**ΑΝΩΤΑΤΗ ΣΧΟΛΗ ΚΑΛΩΝ ΤΕΧΝΩΝ**

ΣΧΟΛΗ ΚΑΛΩΝ ΤΕΧΝΩΝ

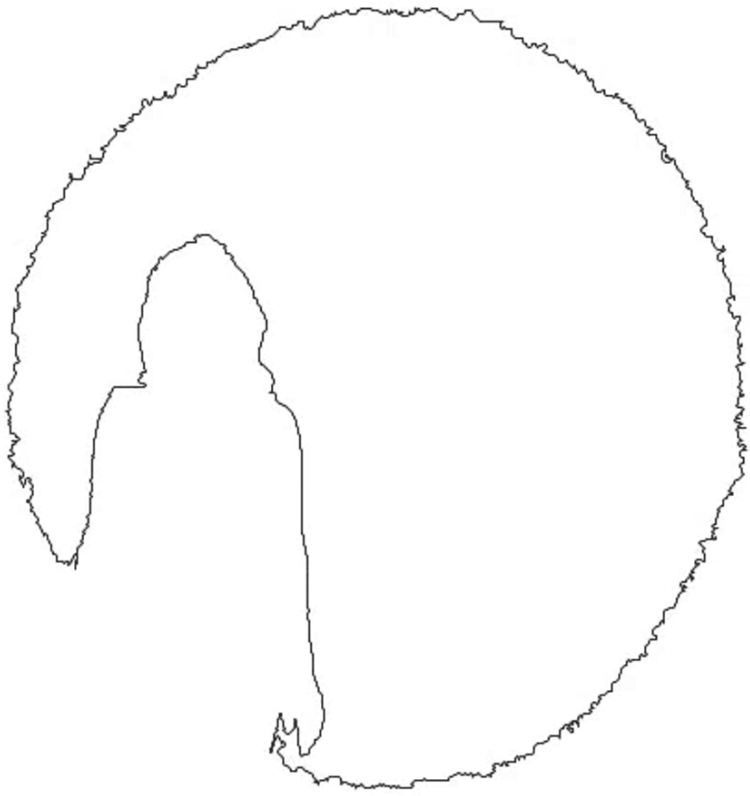
ΤΜΗΜΑ ΕΙΚΑΣΤΙΚΩΝ ΤΕΧΝΩΝ

ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ

**ΤΕΧΝΗ, ΕΙΚΟΝΙΚΗ ΠΡΑΓΜΑΤΙΚΟΤΗΤΑ ΚΑΙ ΠΟΛΥΧΡΗΣΤΙΚΑ ΣΥΣΤΗΜΑΤΑ ΚΑΛΛΙΤΕΧΝΙΚΗΣ ΕΚΦΡΑΣΗΣ**

# Partnering YourSelf

## An Interactive Mirror



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# Partnering YourSelf

## An Interactive Mirror

**Any movement could be dance and any body could be viewed in some way as “an aesthetic conveyor”.**

**-Merce Cunningham-**

# Περίληψη

Τα τελευταία χρόνια υπάρχει όλο και μεγαλύτερο ενδιαφέρον για τον συνδυασμό διαφόρων τομέων και επιστημονικών κλάδων. Στις επόμενες σελίδες αυτού του βιβλίου, αναπτύσσεται μία έρευνα σχετικά με την ανθρώπινη κίνηση, το χορό, τις νέες τεχνολογίες και το αποτέλεσμα που μπορεί να προκύψει μέσα από το συνδυασμό τους. Πιο συγκεκριμένα, στην αρχή, γίνεται αναφορά στην ανθρώπινη κίνηση, μελετάται ο αυτοσχεδιασμός στο χορό και το contact-improvisation και οι αρχές που το διαμορφώνουν. Στη συνέχεια, παρακολουθούμε εν τάχει πώς εξελίχθηκε η Digital Performance και κυρίως το κομμάτι του χορού. Επισημαίνονται κάποια στοιχεία της μεθόδου του "Partnering", το οποίο ανήκει στον αυτοσχεδιασμό, όπως η διάδραση που είναι το βασικότερο, καθώς επίσης, αναφερόμαστε και στο φαινόμενο του alter ego που συναντάται συχνά στην τέχνη, για να καταλήξουμε τελικά στο κύριο project-πείραμα, το "Partnering YourSelf" το οποίο στηρίζεται σε όλα τα παραπάνω θέματα. Μέσα από το "Partnering YourSelf" δημιουργείται ένας "δυναμικός" ψηφιακός καθρέφτης μέσα από τον οποίο ο χρήστης έχει τη δυνατότητα να αναπτύξει ένα κινησιολογικό "διάλογο" με το ψηφιακό του "alter ego" που λειτουργεί σαν δυναμικό, αυτόνομο είδωλο ανακαλύπτοντας έτσι στοιχεία που αφορούν την κινησιολογία του, αλλά και δημιουργώντας κάθε φορά ένα διαφορετικό, μοναδικό οπτικό αποτέλεσμα.

**Λέξεις-Κλειδιά:** Διάδραση/Αλληλεπίδραση, Συμμετοχική Τέχνη, Αυτοσχεδιασμός Χορού, Κίνηση, Νέες Τεχνολογίες

# Abstract

In recent years there has been a growing interest in combining various fields and disciplines. In the following pages of this book, a research is developed on human movement, dance, new technologies and the result that can arise from their combination. More specifically, the first issue that is mentioned is the human movement and we investigate contact - Dance improvisation and the principles that form it. Then, we observe briefly how Digital Performance evolved and especially the part of the dance. Some elements of the "Partnering" method, which belongs to improvisation, are highlighted, such as the interaction that is the most important, as well as, we refer to the phenomenon of alter ego that is often found in art, to finally end up the main project-experiment, "Partnering YourSelf" which is based on all the above issues. Through "Partnering YourSelf" a "dynamic" digital mirror is created through which the user has the opportunity to develop a kinesiological "dialogue" with his digital "alter ego" that functions as a dynamic, autonomous reflection, thus discovering information about its kinesiology, but also creating a different, unique visual result each time.

**Key-Words:** Interaction, Participatory art, Dance improvisation, Movement, New Technologies

# Résumé

Les dernières années il y a un intérêt qui augmente (croissant) concernant l' union des secteurs différents et des domaines scientifiques. Dans les pages suivantes de ce livre, on développe un recherche concernant le mouvement humain, la danse, les nouvelles technologies et le résultat qui peut en déduire par leur combinaison. Plus précisément on fait un rapport au mouvement humain, on étudie la Danse contact - improvisation et les principes qui le forment. Ensuite, nous observons brièvement l'évolution de la Performance Digitale et surtout la part de la danse. Certains éléments de la méthode "Partnering", qui appartient à l'improvisation, sont mis en évidence, comme l'interaction qui est la plus importante, ainsi que, nous nous référons au phénomène d'alter ego que l'on retrouve souvent dans l'art, pour finalement aboutir l'expérience-projet principale, "Partnering YourSelf", qui est basée sur toutes les questions ci-dessus. Grâce à "Partnering YourSelf", un miroir numérique "dynamique" est créé à travers lequel l'utilisateur a la possibilité de développer un "dialogue" kinésiologique avec son "alter ego" numérique qui fonctionne comme une réflexion dynamique et autonome, découvrant ainsi des informations sur sa kinésiologie, mais aussi créer un résultat visuel différent et unique à chaque fois.

**Mots-clés:** Interaction, Art participatif, Danse improvisée, Mouvement, Nouvelles technologies

# Acknowledgment

Through such a full year, I gained a lot of knowledge and experience and thanks to the contribution of some people, I had many pleasant moments.

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# Contents

# Introduction

For the elaboration of this thesis, a study is made on the movement of the human body and dance and how they help human mainly in his survival, but also in his communication with the environment. Also a survey is done about how technology, which plays a leading role in today's life, has penetrated into art, giving it other dimensions and new forms. One of the main topics of the dissertation is the compound and the interactivity of dance and specifically Improvisation Dance with new technologies and coding and the results they can give. This type of dance has been chosen because it is based on the normal and physical movement of the human body and everyone can follow its basic principles without having to know any dance technique or follow stylized dance forms.

Another equally important element is the interaction that exists everywhere in the environment, but also in art. Any fraternization between us and someone or something is an interaction. The dance is full of interaction and the performances are based on this aspect. The technology is based on the interaction between the user and the machine. The questions that posed to implement this dissertation and the project that is developed are based on the concept of interaction:

How can a person through movement "speaks" and interacts with himself? How can a kinesiological dialogue be created between a person and himself through a "dynamic mirror"? How can programming and technology be combined with dance and movement and contribute to this dialogue and interaction and what can be the result?

These are the main questions I try to answer through my project "Partnering YourSelf" which is based on movement, coding and the interaction between them to become a useful tool that anyone can use.

## Note:

The definitions that can be given in the text exist simply to define the context of the research and not to define the object itself.

# 1 Movement and Dance

## 1.1 Introduction

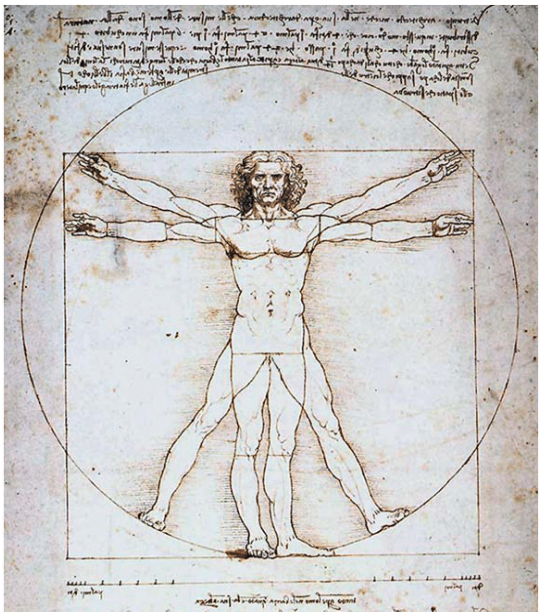
In this first chapter, human movement is studied as a means of survival and as a way of communicating with the environment. Some general information are mentioned about dance and some issues are investigated about improvisation in dance, its principles and characteristics, how it developed and what is the form of dance improvisation in the performance.

## 1.2 The movement in human body

### 1.2.1 Way of survival and development

Movement is one of the most important elements for the human body and is an integral part of human existence. From the moment it is born until the moment it passes away, human body is in constant motion, having a big range from the largest and most open movement such as a large and dynamic jump to the smallest movement such as a faint shaking of a finger or a blink of the eyes. Even when the body is in a state of immobility, sleep or suppression, its internal vital organs are in constant motion.

Therefore, it is perceptible that movement does not only aim at the movement of the body, but also at protection, functionality, maintaining good condition of it and of course survival. As a consequence, first of all it has practical convenience and reason for existence and the support of the human body is the main reason why there are so many different types of movement, since it must respond to its desires, as well as to the stimuli and challenges of the environment. The movement, apart from being practical, is also expressive since it contributes and promotes the way of human development and evolution. The perceptual ability and adaptability that human has in terms of his needs are the elements that cause and develop the various movements. Also, depending on the needs of each body, specific kinetic properties are developed resulting that each body has its own “kinetic identity”.



*1. Vitruvius Man drawn by Leonardo da Vinci*

However, the body, due to its construction, has some physical limits that restrict movement, leading to the fact that there are usually certain motion abilities that the average person can have. Those who move within their physical limits and always try to overcome and expand them by gaining even greater range of motion are the dancers and athletes who have clearly greater demands and performance than the average person. For this group of people, physical limitations, confinement of movement and physical capabilities reduce imagination, expression and great performance. Improvisation is one of the best ways to discover one's physical limits and to expand them in a natural way through spontaneous movement, while having the joy of creation. Below, there is a further analysis on this technique.

*2. Each body has it's limits, but they are different.*

## 1.2.2 Way of Communication

The usefulness of movement, however, is not limited to the above, as it is perhaps the most important and most direct way of communication. Human movement is considered as a kind of human language with common bases for the whole human species, but with different extensions and semantics depending on the cultural differences that exist. Scientific surveys have shown that at least 70% of daily communication takes place on a non-verbal level. It is no coincidence, after all, that in recent years, an entire scientific discipline based on "body language" has developed. Even verbal communication most of the time is accompanied by non-verbal cues which may obscure the substance of the messages. The physical presence and the movement, contribute significantly to the meaning and the immediacy of the narration.

*3. Movement is communication. Non-verbal communication is more powerful.*

Dance and especially improvisation, which promotes the natural movement and evolution, are based on these communication properties of immediacy and expressiveness. As observers, through common references that most people have in terms of movement and emotion, we can connect emotionally and communicate with people who try to project an idea, an image or an emotion through dance and movement. Whether on the part of the dancers or on the part of the audience, movement and dance can be the connecting link that helps us to understand, to feel, to empathize.

# 1.3 Dance

## 1.3.1 A few words

The body is the main tool with which human cans perceive the environment around him/her and communicate with it. Even in the simplest form of a stimulus, the body (or even a part of it) is what first comes into "contact" and "interaction" with it. The movement, whether natural or more technical and sophisticated in collaboration with the body are the main means of creating dance.

*4. Prehistoric Dancers of Bhimteka*
*Image Credits: Adventure Nation*

Dance, strange as it may sound, was a necessary and vital element for human and his evolution long before it was considered an art. Just like many species of animals in nature have their own kind of dance (to communicate, to mate, to defend themselves), so human has incorporated dance into his life since prehistoric times. Through the need for self-expression and communication, dance has been an integral cultural part of any human society in every period.

It can be considered a versatile and flexible tool that adjusts to different cultural characteristics but also depending on the needs it serves and attends on. After all, it has been used for various purposes over the centuries such as entertainment, fitness, celebrations, communication between people, seeking divine elements and communication with them, rituals, healing reasons, etc. and it is well known that there are the numerous physical, mental and spiritual benefits that someone can obtain from the dance.

It is also considered a very important social element that becomes a carrier of aesthetics, thus contributing and promoting broader artistic, social, and ideological models of thought and organization. Through dance there an is interaction between the people who work on it on techniques issues, ideas, institutions, etc. and this is the reason that the individual always coexists in dance along with the ideas and social situation of each period. It is how someone understands the construction and relation of the body to the mind as well as of the whole existence. Although there are many types of dance that help in this understanding, Improvisation is considered one of the most appropriate tools for this purpose and we will see below why.

*5. Dance is the means by which someone understands the construction and relation of the body to the mind as well as of the whole existence. Photo: Ahmad Odeh*

## 1.3.2 Improvisation & Contact Improvisation

Improvisation has always existed and was used by dancers as a tool for creating choreographies as well as being an element for more folk spectacles, but has never been the focus of study and research. It was not until the 1960s that a special interest in this type of dance began, starring Steve Paxton, Yvonne Rainer, Trisha Brown, and Anna Halprin, and a little bit later, in the 1970s, Contact Improvisation appeared, which is part of the whole Dance Improvisation industry, but the two terms are usually combined and often considered identical. The pioneers of Contact Improvisation were thought to be Steve Paxton who through his knowledge and training in Aikido and other martial arts was identified as the main inspirer, but also Nancy Stark Smith, Danny Lepkoff, Lisa Nelson, Karen Nelson, Nita Little, Andrew Harwood and Ray Chung who contributed significantly to its development and dissemination. Therefore, Improvisation Dance was shaped by influences from martial arts, dance, sports and personal contact.

*6. Photograph by Stephen Petegorsky Steve Paxton and Nancy Stark Smith / duet (1980) against the wall, from left to right: Lisa Nelson, Danny Lepkoff and Christina Svane*

Various definitions have been given from time to time by professionals who have been actively involved in what Improvisation and contact Improvisation are Steve Paxton reports:

*"CONTACT IMPROVISATION is an activity related to familiar duet forms such as the embrace, wrestling, martial arts, and the jitterbug (swing type of dance), encompassing the range of movement from stillness to highly athletic. The exigencies of the form dictate a mode of movement which is relaxed, constantly aware and prepared, and on-flowing. As a basic focus, the dancers remain in physical touch, mutually supportive and innovative, meditating upon the physical laws relating to their masses: gravity, momentum, inertia and friction. They do not strive to achieve results, but rather, to meet the constantly changing physical reality with appropriate placement and energy.*

*CONTACT IMPROVISATION may be described as spontaneous mutual investigation of the energy and inertia path created when two people engage actively — dancing freely, with their sensitivity to guide and safeguard them. Parts of the body may come to support weight which are unused to this, and several weeks of conditioning are essential to strengthen and communicate to the muscles what new stresses they may expect."*

Trying to combine and include as many elements of improvisation as possible, we could say that it is a natural and spontaneous kinetic and kinesthetic dialogue between two (or sometimes more) moving bodies that arises the contact and interaction between them, but also through the effect of physical laws, such as gravity, momentum, inertia. It is an evolving kinetic system that deals with the organic movement of bodies and forms of motion that unfold between them under the impact of the forces of nature and the interaction of them to the bodies.

*7. Danny Lepkoff in Dance Improvisation*
*Photo: Bill Arnold photographs*

In improvisation, the dancer is treated simply as a person who has a natural and everyday behavior and avoids sophisticated and dancing movements. There is no restriction on movement, no coded movements (except for some very basic notions) and the only laws that apply are those of nature such as gravity, momentum, inertia, etc. After all, when contact improvisation was arisen, it was based on concerns and seeking on physics and its redefinition. The range of motion can be from the smallest movement to the largest jump and the range of contact and communication between partners can be from full contact and acceptance of the other's body weight to even the simple "visual contact". It is the body's capabilities that set the limits and the restrictions of movement.

*8. A natural and spontaneous kinetic and kinesthetic dialogue between two (or sometimes more) moving bodies.*
*Photo Credit: deephoto via Compfight cc*

The dancers focus mainly on the physical senses and the inner space of the body and later on the arrangement of the body in the three-dimensional space, by creating lines, curves, shapes, etc. Any kinetic activity is completely improvised and spontaneous without any preparation. There is no pre-determined scenario and specific and strict instructions are an uncommon thing. Thus, participants perceive the physical limits and abilities of theirs and their partners' body in the most

natural way and they create new movements in order to respond to the changes that will occur from the interaction with their partner and continue to move on.

From the attributes above, it arises the fact that improvisation requires immediacy, decisiveness and the participants must always be ready, since the dance they "produce" is spontaneous and according to Simone Forti "is produced on the spot, out of nowhere and instantaneously" and it is something very fluid which is constantly changing form through the interaction of bodies. Therefore, it is required constant vigilance, in order to be progress through the common course of the dancers, maintenance and development of the inventive kinetic vocabulary, constant awareness of the environment and the prevailing conditions as well as correct reaction and response to the constant changes and the unknown that follows, as mentioned by Susan Sgorbati, who spoke about "Embodying Complexity".

It is also necessary for the participants to be adaptable and flexible because they are asked every time to decide about the evolution of the movement through a non-verbal communication, by exchanging information and making mutual "agreements and concessions" at the same time and discovering the unknown together. Besides, the excitement for the next "unknown" moment and the movement of the other person is one of the main features of improvisation. This, of course, has the consequence that the dancers of improvisation, are responsible for any problem that arises as well as for its solution, linking in this way the meaning of the dancer and the choreographer.

*9. A typical partnering in contact improvisation*

However, in order to have a proper communication, it is necessary to observe the participants on their bodies and their partners. So, improvisation is a great tool for the participants to develop ways of communication, to get to know each other and to develop motion empathy. With the help of a partner, there is better investigation about movement and through experimentation and playing, dancers discover new possibilities on the movement that they could not do on their own. Also, there is kinesiological communication which is much more intense and powerful than verbal, resulting aspects of the participants that even they did not know, to come to the surface. That's why, in addition to dancers, it attracted people who were not related to dance (as an artistic medium) and mainly therapists and psychotherapists, and this is why dance therapy has become so popular in recent years among people with physical and mental illnesses.

Improvisation, however, apart from being an artistic, recreational and therapeutic tool, was also a social phenomenon, as it expressed the social ideology of the 1970s based on the rejection of traditional gender roles and social discrimination and hierarchies. It is the dance in which everyone is equivalent and equally important, without any element being superior. The power and the usage of momentum are to support each other and not to control and manipulate each other. It is meaningful that for the first time the sexes are eliminated and a duet can now take place between a man and a woman, between two men or between two women and there is no longer any narrative content that wants the man to be strong and to handle and lead the "weak" woman. In this way, they broke the social stereotypes that prevailed until then, and also the cultural taboos on issues of physical contact and personal space of the era.

*10. Everyone is equal and there are no traditional gender roles*
*Photo: Bill Arnold photographs*

Due to the nature of improvisation, which is characterized as an open-ended dance in the sense that anything can happen and there is no end (due to non-narrative content), dancers and spectators recognized it as a means of expression and way of life. The spontaneous movement that is used gives the dance the quality of the real, the natural and the honesty since it is based on the daily movement and action and incorporates it in the art. It contains, however, oxymoronic elements, considering firstly that it connects individualism (study of one's movement) with equality (all are equal and supports each other) and second it links nature (spontaneous, natural movement) and culture which is an artificial piece (improvisation is a kind of dance art). Improvisation represents life and society through the prevailing uncertainty and the rapid and constant changes.

### 1.3.3 Improvisation in performance

Seeing improvisation is a participatory dance that has an undefined and raw structure, many people have argued that it did not have the appropriate form to be used in performance. The truth is that there are various difficulties and obstacles that must be overcome in order to have a good and interesting result and as much uncertainty as there is in improvisation, the final result of a performance based on it is just as uncertain. However, as already mentioned above, improvisation has been a tool for creating choreographies and certainly occupies an essential part in the performance chapter.

Through improvisation in performance, the audience now gains access to something that until then had a much more closed character and now has a more active role. The entry of the public into something that until then had a purely private nature and the gradual change of improvisation to a public spectacle was a big deal. The first forms of improvised performances were very simple and there was just a demonstration of the form. Later, there was a need to enrich the content of the performance as the dancers had progressed and had clearly acquired more aesthetic and technical skills and realized that the original structure was insufficient to hold the interest of the audience. Furthermore, dancers had moved away from the early stages of experimentation and research into the body, physics, and the rules that governed it, and now they had interests about combining improvisation with other elements such as music (especially in the beginning, improvisation was done without music, silently), movement beyond the basic rules of improvisation, etc.

*11. Nancy Stark Smith and Nitta Little Contact Improvisation concert 1976*
*Photograph by Uldis Ohaks*

However, presenting the form and nature of the improvisation to the public was a very important matter, as it was something new and the spectators came in contact with it for the first time. Therefore, it was almost obvious that the "education" of the audience had to precede in order to understand better what they were watching, what is the meaning and what the basics were. The performers placed special emphasis on the ephemeral and spontaneous character of the dance, but also on how risky this endeavor is, pointing out that this is its beauty, but these are also the elements that challenge them to engage in improvisation.

Every performance based on improvisation is a bet for both the spectators and the performers. The concepts of improvisation and performance are somewhat contradictory, but also complementary because improvisation focuses on the "process", while performance on the "final result". So, through their combination, the "process" is now presented as the "final result" and this is something that dancers may find interesting, but how sure is it that the audience will like it too?

*12. The "process" now is the final result*

From the point of view of the spectators it is very fascinating to watch this whole process and in many cases to be part of it as they may be asked to participate or give stimuli, instructions and interact with the dancers. Through this process, the audience realizes that the performance is a purely interactive event and the interaction lies not only in the physical or sound participation, but even in the attention they give to a spectacle, supporting the performers, sharpening the boundaries that exist, speeding up processes, etc.

*13. The dancer has to be very well-prepared in order to avoid surprises.*

The performers, on the other hand, are possessed by a raw tension, but however it is necessary to put partially a curb in order not to create situations that will get out of control. So, through a restrained spontaneity, they are asked to find the harmony and balance between freedom, intensity and the control and art, to interact with each other, but also with the audience to the maximum extent and to locate any momentary stimulus that arises, develop it and deploy it at full blast. It is the dynamics and the interaction of the participants that gradually shape the choreographic structure and the complexity of a performance.

But there must always be enough investigation, research and practice because there are many pitfalls that can exist and the performance could become a boring spectacle. Even a performance by the most experienced participants carries a high degree of risk and the dancers must always be prepared to face

a difficult situation or even a failure. The book “The Moment of Movement: Dance Improvisation” typically mentions the following example:

*“It is interesting to note that in India only mature dancers-those with life experiences-are allowed to improvise in performance.”*

It is clear, then, that only well-prepared individuals can cope with such a demanding task. A conventional performance is based on specific skills and techniques that are perfected before the final performance. On the contrary, the improviser cannot see, feel, nor has the general view of the progress of the show, he does not know the speed, flexibility, coordination and many other elements that are necessary for the best result. Therefore, he/she must be physically and mentally fully coordinated, without being able to focus and develop specific skills and he/she is often forced to rely on the strongest qualifications he/she has and not necessarily on the needs of the moment. As a result, continuous training is the only way to expand someone’s skills, reduce the limitations and confront challenges in the best possible way. It is also equally vital to develop skills related to performance and public exposure and action, considering that improvisation is now out of the confines of private studios.

The greatest danger in such a performance is that it quickly becomes boring for the audience for various reasons: either because there is no internal structure, or because there is no end resulting that the meaning and the reason for its existence are lost, or because it has created to serve some personal purposes and needs but without having to say anything to the audience. Thus, there are some agreements in order to avoid such risks and to find solutions to obstacles that arise:

*14. A Performance based on Improvisation Dance is risky, as nobody knows what will be the final result*

One solution is to have a leader who gives some choices, changes directions, encourages participants and gives an overall structure and direction.

There should be an accompanist, who acts as an external agent to direct, orient participants and audience, to encourage, etc. usually through the music. However, the participants are still the ones who have the main responsibility for internal structure and direction of the show.

Another solution could be to put an end either to an agreement that will have been preceded, for example, by a certain time limit, or to some external factor such as stopping the music, removing the spectators, dropping the curtain, etc.

It is practical and useful to have an understandable internal structure in the show with distinct roles and relationships so that the audience can understand more and also that even the more inexperienced dancers can take part based on some principles, avoiding situations they do not know how to react and deal with. The structure is the one that helps in the most useful way in the completion of a performance, leading it to the end and maintaining the relevance between the elements that make it up. Free improvisation definitely gives more freedom to the dancer, but it also requires more skills so that the audience does not get bored as it also requires more informed and "trained" spectators in the part of improvisation.

In whatever category the performance belongs to, the performer must be able to interact with the audience and actively participate in the "kinetic dialogues" and "controversies" that will arise. The general feeling that the audience gets from an Improvisation Performance is that there is interaction everywhere and every experience in life is unique like every performance based on improvisation and that through experiences, difficulties and failures you explore life and learn to maneuver, knowing that there are always choices.

*15. In Improvisation Dance there is interaction everywhere. Danniel Lepkoff and Steve Paxton performing at Merce Cunningham studio, New York, 1977, Photo: Stephen Petegorsky.*

## 1.4 Conclusion

Through the first chapter it is perceptible how crucial movement is for people, but also how many benefits someone gets from engaging in dance, not only physically, but also spiritually, socially, psychologically, etc. Also, the basic principles of dance are identified, especially those of improvised dance, which will play a crucial role in the function of the "Partnering YourSelf" project.

# 2. Digital Art, Interactivity and Alter Ego

## 2.1 Introduction

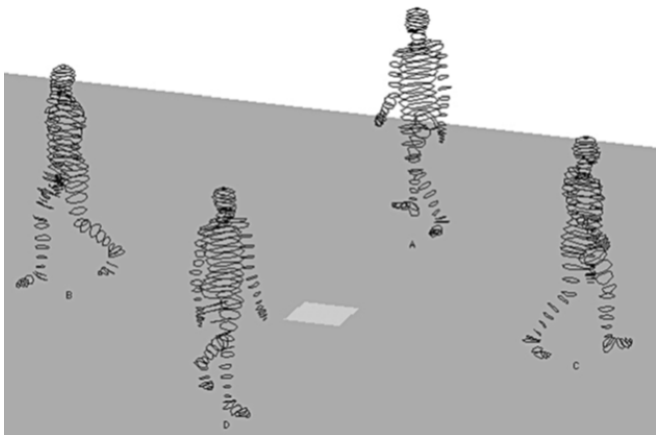
In this chapter we will examine the part of dance in Digital Performance and some basic software developed from its inception as well as the Interactivity that is created in Digital Performance. We will also see the term alter ego in art and artists and since it is related directly with Interactivity, but also with the main project “Partnering YourSelf”.

## 2.2 Digital Performance & Dance

In recent years, Digital Performance has made a dynamic entry into the world of art, so more and more artists, creators and performers want to approach this field trying to exploit as many capabilities and opportunities as possible provided by technology.

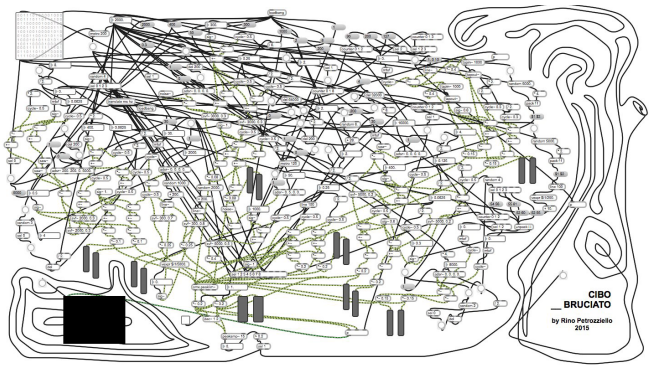
Although it became extremely popular, therefore, commercial programs that already exist are mainly used and the development of software by artists and performers is limited, although from time to time very remarkable programs have been created. It is worth noting that most of the software developed was in the field of dance and the most beloved and popular were those that provided movement and dance simulation.

One of the first and most famous software was *“Life Forms Dance Software”* by Credo Software Products created in 1989 and based on the new dance technique developed by Merce Cunningham at that period. The computer was used as a drawing board to produce movements or whole sequences of movements and the choreographer could use it before entering the room with other dancers or the patterns were often used as an element in digital performances. Although it became widespread, it was complicated and had limitations. It was more for choreographers and especially for those who corresponded with Cunningham’s dance and aesthetics. However, it became really popular and was used for commercial purposes in cinema, television and video games.



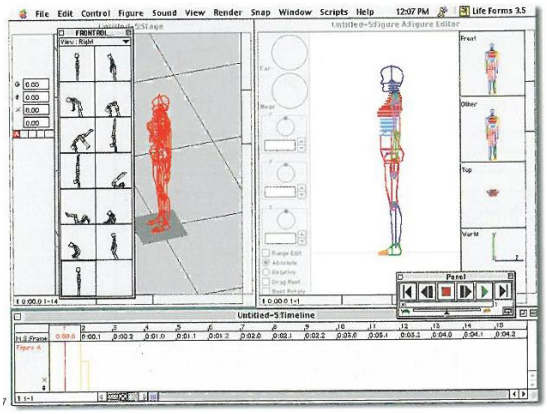
*16. Figures from the software “Life forms Dance Software” by Credo Software Products*

Later, in the 1980s, another popular program was created, *Max / MSP* by Cycling 7427, which was used in digital performances and was described as a flexible and high quality commercial software. It is now one of the most popular in the field of Digital Performances. It uses graphic illustration and not mathematical code and the choreographer has to handle the graphics. The program gave the user the ability to see or hear the result arisen directly, as Max was for motion and MSP was for audio.




*17. The Max / MSP patches from the homonym Software by Cycling 7427*

However, there were many artists who wrote their own code for digital performances, in which they preferred programs that interacted with the movement of dancers in real time. Therefore, they were very concerned with sensors that they wore on their bodies and communicated with a computer that was analyzing the receiving data. So a live relationship was created between the performers and the graphics. As technology evolved, so did the software, but also its complexity. Today, there is a huge development in the communication and interaction of performers with machines. A dialogue is created between two entities (human - machine) that perceive each other. It is also important that the aesthetics have changed nowadays and simplicity and minimalism are adopted in contrast to previous years when more and more elements were used in order to give a result that is as impressive, spectacular and rich as possible. Now, however, the term Digital ceases to evoke that excitement and impression it once caused because it has become fully understood and accepted and has been fully assimilated by the world of performance and now the majority is quite familiar with it.




*18. Motion simulation program were really famous*

## 2.3 Interaction

It is a term we understand its general meaning, but it is difficult to define, perhaps because we do not know exactly what it is and what all its fields are. When it comes to art, everything is interactive. All works of art are interactive and the public interacts with them. In digital interactive art and Digital Performance there is a great deal of interaction with the audience because their participation in such an action can influence, play, activate or even completely change an interactive work.

*19. In digital interactive art and Digital Performance there is a great deal of interaction with the audience*

Interaction of audience in interactive performances is first encountered thousands of years ago in ceremonies and community dances that took place in the various societies and cultures of each era. In the most recent history, we encounter this phenomenon strongly in the futurists in the 20th century. A.D. who used extreme interaction with the audience in their performances through challenges and conflicts that they sought to create.

*20. Dance Performance combined with Interactive Digital Projection*

Many people were those who tried to give a definition, always formulating it from their own point of view. According to Steve Dixon in his book *"Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation"*, the author argues that there are four different levels of interaction. The first is the one who have the least and most superficial interaction and it is Navigation. Navigation could even be considered the push of a button. Then there is Participation which has a bit deeper interaction, Conversation and finally Collaboration which has the greatest depth of interaction and is usually sought and achieved by people who want to work together to create something using computers. However, the boundaries between these categories are often blurred because some concepts are similar. Steve Dixon, who has made this categorization, explains that one category is not worse or inferior to the other, audience just has a different percentage of interaction and freedom. However, freedom is usually symbolic because in many interactive actions the public believes they have more freedom than they actually have. To whatever extent there is interaction, however, the participation of the public in an action or a project, causes great excitement, joy, interest and pleasure.

It is no coincidence that Peter Dalsgaard and Lone Koefoed Hansen in their work *"Performing perception-staging aesthetics of interaction"* in 2008, state that in an interactive installation, a user is always in a triple state, that of the operator, the performer and the viewer and through it the perception and understanding of the interaction is formed. Equally essential was the contribution of Augusto Boal, founder of the *"Theater of the Oppressed"* and inspirer of the term *"Spect-actor"*, who describes those who participated in the "Theater of the Oppressed", where the audience becomes active, gets the double role of the spectator and the actor and now has the ability not only to watch, but also to explore, analyze and transform the reality in which they live as well as to create dramatic content and action in a performance having equal power with the actors and not only as mere observers.

*21. Augusto Boal, founder of the "Theater of the Oppressed" and the term "Spect-actor"*

# 2.4 Psychology of Alter Ego

## 2.4.1 What is it?

Of course this research does not deal in depth with psychology, so it would be absurd to give a clear definition of what an alter ego is. However, we have previously referred to interaction and partnering and because in the research and through the project we lead somehow to create a digital-kinetic alter ego, it would be useful to define some frameworks in which to move and with what meaning the term alter ego was used.

Therefore, the term could express the finding, discovery or even use of an alternative self and a different personality with different behavioral elements and perhaps an alternative way of thinking which may be a little different or extremely different from the normal situation of a person's reality.

*22. What is actually the alter ego?*

It is a subject that has always fascinated the field of art and we meet it very often in most forms. It has a special place in literature where the author often identifies with one of his heroes and actually develops an entire story based on an alter ego. Respectively in the field of performance where there is acting, dance, music and a lot of exposure to the public, the element of alter ego plays crucial role.

## 2.4.2 Alter ego in art and performers

People like performers who come in contact with a lot of people and have a lot of exposure may seem to have a lot of confidence and feel comfortable with themselves, but sometimes the reality is different. Even the most talented artists have various insecurities, phobias and it is not uncommon for them to feel uncertainty. Having an "Alter Ego" is the way they often deal with these problems. An alter ego that has all the characteristics they would like to have to avoid these difficulties, but are unable to acquire them in their normal, daily lives. The artist, for example, may be insecure about being exposed, but his alter ego wants desperately publicity and fame. Or one may be shy, but his alter ego is a brash character who wants to take bold actions. The alter ego uses existing personality traits that need empowerment.

*23. Alter ego inspired many artists in most fields of art.*
*Name of artwork: Alter Ego*
*Artist: Tania Rivilis*

It is not something that is deliberately created, but emerges as a shield and defense for artists to cope with what is asked of them to do and wherever it is needed. It is not necessary to exist, however, when it happens, it starts to be cultivated and it is not uncommon for the artist even to give a name to his/her alter ego and start developing a whole character with his/her own temperament and can have his/her own characteristics, thoughts, ideas, fears, behaviors. Thus, the artist becomes an active observer of a completely new and different side of himself/herself, discovers unknown aspects, the imagination, the expressiveness and the creativity get off the ground and somehow, a collaboration begins from which he/she draws energy, inspiration and motivation. A big part of the art has relied on artists' collaborations with their artistic alter ego.


*24. Beyonce call her alter ego Sasha Fierce*

A typical example is Beyonce Giselle Knowles-Carter who is an American singer, songwriter, record producer, dancer and actress who has created a fictional character named Sasha Fierce with whom she identifies when she is on stage and who helped her a lot to conquer things that would be very difficult to achieve on her own. She has a statement in an interview that:

*"Sasha Fierce is kinda my Alter Ego on the stage, and it's like "Crazy in Love", the really sexy, fun, high fashion…it's like the personality I created on stage while I'm performing",*

while she is more serious, natural, thoughtful, emotional. It works as an artistic consultant and influencer, but exists only at the area of work and not in everyday life.

The alter ego not only helps an artist overcome his/her fears and gain confidence, it also helps to try and broaden the limits, pushes him/her to make changes that he/she have wanted for a long time, but did not dare to do them alone and helps him/her to acquire a personal style, to reconcile with it and to establish it in public. Many times, it can start from a very simple thought and due to the demand and love from the audience, the figure can begin to be embellished and an entire persona can be created with which the artist identifies. In this category belongs David Bowie, one of the most famous rock stars, who created Ziggy Stardust, a supposed alien rock star who starting from a simple figure embodied by the artist,  but the audience loved and hugged him and so an entire persona was eventually created around the name Ziggy Stardust.

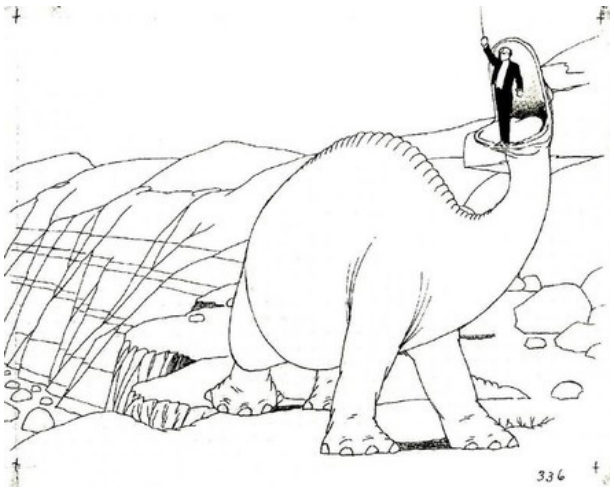
*25. David Bowie is preparing to become Ziggy Stardust*

*26. BDavid Bowie in real life*

As much as necessary it seems to be for some artists to have and cooperate with an alter ego, it should be done prudently and not prevail over their real personality especially in their normal life. It is a finding that should be under control and help to discover positive elements of a character but when it is necessary, the person has to leave it, while maintaining the new positive characteristics.

### 2.4.3 Digital Alter Ego

The concept of alter ego, is actively found in the themes of Digital Performance and challenges many artists to deal with it and its digital illustrtion in a performance or a project. Dealing with the alter ego dates back to 1914, when Winsor McCay portrayed himself as a tamer in the form of an animation at the end of the cartoon "Gertie the Dinosaur", where he came in "contact" with the dinosaur Gertie.




*27. Gertie the Dinosaur and her creator Winsor McCay as an animation character*

The depiction of a "digital alter ego", if we can use this term, is usually darker since according to Hans Holzer, there has always been the belief that human has two sides, the good one which is brighter and more positive and the evil one that is darker and scarier *(Holzer, Encyclopedia of Witchcraft and Demonology)*. Usually the alter ego is presented in an intangible form. A typical example is the performance "Anima" by the company Lemieux Pilon 4D Art where advanced projection equipment was used with screens and mirrors, invisible to the naked eye, thus creating the optical illusion of three-dimensional figures based on performers.

The alter ego is a theme that offers inspiration and many options and possibilities in a digital performance because it gives the opportunity to creators, artists and performers to play with technology, deplete the possibilities it offers, to provoke and implement even extreme ideas.

## 2.5 Conclusion

It is understood, in this chapter, the fact that in all areas of art, Interactivity plays a leading role and especially in terms of Digital Performance where there is even greater Interactivity because technology is now added. Therefore, it is not only the artists, who interact with the public and vice versa, but also the artists - and often the spectators - with the devices and technologies that are used.

As for the theme of the alter ego, it is a source of inspiration for artists, a means of expression and liberation, but it has also been a key theme for many artistic performances in which Interactivity is also developed to a large extent between a character and his partner himself.

# 3. Partnering YourSelf: The experiment

## 3.1 Introduction

In this chapter we enter into the practical part of the project "Partnering YourSelf". First we will mention the influences and resources from which the project was affected and we will analyze the whole work and the reasoning behind it and then we will move on to how the whole system works and its algorithm.

## 3.2 State of the art

As mentioned before, there have been many works that combine arts and technology and especially in the field of dance, there are countless experiments and projects from the first years that digital technology entered the field of performance.

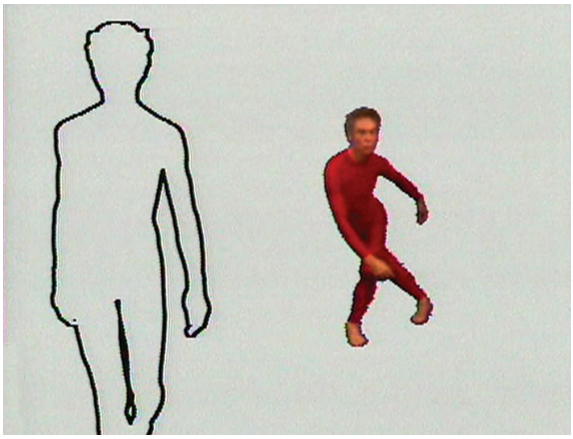
The first source of inspiration is the performance *"Anima"* in 2002, by the company Lemieux Pilon 4D art which is a special example in the field of digital performance. Playing with the theme of the alter ego and using specially made screens that contain half a mirror and are invisible to the naked eye, performance manages to create an optical illusion with 3D entities based on the performers themselves and their form, but which coexist with the performers in same scene and in the same 3D space and not with a projection on a screen. So, for example, there are times when a woman dances and there are traces of her movement around her or there is a man who is divided into two parts and in fact the real performer interacts with the optical illusion-alter ego.

*28. ANIMA performance 2002*

In 2001 the Plancton Art Studio team created the performance *"Aurora di Venere"* in which dancers interact with digital three-dimensional entities that are projected on two translucent screens on stage. Entities can be reproduced and have neural networks that reflect the movements of dancers, but they have their own course, and have a system of auto-learning and decision making. As the performance goes on, the spectacle grows, the entities travel inside the theater, producing 3D sounds and try to interact with the movements of the audience.

*29. Performance "Aurora di Venere"*

Going back, we meet in 1975 one of the first experimental videos "dance for screen" as it was called, the *"Merce by Merce" by Paik* created in collaboration with Nam June Paik, Charles Atlas and Shigeko Kubota with Merce Cunningham and was a video collage and captured Merce Cunningham dancing in various places and interacting with other dancers, objects, etc. playing and making changes with bright colors and contours. The main issue of this video is the time and reversibility.

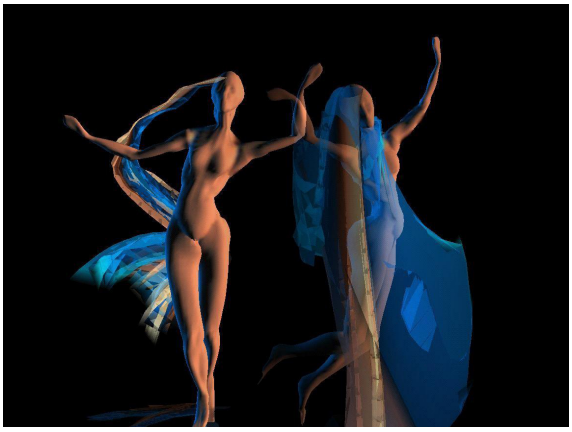


*30. "Merce by Merce" by Paik*

*31. InterACTE project*

In recent years, Jégo Jean-François and Guez Judith have created the "InterACTE" project which uses latest technology findings (Motion Capture Databases and Genetic Algorithm) to create an interactive installation in which participants interact and improvise kinetically with the projected shadow of a virtual actor. The project is divided into two parts. In the second part there is a corresponding interaction, but in a 3D virtual environment and the user can see and interact there with the virtual figure, which is now made of particles.

At the beginning of the last millennium (2000-2002) Michel Bret in collaboration with Marie Hélène Tramus, combining the art and latest technological findings, created the project *"Danse avec moi"* which is based on movement, dance and interaction through technology. More specifically, it is a program in which the user interacts kinetically, in real time, with a virtual dancer who in turn improvises her kinetic steps depending on the music that exists and the user's movements that are interpreted as forces exerted on in the virtual model. The interaction takes place through a position sensor and the virtual dancer is controlled by neural networks.



*32. Danse avec moi*

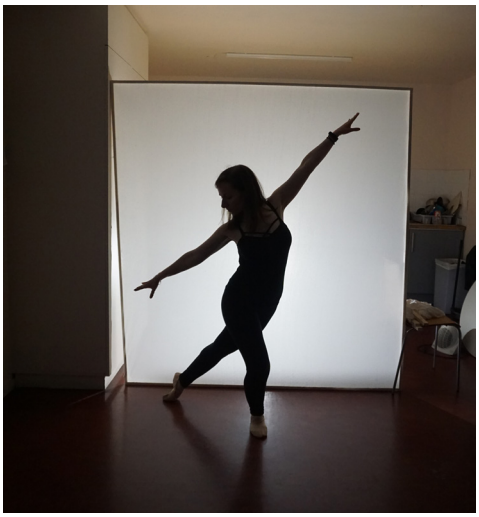
*33. E-Sparks by Mauro Annunziato and Piero Pierucci*

Another project is the *E-Sparks* by Mauro Annunziato and Piero Pierucci which consists of a hybrid society of artificial beings, is based on genetic art and it can be a mirror of a human society, communication and thought. Within an installation, artificial entities can interact with users either by gestures or by voice, through a camera and a microphone. Equipped with sensors and an artificial brain, they "listen" and "learn" users' speech, process data and reconstruct words and conversations so they can develop dialogues with users using expressions from previous visitors. In this way the project tries to create a participatory action and studies the communication between visitors who interact with "smart" digital entities.

All projects have very interesting elements that offer plenty of inspiration and make full use of the technology of each era to create innovative ideas and results in the field of art. So taking facts from everyone, below we will analyze the project "Partnering YouSelf".

## 3.3 About the project

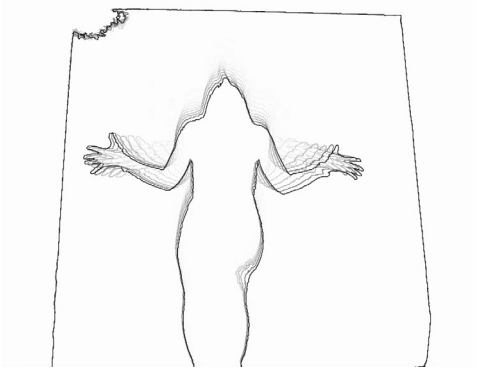
As already mentioned in the first chapter, movement for man is a vital element that serves various purposes, from survival to communication, expression, etc. On the other hand, there is technology that evolves every day, it is upgraded, and there are new, even more advanced forms, with the help of which we achieve more and more accomplishments. Technology, especially in recent years, has flooded our lives, considering that even for simple operations we try to integrate it into everyday life by using gadgets, applications, computers, etc. It is also meaningful that the majority of people in developing and developed countries now have access at least to simple forms of technology and programs and applications' development. Informatics and coding are introduced from a very early age even in the lives of children and lessons on robotics are taught even in classes of primary school, assuring that the IT sector is one of the most crucial sectors of the future. But how can these two fields, motion and programming, be combined and coexist, and what effect can they have?



*34. The user gives kinetic vocabulary*

Therefore, the project "Partnering YourSelf" was created, in order to utilize the technologies that are available to the general public and by combining them, the user can understand and explore some things about the body and movement, experiment, learn, etc. With the help of the coding in the Processing program, an algorithm was created that can form the contour of the user's silhouette or shadow and can also detect motion to record and save it.

So after the user starts to move, he gives the system his kinetic vocabulary, thus filling the "storage space" of the system. Once the system is full of movements, they start displaying in randomly. Thus, an entity appears with the form of a contour which has the shape of the user because the contour has come from the user's silhouette and kinetic identity and now moves autonomously like another self, an alter ego that the user gave life to. It is a dynamic interactive mirror with which the user interacts.



*35. The system displays the given movements randomly*

But the interaction is not one-sided. It is not just the user who gives the kinetic vocabulary to the system. It must continue to move because otherwise the system realizes that there is no interaction and stops until it detects motion again and continues to project movements through the contours. Thus, it is like there is a real kinetic dialogue between the user and his digital self and when the user stops "talking-moving", then the

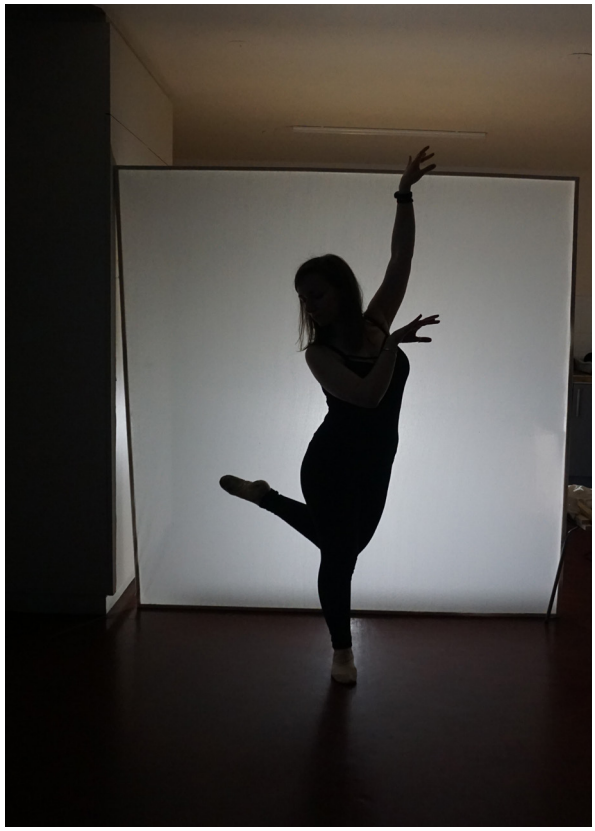
system-dynamic mirror stops responding. Just like in a normal dialogue where two people are talking, but when one stops, after a while the other will stop too. Therefore, it is understood that in the project there are many levels of interaction:

- Human – Machine
- Machine – Human
- Movement and Environment - Visual effect / Graphics
- User - Digital Alter Ego

### 3.3.1 Principles

The system is based on the principles of Dance Improvisation and Partnering in which there is interaction with at least one partner to a very large extent. Also the name of the project came from there, seeing that the user's contour is his digital partner. Thus, in the project, through the "contact" and the interaction of the user with the digital partner, a kinetic and kinesthetic dialogue emerges. The interaction and communication is done in a non-verbal way as in Dance Improvisation and mainly with visual contact and movement.

It is also important to note that there are no restrictions on movement other than the effect of the laws of nature and the limitations of each body and each user can choose to move in any way depending on his style. But the same freedom is given to the system, because although the user must give it the moves, the user cannot force the system to choose a specific movement. Consequently, both sides are equal and equivalent, they become dancers and choreographers at the same time and the user should be in constant vigilance and movement and predict what will be the next movement of the system, since the choice is random and there is no choreography or predefined scenario. In this way, the user's enthusiasm for the next unknown system's movement is also maintained, as is done in Partnering in general.



*36. The user can move however he/she wants*

Therefore, the movements and especially their sequences are spontaneous, improvised, without preparation and every moment both the user and the system "decide" on the spot for the next choice of movement. This makes the result unique because since there are no choreographed steps, each "kinetic dialogue" is as unique as the result in a Dance Improvisation Performance.

### 3.3.2 The Experience

#### As a tool

*37. A tool for everyone to experiment and have fun*

The project can be used as a tool for the user in order to discover kinetic skills that he may not know that he has (just like with the characteristics of an alter ego, but at the aspect of movement), he can correct movements or the position of the body because capturing a contour is more neutral and often more "honest" than a photo or a regular mirror and getting acquainted with his image. The user can experiment with movement, create, play and have fun. Even people who feel uncomfortable with their movement or body can use it because it is like having an impersonal version of themselves and not someone who will judge them.

#### As a Digital Performance

People in performance world could also experiment and create works that will be unique each time as there is nothing choreographed. Even if the user uses choreographies, he cannot intervene in the system, which will always choose movements randomly. This of course is quite risky when it will work in a performance because the result may not be the desired one and the user should be well prepared to avoid possible unpleasant situations and deal with any surprises. It has the same logic as a performance based on Dance Improvisation.

*38.A tool for performances with unique and different result every time*

**As a Spect-actor**

From the above information we conclude that the project "Partnering YourSelf" functions as an interactive installation based on participatory art and was created for the spectators who become a kind of Spect-actors as their actions affect and define the course and the main visual effect that will be produced and their participation is the one that causes the main action and the function of the whole project.

*39. The participation of the audience causes the main action.*

## 3.4 Equipment/Environment

Partnerign YourSelf, is a project that has some special requirements. It may be a project that relies primarily on coding, but specific conditions are needed for a worthwhile result. The first and most necessary elements are the usage of a computer on which the algorithm will be activated and a webcam which is connected to the computer because from there the algorithm will take data to do the processing. In fact, the image from the webcam is the most important data that the algorithm receives and processes.

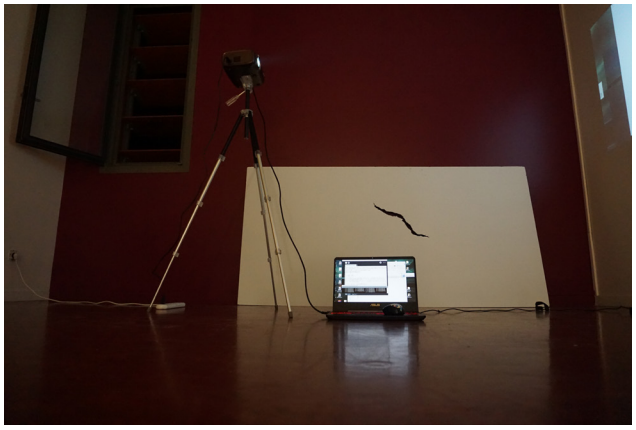
*40. "Theater of shadow puppetries" technique shows the silhouette on the best way*

Even with only these two elements a result can be obtained, however the conditions that prevail in the environment are those who make the difference in the final result. In order to be able to create the contours clearly, the algorithm needs to load from the camera as simple and clear image with the user's body as possible. To make the work of the algorithm easier, only the silhouette of the user should be visible on the camera. This is achieved relatively easily either by capturing the user's shadow, or by a technique similar to "theater of shadow puppetries" where the silhouettes of objects are captured with great clarity due to the intense contrast created between light and shadow and are free of unnecessary details that

would confuse the algorithm. Hence, it is necessary to build a back projection wall and by using a powerful projector with strong light behind the back projection wall, only the silhouette of the user, who will be standing in front of the specific wall, will be captured. Therefore, the supply of electricity is also necessary.

It is very essential to have as few objects and obstacles as possible in the frame that is recorded by the camera because the contours can be changed and deformed very easily with the insertion of an object. It is also necessary to have a distance between the user and the camera in order to be able to record the whole body, with as little detail as possible which can interfere and disturb the overall image of the contour or even create strange shapes that do not make sense. Therefore, there is a back projection wall, behind it there is the strong light and from the front the user moves. In front of the user, there is the camera and the laptop to record the user and the movement without distortion (this is the reason why the shadow recording was not selected).

*41. The back projection wall*



*42. The webcam is ready to capture the user and the projector projects the movements*

When the recording of the movements is finished, it is time to display the contours created by the algorithm. So, it is vital to have a blank light-colored wall, on which the contours will be projected. In order to display the final result, it is necessary to use a projector that is connected to the computer in order to be able to project the final visual graphics. As a result, after a while the silhouette of the user and the contour are in the same area, one next to other moving at the same time, but with different movements creating a kinetic dialogue. It is notable that the user must stay and continue moving in front of the webcam shot otherwise the dialogue will stop. The webcam is the “eyes” of the algorithm and therefore the “eyes” of the user’s digital partner.

Equally important is the ambient light. Daylight coming in through a window or door can be distorting and destructive to the final visual graphics, so the best possible solution is to set up the project in a dark room with only the strong light from the projector that located behind the back projection wall.

Of course the environmental conditions can change depending on how much the user wants to experiment and what result he wants to get. However, for the experiments performed on this project, the above descriptions correspond to the “ideal conditions”.

*43. Daylight coming in through a window or door can be distorting and destructive to the final visual graphics*

# 3.5 Technologies

## 3.5.1 Introduction

This chapter will provide a brief analysis of the technologies, techniques and programs implemented in the “Partnering YourSelf” project as well as how they are implemented.

## 3.5.2 Processing

Processing is a flexible program and Java-based programming language using some simplifications and was developed primarily to create graphics and interact with them in simple and easy to use ways. It was created by Casey Reas and Ben Fry in 2001, but it was not the first attempt to do something like that since the “Logo” and “Design by Numbers” pre-existed, but with limited features.

Processing is open source and with quite a friendly operating environment even for people who have no experience in coding. It is used by several industries such as architects, artists, designers, researchers and generally people who want to deal with the production of graphics, animation, etc. and learn the basic operations in coding. The results

that users get from the visualization of the algorithms are immediate, hence increasing their interest. It is a way to combine creativity with coding and having immediate visual effects.

*44. Processing*

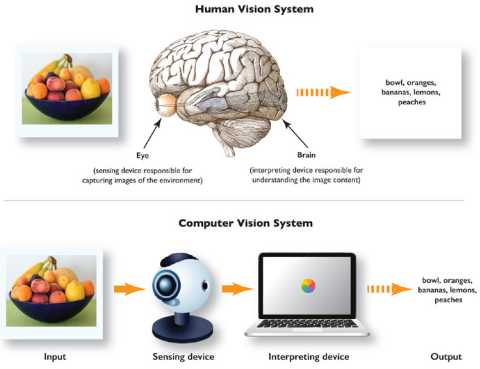
Although it is based on Java, there are many versions for other languages such as JavaScript, Python, there is Processing for Android, communication with Arduino, Raspberry Pi etc. It is a program with which someone can produce the simplest graphics with a one-line code, until he deals with greater researches such as Computer Vision which we will see immediately below.

The "Partnering YourSelf" project has also been developed in Processing, due to this flexibility and interaction offered by the nature of the program and the many possibilities it provides to users concerning creating and editing graphics.

## 3.5.3 COMPUTER VISION

The term Computer Vision usually refers to the techniques used in computers in order to find ways for them to "see" and "perceive" elements and content that emerge from the digital visual field. Therefore, data such as digital images, photographs, videos, video sequences, views from multiple cameras, etc., are mainly used to "train" computers in the way in which they "see" these data sources through appropriate algorithms.

It is part of the broader scientific fields of artificial intelligence and machine learning in order to simulate as much as possible the human visual system, but also to create some automated systems related to processes and capabilities of the human visual system.




*45. How people see VS how computer vision "see"*

### 3.5.4 Hardware

There are different types of computer vision systems that have different needs to work. However, in general, most of them have some basic elements on which they are based: they have some power source, some system that captures images, videos, etc. such as a camera, processors, wired or wireless network, monitor for monitoring the system and the corresponding data processing software. Depending on the type of system, they can have more specialized equipment, sensors, etc.

**Basic workings**

Depending on the type of computer vision system, there are differences in the way it works and the procedures that are followed, however, the general method used to obtain the desired results, consists of some basic steps.

- Through a system that captures images, videos, etc. such as a camera mentioned above, the computer vision system is able to receive in real time, visual data of images, photos, videos, 3D elements, etc.

- After entering the visual data, they are edited with the help of deep learning models which train the CV system with an automated process. Usually, this training is done by feeding a large amount of predefined images.

- After processing the data and training the system, comes the extraction of the final result which can be either the modified reproduction of an image, the identification of an object, its classification, etc.

Below are the basic techniques used in a CV system and the results that can arise from them.

### 3.5.5 Computer Vision Techniques

There are many features in Computer Vision that are used in a variety of ways. Some of the key features are:

***Image splitting:*** the image is cut into individual pieces so that they can be processed separately.

***Blob / Contour Detection:*** Uniform areas with homogeneous / similar brightness are identified and contours are designed based on some thresholds that have been set.

***Background Subtraction / Motion Detection:*** Each frame is compared with the previous ones in order to detect differences and therefore it detects motion.

***Object Detection:*** Detects a specific object in an image. In more advanced systems it is possible to detect more than one object.

***Face Recognition:*** It is an advanced version of object detection which can identify a person and even identify a person with specific characteristics that have been given.

***Full Body Recognition:*** Just as a face is recognized, the same process can be done for the whole body.

***Gesture Recognition:*** By recognizing specific gestures, interfaces can be created without physical contact.

***Edge detection:*** The boundaries of an object are detected in order to be easier detectable in the image.

***Pattern detection:*** The method by which some repetitive colors, patterns, or other visual elements are identified that may create a visual pattern. Such a method could be used even in AR applications as the recognition of some visual indicators can be a trigger for the appearance of some virtual elements.

***Image classification:*** Classifies images into different categories depending on some features.

***Feature matching:*** It is a way to detect and classify patterns according to some similarities found in them.

Simple Computer Vision systems typically use one of the above methods, but more sophisticated and advanced applications have the ability to use multiple techniques simultaneously. Later, the techniques with which "Partnering Yourself" system works will be mentioned.

### 3.5.6 Open CV

OpenCV was created in 1999 by Gary Bradsky and is one of the most well-known software libraries suitable for Computer Vision and machine learning. It is offered in open source format and is useful to provide a common operating structure, but also to speed up processes in the respective applications.

OpenCV continues to grow and evolve, while it already contains over 2500 algorithms suitable for machine learning and which are responsible for the implementation of the computer vision techniques mentioned above with the main ones being the detection, identification and classification of persons, objects and patterns, motion detection and monitoring etc. It supports major operating systems such as Windows, Mac OS, Linux and Android and is written in C and C ++, but is also accessible from Java and Python through other libraries.


*46. Open CV*

### 3.5.7 Computer Vision and OpenCV in “Partnering YourSelf”

In order to work the algorithm on which the project “Partnering YourSelf” is based, they were used some of the mainly techniques from the OpenCV library of Processing. Initially, the Blob / Contour Detection method is used, through which, through the image loaded by the camera, uniform areas with similar brightness are detected in each frame and their contours are drawn. That is why it is necessary to have a strong contrast in the brightness of the shot recorded by the webcam and to form the contours of the user as clear and well-rounded as possible, giving a clear image, without unnecessary details. This is also why we avoid interfering with other objects and pursue a clean and bright shot, as objects will affect the user’s contours by creating additional areas of similar brightness, unless this is desirable. Also, the uncontrollable light that enters the room affects the brightness of the whole environment and distorts the contours.

The second OpenCV method used is Background Subtraction / Motion Detection which relies on dynamic Background removal and compares frames with each other to detect differences, and therefore motion. So in the project, by saving all the contours in ArrayList, comparisons are made between the frames to detect changes and therefore movement. In the following, we will look more closely at how these methods work within the algorithm and how they help to produce the final visual result.

## 3.6 How it works

The project as already mentioned has been developed in Processing and is based on OpenCV, using Computer Vision techniques for the final result. The interaction between the user and the developed system is essential. Briefly, we could mention that the user initially stands in front of the computer webcam. The system creates the contour of his body shape. The user starts and gives some movements to the system which projects them randomly after recording and saving them. As long as the system “sees” the user moving, it continues to display the moving contours. If the user leaves the webcam shot or stops moving, the system will stop projecting graphics. The user can now observe himself and his movements, play, experiment, create, etc.

This is the main process that is perceived by the user. But to achieve this result, there are some further processes that we will analyze below. First of all, the system cannot work on its own. If there is no interaction with a user, the system will begin its function, but will never produce a visual effect. To create the user’s contours, the system relies on the methods of dynamic Subtraction and detection of single areas with similar brightness (Contour Detection) based on a threshold used.

To begin with, use the processing.video.* and gab.opencv.* libraries to capture images from the computer webcam and access opencv techniques. Also, the user each time states how many sequences of movements he wants to give to the system. For example here we have stated that we will give 6 sequences.

```
int arraylgt=6;
```

where arraylgt, is the variable that indicates the number of sequences that will be given to the system. To be able to create the final visual effect, the system is equipped with three ArrayLists. The first one, which is internal, stores all the contours created inside a frame, so all the cells together in this ArrayList compose a frame.

```
ArrayList<Contour> contoursBackSubtract = new ArrayList();
```

The second, which is the middle, contains all the frames of a sequence and therefore all the cells of the first ArrayList compose a cell of the middle ArrayList and all cells in the second ArrayList compose a sequence.

```
ArrayList<Contour> contoursSilhouette = new ArrayList();
```

The third ArrayList, which is external, stores all the sequences given by the user and will be played later, so it is all the "kinetic vocabulary" that the system receives to use later.

```
ArrayList<Contour>[] sequences = new ArrayList[arraylgt];
```

We notice that while the previous two ArrayLists are open and unlimited and can add as many cells as we want, the third has a finite number of cells, which can be set by the user but he put as big number as he wants. By giving a large number of cells to the external ArrayList, the user should give clearly more movements, but will also have a richer final, visual result.

After defining all the above and the first variables, the system is divided into two parts: in the first there is the whole process to fill the ArrayLists, while in the second there is the process for their display. Going to the first part, we start by loading an image from the webcam as well as using the threshold limit that we have set before to create contours. To start recording a movement, first it is necessary to detect motion and second, the motion must have a range, above a defined bottom. This means that very small movements may be detectable, but they are not stored and do not appear in the final result. Therefore, what happens in frame by frame is to measure the area of the pixels that show us a change in the movement. So the condition we check each time is if this area is large enough - in this case the area is set to be over 10000 pixels.

```
if (movingSurfaceArea > 10000)
```

in which movingSurfaceArea is the variable that measures the area in pixels. When the condition becomes true the recording of the contours begins until the condition becomes false, i.e. until the user remains motionless or leaves the frame. We also count the time that has passed since the last frame in which motion was detected in milliseconds. As soon as it stops detecting motion, another condition is checked which states that if the user remains motionless (and the area of the pixels showing change is less than 10000pixels) for more than one second, then the system stops recording frames and everything detected is stored in an external ArrayList cell.

```
if (motionDetectedInFrame == false && millis() -  lastTimeMotionDetected > 1000)
```

in which motionDetectedInFrame is the variable that indicates if motion was detected in a frame, and lastTimeMotionDetected the time that passes from the last frame in which motion was detected in milliseconds. This whole procedure creates a movement in the "kinetic vocabulary" of the algorithm. The algorithm also checks the availability of free cells each time. If the condition is true, then it moves on to the next cell,

```
if (index < arraylgt-1) index++;
```

in which index is the variable that shows in which cell of the external ArrayList we are and when it gets a value greater than the total length of the external ArrayList we have set, the algorithm stops recording extra movements because the external ArrayList is full. The following command is also used,

```
else stopFill = true;
```

in which stopFill, the variable that is activated when the external ArrayList is full and we move to the second part of the algorithm which is the display of the graphics.

In the second part this condition is checked:

```
if (goToNextSeq)
        {
        index = int(random(arraylgt));
        goToNextSeq = false;
        }
```

in whih goToNextSeq, the variable that indicates whether another cell of the external Array sequences should be selected. Therefore, if the condition is true, the algorithm randomly selects a cell of the external Array sequences and the goToNextSeq variable becomes false so that the entire contents of the cell can be displayed. If a cell is already selected, it simply displays all the frames recorded and located inside it. To ensure that all frames are displayed, we check the following condition:

```
if (seqFrameIndex < sequences[index].size()-20) seqFrameIndex++;
```

and it is checked whether the variable that measures the frames of each sequence (seqFrameIndex) is smaller than the size of the sequence cell (sequences [index] .size ()). As long as the condition is true the next frame is displayed. For aesthetic reasons, each time the last 20 frames are removed because there is no movement due to a previous condition and to make the movement of the contours look more continous.

Finally, to add more interaction to the algorithm with the user, we create an effect in which when the user leaves the scope of the webcam or stops moving, the algorithm displays a black background and the graphics disappear, until motion is detected again where the graphics will appear again. To do this, we call and use the `PGraphics pg;` library

to be able to draw a black rectangle in the projection window and disappear depending on the interaction “perceived” by the user.

```
if(isIt){
  pg.beginDraw();
  pg.fill(0);
  pg.rect(0, 0, camW, camH);
  pg.endDraw();
 }else {
  pg.beginDraw();
  pg.clear();
  pg.endDraw();
 }
```

So, what the system actually does is create the contour of the user or possible objects and record all the movements frame by frame and create a kind of short animation films that stores them to play them later continuously and in random order but only when it detects motion.

## 3.7 Limitations

In every project there are difficulties and limitations related to technical or physical factors. Below are the difficulties identified during the experiment.

### 3.7.1 Technical limitations

#### Space

A project that is directly related to physical movement usually needs enough space for the user to develop his movement. In this particular experiment, space is limited because the user has in front of him (at some distance) the camera that records his movements. In addition, during the data entry in the algorithm, the webcam records a certain range of shot so that there is a specific space in which the user can move. Also, during the recording of the movement, the user should be close enough to the back projection wall otherwise the contours that are recorded will be distorted or they will be joined with contours from other objects that can be detected by the webcam. After recording and saving the movements by the system, the user can move freely within the range of the shot that the webcam has.

#### Back Projection Wall

The Back Projection Wall should be large enough for the user in order to move more freely and have a wider kinetic range. Also, if it is small in size, it affects the final result because the camera detects its limits and integrates them with the user’s contour.

## 3.7.2 Physical limitations

### Chorophobia

There are many people who avoid dancing and anything related to it while they may not even participate in celebrations, events, activities related to movement, etc. The phobia for this dance is called chorophobia and the word comes from the Greek word “choros” which means dance and phobia. Anything related to dancing and physical interaction can trigger this phobia and the negative emotions it evokes.

This phobia may have been triggered by an awkward or negative experience that one might have had in childhood and thus created negative feelings about such activities or a bad experience in front of an audience may have created insecurities about the subject. What is more, insecurities about the body or low self-esteem can lead to such behavior. Usually this phobia exists in combination with other phobias such as agoraphobia, social phobia, fear of exposure to the public, low estimation for one’s body or movement. Also, the upbringing and the beliefs that one has play an important role. If, for example, he grew up in an environment with strict principles or religious restrictions, such behaviors are the least expected.

Another inhibitory factor may be depression. People with such psychological disorders have a complete rejection to move and do an activity like that because they have low levels of serotonin, the hormone that is responsible for good mood, but which can be increased through exercise and dancing.

*47. Chorophobia is the fear o dancing*

The reason that Chorophobia is mentioned is because “Partnering YourSelf” is based mainly on the movement and the interaction that the user can have by using his body and the movement as a tool and means. Thus, there were many people who avoided taking part in this project, due to insecurity and embarrassment. The positive side was that they were not negative in watching someone else interact and participate in the project and there were positive reactions as well as some were persuaded to try it.

“Partnering YourSelf” is a pretty good environment to improve the bad effects of Chorophobia, since the user can use it alone, without the presence of anyone else, to play with his movement, to interact and experiment and begin to improve both physically and psychologically.

## 3.8 Conclusion

After the elaboration of all this study that was done and from the experiments that were carried out, we come to some conclusions for this project.

First of all, it is a work that combines natural functions and classical art forms such as movement and dance with new technologies, thus developing new ways of creating unique digital art performances, considering that each time the result produced is different.

In addition, as a project that deals with movement and functions like a kind of mirror, it helps the user to become familiar with dance, movement and his moving image, by finding his “kinetic ID”. Therefore, it is a project, suitable for training and experimentation on movement and dance issues in a fun and entertaining way.

Despite the limitations due to physical and technical difficulties, the project “Partnering YourSelf” worked well and it is important that it is a portable project, so one can set it up anywhere and deal with it without having to carry special equipment. Certainly, environmental conditions play vital role, because depending on the environment the visual graphics change, but even without ideal lighting conditions one can experiment and create interesting results.

# 4 Conclusion

## 4.1 Feedback

In terms of the feedback I received from both users and viewers, most of the reactions were positive. More specifically, it was characterized as a pleasant, interesting and fun project. The depiction of the graphics, the simple and detailed design of the contours resulting from the processing of the data and the accurate recording of the quality of the movement received positive comments. It is meaningful that also a person who does not feel comfortable with dancing took part and had a positive experience due to the fact that the result that is captured is not personified through a specific image, but it is only a contour that gives a more neutral and impersonal result.

Sometimes, however, there was a problem with the contours of the users which were mixed with those of the back projection wall due to the fact that it was quite small in size and the camera recorded it as an additional object. Even with this mixture, however, it was expressed that the created shapes were very interesting. Also, sometimes the interaction between the user and the system was not clear from the beginning because there were some slow system reactions when the user stopped moving. However, the participants found interesting the fact that the interaction between the user and the system provoked them to dance even more to keep the graphics running.

## 4.2 Future Steps

"Partnering YourSelf" is a project based on dance, movement and interaction that these elements can cause when combined with programming and technology. However, there is always space for improvement and as technology upgrades there will be even more potentials. The first future step of the development of this project could be the learning of new movements of the algorithm during the whole processing of the interaction with the user and not only on the first part. Thus, as the user makes new moves, the algorithm will constantly add new moves, enhance its kinetic vocabulary and offer a much greater experience. So the element of machine learning would be introduced more actively.

Making the algorithm "smarter" in order to perceive the user's movements and projecting a movement that better respond to what it "sees" is also an important development, but that does not mean that it should always choose a specific movement. This would be contrary to one of the principles of Improvisation Dance on which the project was based and states that we cannot impose our desire on our partner (whether real or digital) about what movements he will make, we just try to interact with him in the most functional and efficient way. But starting the algorithm to understand the user's movements and choose to project something according to them will be perhaps one of the most meaningful and essential steps that will be taken, thus entering the fields of artificial intelligence and machine learning.

Generating sound signals according to the user's movements or algorithm's projections would also be an interesting future step, thus adding another form of interaction to the already existing ones, thus delivering an even richer result. A separate algorithm has already been developed which is based on cooperation between Processing and Super Collider and in which based on the contours that are created, corresponding audio messages are produced.

These are steps that can be taken even to a limited extent with the technology that already exists. As the technological achievements upgrades, so will the options that will exist to develop the project and its possibilities. Guided by imagination, creation and technology, the experience of "Partnering YourSelf" will be enriched by constantly offering the user additional features.

## 4.3 Conclusion

The experimentation and restless spirit of the artists from a very early age as well as their acceptance and cooperation with technology and programming, have led us to highly developed and specialized programs that serve the needs that arise. As a result, they become tools and means to be able to produce very interesting and varied results by utilizing the wide range of possibilities they provide us and to look constantly for new ways of rendering and representing images and ideas, new ways of expressing feelings and opinions and new ways of capturing facts and reality as well.

The project “Partnering YourSelf” is the result of such a collaboration between human movement, dance and programming, trying to produce an interesting and enjoyable visual result and at the same time motivate people to deal with their body, to find movement qualities that cannot even knowing that they have, to experiment, to find their kinetic alter ego through a dynamic mirror.

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