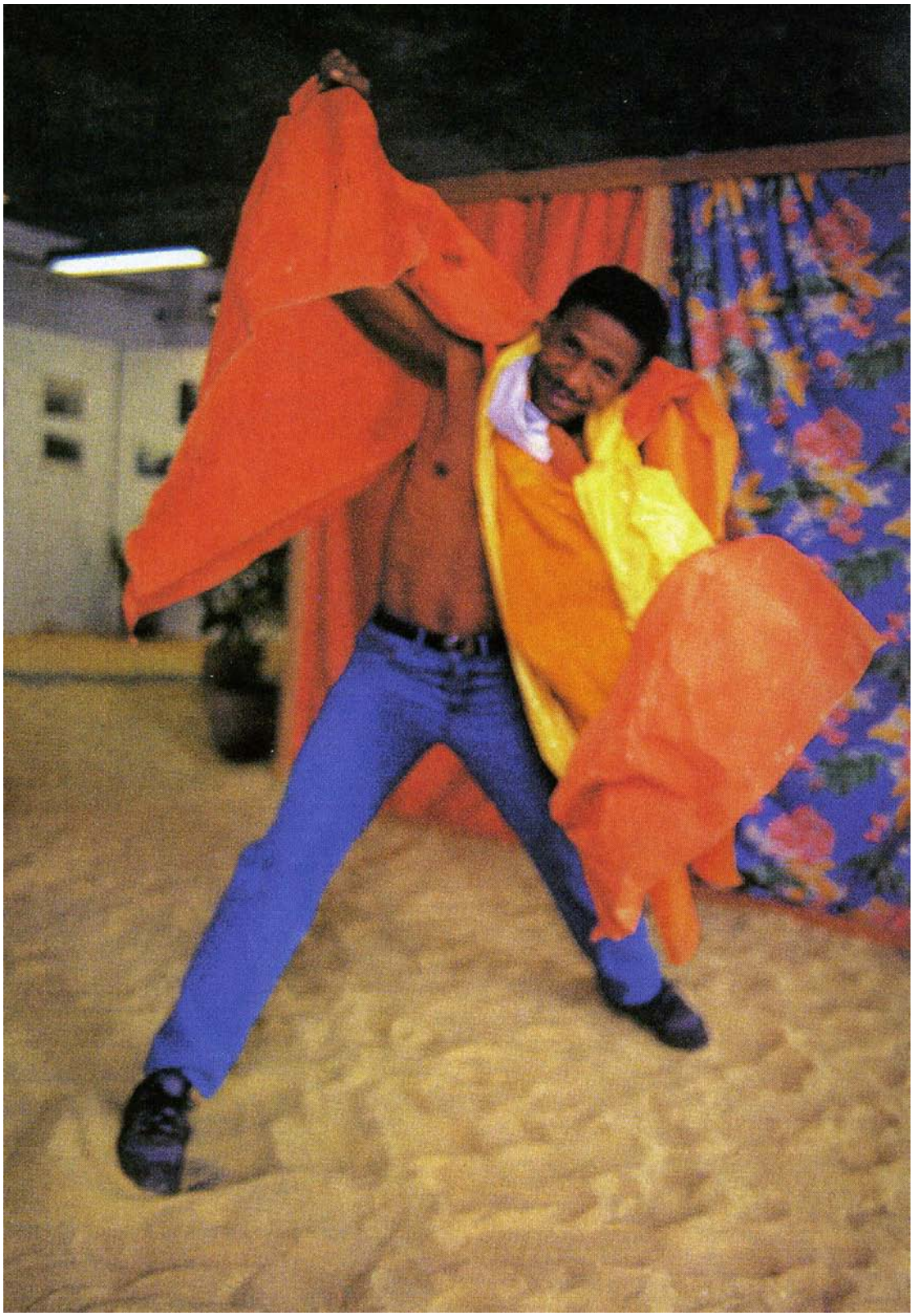

Figure 43: Man performing the *Parangolé*. © Generali Foundation

A monitored dialogue between the devices creates a transcultural dialog built among various worlds and different experiences. The sound samples when performed together work as a metaphor of a multicultural agglutination and alter the "mood" and rhythm of the environment.

The multicultural agglutination created by the performance of "*Parangonet 1.0: sonic dimension*" reflects one traditional aspect of Brazilian people, by which we embrace other cultures and build our own, in a metaphorical anthropophagic cultural banquet.

The *"Parangonet 1.0 sonic dimension"* performance forms a sonic environment that embraces the Brazilian culture but also the culture from where it is performed and all others cultures that are represented by the pre-recorded sounds (see chapter 4.3.5).

"Parangonet 1.0: sonic dimension" allows access to a new spatial, temporal and sonic perception. The user can act as she/he wishes and realizes movements, actions, gestures and noises. By doing so, the user is able to create new syntaxes in the space while wearing and completing the piece according to the concepts previously discussed on Chapter 3.

This piece aims to break the common routine and present new elements that have the possibility to enhance the perception of the objects, the sounds and the surround space where it is performed. It opens a chance in daily life for the raise of creative actions. The users can play freely with the signs that form the message (colours, sounds and shapes) and promote the absorption of the space and time for an extremely creative attitude.

During the performance of "*Parangonet 1.0: sonic dimension*" what matters is the appropriation: of the time, space and sensations of the collective in order to built new spaces, time, experiences and sensations.

4.3.1 Fashion Design, Interface Design and Wearability

The original "*Parangolé*" was made out from ordinary materials such as, banners, plastic bags and anything you could reach out for in the slums of Rio de Janeiro. However I decided to bring the "*Parangonet*" a bit closer to the fashion world. Therefore, I invited the fashion/textile designer Nathalie Pelet to help me design the costumes. Nathaly is a student at Textil/Kunst &Design Kunstuniversität Linz and has worked in theatres and dance plays as fashion designer. Her knowledge of materials and sewing techniques has improved the final appearance of the devices. For each device a name was given: "*Parangonet 1: be legendary*" and " *Parangonet 2: lebenserfahrung*".

For the "*Parangonet 1: be legendary*". We decided to create a sort of cape the user can put on top of him/herself or use as a superhero cape. Our goal when designing this piece was that the "*Parangonet 1: be legendary*" should let the user and his/her imagination flow free through an extremely simple costume. I took the name "*Parangonet 1: be legendary*" from an old t-shirt I found in my flat and decided to use it as part of the piece. On this t-shirt was written the sentence: "be legendary". I found this sentence quite appropriate for this cape. Helio Oiticica named one of his "*Parangolés*" "be marginal, be a hero". "Be legendary" could be the natural consequence of someone who was a hero. The same with the "*Parangonets"* that are consequence of the "*Parangolés"*.

In regards to the material, we used a mix of many fabrics composing a patchwork. Each fabric has a typical pattern from a different country, mainly Brazil and Austria due to location reasons. The outcome was close to the tropicalist aesthetic and concept. We found this mixture quite interesting and a good metaphor to what the "*Parangonet 1.0: sonic dimension*" is about. (see figure 49)

Figure 44: First drawings of "*Parangonet 1: be legendary*". Drawings by Nathaly Pelet

For both garments, the design were developed aiming a comfortable and unobtrusive wearability. To decide on the design of the garment, how to shape the hard components and where to place them I took into consideration some parameters established by Francine Gemperle (GEMPERLE, 1998) such as:

1. Placement (where on the body it should go)
2. Form Language (defining the shape)
3. Human Movement (consider the dynamic structure)
4. Proxemics (human perception of space)
5. Sizing (for body size diversity)
6. Attachment (fixing forms to the body)

Some points were more relevant on the developing of the "*Parangonet 1.0: sonic dimension*" than others. For example item six, attachment, was not important once there is no direct contact between the body and the hard components during the performance. However, most of these guidelines were integrated during the process. (see figure 49)

The placement of the components, more specifically the sensors, should take in consideration not only the user's comfort but also the quality of the data that the

sensor sends to the computer. This aspect is even more relevant when the sensor is used to track movements, which is the case in "*Parangonet 1.0: sonic dimension*". In the "*Parangonet 1: be legendary*" the sensor used to interpret the movements of the wearer is an accelerometer[35]. The accelerometer was fixed in a distance of about 30cm from the centre of the cape, which has demonstrated not too much range on the output data. This issue was solved when I fixed the accelerometer on the top of the cape. After this change the computer started to receive a better and larger range of data which reflected in a better control of the sound.

Figure 45: First drawings of "*Parangonet 1: be legendary*". Illustration: Ricardo Nascimento

The "*Parangonet 2: lebenserfahrung*" has a microphone embedded on it. The biggest part of the hardware is the sender (see figure 48), which was fixed just behind the

[35] Accelerometer is a type of sensor that measures the acceleration on two or three axis. For "*Parangonet 1.0: sonic dimension*" I used the LilyPad accelerometer that measures the acceleration on three axis: x, y and z. It is based on the ADXL accelerometer from Analog Devices and can detect joint movements as well inclination and vibration.

neck, a place that does not disturb too much the movements as also Gemperle has pointed out (GEMPERLE, 1998). However the microphone itself was positioned on the front left side. The decision to put the microphone in this position was made rather for poetical than functional reasons. The microphone was fixed near the heart to create a symbolic emotional connection with the wearer. The microphone is covered with rocks that reflect the light and create an interesting visual effect. The microphone was turned into a jewel that preciously absorbs the surrounding space sounds. (see figure 46)

Figure 46: Detail of the microphone at "*Parangonet 2: lebenserfahrung*". Photograph: Ricardo Nascimento

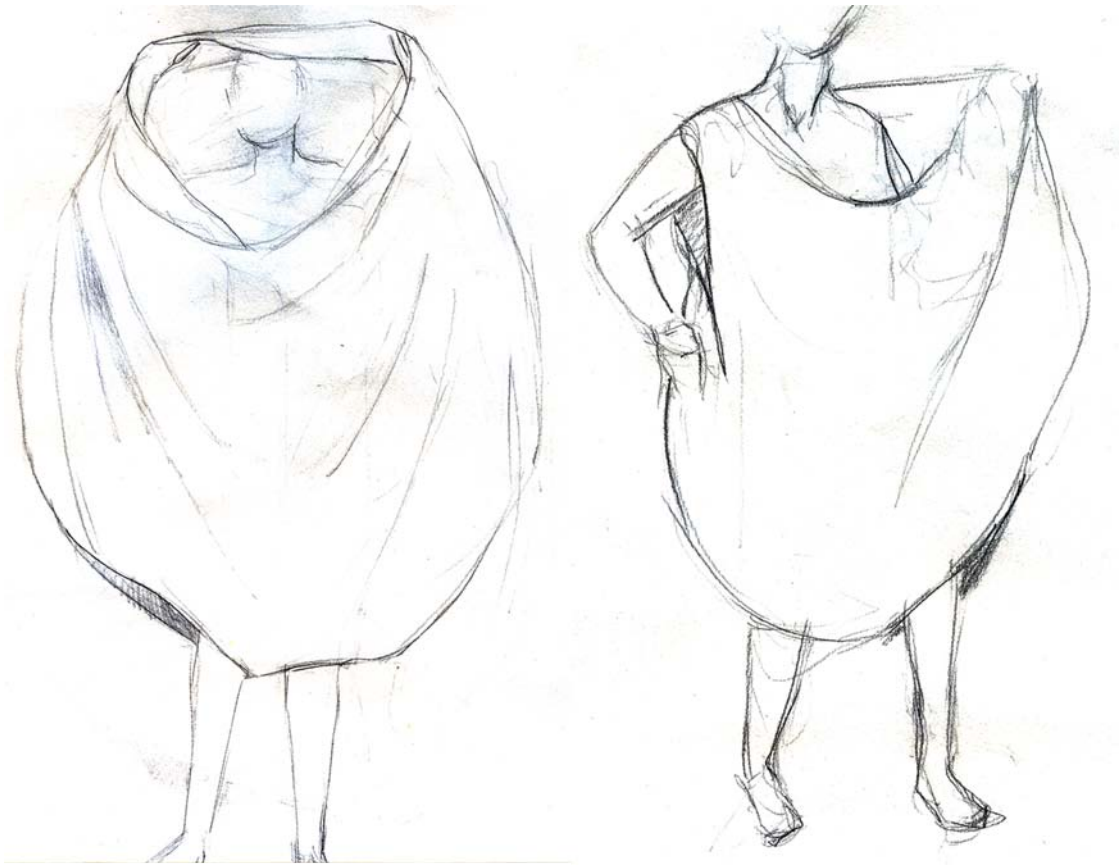

Figure 47: First drawings of "*Parangonet 2: lebenserfahrung*". Drawings by Nathaly Pelet

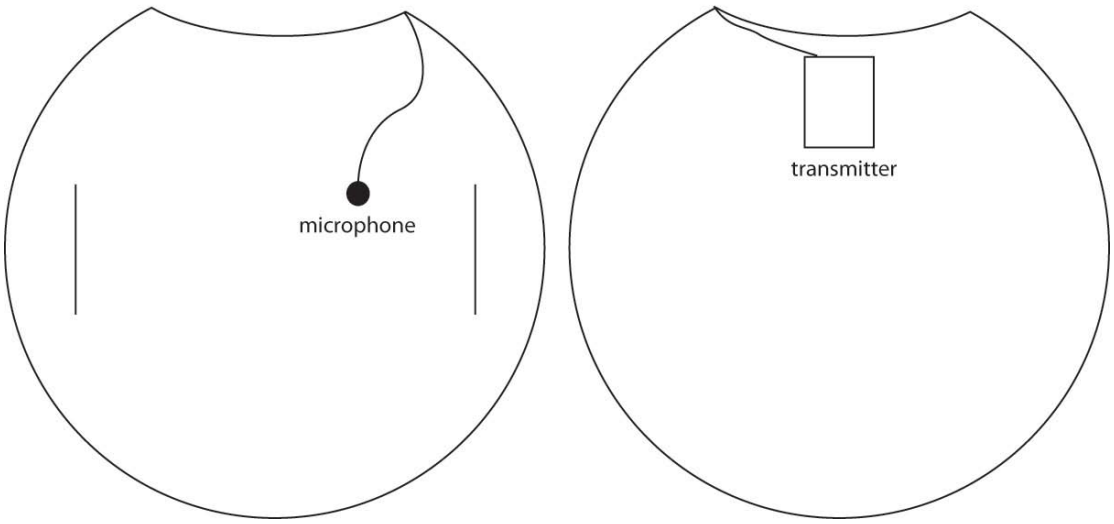

Figure 48: First drawings of "*Parangonet 2: lebenserfahrung*". Illustration by Ricardo Nascimento

4.3.2 Functioning of the Parangonet 1.0: sonic dimension

For this project a set of two different interactive wearable devices were produced. These devices open the possibility of generating and capturing data according to the audience usage and of creating an immediate sonic output that changes and re-creates the sound landscape.

The garments themselves are a big electronic circuit with sensors embedded on it (accelerometer and microphone). According to its movement and manipulation a different data is sent wirelessly to the computer that triggers and transforms sound patterns specially created for the project. Below I describe each garment in terms of technical aspect.

Parangonet 1: be legendary

Through a motion detection system composed by one accelerometer and an Arduino[36] board the "*Parangonet 1.0: sonic dimension*" controls rhythmic and melodic music patterns. It is connected to a computer via wireless using XBee[37] interface. The accelerometer measures the acceleration on the three axes (x, y and z). This data is used to detect the movements of the wearer and based on those movements the computer applies some filters on the sound and changes the sound loop that is played.

[36] Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language and the Arduino development environment. Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP). Source: arduino.cc

[37] XBee, as described in the fabricant website (www.digi.com), is a module that provides wireless end-point connectivity to devices through the ZigBee protocol. They are designed for high-throughput applications requiring low latency and predictable communication timing. The XBee can operate in a range up to 90m and operates at the 2.4Ghz frequency (http://www.digi.com/products/wireless/point-multipoint/xbee-series1-modulespecs.jsp)

The outcome is broadcasted into stereo speakers connected to the computer.

Figure 49: "*Parangonet 1: be legendary"*. Illustration by Ricardo Nascimento

Parangonet 2: Lebenserfahrung

The "*Parangonet 2: Lebenserfahrung*" carries a microphone that records 5 seconds of the surround sound landscape every 15 seconds and rearranges/transforms these sound into a metaphor of the anthropophagic banquet imagined by the tropicalists. The microphone sends the captured sound wirelessly though an FM sender to a receiver connected to the computer. The computer broadcasts the recorded sound in a continuous loop, feeding the system with its own sound. This feature gives a retro feedback aspect to the work. The sound is broadcasted in stereo speakers connected to the computer.

Figure 50: "*Parangonet 2: lebenserfahrung*". Ilustration by Ricardo Nascimento

4.3.3 Technical description

On the "*Parangonet 1: be legendary*" an accelerometer is used to map the movement of the user. The circuit was made using basic micro computing components as shown in the following figure:

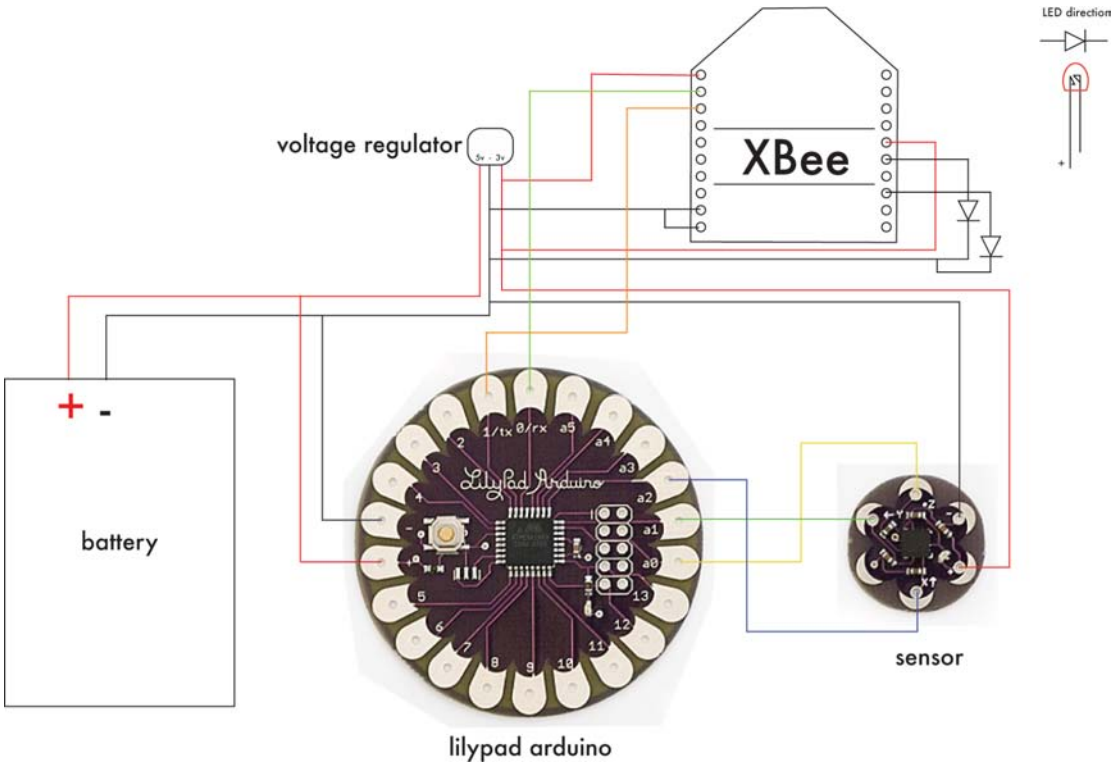

Figure 51: Circuit of "*Parangonet 1:be legendary*". Illustration by Ricardo Nascimento

The electronic parts of the circuit were connected using wires and conductive tread and fabric. The use of conductive fabric and tread brought to the cape more flexibility and lightness. All the components except the XBee module, that you can easily remove, are washable.

In some firsts versions of the wireless communication I used Bluetooth®, however due to the distance between the "*Parangonet 1: be legendary*" and the computer and also the presence of other Bluetooth® devices (mobile phones, other computers, etc…) the signal was lost at times. In a performance situation lost connection between the device and the computer is problematic because there is no time to reset the

system and establish a new connection. This problem did not occur with XBee, which was more stable and had no external interference on its signal.

On the "*Parangonet 2: lebenserfahrung*" a wireless microphone is attached to the cloth (see figure 48). The audio signal is controlled and processed by the computer.

On the computer side an FM receiver is mounted on the audio input to capture the sound from the microphone. The microphone receiver works via FM radio waves with an answer frequency of 80 to 12.500Hz and operates until 50m from the source.

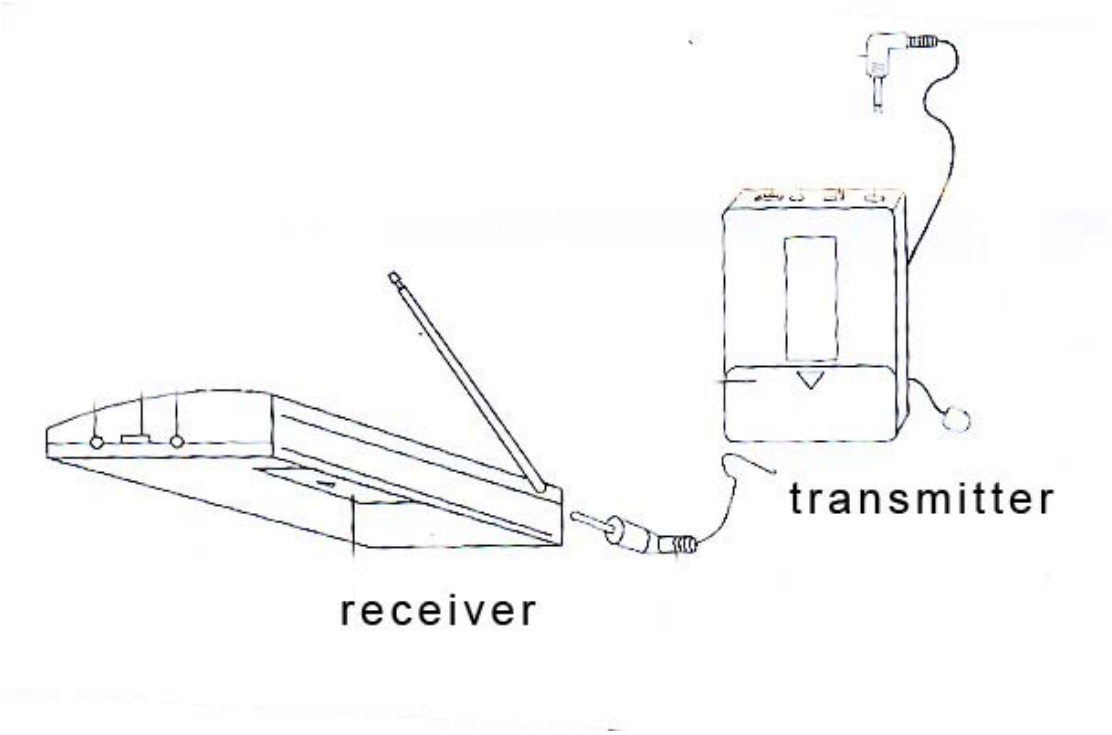

Fig. 52 The receiver is connect to a computer and the transmitter is attached to the "*Parangonet 2: lebenserfahrung*". Illustration by Ricardo Nascimento

4.3.4 Code

The computer was programmed using the software Max/MSP 5 from cycling 74[38] This software is a graphical programming environment that among other features enables sound manipulation (see description at chapter 4.2.4).

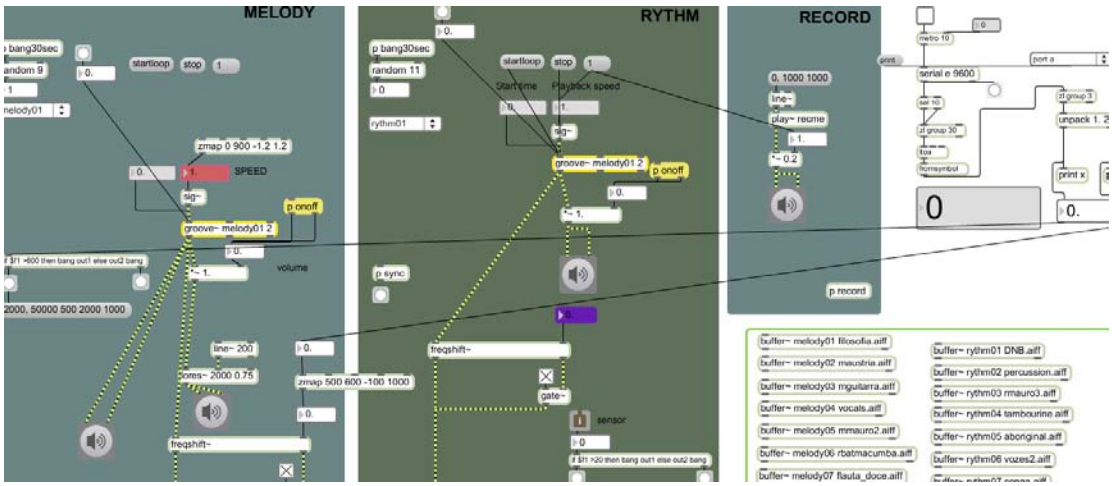

Figure 53: Detail of my Max/MSP 5 patcher.

No special library or object was used in this project. The pre-recorded sounds are stored in many buffers that are called according to some parameters triggered by the movement of the "*Parangonet 1: be legendary*". Also those movements are used to change de values of two different types of filters: lores[39] and freqshift[40].

Also in the code part a subpatcher was created to keep all the sounds synchronized one to another. This synchronization guarantees the feeling of unity when many sounds are simultaneously broadcasted. The data from the sensor is received through the serial port and then manipulated by the software.

[38] www.cycling74.com

[39] Lores is a resonant lowpass filter that implements an inexpensive lowpass with an adjustment that lets one add a specified resonance.

[40] Freqshift is a time-domain frequency shifter that shift the frequency in Hertz.

4.3.5 Sound design

I asked several sound artists from different countries to produce loops inspired on the tropicalist movement but also that refer to their own culture. Each artist created some loops of about 4 seconds, 120 beats per minute and a variable sample rate[41].

Those sounds are the starting point for the transformation through the "*Parangonets*" and because it is the basis they should not be complex, with a simple melody or rhythm pattern. The final loops selected for the project were tested before whether they would create a confuse mass of sound or not. After some testing putting together those loops in many possible combinations the final sounds were selected. However it was not the concern of my project to deal with harmony and to create a musical composition. The sound sources came from different artists that have different backgrounds, styles and taste. Sometimes when two sound loops are put together they seem not to fit and sound strange. Sometimes they sound surprisingly good. This creates a tension during the performance which I found very interesting.

4.3.6 User Interaction – considerations

When performing it is important that the user assumes a critical approach to the experience or, in Gadamer words, put in the game a self-seriousness (GADAMER, 2004). When the wearer takes the experience seriously the act of co-authoring, as discussed in chapter 3.1, can be effective and not only an allegory.

This piece was first presented at Ars Electronica Festival 2009 on the opening of the student exhibition from Interfaces Cultures called " The Royal interface Culture Masquerade Ball" on 3rd September 2009 (STOCKER, 2009). It was a four minutes performance.

From this presentation I could learn that the relation between the movements of the user and the changes in the sound should be extremely clear. I found out after the presentation that some people got confused because the relation between the

[41] As each artist produced the sound files in a different form and equipment, the sample rate was not fixed.

movements and the sound was not clear enough.

To diminish this problem I decided to map only three movements: One to change the sound loops, one to apply a filter on the melody sounds and one to apply a filter on the rhythm pattern.

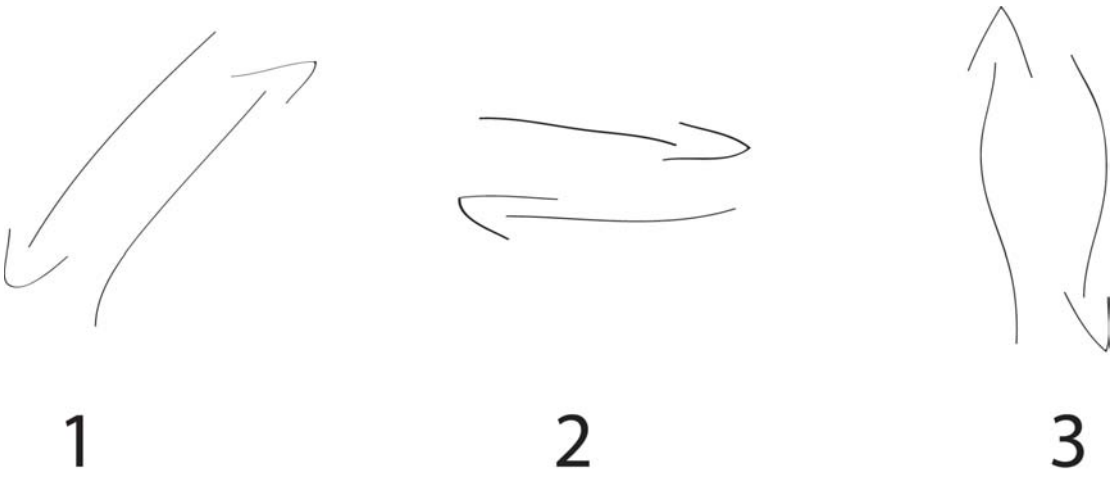

Figure 54: Drawing of the movements that trigger special features. Movement number 1 applies an effect on the rhythm loop. Movement number 2 changes the broadcasted loop. Movement number 3 applies an effect on the melodic loop.

After mapping the movements and choosing only three movements to control the sounds the interaction became easier and the learning curve diminished. After some tests with people who did not know how to interact and with no written instructions I found out that in general they needed less than a minute to learn how to interact with the piece.

The electronic components presented no problems and did not disturb the interaction in both of the "*Parangonets*".

4.4 Conclusion and outlook for the future

My work "*Parangonet 1.0:sonic dimension*" was reported to be visually appealing and the first impression on the audience was the easiness to establish quick communication encouraging the users to interact with the "*Parangonet 1.0: sonic dimension*". The tropicalist aesthetics and the connection to this Brazilian art movement, presented in chapter 2.1, could be recognized. The project has accomplished its goal of revisiting the concept of the "*Parangolés*" and through technology extended its possibilities, turning them into "*Parangonets*".

The "*Parangonet 1.0: sonic dimension*", as in Martin Kush's work, "established two pivotal parameters: the active participation of the public, and, in relation to the physical and socio-cultural context of the place, the configuration of space." (KUSCH, 2008)

During the presentation of "*Parangonet 1.0: sonic dimension*" it was clearly visible that the body, as discussed in chapter 3.2, performs important aspects and occupies a central position in this piece.

The technology used in "*Parangonet 1.0: sonic dimension*" is relatively simple and does not present a great innovation. However, it reveals the technology's potential to be used in an artistic manner and by doing so I hope to create new poetics and meanings.

Future improvements could lead to the development of new versions of the "*Parangonet*" with different inputs (other sensors such as: pressure sensor, light sensor, temperature sensor, etc.) and outputs such as: visual, textual, smell and tactile output. All those senses played and stimulated at the same time would definitively recreate the ultimate proposal of the tropicalists: process as much information as available and mix it. Maybe something new could arise from this tasteful cultural and sensorial salad.

Figure 55: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 56: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 57: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 58: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 59: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 60: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 61: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 62: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 63: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 64: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

Figure 65: People interacting with *Parangonet 1.0: sonic dimension*. Photo by Hugo Camargo.

List of figures

[42] Alceu Pena (1915 - 1980): Brazilian fashion designer and illustrator. He worked with the tropicalists in fashion shows promoted by Cia Rhodia Brasileira.
[43] Source: http://www.fashionbubbles2.com

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APENDIX A

This is the code created for the Taiknam Hat (see chapter 4.1) to program the Arduino board.

```
int servoPin = 9;
int myAngle;
int pulseWidth;

void servoPulse(int servoPin, int myAngle) {
  pulseWidth = (myAngle * 11) + 500;
  digitalWrite(servoPin, HIGH);
  delayMicroseconds(pulseWidth);
  digitalWrite(servoPin, LOW);
  delay(20);
}

void setup() {
  pinMode(servoPin, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  myAngle= analogRead(0);
if (myAngle > 10 ) {
    Serial.print("on - ");
    Serial.println(myAngle);
    servoPulse(servoPin, myAngle*10);

  }

    else {
      Serial.print("off - ");
      Serial.println(myAngle);
```

```
      servoPulse(servoPin, myAngle);
    }

   Serial.println(myAngle);

  delay(10);
}
```