Artificial Relational Intelligence: Breath as Interface

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While binary, digital systems tend to measure and define extensities, which cancel out, 'cover or explicate intensity' (Deleuze 2001: 235), I am exploring ways in which intensities can be artificially shared between bodies which thus converge toward *relational intelligence*. I want to propose that the breath in its immediate relation to kinaesthetic enactment can function both as a non-representational indicator of an affective disposition and as an interface for planned as well as emergent coordination of bodies. As a nexus the audible breath remains intense when heard while its data can simultaneously be tapped and turned into information by algorithms. Diverting multiple systems into one kinetic network by converting the sound of breathing bodies into electrical energy with a focus on correlating tensions in their interrelated kinaesthetic field, may provide the basis for a diverse, somatic, and artificially shared intelligence.

While many organisms would face severe difficulties unlearning their register of multiple 'distinct' bodies, machine learning algorithms can train on diversified inputs without preconceived notions of this separation. Within the reciprocity of kinaesthetic awareness and the inherent feedback of kinaesthetic perception lies a nuanced methodological potential and an implicit force which has been largely neglected in the predominantly positivist development of affective computing. This focus on a kinaesthetic sense of awareness may enact repercussions which call for a revised notion of relationality as well as for digital technologies beyond the binary.

Introduction: Intense Entanglements

Can intensities be shared between bodies? In the following discussion I chart the audible breath as a means of expression which can be rendered an extensity while simultaneously remaining intense. The study probes the breath as it relates to kinaesthetic awareness of bodies as well as to electrical energy when converted through a microphone. Specifically, I am investigating a mode of kinaesthetic communication between two or more bodies which are guided by the sound of each

other's breath. Situated via philosophies of difference the audible breath may provide both, a type of data which when listened to is affective, intense, and sensitive, thus not computable—and simultaneously electronic, extensive, numeric data which can feed a digital interface between these bodies. Further, this interface could potentially make explicit the movement which is not yet fully formulated or executed and facilitate a coordination of human bodies through the sound of their breath.

With the term 'sensitive' I refer to the concept of *sensitive memory* by the French philosopher Maine de Biran (1929: 164). Positioned between mechanical and representative memory, he describes sensitive memory as strictly non-representational. Two generations later, in the same school of thought, Henri Bergson suggests that embodied cognition tends to involve processes which flee awareness, and thus representation, as they are displaced by the performed act itself (1944: 159), creating *duration*, or a field in which *difference* can play out (1944: 361). Gilles Deleuze, after him, describes *intensity* which he defines as the 'form of difference' (2001: 222) in the following way:

> Intensity is simultaneously the imperceptible and that which can only be sensed. How could it be sensed for itself, independently of the qualities which cover it and the extensity in which it is distributed? But how could it be other than "sensed", since it is what gives to be sensed, and defines the proper limits of sensibility? (Deleuze 2001: 230)

Deleuze lays out how immediately the notion of difference or intensity is bound to that which is intelligible and extensive, and I propose that the audible breath moves bodies along these limits of sensibility. Intense, enacted, somatic elements which both flee and distribute categorization may indeed be one foundation of intelligence itself. For instance, according to the psychologist and cognitive scientist Lawrence W. Barsalou, any 'conceptual processing uses reenactments of sensory-motor states—simulations—to represent categories' (2003: 521). Through his *Situated Simulation Theory*, Barsalou argues that '[a] concept is not a single abstracted representation for a category but is instead a skill for constructing idiosyncratic representations tailored to the current needs of situated action' (521). The conceptual system might thus not be organized around taxonomies but rather around 'situated action', or processes which are not representational and externally bound, but intense.

Interrogating the workings of intensity, however, poses difficulties, as a downside of intensity is its unsustainability, or as Deleuze puts it: 'Intensity is suspect only because it seems to rush headlong into suicide' (2001: 224).

To reiterate, situated action or idiosyncratic data need something else in order to 'survive' long enough to be rendered graspable. Representation, or a coherent and formal analysis of information, covers over intensity or difference and, as artist and media theorist Alexander R. Galloway describes it, potentially makes things look or feel the same because of a lack of poetics (2012: 85) or singularities. He situates data as formless and lacking information in itself, ontologically along the concepts of Baruch Spinoza's *substance*, and Alfred North Whitehead's *actual occasions*, Alain Badiou's *pure multiplicities*, and Deleuze's *intensities*. All of these names seem to bear a certain paradox in their attempts to designate the unrepresentable. Galloway goes on to lay out that, on the contrary, the notion of information, in Deleuze, is tightly bound to form (2012: 84). I argue that within the audible breath there is both data and information, that audible breath is intense and simultaneously computable. Further, when acknowledging the concepts of the philosophers listed above, it is indeed the body itself within the breath which is in the process of being an interface, or interfacing. The breath presents a constant rhythm and hearing another body breathe tends to convey intense, affective information about that body.

When thinking about this audible breath as an interface of bodies, and specifically an interface through which intensities might be passed on—data which is not fully intelligible, yet as discussed by Barsalou, very much integral to what intelligence itself might be—the notion of sharing intelligence appears quite literal. Since nuances within the breath of another body are usually not audible from even a small distance, the breathing would need to be amplified and distributed via, for instance, an earpiece, in order to be heard. The breath in its electronic form could be simultaneously fed to an algorithm which does not automatically distinguish between these bodies, if not taught to do so. I want to try and think through *relationality* on conceptual machinic terms and along the notion of difference. I will not specify technical approaches or relate to specific algorithms within the expansive field of machine learning (ML) at this point; consequently, it will not yet be my concern how a dataset could be generated—especially, should these suggestions push

towards a possible implementation through deep learning neural networks. I further do not claim scientific accuracy with regards to the recording as well as the inferences made. Instead, I am employing some of the visual vocabulary and methodologies of ML to evoke and work though a perhaps unorthodox proposal for an artificially intelligent interface. This interface is taking advantage of positivist pattern recognition while, at the same time, focusing on patterns which only emerge in relational and thus non-binary modes of expression. The detection of patterns by a machine is productive in this context because the machine is capable of ignoring boundaries between bodies which would be difficult to overcome by a human agent, as I will lay out in the following section. Through this collaboration machine and human may thus render the notion of relationality one which is additive rather than comparative, that is, *different*.

Breathing Multiplicities

In *Difference and Repetition* Deleuze asks: 'Cannot difference become a harmonious organism and relate determination to other determinations within a form - that is to say, within the coherent medium of an organic representation' (2001: 29)? I want to juxtapose this question with the following images:

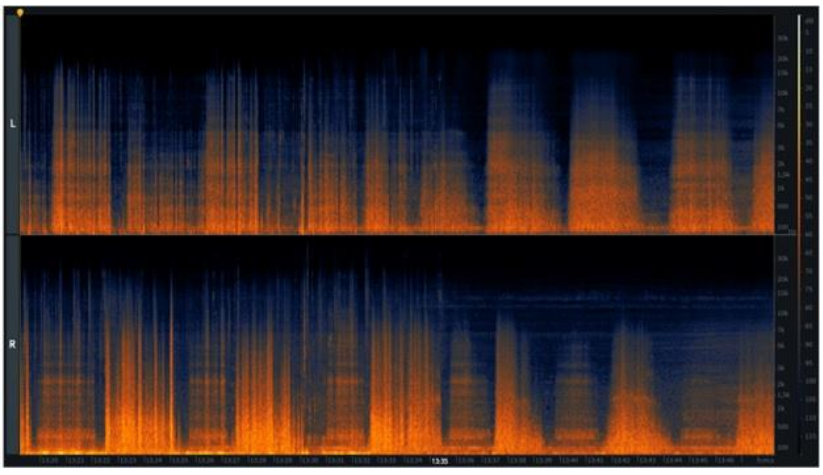

Fig. 1. Stereophonic spectrograms of the separate recordings of the breath of two walking human subjects who come to a halt together around 13:35m. One subject's breath represented on the left (top) and the other on the right (bottom) channel.

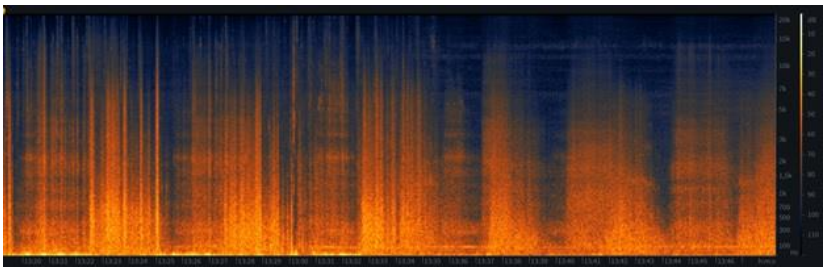

Fig. 2. Spectrogram of the two channels of Figure 1 merged into one monophonic representation.

These images are spectrograms, a common tool in audio signal processing which visually represents the spectrum of frequencies of a sound signal as it varies over time. An alternative, and another common acoustic feature representation in audio analysis would be to show *mel frequency cepstral coefficients* (MFCCs), which mirror the human auditory system more closely. For the purpose of this discussion I use the spectrogram specifically because the human auditory system may not necessarily be the main point of reference, and it might be fruitful to move beyond it. The three dimensions represented in these spectrograms are: time measured in seconds represented on the x-axis, frequency in Hertz (Hz) on the y-axis, and the amplitude of the particular frequencies at a particular time in decibel (dB) represented by the color of each point in the image. Figure 1 shows the sound of the breath of one human subject on the left channel (top) and the sound of another human subject on the right channel (bottom). Each of their breath was recorded with a separate lavalier microphone at their nose. These two people have been walking together until they come to a halt around 13:35m. They continue breathing while standing in proximity of one another. The shifts in activity can be seen in the different visual pattern. Figure 2 shows both of their auditive breath signals merged into one monophonic signal.

By merging the two signals the data of each body's breath is altered and arguably relates 'determination to other determinations within a form' as Deleuze calls for when describing difference in the citation above. Here, I return to the claim that machines do not immediately categorize along the lines humans tend to categorize. The data above could be presented to an ML algorithm and the machine can 'hear' and analyze one as opposed to two bodies while most humans will continue to hear two distinct bodies regardless of whether they

are listening to a stereophonic or monophonic audio signal. Taking advantage of machines' ability to resist immediate categorizations towards discrete 'individual' bodies might in this case permit the analysis of patterns within the sound of this multiplicity over time. This is practiced, for instance, in ML models which perform *sequence regression*, a particular technique which targets values from a continuous range, used when estimating musical tempo or predicting successive audio samples as laid out by Hendrick Purwins *et al* (2019: 207). The Deleuzian notion of difference or intensity proves to be useful in this context because it provides a logic of the relational which is concrete enough to be implemented within the logic of an ML model in ways such as the one laid out above. Despite the simplification, the discussion of audio signal processing may visualize and render operational the bodies' reciprocal influence on one another in a technical register. With this suggested implementation in mind, I want to turn to *difference* and the *relational* in more detail and point to the potential of their logic for an interface which utilizes multiplicities rather than the individual to be analyzed via ML algorithms while the sound of the breath is shared and is simultaneously both computable while heard in its intensity.

Deleuze explains that '[i]ntensity is difference, but this difference tends to deny or to cancel itself out in extensity and underneath quality' (2001: 223). This difference is not concerned with comparison or verdict, it is a 'concept of difference without negation, precisely because unless it is subordinated to the identical, difference would not extend or "would not have to extend" as far as opposition and contradiction' (xx). Extensity can be measured, can be determined qualitatively as of a certain kind, and might bear a particular quantity, have a certain degree. Intensity, or intensive quantity on the other hand is neither divisible like extensive quantity, nor indivisible like quality (237), but rather 'unequal in itself', or the quality which belongs to quantity (232). Constantly in process, Deleuze claims that the Self, or the I, is disrupted because it consists of 'multiplicities, made up of differential relations' (257) which evolve together ceaselessly. Figure 2, the spectrograms showing the two merged signals of the human breaths, depicts a multiplicity derived from this logic, a 'difference in itself' as opposed to the positivist notion of a difference in kind or degree.

I return to Galloway who calls for a 'poetics' for algorithmic systems, for a 'counter-aesthetic' in opposition to 'a positivistic dominant of reductive, systemic efficiency and expediency' (2012: 99) in order to find an adequate language to represent these systems. The breath might provide an instance of such a poetics. It is within its tension of data, information, and representation that I believe the breath, both in its immediate, intense as well as in its technologically augmented form, serves as an interstice between organic bodies and organic bodies and machines. Media theorist and practitioner Anna Munster describes the potential of this space in the following manner:

> [I]t is in the gaps between the series of corporealities and the informatic renderings of bodies that the interface can emerge as an *interfolding* of disparities or disjunction. Embodiment need no longer be situated as inadequate if we focus on the interstitial space between matter and code. (2006: 139)

When it comes to computing affective states or 'informatic renderings of bodies', however, it seems challenging to keep these affective intensities intact, or rather, in motion. Focusing on affective attunement as it is conveyed when hearing breath, might make an effort in this direction, as it is less concerned with designating discreet or constructivist emotional states—one central objective in what the scholar and inventor Rosalind Picard (2000) coined as *affective computing* in 1995—but, by contrast, apt to let intensities play out. Instead of analyzing continuous classifiers or concrete facial expressions in an attempt to label them—categorized and catalogued through the attribution of facial muscles by for instance psychologist Paul Ekman—analyzing the audible breath might disclose both intensities in the Deleuzian reading of the term, as well as discernible information prone to be turned into code. Sounds of the breath, specifically their timbre and the 'gaps' between in- and expiration, may not only provide information about levels of arousal within a body, like for instance measurements of blood pressure and heart rate but concurrently *singular* data: rhythm, habit, friction, and strangeness within and between organisms. In positivist applications of affective computing singularities are seldom sustained.

I borrow the term 'singularity' from scholar and curator André Lepecki who stresses that in his reading of the term—through the philosophers John Rajchman, Gilles Deleuze, and George Didi-Huberman—singularities are decidedly not synonymous

with the individual or particular but rather 'irreducible' and hence 'bearers of strangeness' (2016: 6). Lepecki describes singularities and strangeness as 'non-recognizable' (2). As cited by Lepecki, Deleuze writes in *The Logic of Sense*: 'Singularities are turning points and points of inflection; bottlenecks, knots, foyers, and centers; points of fusion, condensation, and boiling; points of tears and joy, sickness and health, hope and anxiety, "sensitive" points' (1990: 52), and they are always events. In his last publication, *Pure Immanence: Essays on a Life*, Deleuze further specifies:

> The singularities and the events that constitute a life coexist with the accidents of the life that corresponds to it, but they connect with one another in a manner entirely different from how individuals connect. It even seems that a singular life might do without any individuality, without any other concomitant that individualizes it. (2005: 29, 30)

The text at hand is an attempt to analyze this notion of accidental unpredictability in reference to the singular event and the breath in its function as a nexus which behaves differently from the manner in which individuals connect. Through the breath and its function of feeding muscles with oxygen I want to suggest that this interface aids and feeds off of kinaesthetic communication between bodies. By articulating this kinaesthetically informed mode of intersubjectivity as it figures through the breath, I hope to offer impingements of concepts of the body that emerge in this interdisciplinary context of philosophies of difference, psychology, numerous movement theories, and certain aspects of machine learning models.

The Breath and Kinaesthetic Awareness

In an immediate sense, breath implicates kinaesthetic awareness, not only because it is just when breath percolates the body that it moves, but because of *how* breathing shapes the body's movement. Kinaesthesis, also kinaesthesia/kinesthesia (Greek *kinein* 'to set in motion; to move' and *aisthesis* 'perception'), is a term first coined in 1880 by psychologist and neurologist Henry Charlton Bastian as the 'Sense of Movement', or 'sixth sense'. It describes 'the perception of weight, effort and resistance, movement and position […] involving the sensibilities of muscles, tendons, joints and skin' (Boring 2019: 525). In the middle of the nineteenth century, the two kinds of

sensors most active in kinaesthesia, namely the *muscle spindle receptor* and the *Golgi tendon organs* were discovered; they measure the position and force of limbs respectively (Boring 2019: 530-531). Jumping ahead roughly 150 years, contemporary psychologist and neuroscientist Jennifer Groh (2014) makes the assertion that the kinaesthetic sense is most accurate in the very moment the body moves as it is this change in position which makes the receptors react; with the passage of time, it becomes more difficult to sense where the limbs are located and how the body is arranged. She further points out that the sense of touch behaves similarly (67). Touching cannot occur without moving, and moving is adjusting; when one moves, the whole body is involved as it needs to find a counterbalance. This involvement of the entire body in kinaesthesia in combination with its reliance on the act of movement itself in order for it to be accurate (similar to touch), suggests that kinaesthetic awareness, and thus also the breath, are tied into a feedback loop—a body *being and simultaneously negotiating* velocity and force.

In her book *The Thinking Body: A Study of the Balancing Forces of Dynamic Man*, published in 1937, Mabel Elsworth Todd, movement theorist and founder of what was later termed 'Ideokinesis', a form of somatic education, suggests that the human needs practice in order to experience the synergy between breathing and movement which many animals utilize in modes of defense and escape (2008: 258). She labels the connection of breath and movement in the context of an animal in fight or flight mode ideal 'with as little waste motion as possible' and she continues:

> the breathing rhythms must be able to harmonize so perfectly with the locomotion rhythms that the mechanisms for locomotion and the mechanisms for breathing may serve the common purpose for survival. Muscle cells burn rapidly, and must have a continuous supply of oxygen to burn. The nerve mechanisms for breathing rhythms and locomotion rhythms therefore must be very closely tied. (Todd 2008: 249)

I want to emphasize this tie by showing a set of spectrograms similar to the ones above. This time the left channel shows the audio signal of a horse breathing, and the right channel the audio signal of a human breathing while walking next to the horse at the same pace. The audio signal of the walking horse's breath clearly differs from that of the human, most obviously in pace

and amplitude. There might be more subtle and informative differences within the representation of a single specie's breath—here, the juxtaposition of horse and human serves to show that different bodies breathe in different rhythms and that these sounds relate to their locomotive rhythms.

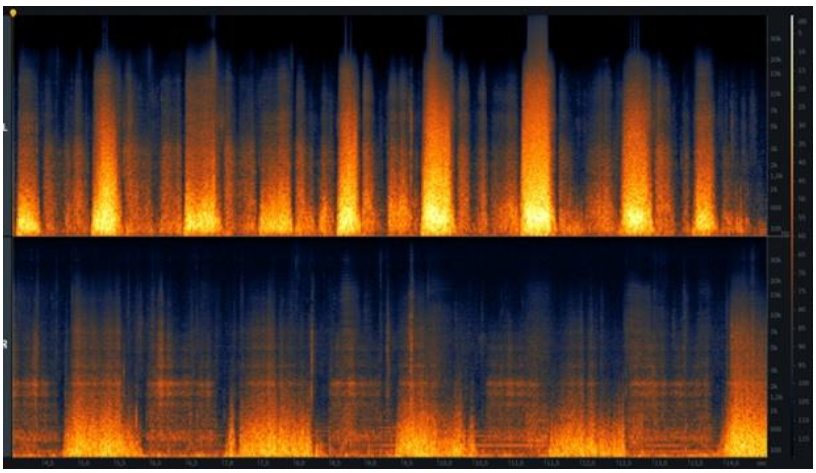

Fig. 3. Stereophonic spectrograms of the recording of the breath of a walking horse on the left channel (top) and the recording of the breath of a human walking next to the horse on the right channel (bottom).

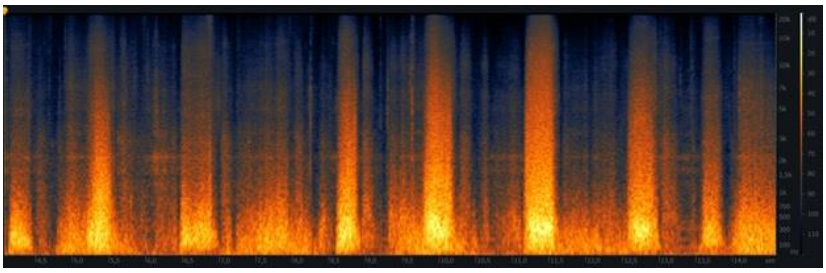

Fig. 4. Spectrogram of the two channels of figure 3 merged into one monophonic representation

Moshe Feldenkrais, another founder of a somatic education practice and indebted to Todd, writes with regards to breathing and bodily position: 'there are as many breathing mechanisms as distinct attitudes of the body. In proper development, breathing follows a definite rhythm, unhampered by the position of the body' (2005: 154). Despite Feldenkrais' frequent and

problematic generalizations, a facet of his comment on kinaesthesia and waste movement proves useful in this context:

> Unskillful doing uses up more energy than proper doing. The part of the energy which is not accountable for in the act performed is used up in affecting the tool, the organs, and the other mechanisms involved in the act. No action is ideally efficient, i.e., the total energy involved is always greater than that accountable for in the action performed. The difference in the living organism is sensed as difficulty. Efficient activity is sensed as easy and fluent, and for reasons we cannot discuss at the moment, looks and feels graceful. People with a low kinaesthetic sense feel only extreme inefficiency. (2005: 150)

It is this sense of the body's tendency to 'as little waste movement as possible' or kinetic efficiency specific to each body, as it is communicated not only through gestures but also through the sounds and sways of the breath, which, in accordance with that particular body, creates a point of reference. Through this point of reference—the measure between necessary movement and wasted movement—the breath is rendered into a kinaesthetic nexus between bodies. Breath thus functions as a nexus or transducing signifier which only carries whenever the space of each body is respected, and each's silence is heard.

The cyclical nature of the breath, its rhythm, both in the movement of the body as well as perceptible through its sound, can be subject to emergent coordination as to entrainment. Psychologist Robrecht P.R.D. van der Wel and cognitive scientists Natalie Sebanz and Günther Knoblich explain that emergent coordination is not limited to biological systems and does not depend on a brain or nervous system, that for example 'clocks hanging on the same wall will tend to fall into synchrony with one another, purely due to their physical coupling' (Fischer 2016: 169). They continue by stating that *entrainment, common affordances,* and *perception-action matching* encourage emergent coordination, for example when people walking next to each other synchronize their behavior. *Entrainment* can be described as the spatiotemporal coordination which tends to occur spontaneously between parts of a moving system. Since these parts do not need to necessarily be linked directly, this can occur between human bodies (170). By *affordances* they refer to psychologist J.J. Gibson's original sense of the term: action

opportunities provided by the environment to the particular action repertoire of an agent. Embodied approaches of cognition state that 'action perception and action production rely on common mechanisms' (171), this process is called perception-action matching. These three elements thus provide a basis for bodies to emerge in coordination, the breath certainly receptive to entrainment and closely entwined in *perception-action matching.* A particularly interesting part of their study in this context is the discussion of an investigation linking planned joint coordination with entrainment and emergent coordination:

> In one such study (by van der Wel *et al.* 2011), participants learned a new coordination task either alone (bimanually)[1] or together with an action partner (unimanually). The task involved moving a pole (resembling a pendulum) back and forth between two targets by pulling on two strings (one on each side) at the base of the pole. The results indicated that individuals and dyads learned this coordination task at similar rates. Importantly, dyads entrained more than individuals did, as evidenced by the increase in overlapping forces exerted on the two sides of the pole. Generating such force overlap supported emergent coordination by providing haptic information about the action partner, thereby reducing the need to represent the other actor's actions. (Fischer 2016: 175)

The concept of representation relates in this context specifically to the process during which bodies—when for instance lifting up an object together—represent where and when the other is holding and lifting it, in order to coordinate their own behavior accordingly. In the context of imagining an interface which utilizes the breath as a sonic indicator of kinaesthesia, this experiment proves informative in that it lays out a correlation between entrainment and coordinative tasks between subjects. My interest lies in determining in what ways the breath stimulates entrainment through the cyclical mode in which it is expressed and how it might produce enough 'friction' to provide graspable kinaesthetic information about an action partner. If there was such a process in which the amplified breath would reduce 'the need to represent the other actor's actions', as the study above investigated in relation to touch, it might offer a different capacity for joint creation.

Relational Intelligence

Cultural theorist and artist Erin Manning has explored kinaesthetic awareness as a dancer and writer; she claims that kinaesthetic adjustment is partially comprised of marginal movement which arguably flees the recognition of both human and machine. She calls the slight physical impulses *elasticity of the almost* (2012: 31), or *preacceleration* (5). According to her, an awareness of this micro-movement is indispensable to any kind of creation or improvisation between organisms, as it creates relations:

> The relational body is populated by virtual intervals. Yet these shifting intervals are also always in a potential state of disappearance. They are like spirals of preacceleration poised to be tapped. Movement revels in the potential of the interval precisely because it contains the magic of forgetting that assures that every movement will begin anew, despite and because of the endless potential of its preaccelerated state. For preacceleration cannot be known as such. It is felt in its effects. It colors the way the movement becomes. But it can't be repeated in exactly the same way. Preacceleration is the expression of movement's capacity for invention. (Manning 2012: 18, 19)

Tapping into 'movement's capacity for invention' through *symbiotic* or *collective individuations* (Manning & Massumi 2014: 54) as a means to better understand tacit dimensions of knowledge, welcomes inherent misunderstandings. It becomes symbiotic, when the engagement is perceived as simultaneously active and passive by each participant, when no one of them is leading or following and they are moving together (Manning, 2007: 101). This involves misinterpretations because shared knowledge must necessarily figure though a 'logic of disagreement, of misunderstanding (*mésentente*)' (2007: 14), as Manning lays out in her *Politics of Touch*. Here, relational bodies are themselves gestures in motion and advancing in time necessarily involves negotiating each other's impulses closely. Attending to each other's preaccelerations, the intensities which suggest a becoming, cannot be based on hierarchical power structures, as a preconceived notion of control eliminates the need to attend to these immediate impulses. Relational bodies on the other hand, as Manning suggests, act within 'an opening toward a production of power that incites us to act' (2007: 14). These politics stress to reach beyond the individual, when read

less literally, beyond the nation-state, and Manning relates her theory closely to Derrida's *Politics of Friendship* (which interrogates a politics of brotherhood, *fraternité*) when she points out that preceding calculation seems too goal oriented to keep up with the dynamics of this politics:

> This is politics, a politics of friendship: in politics, calculation cannot happen in advance. A politics of friendship is akin to what Derrida terms "destinerrancy," a movement without destination, a politics without end. A politics of friendship is about disagreement, about misunderstanding, about the necessity to listen in order to be heard in order to listen again. (Manning 2007: 46)

In the context of the calculations that artificial intelligent agents perform it seems that there is a certain amount of variation within the 'nature' of calculation. Even though ML algorithms will necessarily execute a sort of comparison, they may, for instance, compare patterns of multiplicities over time as opposed to individual *kinds* and *amounts*, determining overlap or 'difference in itself' which would imply that the process remains intense despite calculations. Further, and with regards to misunderstandings and AI, mathematician and pioneer in the development of computational systems Alan Turing already in the 1940s demanded a 'fair play for the machines' (Copeland 2004: 394). He insists that machines need to be allowed to make mistakes just like a mathematician in order to learn from experience. Psychologist and cultural theorist Elizabeth Wilson comments on this note: 'The trick to reading Turing may be not simply to accommodate or minimize failure but to see how stumbles and blunders and confusion and error are part of what makes a system work, part of what makes it intelligent' (2010: 57). She describes innovation and error, convention and eccentricity as being interdependent and calls arguing for this interdependency an opportunity (57). Quite literally, in the case argued for here, the human convention of hearing two separate bodies, of hearing their breath as an indication of individual subjectivity is corrupted by meshing their sound signals. It could be argued that information is 'lost' in the overlay, an erroneous eccentricity which is beneficial only if the convention of individuality is abandoned for that of multiplicity.

As the movement toward another, be it organic body or machine, is guided by inevitable misunderstandings, it amplifies the potential of uncertainty and the drive away from what is

already known. Psychologist Robert Keith Sawyer similarly points out that intersubjectivity in group inventiveness is each participant's contribution to a joint activity as opposed to a state of agreement: '[t]he key question about intersubjectivity in group creativity is not how performers come to share identical representations, but rather, how a coherent interaction can proceed even when they do not' (2003: 9). As misunderstandings prompt to listen more closely, and to listen again, this process of attunement might lead to a reciprocal seduction of the bodies involved, to an invitation to surrender to what they simultaneously suggest.

Manning lays out one specific challenge when it comes to acknowledging and attending to the unavoidability, disruption, and creative capacity of misunderstandings via technological means. She points to attempts made in the field of dance to capture and augment movement and emphasizes that it is the relational dimension which is missing more often than not in pieces which utilize a particular 'more-than' notion of the prosthetic. Attaching technology to the body or the body to technology often foregrounds the very mediation between the different systems and renders a mere 'interaction', as opposed to a 'relation', into an at least partially preconstituted and stable encounter of pre-formulated individuals. Relationality needs, however, to be metastable in order to establish a sense of singularity and what she terms 'new ecologies of experience' (Manning 2012: 64). Maybe audible breath, metastable in its heard, intense, and simultaneously computable form is a vehicle to implement a relational ecology of experience when colliding the logic of philosophies of difference and the process of training and implementing machine learning algorithms in a manner pointed to here. This is an ecology less concerned with comparison than with the way in which the process and possible patterns of a relation play out.

Outlook

In order for algorithms and kinaesthetically aware bodies to communicate, unfamiliar points of reference need to be found; one possible nexus is the breath. It seems that breathing and kinaesthetic awareness are doing both, sustaining intensity while being expressed through waste movement's deviation from what thus becomes a computable point of reference. In other words, bodies that hear each other's movements and deviations, that is,

waste movement, may find a joint form of coordination and move along patterns which are transparent to ML algorithms. Within this process of perpetual readjustment—a process which keeps being intense—bodies may be linked on a kinaesthetic level through the sound of their breathing. A potential for entrainment and emergent coordination appears to be inherent in both the progression of kinaesthetic adaptation and the rhythm of the breath. This constant adjustment which kinaesthetic feedback as well as the breath entail, offers a stream of intense data through which ML models might be able to aid a redirection towards a cooperative capacity of organic and machinic systems. Attending to environmental and social affordances of multiplicities rather than to the idea of individual mastery, as suggested by post-structuralism and the feminist new materialism discussed here, marks a notion of agency informed by this necessarily joint empowerment. Through this cooperation unfamiliar ideas may emerge. There are obvious problematic effects tied into the concept of entrainment; the term connotes following a dominant rhythm. For the moment I want to try and divert problematics around control towards a sense of Deleuzian difference. I am aware, however, that this presupposes a ground on which this is possible, and which remains illusory for many. At the same time, I wonder if relating through the kinaesthetic sense and through the sound of breathing might, even in disillusioning contexts, gently, perhaps subversively demand for respectful engagement because of the effort made not to overwrite or silence the *difference* of multiplicities. It offers at the least a disparate, possibly productively opaque and rewardingly intense alternative ground to the more familiar one of binary differentiation.

This rather abstract discussion demands concrete implementations of both a wearable mechanism for hearing another body breathe and algorithmic models which can further accommodate breathing multiplicities and discern patterns in their relation. Specifically, the notion of Manning's *preaccelerations* or becoming movement poses an interesting provocation when observing patterns of joint movement with the help of algorithms. Might certain 'different' ML models be able to discern rhythms of preacceleration within shared breathing? If so, this would create further paradox possibilities for joint creation within an intensive realm in which participants are presented with an unfamiliar sense of time, a dispersed time in which future movement is confused with the present, a layering which suggests moving in multiple directions at once. This

raises the question whether a process reliant on the notion of difference in itself or intensity is prone to abuse or 'immune' to it, due to intensity's reliance on consent. Here, consent can be understood as a prerequisite of multiplicities in which elements are both active and passive, leading and following simultaneously. Issues around control might be reframed along those of time and direction within a micro-ecology of experimentation which probes artificial relational intelligence and the joint and necessarily misunderstood sense of orientation it encourages.

Notes

1. Bimanually referring to both hands of one person, unimanually referring to two people, each using only one of their hands. My annotation.

References

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