On Self Codes: a Case Study within Mathematics and Performance Art

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ABSTRACT

Unicity and existence of bounded solutions are interesting results not just for PDE (Partial Differential Equations) but can also be extended to minimization problems in Calculus of Variations. These results also have a very interesting behavior. The reasoning and research involved in these theoretical results were part of an artistic process in performance art: the performance piece “On Self Codes”.

This paper is devoted to the development of possible connections between mathematics research in Calculus of Variations and performance art through a case study. How can one construct a performance art piece inspired on specific research within mathematics, without translation and using intersubjectivities instead? How can we relate two different fields without using them hierarchically? Can we agree on affirming that this type of work is a statement regarding transdisciplinarity, or it maps the ways in which a contemporary body of work can be shaped today? Are these two features incompatible? These are some of the questions that originated this paper.

KEYWORDS

Performance Art; Intersubjectivity; Mathematics; Infiltration.

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1 | INTRODUCTION

In the last decades, many studies have been developed around possibilities of connecting different fields of study and/or practice: arts-based research, qualitative research, transdisciplinary research, as in the works by Denzin & Lincoln (2005), B. Nicolescu (2012), J. Saldaña (2013), among many others. In particular, regarding mathematics and arts, works by M. Field (2009), K. Walisewska (2012), M. Emmer (1993), K. Schaffer & E. Stern (2001), among others, are important keys to understand the connections between art and mathematics.

This paper is devoted to the study of possible connections among two specific fields that, apparently, have no connection: mathematics research processes in calculus of variations and performance art. Some connections between mathematics and performance art have been already established as we can perceive, for instance, in the work developed by Irma Optimist [1], a Finnish performance artist and a mathematician, specialized in dynamical systems, where a politics of identity is constructed through being a woman, a mathematician, an artist within her biographical experience and through the construction of a thought around it. Some of her pieces are concretely inspired in mathematical concepts or results, they are always present, also as part of her life: she is, academically, a mathematician.

As a mathematician, performer and performance studies researcher, I have been dedicating myself, in the last years, to a larger research on the analogies and interferences between mathematics research

and artistic creation, particularly in performance art context. I have been developing performances related with the research in mathematics I am developing at that specific time, as “On a Multiplicity” [2], a documental performance based on improvisation movement and speech videos inside the several homes I lived in along the last year of my PhD in Mathematics; “In Between Selves” [3], the documental performance based on improvisation movement in several places and mathematics research, developed along my PhD in Arts; “Unnamed Scroll” [4], where I used a communication in a mathematics conference as a concrete tool to construct a narrative on a contemporary multiple body of work; among others [5]. In these performances, the research in mathematics is present mostly as part of my individual way of perceiving the world, as implicitly present, and as a concrete tool: the sound of my communications in mathematics conferences, or the use and projection of videos where I talk about the difficulties and amazing theories and developments associated with the mathematical results involved in my specific research, ways of reasoning as paths within the performance. In the performance piece discussed in this paper, “On Self Codes”, mathematics is present as sound of mathematical reasoning and as one of the elements involved in the choreographic construction. Its aim is to understand the possible common moments between its choreography and the mathematics research I am involved in. Not as translation, but as *infiltration* of mathematics into performance art.

I start by introducing in a simple and general way the mathematical problems I have been studying. I intend to highlight their geometrical and conceptual features, since it seems easier in this way to map their own existence along the paper. I introduce two qualitative properties of solutions to partial differential equations – Strong Maximum Principle and Local Estimates – whose validation is proved also in Calculus of Variations context. Partial Differential Equations is a branch of mathematics focused on differential equations containing unknown multivariable functions and their partial derivatives. They are used to describe several physical phenomena: sound, heat, electrostatics, elasticity, fluid dynamics. Calculus of Variations is a branch of mathematics where the study is focused on minimizing or maximizing functionals, which represent several physical, economical, biological, or social phenomena.

Then, I introduce some characterizations and perspectives on performance art. Performance art is a practice, where integrating ideas and artistically perceiving and sharing actuality are part of its features. Performance art can be, in this sense, seen as a barometer of society and how it is shaped within social, economical, anthropological, political laws and forms of connecting and managing relationships. The development of several technologies, software and internet-based platforms allow performance art to expand itself, bringing new ways to relate different environments: virtual reality, concrete body presence, real time connections and theoretical reflections embedded in the performance as tools. Performance art intends to provoke the fixed structures in which thought, the development of new ideas and new theories are produced. My work in performance art can be characterized by movement improvisation research in restricted spaces, the use of media tools, and the biographical experiences on ways of being perceived as a scientist, an artist and a woman nowadays, within their subjectivities. It is autobiographical, but cannot be described as a poetic view on life, on suffering, or on “being me”. Instead, I use some autobiographical moments as subject and object to create mixed and not-apparently connected environments.

Finally, I propose a case study, the performance “On Self Codes”, as an example of what is enunciated first in this paper: performance art doesn’t have to be disconnected with scientific research, it can be in fact a way of disseminating various ways of living and turning biographies and perspectives into performances.

2 | THE RESEARCH IN MATHEMATICS: DIFFERENT PERSPECTIVES

For over a decade, I have been dedicating myself to both mathematics research and performance art. In mathematics research, I have been investigating the hypotheses that allow us to obtain qualitative properties for solutions to minimization problems in Calculus of Variations, as results on local estimates for solutions, the Strong Maximum Principle and the Harnack inequality. These qualitative properties were studied and validated first in Partial Differential Equations context and my aim is to propose them in Calculus of Variations’ setting.

The Strong Maximum Principle and results on local estimates for solutions have been studied by Arrigo Cellina, Vladimir Goncharov and myself, among others, in Calculus of Variations context. The Strong Maximum Principle (SMP) affirms, roughly, that, under specific conditions and considering an open set, if a nonnegative continuous solution to a rotationally invariant problem touches zero on the interior of the set, then it must be always zero on all the set. This means that a nonnegative continuous solution to a specific minimization problem, under some conditions, is positive or it is always zero. It was first formulated by Arrigo Cellina (2002) when the problem involves a function that equals zero at the origin, is rotationally invariant, smooth and strictly convex at the origin.

This result was improved by Vladimir V. Goncharov and myself, proving that the SMP still holds when it is considered a minimization problem invariant with respect to a closed convex set instead of being rotationally invariant. We were also able to prove in *Local Estimates for Minimizers of Some Convex Integral Functional of the Gradient* (2011) the validity of a more general version of SMP, as well as some local estimates. This more general version states, roughly, that under some conditions and considering a set, there exists always a line depending on the infimum (supremum) of the solution such that the solution is always above it on that set, which also helped us to prove results on local estimates.

Another important concept in partial differential equations is turbulence. We say that a flux is laminar when it does "behave" well, continuously and without oscillating too much, and it becomes turbulent when it oscillates to the point of chaos, despite its deterministic nature. For example, when we boil water, it starts as a laminar flow and when it starts to boil becomes a turbulent flow. In performative arts setting, turbulence was studied by authors as Eugenio Barba (2000), among others. In this paper, going along with Santos (2014), it makes sense to introduce this concept, to use it as a metaphor to the immanent moments within a performance art piece.

3 | PERFORMANCE ART: OBJECTS AND THEIR LAYERS

Performance art is an artistic expression where, unlike theater, dance, circus, the performer doesn't build a character nor intends to tell a story. In performance art, the performer creates environments where he can metamorphose himself into other possibilities of being there, connecting with the audience. This connection can be explicit or implicit: the performer can deliberately embed the audience within the performance, generating new perceptional states, or he may create environments where the audience can identify itself and create new ways of perceiving the world.

In fact, performance art is not linear nor easily explainable. It is an open road made of communities of people who pursue diverse and dynamical ways of connecting with the political, the social, the gendered, the contextual. Case studies and theoretical discussions around possibilities and characterizations have been essential to bring to life events that sometimes were shared only once and just with a few people, and to map them within historical and cultural studies.

In the context of this paper, performance art can be understood in the same direction as Amelia Jones characterizes body art in *Body Art – Performing the Subject* (1998):

> *"Body art does not strive toward a utopian redemption but, rather, places the body/self within the realm of the aesthetic as a political domain (articulated through the aestheticization of the particularized body/self, itself embedded in the social). (…) Body art proposes the art 'object' as a site where reception and production come together."* (pp. 13-14)

The self as embodied is part of postmodernist discourse, where cartesian dualism is dissolved and the ways in which the body in performance shows its own lack are discussed. As Peggy Phelan (1993) affirms:

> *"Performance uses the performer's body to pose a question about the inability to secure the relation between subjectivity and the body per se; performance uses the body to frame the lack of Being promised by and through the body – that which cannot appear without a supplement. (…) Performance marks the body itself as a loss. (…) For the spectator, the performance spectacle is itself a projection of the scenario in which her own desire takes place."* (pp. 150-152).

There is another key concept when we refer to performance art: intersubjectivity, the argument for presenting the self as embodied, performative and interconnected, generating the perspective of understanding a performance piece as a matrix. As Judith Butler (1993) writes:

> *"Unlike other objects in the world, the body cannot be thought as separate from the self. (…) Phenomenology interprets and produces the self as embodied, performative and intersubjective (…) The relation to the self, the relation to the world, the relation to the other; all are constitued through a reversibility of seeing and being seen, perceiving and being perceived, and this entails a reciprocity and contingency for the subjects in the world. (…) The body/self is simultaneously both subject and object."* (pp. 39-41)

The performances I have been developing since 2006 can be seen as autobiographic experiments around improvised movement in restricted spaces (as a metaphor for our daily lives and experiences, culturally and socially contextualized, where most events are planned, restricted, scheduled, and with little space for improvisation), where the mathematical research I am involved in is present, even if in an apparent absent way. Autobiography is a broad concept and, in each performance artist, it is possible to recognize different biographic experiences chosen to be featured in each performance. In this sense, mathematics is not always explicitly present, but, it is part of a constructed way of, even if part of a critical discourse, perceiving the world.

In performance art, objects and props are important to create paradoxical images, where the spaces in between stereotyped images are fulfilled, along with abstract, unconventional and mixed ones. Guillermo Gomez-Peña, Carolee Schneemann, Chris Burden, Ana Borralho & João Galante are, among many others, examples of performance artists that use objects and props in different directions and with different intensities and purposes.

Objects and props are also part of my performances. They are subjects in an intersubjective matrix along the creation process, using them as part of my personal narrative. Some of them remain and become part of the actual performance art piece. Each of the props has an identity and encompasses several layers of meaning, depending on the contexts in which it is inserted. But the most interesting aspect of props is the diverse and multiple landscape generated by their intersubjective connections when put together.

4 | ON SELF CODES

Life is fulfilled with codes. Codes which attribute us a space, a time, a place, an identity. "On Self Codes" is a metaphor for a set describing possible self-(re)presentations, as memory through video, in real time, and the abstract non-defined spaces in-between. Each (re)presentation is an action code, an honor code, a code as a choreographic set of specific moments.

Mathematics and its associated universal language, choreographed movement and its associated universal language, verbalization/sharing of sensations and thoughts and its associated universal language, mathematics as a way of reasoning and mapping the above elements. The love in-between all of this. A body destroying its own image, reformulating it, metamorphosing itself around recognizable codes, even if not easily connected. Movement improvisation as subject, object, center, boundary of creation. The importance of existing in the middle of chaos.

"On Self Codes" became a one-time shared performance, built from an invitation by Isabel Maria Dos to participate, with a theoretical communication and a performance, in *Neurological Landscapes #3*, on the 14th of October 2016. *Neurological Landscapes* is a meeting between artists and scientists around the connections between research and creation, being this third edition dedicated to *Art and Science* [6]. I immediately decided to engage in a process where the research in mathematics would be directly connected to the performance art piece and that they should dialogue within their foundations of thought. The performance art piece was presented at an arts center in Condeixa – Portugal, inside a gallery room.

The depart point of "On Self Codes" was the question: how to connect the results in my mathematics research to the construction of a performance, as an *infiltration,* permeating its own *agenda*? I decided to start with the specific problems for which the Strong Maximum Principle was proven

and let them influence the creation process of a performance art piece on self (re)presentations as codes on possibilities of a contemporary body.

The Strong Maximum Principle (SMP) states, in its simpler version, that if a solution to the Laplace equation, defined on an open set Ω, touches zero on an interior point of this set, then it is identically zero on Ω. The physical meaning of the Laplace equation $\triangle v(x)=0$, $x \in \Omega$ is that it is satisfied by the potential of any such field v in source-free domains. For instance, this equation is satisfied by the potential of the gravity force in domains free from attracting masses, or the potential of an electrostatic field in domains free from charges. We can also say that the Laplace equation represents the conservation law for a potential field. We can, then, affirm, that solutions to the Laplace equation are identically zero or strictly positive inside Ω, even if it is zero on the boundary.

Recalling the initial quote in this section, by Sylvia Plath, there are three directions of composing body narratives in this setting: to be introspectively passive, or null ground, to be constantly moving above the null ground, or ricocheting in between, with one important rule: each time the narrative in the performance *touches the ground* - it can be the literal floor, the *zero* energy, or a state of the body defined hierarchically as the lowest one – it stays on the ground inside the specific set defined initially. The only possibility is then, to stay on the ground until the environment metamorphoses itself into another equation defined on another set. “On Self Codes” became, then, a performance piece where the action takes place along several different contexts, or codes, of the body, with *zero* moments of transition.

The SMP also disseminated itself along the creation process in several directions – sound, movement, meaning – within the idea of coding self-(re)presentations coming from some well-known performance techniques: the use of some objects and props to purpose more layers of relating possibilities, defying images’ length, undressing and dressing in-between actions. I ended up with four codes, after movement improvisation rehearsals, video editing trials and the focus on the directions in which the SMP would have to be applied: #1: Maths; #2: Movement Improvisation; #3: Performance; and #4: Identity. These codes don’t belong to the same set. Instead, each code has a pre-determined conceptual direction, even if it relies on improvisational and free-directed tools. In #1: Maths, I explore the SMP as discourse: the use of recordings of myself presenting one of SMP’s result. In #2: Movement Improvisation, I explore moments when I am focused on SMP and simultaneously improvising movement as memory, that is, through video recordings. In #3: Performance, I intend to explore thought as a body experience through movement; and in #4: Identity, I explore the geometrical idea behind SMP, that is, to explore the way I connect the several ideas, objects as subjects, into “On Self Codes”: with positiveness above the trivial, open boundaries and some symmetry as tools.

In each code, I identified what generated turbulence and the way in which it can be organized within the performance. In #1: Maths, repetition and invisibility are the initial conditions allowing turbulence to arise; in #2: Movement Improvisation, several layers of body control provoke turbulence; in #3: Performance, nonstop movement improvisation is the initial condition to allow turbulence to appear. Finally, in #4: Identity, it is endurance and multiplicity that generate turbulence.

“On Self Codes” starts in the dark.

4.1 #1: MATHS

At the center of the gallery room, there is a big black plastic bag with the word “fragile” written on a yellow adhesive tape used to connect several plastic bags into a big one while the public enters the room (Figure 1). The plastic bag starts to move and suddenly, it is possible to recognize a person moving inside the bag through the floor. The movement starts to be larger, to occupy more area

Figure 1 | Photo by José Cruzio.

in the floor and to develop different velocities, as unified block occupying space, demanding territory, while one can listen the recorded voice of a person – the performer – talking about mathematics. This first moment has maths research in the audio and a performance "cliché" as action, with a person inside a black plastic bag used to put trash and with yellow adhesive tape with "fragile" imprinted. It starts slowly and becomes chaotic, with active and positive energy, until the point of a *zero* state, a suspension moment before the metamorphosis into a new context.

4.2 #2: MOVEMENT IMPROVISATION

At some moment, the performer gets out of the black plastic bag and starts doing some pilates exercises, while it is projected the same performer improvising movement outside a house with garden and a pool (Figure 2). The performer dressed yellow *collants* and a black *maillot* as a track from the bag used. This context is settled through the execution of pilates exercises, under the mottos of repetition and persistence, until the moment when the image turns itself into a *zero* state of the body, before the next landscape starts to be shaped.

4.3 #3: PERFORMANCE

The performer undresses the *maillot* and starts to improvise movement continuously across the space while the same performer appears projected talking about the creation process of that same performance (Figure 3). The performer started inside a black plastic bag, invisible and just insinuating the presence of a precarious human being, and gets out of the bag, setting herself free from imprisonment through the language of pilates technique, and this next code of movement improvisation is the highlight moment of wildness and freedom, even if the fear is present. Limits are a metaphor for the achievement of a boundary of one of the possibilities within SMP.

Figure 2 | Photo by José Cruzio.

Figure 3 | Photo by José Cruzio.

4.4 #4: IDENTITY

The performer undresses herself totally and starts to run naked on the same place, in front of a projection of the audio and video of the precedent codes #1, #2 and #3 on the same screen, multiple, simultaneous, chaotic and projecting an idea of identity: multiple, unique, strong through fragility, enduring through the unknown, through doubts and insecurities.

The performance was documented on video by Isabel Maria Dos and can be seen here: https://www.youtube.com/watch?v=QPUP7EVnQiw.

The video projected on the wall along the performance can be seen here: https://www.youtube.com/watch?v=zu99r4ntZoI.

7 | CONCLUSIONS

It is interesting to thing about different ways of connecting different fields in order to create other modes of understanding artistic production and artistic creation in performance art nowadays. Nevertheless, it is not accurate to think that two complex different areas could be linked through direct translations or simple exercises, as if this simplicity could give us a new field of investigation/creation to understand "it all". To think about mathematics research as a biographical experience to work within my performance art practice is a constant challenge, since I aim to create a new landscape where they coexist without having to be pedagogically approached.

Herein a performance art piece is presented as a case study where boundaries meant to be blurred regarding artistic techniques and what should be the

background of a performance artist. Performance art is an open field, even if it can be characterized by scholars or performers. In these turbulent times, when capitalism is overwhelming societies, where radicalized thought is at the center of attention, new ways of perceiving multiplicity are urgent, even if they start to rise as individual voices claiming existence.

Being performance art an open, broad artistic practice, even if delimited in its characterizations, it is almost impossible to map it in a generalized and categorized way. It has been mapped through reflections on its connections with politics, economics, social and cultural contexts, but also through documentation and case studies. These case studies allow readers (and audiences) to create their own perspectives and opinions on what can be said and written about performance art along time, especially since the 1960's.

In this paper a performance art piece was presented as a case study for a theoretical approach on specific possible connections between mathematics and performance art. This research project has two main interconnected goals: to represent individuality and personal identity, as well as to be part of a globalized, multiple and actualized body in performance. The development of possible connections between these two goals was made under some pre-established rules: to use objects, props and stereotyped images from performance art field and to feed the continuous presence of the Strong Maximum Principle in its several directions/layers: sound (audio recording of a talk in a mathematics conference), movement (improvised movement constructed along the performance based on the idea of zero energy as a transition state) and meaning (the performance's narrative/landscape created under the idea behind SMP as a property of positiveness or nullness of solutions as the only two possibilities inside a set).

The experience of "On Self Codes" lead me to argue that biographical experiences are one of the main ingredients on the construction of a performance art piece inspired on intersubjective connections with mathematical research, and not as a set of concepts translated into a piece, nor a pedagogical move. This means that the interest of this research is not on developing ways of translating mathematics within other fields, nor on constructing pedagogical methodologies crossing mathematics and performance art, usually one of them serving the other. I am searching, through case studies, for connections between artistic creation and mathematics research processes, where elements from both of them are present as tools in different directions and layers. In this direction, it makes no sense to argue generalization, but to map contemporary creation and self-(re)presentations instead.

The case study "On Self Codes" reports to the creation process of a performance art piece where some mathematics results obtained on the validity of SMP are present as tools but none of them in any kind of hierarchical position towards any other or towards the performance art itself. This non-hierarchical specific and individual way of perceiving artistic creation as mathematics research is also a political statement: the validity of non-hierarchical views and perspectives as possibilities on self-(re)presentations within contemporary life.

This type of work is transdisciplinary on the sense that a new object is created from permeating connections between two different fields, without creating, divisions, locks, or even concretely identifying any of them isolated from the others in the context of a specific and unique moment, the participation in the performance art piece as part of the audience. It cannot be seen as a statement regarding transdisciplinarity, but instead as an element of the landscape of contemporary creation, where transdiciplinarity can be discussed and actualized.

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MATHEMATICAL ENCYCLOPEDIA

This subsection is composed by several mathematical concepts considered as part of the foundations as well as the main structure presented in this paper. Its main goal is to fulfill some readers' curiosity regarding this research mathematical topics.

Definition 1

(a) A **set** A is a gathering together into a whole of definite, distinct objects of our perception and of our thought – which are called elements of the set. We denote a $\in$ A when we want to say that a is a element of the set A;

(b) We say that B is a subset of A, or that B is contained in A, and we denote by B$\subseteq$A, if every element of B is also an element of A.

Definition 2 A set A $\subset \mathbb{R}$ of real numbers is bounded from above if there exists a real number M $\in \mathbb{R}$, called an upper bound of A, such that x $\leq$ M for every x $\in$ A. Similarly, A is bounded from below if there exists m $\in \mathbb{R}$, called a lower bound of A, such that x $\geq$ m.

Definition 3 Suppose that A $\subset \mathbb{R}$ is a set of real numbers. If M $\in \mathbb{R}$ is an upper bound of A such that M $\leq$ M′ for every upper bound M′ of A, then M is called the supremum of A, denoted M = sup A. If m $\in \mathbb{R}$ is a lower bound of A such that m $\geq$ m′ for every lower bound m′ of A, then m is called the or infimum of A, denoted m = inf A.

Definition 4 A convex set *C* contains the line segment between any two points in the set:

$$x, y \in C, 0 \leq t \leq 1 \Rightarrow t\,x + (1 - t)\,y \in C.$$

Definition 5 Consider the set of real numbers $\mathbb{R}$, any fixed element of this set, that is x $\in \mathbb{R}$, and consider also any fixed sufficiently small positive real number, that is, ε>0. A **neighborhood** is an interval that goes from the number x minus the small ε to the number x plus the small ε, and we denote it by]x-ε, x+ε[.

Definition 6

(a) An **interior point** of a set A $\subseteq \mathbb{R}$ is a point a $\in$ A such that considering some small limb of this point a, all this small limb is contained in A, that is, this limb is a subset of the set A;

(b) An **exterior point** of a set A $\subseteq \mathbb{R}$ is a point a $\in$ A such that considering some small limb of this point a, all this small limb is outside the set A, that is, this limb does not have any point in common with the set A;

(c) An **isolated point** of a set A $\subseteq \mathbb{R}$ is a point a $\in$ A such that on some limb of this point a, it is the only point of A inside this limb. That is, it is a point such that it's the only point in common with some limb is the point itself.

(d) A **boundary point** of a set A $\subseteq \mathbb{R}$ is a point a $\in$ A that is nearby points that are members of the set A and at the same time nearby points that are not members of the set A is on the boundary of the set A. That is, considering any neighborhood of this point a we can find points from the set A and from outside the set A.

Definition 7 A **function** f is an operation that maps elements of C $\subseteq \mathbb{R}$ into elements of D $\subseteq \mathbb{R}$, that is

$$f: C \subseteq \mathbb{R} \rightarrow D \subseteq \mathbb{R}$$

$$x \mapsto f(x)$$

For each element x $\in$ C we correspond one and only one element which is the value of *x* through *f*, that is, *f(x)* $\in$ *D*. We usually denote by *C* the domain of the function f, i.e., *C = dom f*, that is, the set of members of C for which the function *f* is defined and achieve real valued numbers.

Definition 8 If f: $A \rightarrow \mathbb{R}$ is a function, then

$$sup\ f = sup\ \{f(x): x \in A\}\ ,\ inf\ f = inf\ \{f(x): x \in A\},$$

where *{f(x): x* $\in$ *A}* and *inf {f(x): x* $\in$ *A}* have as elements the values of *f* through elements belonging to *A*, or *x* $\in$ *A.* A function *f* is bounded from above on *A* if *sup A* f is finite, bounded from below on *A* if *inf A* f is finite, and bounded on *A* if both are finite.

Definition 9 f: $\mathbb{R} \rightarrow \mathbb{R}$ is convex if *domf* is a convex set and $f(tx + (1 - t)y) \leq t\,f(x) + (1 - t)\,f(y)$ for all *x, y* $\in$ *domf*, 0 $\leq$ t $\leq$ 1.

ENDNOTES

[1] Irma Optimist's work can be seen in http://www.suspectculture.com/content/microsites/strangebehaviour/maths_optimist.html.

[2] See http://telmasantos76.wix.com/onamultiplicity.

[3] See http://telmasantos76.wixsite.com/inbetweenselves.

[4] See https://www.youtube.com/watch?v=nsfuwcovi3Q.

[5] See http://www.telmajoaosantos.net.

[6] More information about Neurological Landscapes #03 can be found in https://isabelmariados.com/paisagens-neurologicas-03/.

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BIOGRAPHICAL INFORMATION

Telma João Santos holds a PhD in Mathematics (Calculus of Variations) and a PhD in Arts (Performance Art). She is a Professor at the Department of Mathematics - University of Évora, where she also teaches at the Department of Scenic arts. She is a performer and also collaborates through performative and classic writing for some portuguese dancers.

She researches in Calculus of Variations and in the interconnections between mathematics and performance art. Her artistic work in performance art is multimedia-based and uses mathematics in several directions. www.telmajoaosantos.net.