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Performing the Quality of Imperceptible Interactions Between Individuals: A Technological Challenge Regarding the Collective

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When I was student at the Royal Conservatory of Liège in theater, we performed a "plateau balance" exercise in complete darkness. We used to practice this exercise almost daily in our trainings, but not without lighting. I was surprised about the group's ability to share a narrow space, in an intense energy and velocity, without generating any accident or touching each other. We were collectively engaged with each other through a deep listening, probably increased by the darkness.

I especially understood during this event that we were acting as particles in a homeostatic state. We were able to adapt to each other's presence and organize our sharing of the space without any dialogue, but simply by responding to the constantly changing environment produced by our movements. Through this experience in great focus and adaptation, my own body responded by movements that I didn't know I was able to perform. I decided then to investigate theoretically and to experiment this collective intelligence in motion to produce art.

As I wanted to approach this phenomenon both from a theoretical and practical standpoint, I enrolled as a Candidate in UQAM's Arts Studies and Practice doctoral degree, and my work follows a research-creation investigation. Practiced in Montreal since more than twenty years, research-creation aims to generate knowledge from within practices, through an analysis of artistic processes and their disciplinary intersection with Science or Social Science (sociology, anthropology, philosophy, performance studies, art history, media studies, communication, etc.). Research-Creation attempts to study Art from within, distinguishing itself from a more distanced analysis such as the practice of art historians. This standpoint surfaces a lot of complex issues regarding academic demands and develops itself around specific methodologies, among which the archive as a primary requirement as well as being of an utmost necessity. Western societies still tend to maintain the dichotomy between *doing* and *knowing* (Gosselin & Le Coguiec, 2006, p. 22), whereas a practice in Research-Creation tends to unite.

My actual research stands at the crossroads of theater and dance and focuses on chorality and the collective-body in motion and in relationship with new technologies. My main concern is to analyze and understand how individuals move within a collective, while defining of the chorus' *states*, through identification of the qualities occurring in relationships. This goal, among others, was the reason I began using new interactive technologies as well as real-time data processors. One of the objectives of this Research-Creation process is to produce an original work of art, a performance. I want to valorize the laboratory as an art practice in itself. This choice is not particularly innovative, neither in art, technology nor in theater, but remains rare in regard the production of shows nowadays.

The creation portion of my research articulates around a "performative apparatus" which will capture a chorus' improvised motions to then be processed in real time, generating shifting shapes and sound projected into space. The theoretical portion has three main problematics: can we record the qualities that

spawns from relationships within a collective performance? How would we use these data as artistic material? And what could be a performative apparatus? Although being widely used, this term has no fixed definition to this day. We may wonder if all apparatus aren't performative in themselves. This target will mainly be approached by interpreting motion detection into other shapes. Finally, can we avoid the generated redundancy into an apparatus that operate as causal loop?

In this essay, I will mainly discuss the use of archives as part of my creative process and how it allows us to solve some of the problems outlined above. I will raise a few questions and theoretical concepts regarding this practice.

Chœur Générateur (Generative Chorus)

"Choeur Générateur" is the name of my performance project, which is built around the notion of chorality through the design of an apparatus using various technologies and software enabling us to record and construe the real-time data of fifteen people sharing a space. The apparatus I am developing intends to be a detailed analysis of Agamben's (2007/2009, p. 14) proposition to define any apparatus: "I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control or secure the gestures, behaviours, opinions or discourses of living beings."

In this Research-Creation, I look to the apparatus through a performative approach. In French, "to perform" can be translated by *interpreter* ("to interpret"). I suggest a potential solution to the redundancy that Agamben's (2009) definition implies through the use of a hermeneutic approach. Reaching toward Ricœur (1965, p. 31), who sees interpretation as an action leading to an addition of meaning: "To say something about something, it is, in its entire and powerful meaning, to interpret."

In order to collect data, we can identify qualities within the collective by way of three pieces of software used in the apparatus development: Isadora, for recording and treating live data; Wekinator, to archive them and define *states* within the chorus; and Unity, for the interpretation of these states into other shapes.

This transdisciplinary project has a dedicated team to elaborate the different steps of the apparatus. Reason being, in addition to my research director**,** Armando Menicacci, whose practice is at the crossroads of dance and new technologies, I have surrounded myself with a mathematician (Moussa Abdenbi) and a Game Designer (Raphaël Dely). We collaborate closely on the practical dimension of my theoretical questions (chorality, performativity, qualities within relationships, non-redundancy).

Before addressing the use of technologies and archives, it is important to go back to the term "chorus," whose roots is found in the Latin word that has various interpretations. As we can find in the definition of the *Grand Dictionnaire Latin*

Olivetti (Chorus, n.d.), the first interpretation conveys the idea of actions: to dance or to dance in a chorus. The second defines the group in itself (a troop), when the third designates the events: meeting, procession, crowd, assembly, gathering, etc. The astronomical field defines it as a "constellation, random drawing in the night sky, produced by alignment of stars of different luminosities and located at different distances—or/and—revolution, orbit, circular motion." The latter, although not belonging to the domain of the arts, seems very relevant for the relationships we try to establish as we work on a choral motion.

Looking back at the early stages of western theatre, the chorus seems to be the link between the ritual and the theatrical representation. Initially, the chorus was a dance, then it became a chant for the doxa's speech in ancient Greek plays. The approach I chose concerns the notion of the chorus' bridge between ritual and theatricalization through an exercise of "plateau balance." As Jacques Lecoq (1997/2000) conceived it, with the intention to reacquaint with ancient chorality, this exercise became ordinary in western francophone schools of theatre.

My objective is to overcome the exercise stage in order to valorize the approach of the individual body; situated within a collective context and as an artistic form in itself. The practice is demanding and requires an intense exo-centered focus, projected towards the group. The open focus, velocity, rhythm and equilibrium of the plateau by the bodies are the main concerns for the performers. In the context of the exercise, understood through the lens of positive psychology, they can sometimes reach a state of collective *flow* (Sawyer, 2015, 2017). This dual concern—firstly, the behavior of the individual body as matter in motion through space and secondly, the logically organized behavior of the collective body in motion (the swarm behavior)—has spawned the desire to record and identify the various "qualities" present within the relationships between individuals. These relationships enable the chorus to be understood as an entity, a "collective body" and to be animated by "states of being" that we can archive and interpret as artistic material. Elaborated below are the three stages of the apparatus: to capture, to archive for analyzing, and finally, to perform.

The Performative Apparatus and the Artistic Use of Archiving

To Capture (Isadora)

Isadora is a real-time image processing software. It is often used by visual artists, stage artists or in VJing performances as it can manipulate an image as well as handling its projection on a stage. Its node-based workflow has made it very popular among artists that wanted to use technologies without having a strong technical knowledge.

As an artist who uses technologies to record, the three main questions I have to resolve are what to capture, why, and how. The apparatus, beyond being a simple data-processing tool, is shaped by the way we design it. The act of capturing is loaded with intentions that requires a series of choices such as: what is recorded, and the specific meaning an artist gives it; the technologies used in their potentials and limitations; the relationship created between the recorded subjects and the technologies; data processing, and the discourse built by said processing; result transmission and the target audience, etc.

It is essential to acknowledge the impact these choices have, beyond simply visual or artistic implications, as they form the elements of a broader discourse. Wondering about what, why and how to capture is as much theoretical as it is practical, and especially ethical. We should not neglect that the original context of the creation of these capturing and transmitting technologies was military (computer, IR cameras, GPS, cellphone, etc.) Today, many areas of application have developed software to answer their needs (e.g., Isadora, Wekinator and Unity).

I want to set up this apparatus to capture the qualities within relationships to identify *states* of the chorus, or *choral states*. I question how we can define these qualities, and if it is even possible. The qualities within the relationships that I am trying to highlight are situated and contextualized through the demands of the exercises on the chorus in motion. In that sense, specific theoretical fields support me in considering distinctions between various qualities through the three types of analysis of motion: motion in relationship with space and time following a more generic approach; individual motion in its relationship to the body; and, the most important for me, collective motion influenced by group organization.

a. Generic Motion

Image recording is in essence capturing a sequence of a certain number of images per second. In recording, there is the possibility to capture motion by way of a series of still images. As Bergson (1934/2014) states, and as Deleuze (2014/1983) will attest, the motion is not in the images themselves but between them. In that sense, it is not positions in space that allow the capture of motion, but the relation of a series of images allowing the identification of a progressive shifting through space. We capture the simultaneity (Bergson, 1922/2009) of individual progressions and give them a collective meaning through their conjunct processing. Each individual motion must acknowledge the perception of collective motion. The processing of this recording is set up in that sense using Isadora: trying to identify bodies to understand their movements, simultaneously for all protagonists. All of the information is then sent to the Learning Algorithm for the purpose of learning through archiving. This knowledge base is gathered on each moving individual within each frame. The shape of a *bounding box* containing the recorded body is formed. The information we have on this is its two-dimensional coordinates: its

center (x and y), its width, its height, its centroid—the potential center of lit pixels within the box (x and y)—and the magnitude of its velocity. This action is repeated each frame throughout a designated period of time in order to sequence them.

b. Individual Motion

Individual motion is not the main focus of my research, the chorus being conceived in such a way that it should not generate a protagonist. Yet, to neglect the individual portion of the chorus would be to neglect the chorus' composition and would raise an ethical problem regarding the participants. The theoretical fields allowing me to scratch the surface of its aspect are the Phenomenology of Perception (Merleau-Ponty, 1945/2005) and Grounded Cognition theories (Barsalou, 1999) that allow a back-and-forth between perception and reactive intelligence intrinsic to bodies facing a constantly changing environment.

The Phenomenology of Perception is, in my understanding, more focused on the perception of time and space of an individual, through spatialization of the body and its ability to interact and move, allowing the participant to situate his experience though its senses: "It shouldn't be said that our body is in space, nor that it is in time. It inhabits time and space" (Merleau-Ponty, 2005, p. 174).

Embodied cognitions (Rosch, Thompson, & Varela, 1991) and grounded cognitions (Barsalou, 1999) allow us to approach human intelligence without restricting it to a modular approach in which the brain, valued as a network of highly specialized systems, engages different layers of representations (images, symbols, etc.) following an essentially sequential mode. Alternatively, embodied and grounded cognition theories valorize the importance of actions and feelings on the memory, and conceive intelligence as always situated. In this case, the interaction with the environment is embodied through the body and not exclusively the brain. These biases are highly meaningful for the understanding of individual interactions within the chorus in motion and the constant individual's adaptation to space modulated by the other individual shifts. However, from a capturing standpoint, the importance of individual motion is far less preeminent. The individuals cannot be identified as a complex persona through the recording of the infrared camera, positioned above the space. The collective motions are the most studied in this research, not the individual.

c. Collective motion

The chorus is based on the performer's motions. They are invited to move in such a way as to "balance" the space with their bodies. It is not contact improvisation dance (Paxton, 1975), but rather a collective strategy to share a space. Contemporary technologies allow incredible possibilities for capturing individuals, but a problem arises when it comes to capturing a "collective body" in motion. One of the most complex issues at hand is the difficulty for the system of documenting

to differentiate several bodies when they are close or when they partially occlude each other from the lens of the camera. The sought solution would be to install the camera on the ceiling, capturing the scene from above. There are limits to this type of capturing: individuals are hard to identify, touch is limited, intense light variations will significantly affect the quality of the image processing, etc. Nevertheless, the performers' bodies don't have to be charged with devices, and the minimal constraints fit well with the chorus objectives.

Certain theoretical groundings allow us to elaborate different aspects of the analysis of the chorus: positive psychology and the concept of collective *flow* (Sawyer, 2017), swarm behaviors in ethology and group dynamics (Van Ginneken, 2013) as well as the concept of mass (Canetti, 1960/1966). The collective *flow* can occur only under specific conditions: clear group goals, close listening, complete concentration, being in control, blending egos, equal participation, knowing team mates, good communication, and being progress-oriented. (Sawyer, 2015). All of these conditions are necessary to process a chorus.

The swarm behavior depends a lot on ethology studies. I am however, under the impression that the study of social behaviors in animal organization and movements can give us significant keys, mainly with the study of the flocking behavior of birds or the schooling fish for example. The swarm intelligence depends of the collective cognition within animal groups (Couzin, 2009, p. 37) and mathematical models can help to understand them.

The concept of mass is significant for this research as well. Although it's study is a bit outdated and might, in various aspect, be insufficient, the analysis that Canetti (1966, p. 12) suggests an understanding of a behavioral paradox for individuals in what he calls "a mass." Notably within this understanding, is the fact that gathered individuals, leaving behind their potential at being a protagonist or renouncing (even partially) to their free will, behave collectively as a single body.

A lot more can be said for collective motion within my field of research, and I'm steel searching in this way how it reveal within the chorus by making laboratories with performers. However, I will now try to define more acutely the importance of my analytic and creative process of the archive capturing the chorus.

To Archive for Analysing (Wekinator)

Wekinator is a Machine Learning software and mainly oriented to the field of music. In my process, as part of the apparatus, Wekinator works as a way to train an algorithm to identify the varying states of the chorus in motion. In order to train the algorithm to recognize these states, I must proceed to a systematic archiving of recording sequences and give them prior meaning.

When searching a way to identify qualities within relationships, during the documentation we must determine what kind of data to analyze and give value to. It's after long reflection with Moussa Abdenbi, mathematician contributing to the

project, that we decided to correlate the positions in space of each performer, bringing a more rhizomatic dynamic, instead of prototypes. For instance, as extended radiating areas whose contact points (fictional) would generate accidents ("frictions"). We considered only acknowledging the mass outline by tracing ephemeral shapes generated by the people positioned the most remote from the chorus' core center. None of these propositions seemed to fit the need to understand the organization of a chorus and answered exclusively to the preoccupation of evaluating the balance of space by the bodies themselves. It is through a calculating for a determined time the evolutions of the many positions in the space that we establish our sequencing.

The meaning is collectively determined by the all of the team. For each sequence, we give three possible interpretations to the algorithm. Collectively identified as a key moment in the chorus progress (we call that moments *Kairos)*, to give three choices to the algorithm, three tinges in fact, allows it primarily to make it more acute. A human can see twice the same thing and interpret it differently according to his own state of senses—this type of multiplicity is what inspires the three tinges but also because it allows to avoid a binary logic of stimuli-response. This dynamic mode, enables itself a reproduction process and getting closer to an interpretation of dynamics.

On the other hand, we decided to work following a fuzzy logic. Instead of teaching the algorithm following a Boolean model (false/true, 0/1), we suggest all the variations between 0 and 1. Each sequencing that we choose to acknowledge the interrelationships between performers, according to various parameters, is analyzed using a more sensible distinction: "rather" or "rather not." The answer is never binary and allows a more grounded understanding of possibilities.

The more we archive the sequences we graduate and identify or interpret; the more the algorithm becomes educated and the more it will be able to further identify these varying "choral states." According to the qualities within the relationships in the collective, the algorithm will build its knowledge base. It is through the archiving of moments (*Kairos*), that we get to undertake an elaborated analysis that, although being repetitive, bears witness of the multiple choral states. We proceed to archiving in order to acknowledge, but also to understand, the organization and the ecology of the swarm behaviors in the chorus. Archiving allows us, through the identification of states and the process of classification, to give an interpretation of these qualities therefore adding meaning to it. These qualities go far beyond the simple coordination of positions in space and their progression in such. The debriefings with the performers, the technological and artistic team, my director and myself are able to recognize, distinguish and differentiate behaviors, moments, shapes and tensions that a simple capture would not be able to acknowledge.

Through the addition of meaning, enunciation and designation of a choral state a performative action emerges. Archiving permits one of these performative steps in the apparatus through the production of meaning; this aspect aligns itself with the acceptance of knowledge being situated, shared and built collectively during our experiences. The process and the data processing by Isadora allows us to pass on data as well as organize them, whereas archiving allows us to interpret raw data as well as pass them on again to the third step of the apparatus: performing the choral states through new imagery.

To Perform (Unity)

The third step of the technological apparatus is done with Unity, in artistic collaboration with Raphaël Dely, a game designer, who makes a procedural visual interpretation of the data outputted conjunctly by Isadora and Wekinator.

Located at the crossroads of his art historian background and his practice as a videogame designer, the artistic work of Raphaël Dely is about the perverting of mimetic technologies to find new semantics and expressive possibilities in interactive arts. His 2016 work, *Monolith*, inspired our collaboration as our individual researches seemed to be interlaced in many subjects. Very involved in the project and at each step of its design, he tries to articulate his shapes in motion with the chorus in a non-mimetic way. At this stage, we are still prospecting, and many questions guide our work that I can only attest to today.

Real-time integration seems to have a double risk between which we must find a balancing point: the risk of generating redundancy between the behavior of the shapes and the chorus' motion, making the work nothing but a simple biofeedback of the chorus. Redundancies might be present in various layers among which the rhythm, the positions and the motions of those moving shapes. In this case, the color choices would be too illustrative of certain states (for instance using red for a strong energy, blue for a moment of calm). The other risk would be to work remotely from the data through more random motions which would not allow for a circular causal loop and would prevent any relationships or any meaning, therefore no intelligible interactions. We must now find how to deal with this double constraint in order to design a sensible interpretation without it being redundant but remain iterative.

This research, still in its early stages, cannot answer all of these questions at the moment. On the other hand, I have yet to mention the creation of a relationship between the apparatus and the audience. This restraint is to focus myself on the aspects revolving around archiving and performativity within the apparatus. Although the event is not dance nor theatre as such, it is impossible to neglect its theatricality and staging, at least to a certain degree. This theatricality implies a staging of the spectators as well as the performers and represents,

willingly or not, a discourse about human behavior and human interactions. Pointing to body-machine relationships, the idea of the spectacle as well as the notion of "production," etc., of which I will include in my thesis.

Archiving is part of the various artistic processes used in Research-Creation and is one often studied within *performance studies* by the artists themselves. This project however does not deal with archiving as a mere trace or an index of what once was, but rather integrates it at the core of its research, its analysis and its creative process in that particular quest. I suggest that we need to acknowledge the constructive portion: identify, define and categorize the varying qualities within relationships in order to understand and interpret the varying "states" of the chorus. The first interpretation of the qualities through archiving is determined by the members of the artistic team, but the algorithm should eventually be capable, through repeated training, to recognize the states itself. This brings to the surface another question: is a machine truly capable of interpreting human data, and would it be able to perceive what we were not able to perceive ourselves at the time of performance? Can a machine perform our data based on what we trained it?

Finally, will we reach the objective of creating a circular-causal loop without engendering redundancy? Is it possible to keep the interaction, the creation of an understandable procedural language without falling into a mimetic logic of shapes, rhythms and motions between the images crafted by Raphaël Dely and the practice of the chorus by the performers? Our next laboratories will allow us to begin a practical work on these very subjects, in attempt to realize a final performance and to produce knowledge of the chorus artistic process, to meet the academic requirements of a Research-Creation.

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