

TanzDIALOGE

**ÜBER |
HALTUNG |
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1# LISTENING. DANCE. BRAIN CYCLES.

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TABLE OF CONTENTS :

PART 1 : RHYTHM FROM AN INDIVIDUAL PERSPECTIVE

- I) How is the brain processing information ? (Tommaso)
- II) The rhythm is structuring and destructuring (Laurent)
- III) Recurrence and high-dimensional states (Tommaso)
- IV) How the space that you go through is becoming a stretch of time (Laurent)
- V) Questioning the verticality (Laurent)
- VI) Learning and changing (Tommaso)
- VII) Where the responsibility of the human being starts (Laurent)

PART 2 : RHYTHM FROM A GROUP PERSPECTIVE

- I) Synchronisation processes (Tommaso)
- II) Beyond the image, the possibility of a group (Laurent)
- II) Distributed cognition
- III) Including the diversity in the perspective

PART 1 : RHYTHM FROM AN INDIVIDUAL PERSPECTIVE

I) HOW IS THE BRAIN PROCESSING INFORMATION ? (TOMMASO)

The brain is processing information rhythmically

How is the brain processing information? When you measure brain activity, you observe electric waves happening rhythmically. Nowadays we believe that those electric waves play a role on how the brain is processing information. There are fast rhythms and slower rhythms.

Fast rhythms, like gamma activity (40 to 80 Hertz¹), are important when neurons are communicating between each other's inside a brain area, or in between brain areas that are close. Synchronicity between groups of neurons regulate how the information flows between brain areas (and specific patterns of synchronicity may dynamically delineate new preferential paths [e.g. attention]).

Slow rhythms, like Theta-rhythms (4 to 8 Hz) are important for timing cognitive abilities, like perception, attention, memory and action. According to recent neuroscientific studies it seems that our perception works rhythmically and that our capacity to initiate movements is rhythmic as well: apparently theta waves in the brain are the metronome of these processes.

The brain is organised in different areas

The brain is divided in different areas. Each area has specific functions and they are organised together according to a hierarchy: brain activity flows from one areas to the next. At the bottom of this hierarchy are the areas receiving sensory information from specific modalities (for example, in the case of vision, the information goes from the eyes to an area first detecting lines and contours, then to an area recognizing specific patterns and shapes, and then to areas selective for object or face identity). After this we can find *multi-sensory areas*, which are integrating information coming from various senses (vision, touch, hearing, smell ...). Then, there are some higher areas where the brain is making associations and predictions, storing information, and taking decisions. Finally, there are the *motor areas* (where movements are planned and the initiation of motor actions is timed).

Continuous reality and rhythmic perception

The world around us looks continuous, but in reality the brain is *rhythmically sampling* the information coming from our senses: it takes defined snapshots, and then it "digest" them (processing this information along the hierarchy of brain-areas). During this process the brain is for a moment "blind", until when another sample of information is acquired. This is happening rhythmically, at 4 to 8Hz.

An example: if I have two persons in front of me, I'm observing two faces, and faces are very rich of information, more then what I can process at once. So what I am doing is not dividing my attention between the two faces, but I rhythmically sample the two of them, one at a time. Because the rhythm is quite fast (8Hz), if one of this faces is changing, I will perceive this change almost in real time.

The possibility to produce an action is also rhythmic. In the laboratory where I work, I have participants pressing a button and being presented with an object appearing on a screen. When this object is presented with different time lags from the button press, one can see that the ability to perceive is oscillating in time. The button press is a motor event, and it synchronises perception.

1 40 to 80 cycles per second

II) THE RHYTHM IS STRUCTURING AND DESTRUCTURING (LAURENT)

The rhythm structure your perception

It is interesting for me to wonder why dancers are sometimes scared for rhythm, or why do they feel uncomfortable with rhythm. And I think it is because the rhythm makes something visible : when you put a rhythm in a space, the "mistake", when you are not in the rhythm, is immediately hearable or visible. Because the rhythm gives a structure, when you go out of this structure you are immediately exposed. So this make that an outside rhythm oblige you to feel the personal patterns that you are usually working with.

And the rhythm has actually a certain control on your body too : it obliges you *to think through* the rhythm, and to organize your body around it. That's why the rhythm suddenly *structures your perception* of the body and the organization of your body.

And actually the origin of the word "rhythm" has to do with "form". As if through rhythm forms are appearing. And you can see this even in painting or in sculpture : it is because there is a clear rhythm that you can recognize that forms appear or disappear.

Rhythm can give you a place from where you can go away from

I have been fighting with the question of the rhythm, by learning music but in dance too, every time I felt that the rhythm is too much structuring a form, and not opening possibilities, that the rhythm is actually closing, and not opening. Until I realised, by learning of music, that rhythm is something which structures, on one hand, but because it structures, rhythm is something that you can leave, and by leaving the rhythm, it *destructures*. So rhythm can close you, but it gives you a structure, a place from where you can go *away* from.

And this creates an other dialectic between structuring and deconstructing, and gives you a place of freedom away from the rhythmical question. Then question becomes : Can we be out of the rhythm, without falling in another rhythm ? Or are we automatically in a rhythmical pattern ?

So regarding the neuroscientific theory that our brain is anyway functioning in rhythms - are we aware of those rhythms which structure us, or not ?

III) CONCEPTS OF RECURRENCE, STATES, AND DIMENSIONS (TOMMASO)

The principle of recurrence in the neuronal activity

Neurons in the brain are recurrently interconnected. The information is always going up from our senses to early sensory areas in the brain, continuing then to areas dedicated to more complex operations (and sometimes reaching areas responsible for motor outputs). This is called "bottom up" flow. But neural activity can move also "horizontally" (in a loop) or in a "top down" fashion (feedback connections form higher areas to lower). This is called recurrence: each neuron in the brain is not only connected with neurons that are in the upper processing stage, but it is also connected with neurons on the same stage or on lower stages.

Therefore it's possible for the neural activity to propagate and to go around in different ways. (Neurons activate each other's sending small electrical potentials.)

The "bottom up" stream is carrying up sensory information while the "top down" stream sends down predictions. This two streams meet in each brain area, confronting what we expect with what we perceive (often completing each other's, but sometimes revealing important mismatches).

Collapsed and high-dimensional states

A moment in between two motor actions is a moment *in between*. A moment when multiple things are possible and nothing is decided yet. As such it has a very high "potential". It is very high in "dimensions". Sometimes our brain is in higher dimensional states and sometimes our brain is "collapsed" into the representation of something. Collapsed states correspond to moments when we are focused on something specific, and higher dimensional states corresponds to moments when we are more open for free associations, for the emergence of intuitions, memories, and elements from our unconscious. The brain can be in different states. In highly dimensional states, our brain have access to all the information it has stored (and everything is possible in terms of combinations of this material). In lower dimensional states, the brain is just representing something clearly, and that's it. I think that at least on the metaphorical level, when Laurent talks about the moments "in between two steps", he refers to a high dimensional state (where everything is possible, and nothing is decided yet).

IV) HOW THE SPACE THAT YOU GO THROUGH IS BECOMING A STRETCH OF TIME (LAURENT)

Polyrhythm

What could be in dance a game around the rhythm ? Or, how rhythm could structure the dance differently, until it destructures it ? Here some examples inspired me. For example the polyrhythm in Igor Stravinsky's *Sacre du printemps* : you have rhythms working on *different structures* at the *same time*. And there, as a dancer, you have a problem : which rhythm do you take ? There is also one of Beethoven's late pieces, in which he is destructing the structure of the sonata through rhythm "attacks" : he uses a pulse *within the rhythm* of the sonata, to cut it. And this rhythm is interesting because it suddenly stops the form : it opens a space where you don't know any more where you are in between these attacks.

Counting from the feet

So those works inspired me to understand the rhythm from an other perspective : if you ask a dancer to count the rhythm, he is counting from his head, or from a center place in himself. And for example if he as to walk on the count when he is walking, he puts the foot after he counts. So he counts [showing simultaneously]: "one!", and the foot is matching to one. For example, in the simple walking "one, two, three four" [showing simultaneously]. And what I try to change, is that for the dancer, *the foot* is giving him the counting, and not him counting the foot. [showing] So it's not "one! two! three!" ; but "-one, -two -three". And this changes *completely* the perspective of the body, because *it opens a space* between the counts in which you can fall. But what is in between ? It is a place which is out of the basic structure that the rhythm would give. It is a space in that you can enter and in which you can dance.

Making space and time the same question

It makes that suddenly the dance is organising itself not just in terms of space but also it terms of time. Because although the distance between two steps is a question of space, as the feet are counting at the same time the steps, it is becoming a question of time. So because you are not organising your verticality through your eyes, but through the hearing of the feet, the space that you go through is becoming at the same time a *stretch of time*. And you are making that space and time are becoming the same question.

The new can just happen in between

In his books about the cinema², Gilles Deleuze talks about Bergson's theory of time³, and says that we experienced the time as a duration between two events, between two peaks. And Deleuze said that the new, the unknown, the intuition, can just happen in between. Not [clap] on the beat. Because on the beat, you are in a frame. And I could say that all my work is influenced by this sentence : What is this future in between ?

Verweilen

So I am interested in the time between the beats, which opens duration, which opens stretch, which opens space because suddenly the time between two beats is the space. And this time opens a room in which you can be. Goethe⁴ would say : "Verweile doch, du bist so schön". It is a space where you can stay, where you can "verweilen". Maybe in English : "spend time". So I am interested in a body which feels the duration of the time. And the duration is beyond the beats.

V) QUESTIONING THE VERTICALITY (LAURENT)

Tempo and verticality

And can we create this space of time on stage ? Can we create this extension where the body is between two points of references. I think we cannot go in the space of duration as long as we don't give up our verticality. The verticality of the human being can be seen parallel to the rhythm in music. The tempo is like vertical moments on which you have to meet the note. And maybe the vertical of the human being has to do with this axe of the rhythm too. So to fall from the rhythm to be between two beats, means for the dancer : to fall from the vertical. But what does it mean to fall from the vertical ? How can we give up this verticality ? Or play around this verticality which has been actually *the thing* that use to separate the human being from the animality ?

Finding an angle between vertical and horizontal

If there is one thing that separates human beings from the rest of the creation, it is their verticality. Freud said about the verticality : „The human being decided to be vertical“. It's the origin of the culture : history, projection, capacity to see in the future... have to do with this position that we took. We projected our eyes, and suddenly „oh, there!“ and not just down, on the floor, where it smells bad, where we smell the genitals of the others, and the dirt on the floor etc.. But how can we actually connect back, or fall from the vertical to find a place between. It's not about going back to animality, but about finding a place, like an angle, between vertical and horizontal, where the place of duration, the place of being in the time could be possible.

The dancing comes from a pure falling

And we saw it today in the workshop, it takes a bit of time to make this shift. It changes your perspective to the floor, and it makes your body becoming unstable in the space : you are all the time out of a place of stability. And then it makes fun to dance, because the dancing comes from a pure falling. And Balanchine for example used it in a quite smart way : he uses the movement of the hip after a pirouette, to make that the dancer is falling from it, and that it gives him a speed. And you see how he manages to *fall* from the vertical through a rhythmical game between the feet and the hip.

2 Gilles Deleuze : *Cinema 1: The Movement-Image* (1986), and *Cinema 2: The Time-Image* (1989)

3 Henri Bergson : *Matter and Memory* (1896)

4 Johann Wolfgang von Goethe : *Faust I* (1808)

And it is very interesting to stay in that fall and not to go immediately back to the vertical. It has actually to do with how do we stand : *the function of the eyes in relation to the ears*. I did a lot of research with the dancers on how to move just by hearing. You can feel it a bit if you close your eyes and move, and there is some improvisation technologies (Ed.: From William Forsythe⁵) around this. But if you let the eyes open, you see how the hearing of the space suddenly makes you move. And makes you fall from the vertical.

This falling for me is very interesting for today to find a quality in dance where the body becomes more fragile, more unstable, disorientated. So the question would be : How can we represent disorientation ? Because there is a paradox between disorientation and representation. When you represent something, you have to act, you have to know, you have to master. And how can we fall from this ?

VI) LEARNING AND CHANGING (TOMMASO)

Plasticity in the brain

When we are learning, neurons are creating "roads" for the information to circulate and to be processed. They are wiring connections between each other's. This is how we learn about our environment, and how we learn to interact with it. The way neurons are interconnected determines the way we interpret sensory information, and how we react to it.

This learning process is happening according to *self-organising principles*: Each neuron follows very simple rules but the interactions between them generate something very complex. More in specific, each neuron produce/experience a lot of connections randomly, and then it keeps only the ones that "make sense" (the ones whose inputs arrive synchronously, giving enough energy to produce an output).

There is not an architect with a detailed plan giving directions in the brain, but everything happens spontaneously, in a self-organized way. (As in some dance pieces where the choreographer just gives very simple rules to each dancers and then simply watches the dynamics emerging from the interactions between them).

Changing

During development the brain is shaped by the environment it has around. Then, during adulthood, the brain can still change, but it can be more difficult.

The connections between neurons are providing an optimal adaptation to the environment which shaped them. If this environment suddenly change, then the brain has to reorganize its own connections (going through some instability). When this reorganization does not happen, the person will have sub-optimal interactions with the new environment (reiterating old behavioural patterns).

When a psychologist says that a patient has a "dis-adaptive behaviour", that behaviour (which is now not-optimal) may have been the best possible adaptation to a past environment.

5 [https://en.wikipedia.org/wiki/William_Forsythe_\(choreographer\)](https://en.wikipedia.org/wiki/William_Forsythe_(choreographer))

VII) WHERE THE RESPONSIBILITY OF THE HUMAN BEING STARTS (LAURENT)

Opening to something new

I had the experience to work with dancers with a highly developed technical body. I worked for example with a dancer who was 16 years with William Forsythe. Her body was then really trained to a certain reactivity, to a certain speed... the muscles are then build around certain movement patterns. It was really interesting to see that she completely understood the philosophy of my work. But she said "My brain or my muscles are faster than my will – my body reacts because of some memory before I can control it." So it needs a lot of patience and a lot of work to free yourself from patterns. Not for leaving them or going against them, but in order to open yourself to something new.

When the consciousness comes in between this action-and-not

And it is very interesting when you come to this place where you feel the reaction through the pattern, and that you are aware of this reaction, because it creates a delay – Again the question of the duration – And when you feel this "moment in between" as a subject, so *when your consciousness comes in between this action-and-not*, then I think the responsibility of the human being start... And of the dancers, of course : because then, you see an active dancer responsible for what he wants to do. And it does not mean he can – but he is aware, exactly at this spot. And then, dance is beautiful.

PART 2 : RHYTHM FROM A GROUP PERSPECTIVE

I) SYNCHRONISATION PROCESSES (TOMMASO)

About entrainment

Our ability to perceive something is rhythmic, fluctuates, and this fluctuation correlates with brain waves that we can measure with an EEG⁶. These electric waves can be synchronized by an external event, which can be a motor, a visual or an auditory cue. And this rhythm can also be a little bit accelerated or slowed down. This is called "entrainment".

For example speech is rhythmic (we place syllables in a 4Hz rhythm), and this behavioural rhythm goes together with some brain rhythms. When we talk together we start sharing a common temporal structure where we both place syllables and words. This may be obtained through a synchronization of our brain rhythms (which are our internal metronomes)⁷.

Maybe when we are anxious we speak a bit faster, and when we are calm we speak a bit slower, but we are always sharing this rhythm with our interlocutor(s), if we try to understand each other's. And this synchronisation persist for a certain time after the conversation stops.

Synchronised dancing

When it comes to dancing or moving with others, we are in a situation in which *we have to place different actions in a shared perception of time and space*. Synchronization for me is not about doing the same movements chorally, but it's about doing different movements which fit into a shared tempo and a shared spatial structure. To achieve this kind of synchronisation, brain rhythms of each participants might have to synchronize.

That's exactly the beautiful thing we did today in Laurent's workshop: we built up together a shared perception of time and space. Then, when there is a moment of silence and stillness (e.g. when all dancers leave the space or stop moving), we notice that *the rhythm is still there*, as a "tension" in that space. And if a new dancer enter that space, he/she will join again the same rhythm which was left before. Even when there is not an external input entraining us, the rhythm still persist inside us.

II) BEYOND THE IMAGE, THE POSSIBILITY OF A GROUP (LAURENT)

Connecting through the floor

There is a beautiful example that Tommaso sent me, of metronomes being together on a surface⁸. But I would say, the synchronicity of the bodies in my work actually comes from the floor. So for me it is about making that the dancers are aware that they are *sharing the same floor*. And it sounds self-evident, but it's not. If you think for example in terms of Laban, the floor is more or less as big as the kinesphere of the dancer. But I work with the floor in terms of *the entire surface* we are on.

6 EEG : Electroencephalography

7 And speech, like dance, involves both perception (listening) and motor actions (articulating sounds).

8 See : <https://www.youtube.com/watch?v=W1TMZASCR-I>

For example now we are not realising that we are sharing the same floor. Because we are all looking at each other, more or less, *through the face*. And a human being usually meet other human beings through the face. We can make a little experience together : if we start to be aware of our chair, and we feel our feet touching the floor, and we open to the back, then we start to feel a perception around us, and there is a moment when we feel "Oh my god ! We are on the same floor !" And then the floor become a *huge* surface. And when you make this in a room, you can almost faint, because suddenly you feel how huge the space around you is.

That is what Paul Cézanne⁹ says, when he says "Isn't it amazing that the human being is able to stand on these two little surfaces of the feet ?". It is actually a beautiful thought ! And that's why when you look at the paintings of Cézanne, they are all the time falling. The statues that he does are sliding on the surfaces. They don't stand.

It's about hearing and the floor

So if we are aware of this common surface, the information circulate through the floor. Which maybe reminds to tribal dances or ritual dances, in which it is about the rhythm that circulates on the floor. And not the rhythm which circulate in the head to make the picture matching. When dancers count it's because they have to be together at a certain moment that the picture for the audience is working. And if you say no, it's about hearing and the floor, then you have a complete other concept of togetherness and sharing information.

II) DISTRIBUTED COGNITION

About mirror neurones (Tommaso)

Through the mirror neurons' system, our brain is always "mirroring" the actions it observes: when I'm observing a movement, my brain activates the same neural circuits that it would use to produce that same movement (simply not pressing "play" at the very end).

This allows us to predict where a certain movement will end (i.e. the consequences, goals, and intentions associated to it).

It is easier to "read" actions that we can perform. Only if we can do something, we have the neural circuits needed to mirror it. (A ballet dancer uses both the *visual* and the *motor cortex* to "watch" a ballet dance, while he/she uses only the *visual cortex* to watch a capoeira dance).

The mirror neurons system allows us also *to learn* from the outcomes of actions performed by others. Watching others performing a particular action, speeds up the learning process for that. Apparently this mirror system is not only working for motor action but also for emotions (providing a mechanism for "empathy").¹⁰

Remembering your path through the others (Laurent)

It is interesting to notice that in a group piece, a dancer can not remember his part without the presence of the others. Even if he has a clear part alone, which is not dependant on the cues of the others, if the others are not *around* – even if it is just being in the room doing other things – this person does not remember her part. It's beautiful to see that they need to feel each other, and suddenly the memory of their own part comes back. It is only when they "connect" with the others, that the "mapping" of the piece is appearing in the space for each of them.

9 See : https://en.wikipedia.org/wiki/Paul_C%C3%A9zanne

10 Concerning this topic see also Francisco Valera and Evan Thompson

Groups as complex systems performing distributed cognition (Tommaso)

What is cognition? Everything that our brain is doing is cognition (perception, attention, memory, interpretation, decision making, etc.). But which is the *basic unit* performing these cognitive processes? Is it a neural circuit? A brain area? An entire brain? A group of brains? The brain plus the body? Or, a group of body(s) and brain(s) plus the surrounding environment?

The philosopher Alva Noë¹¹ is talking about enacting perception. Perception requires bodily actions to unfold (i.e. in order to perceive we need to move, move our sensors in the space, and constantly renegotiate our relationship with the environment). That's how we learn: changing our point of view, and interfering with what surround us. The body we have and the movements we can do determine the kind of interactions we can have with the environment (and ultimately what we can learn from it, and which model of reality we will develop). The body is therefore an integral part of cognitive processes.

When we are together our bodies and brains start to work in a joint network. This originates a complex system hosting dynamics which are beyond the mere sum of what each single "node" can do. We can think to it as an "*extended space*" in which cognitive processes are performed.

For example, ideas in science are usually developed in the interactions between people discussing and thinking together, that's why it's difficult to label them with a single name.

When we are together mirror neurons allow us to learn through the body of others. The other persons' bodies become sort of an extension of our own body.

Another example is when dancers learn a piece by heart. Even if each person "just" learn "his/her" part, the memory of the dance piece often exist only within the group interactions. In fact, the memory is not stored in each single dancer, but in the system "group of dancers", where each dancer performing his/her actions gives important cues to the others. Only putting all the dancers together is possible to reconstruct the memory of the piece (not just interviewing each dancer separately).

The architecture of the environment also influences how we process information, and it also retain memories (e.g. the statues in a city). Electronic devices participate to cognition as well (e.g. performing numerical computations).¹²

III) INCLUDING THE DIVERSITY IN THE PERSPECTIVE (LAURENT)

Maybe it's the biggest challenge today for dance, or let's talk generally about performing arts, what kind of picture do we want to show ? Traditionally theatre has been in Germany since the 18th century about *representing* a certain vision of the subject, a certain vision of society, and to make the audience reflect together on this vision.

But nowadays we don't have a clear idea of how to live together and how to be together. If the religious perspectives are very different, if the visions for society are very different, if we are all from different cultures, what do we represent ? So one solution is to represent different groups every time. Ex : the post-colonialism pieces, the queer pieces... But that does not make a society, because

11 Alva Noë : *Action in perception* (2006)

12 Concerning this topic see also Fransisco Valera and Evan Thompson

it does not make a living together. It makes a living *in groups* together. That is why I say sometimes that the public is dead. I think that there is not *the* public, but rather a series of individuals. So how to formulate the question of the togetherness on stage ?

And here I think that the question of the rhythm, the question of working through a more auditive perspective, and not a visual perspective, is maybe a way to test the problem differently. To try differently. Because the picture is a problem, immediately. You see how between two different religions, the way it is being dealt with pictures, makes it that you can not bring them together – and it should not : differences should be respected.

So what should we do on stage today, which is including this diversity in the perspective ? And rhythm I think can open here other questions, which are not functioning through “how does it look like”, what do we see, but more about a shared togetherness without engaging actually the perspective of the visibility.