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In copertina: Hamedina square (Tel Aviv), the biggest demonstration of the social justice movement in Israel
(September, 3 2011) (© Activestill)

Issues of scale in the Anthropocene

1. Overview

Anthropocene is generally described as new historical era (Crutzen 2002, Steffen *et al.* 2007), immediately generating in the reader a sense of distance from the ordinary, and a certain lack of urgency to go deeper into the definition. More likely, it is a new way to define the present historical context and condition, with the deliberate goal of stressing the aspects of intense and structural interaction between human beings and their environment.

Anthropocene occurs when the adaptation of the species to the environment unfolds within an environment that has been mainly created and modified by the same species (Oreskes 2004, Oreskes, Conway 2014). Relevant processes of modification and strategies of adaptation to the environment are historically well known, and they appear as constant features characterizing all human history in its gradual evolution (Dove, Carpenter 2009, Dove 2014). But in traditional analysis long term environment modification and human adaptation processes have taken place with a gradual and slow pace (Fiske *et al.* 2014), often alternating transformative phases with long periods of stability (Gould 2007), hence allowing the living species, and the human communities at large, to cope successfully with the transformed environmental conditions.

The new and most relevant quality of the modification and adaption processes characterizing the Anthropocene is the increased speed at which present environmental changes arise and develop. The issues of time and acceleration of transformative human actions are therefore crucial to frame correctly the concept of Anthropocene. The concept of era, historically intended as a long duration in time, needs to be completely readdressed, reconfigured and resized down to a scale where the human action is effective, and its effects are visible. At the same time, human transformative actions become increasingly powerful and fast. This double shift in relevance and impact marks the reciprocal coming closer of two historically unrelated time processualities, the geological and the human ones¹.

2. Scales and Time

In a word, Anthropocene compels us to reframe the conceptual relevance of temporal scales. In the recent past, we have been witnessing events and large scale environment transformations that used to require decades or centuries, now unfolding in a few months or a few years (Zalasiewicz 2008, Barnosky *et al.* 2012). The consequences of apparently small facts, as the modified composition of the gas in the atmosphere or the rate of extinction of living species, are enormous and permanent. Together with that of “era”, also the concept of relevance requires a new definition, since our traditional criteria to evaluate “relevance” are no longer suitable not even to measure the present emerging effects: rates of water use and paper consumption, the increase in urban population and in communication technology, the damming of rivers and fertilizers consumption, have accelerated so much the rhythm of their growth to suddenly require new parameters to be described (Steffen *et al.* 2007).

The connection between long duration of natural causes and the relevant and permanent quality of effects needs to be rethought of: in the framework of Anthropocene perspective, relevant and irreversible changes of chemical, geophysical and ecological environments may strike as unexpected and immediate, they appear as unpredictable discontinuities; but at the same, time they grow as consequences of slow and steady processes triggered by human action silently unfolded over long times. The direct interlink between human causes and environmental effects is becoming worryingly weaker and less visible: Anthropocene deals exactly with the interlinks between small scale causes and their large scale consequences. The long duration of processes of environment modifications, often acted without a real awareness, alters the capability to perceive the role of human responsibility in shaping long term effects.

Time, especially in anthropology is not a primary concept, rather it is a quite human and experientially determined quality (Munn 1992). The idea of du-

ration in time doesn't refer to any abstract amount, and the categories needed to quantify a duration in time and linguistically address to it, arise from practice, from experience, from actions and memory. No absolute concept of time emerges from everyday experience, and in fact time definitions and time ontologies change substantially when moving from one cultural context to another².

When different disciplines discuss the concept of "era", they diffusely recall the reference to long lasting events if compared to manifestations of human life. An era may enter the anthropological discourse only through the dimension of myth; mythical time is projected so far into the past that unspeakable changes are considered as possible and ordinary. An era has a somehow overarching duration, outside the grasp of experience. The concept of era is implicitly addressing to an un-sizeable length and distance from now, and its duration is a measure of the relevance of changes occurred during its span. The present effort to redefine the concept of era, pursued to correctly frame in time the concept of Anthropocene, requires that we shift the emphasis from the duration of events to their effective relevance, considered from the point of view of the involved living communities: events, transformations, discontinuities may develop a large scale relevance, i.e. a human relevant scale, despite they occur only in relatively short times, comparable with individual and immediate perception. This is how the concept of era comes back down to primary experience, this is how an era becomes an everyday matter.

A striking example of this case is provided by how climate change evidences are collected and evaluated in the pacific insular communities facing the rise of the ocean levels: the perception of the modified average tides occurs on a seasonal time scale, and the data collected over a few seasons are compared with the traditional knowledge of environment understanding orally handed down. In this comparison, the short and recent "data" recordings coexist with the stable, more reliable knowledge produced over non-measurable long "eras", and the two time-like qualities of information need to be somehow productively combined. At the same time, an alteration of a few centimetres in the tide average level, which is a small effect in term of dimension, provokes major alterations in households facilities, and calls for the rearrangement of coastal fisheries techniques. So, despite the traditional knowledge produced in the deep times of history has a recognized authority and major reliability, the present and most urgent decisions about surviving strategies have to be taken according to the shortest and recent environmental data recordings. The redefinition of fishing tech-

niques and the rearranging of household facilities represent and defines, in many respects, the onset of a new "era". But this new era of new techniques and adaptive strategies has emerged in a human, short and sudden, time scale.³

The concept of era that we introduce is grounded into the consideration that the epochal transformation of styles of life, imposed to communities by apparently minor cases of apparently small relevance, rather than referring to the duration required by the epochal transformations to unfold. Redefining an era is a scaling down from geologic to ethnographic duration, we could say.

3. Scales and Matter

Anthropocene deals with large and small dimensional objects, contributing together to alter the progressive and apparently unstoppable sequence of evidences probing that climate change is already in action. Anthropocene deals with the similarities between collective behaviour of carbon dioxide molecules as components of the atmosphere, shaping the changes of the directions of the high altitude winds, and the adaptive behaviour of nomad communities following their livestock, facing the changes of rainfall and drought rhythms (Brown *et al.* 2007). Both dimensional ends of the issue, the large and the small scale ends, point at visualizing the present planetary global fragile equilibrium, and emphasize the deep interrelation between all active agents, micro as well as macro agents, contributing to determine unique processes of reciprocal adaption.

Dealing with Anthropocene requires the capability of including and evaluating within the same gaze of research both large and small scale objects, and of course their related/relating subjects, as middle scale agents. A research analysis in the anthropogenic context focuses simultaneously on a spatial location, on its population, its environment, its economics, and focuses on the potential crisis and instabilities that may emerge in the relations among all these issues. We call this multilayered object of research an "anthropogenic landscape".

Like most prominent processes characterizing the Anthropocene, a comprehensive observation of the landscapes clearly show the simultaneous activation of micro, medium, large scales processes. Differently dimensioned active agents coexist in the same environments and jointly contribute to shape the same comprehensively outcomes. In anthropogenic landscapes, the emphasis of the observation is placed on the generative interventions performed by the communities: those living and ex-

exploiting them; those benefitting and depending on them from a distance, through economics and land productivity; those shortly crossing them, temporarily migrating through their spaces. An anthropogenic landscape is qualified, at the same time, by its geographic location, its history, its ecological context, population, geologic substrates, all recognizable large scale features, and by the chemical composition of its soil, the altered nitrogen cycle, the disappearing of local water, all small and micro scale features. Natural and artificial actors shape the same environment and co-evolve with it. The investigation of such a landscape requires a multi-dimensional and multi-temporal vision, which calls for the simultaneous activation of non-similar research perspectives converging to assemble a new way of multi-scaled perceiving.

Splitting the analysis of natural and artificial agents, micro systems from that of macro systems appears as an impossible task (and reintroduces a determinism that we had almost succeeded in getting rid of). Anthropogenic landscapes challenge the observer to the construction of a useful conceptual match between distant research approaches; its observation requires the ability to cope with severely diverging implications in terms of different scales in time, therefore different scales in space, in distance, and the hardest to deal with, different scales in resolution. A multidimensional and slippery scenario, which demands a big flexibility of knowledge patterns and calls into the game the useful notion of intra-action.

In her complex reconstruction of how “the matter comes to matter”, Karen Barad describes the capability of objects to establish persisting interrelations and network connections, regardless of their conditions or size (Barad 2003). Just as components of matter produce a field that exerts its force even in the absence of dynamics and interferences, for the simple and evident fact that they exist, the objects composing an anthropogenic landscape interfere with each other, at different but synchronous spatial scale, to determine the dynamics of visible effects. The presence of matter alters the state of space containing it and creates the premises for potential objects intra-actions, tensions of permanent reciprocal interdependencies. The scale of objects doesn't explicitly enter Barad's description, since her focus is on the field, i.e. the space permanent modification that matter produces, generated both by large and small scaled elements, and capable to affect at the same time the largest and smallest objects. Such network of interlinks is an image of intra-actions's powerful conceptualization, and it accounts for the multi layered composition of the anthropogenic fundamental structure. In this re-

spect, the coexistence of disciplinary issues with different resolution could become a systemic feature and a non-binding potentiality.

4. Scale and Methodologies

Still, the main problem in developing the discourse on fundamental structures of research remains open, and arises more severely when we observe that the dominating patterns of organization of knowledge still reflect a rigid disciplinary separation. The competences required to tackle anthropogenic themes are split in separated research fields, large and small scale objects are still considered peculiar research topics “owned” by disciplinary areas using non-homogeneous, non-overlapping and non-communicating discourses and figurations. In any case Anthropocene cannot be simplified nor scaled down from its complex multi-layered and multi-disciplinary composition, so that the main intellectual challenge it poses to the scientific community consist exactly in the need of finding a solid starting point to ground the development of new cross methodologies.

Luckily a few integrative processes aimed at refining and expanding the existing methodologies are already taking place within some traditional discipline. Occasionally researches are caught by the pressing need of resizing their own peculiar field: humans are understood as geological agents, and such a shift in human relevance requires a big leap in the quality of conceptual connections between history, archaeology and geology (Chakrabarthi 2009); neurosciences discuss of double history of the brain, one history descending from biological evolutionary neurosciences, the other from human history, and this proximity requires a close confrontation between deep history and recorded history (Smail 2007); history becomes global history, evolution becomes co-evolution. Each discipline, each case study and approach, still requires a specific-scaled language, but it appears to unfold its entire and most interesting meaning when it is eventually projected on to different, distant fields from its original one.

A productive attitude might be the search of linguistic tools suitable to develop (at least) one discursive methodology, capable of allowing the use of a metaphor as interface between sets of information. Heterogeneous information is gathered with different degrees of confidence, different levels of accountability, different strategies of engagement: in order to interface them at a primary level, a metaphorical bridge is unavoidable. The concepts of singularity and multiplicity (“topology”), the long

distance interrelations among heterogeneous elements ("field"), the interfaces between different scale environments ("phase transition"), all crucial keys to describe the anthropogenic processes, are borrowed from the language of natural sciences, where they are mastered with formal, exact and quantitative tools; but at the same time they play a major role in shaping the theoretical scapes that provide to social scientists the meanings for their social and economic analysis.

In this context, it is useful to point out that even the most exact quantitative model used by natural sciences to reproduce a natural fact is no more than a metaphor, a metaphorical representation of the thin slice of reality it seeks to describe, reflecting rather the author's views, preferences, expertise than the complexity of the selected natural fact. A model doesn't really describe, rather it talks metaphorically about a description, and opens the way to emerging interpretations.

If we go back go back down from a model to a discourse, once more we come across the issue of rescaling: one needs to become skilful in shifting from a small scale to a larger and more inclusive one, learning how to make a projection, create an expanded vision, trying not to lose in resolution. The process of connecting different scales to one other through the quantitative down-scaling of a metaphor and through the qualitative up-scaling of a model, is exactly the main ongoing exercise we are asked to handle by the complexity of Anthropocene.

A different and perhaps more promising ground to enhance the potentials of conceptual anthropogenic analysis, informed by the superposition of theoretical backgrounds, is trying to expand it with insights arising from embodied experience. When we talk of direct landscape observation, or encourage to do ethnography, we are calling for a direct personal involvement of the body in the researched matter, with its capability of physical and abstract perceptions, both equally relevant, simultaneously and reciprocally activated. The research experiences that attribute to the embodied practice a primary role are actually performing a serious epistemological choice: they are deciding, so to say, to place the meter of their investigated objects at a middle range scale. Nor micro scale, as the concentrations of particles of carbon dioxide we can breath before being poisoned, nor macro scale, like the El Niño's periodical oscillations of the ocean-atmosphere system: the interface between the large and the small, the macro and the micro, is represented and occupied by the body and experienced through the body. Interfaces among scales are therefore interfaces among methodologies, and the interfaces among scales are the spaces to inhabit, to give meaning to.

They are boundaries, rather shifting and unstable boundaries, determined by the scales proper of neighbouring systems, bridging the heterogeneous, and perceived through the body.

In this framework of methodological recombination, embodied experience seems to acquire a primary role: on one hand the central role of the body give to anthropogenic research a material grounding, on the other experience is always introduced as a partial phenomenon, as an individual, singular, almost private fact. How reliable is the process of knowledge acquisition based on individual experience?

If the inclusive and wider concept of research can be disclosed into the superposition of individual experience plus shared knowledge, we can conclude that research is also based on private and individual experience, but experience can be projected towards knowledge through the awareness of a historical consciousness. Such awareness consists in the human capability of positioning the momentary, individual, singular and embodied experience inside a long term scenario, in a time that is dense with historical depth. Once more, experience is up-scaled to become a source of possible knowledge, and it is a qualifying element contributing to define research methodology, when we shift it back and forth in a multiply scaled scenario.

It is straightforward to ask what kind of knowledge may arise from this dynamic picture: in which temporal frame does knowledge develop? And more generally, how does knowledge arise? Can we always state that knowledge arises from experience? Is knowledge rather the practical capability of solving a problem, a clear outcome of experience, or the capability of structuring a new general model for general problem solving? Maybe the difference between the first and the second picture, between "first and second order of systems of knowledge" (Renn 2013), is again just a question of time scale. Surely, at the moment we cannot give up on any of the possible pictures, and the real open question is how to recombine the many forms of knowledge systems available for us to try to shape 'the new knowledge we need'.

5. Conclusion

Anthropocene is not only a large scale effect, it is not only about big numbers, impacts, crisis. Anthropocene unfolds as a composition of micro events becoming active agents of complexity. Once we acknowledge that different scales coexist and interfere, we have to develop a capability to understand the interfaces between scales: the effort

we make is therefore oriented towards the construction of methodological connections between research strategies that typically employ different paradigms and follow distant approaches.

Disciplinary bounds are here put into dialogue, together with the different and peculiar scales of their investigated subjects. The issue of scale is easily connected with the issue of relevance, in the perspective of expanding and deepening the definition of anthropogenic matters towards a multiplicity of meanings, cross implications, and evident scales-and-relevance interdependencies. The relevance of the duration if time is challenged by the need to reconsider temporally relevant scales with respect to human actions. Anthropogenic landscape appears in this sense as a useful object to analyse, especially when facing anthropogenic emergencies, as climate change. To investigate an anthropogenic landscape, we might acquire multiple large scale sets of data, from natural sciences, and simultaneously go back and reposition all analysis on a middle scale, an intermediate scale range in size and time: this appears to be the body, calling for an embedded form of knowledge, a promising possibility to try to handle the future.



Seaweed farming at Tabiteuea, Kiribati | Photo: George Steinmetz/Corbis

Notes

¹ The problem of providing an exact definition for the concept of Anthropocene has some important implications: first of all, no general agreement has been found about the time of its beginning. To identify the beginning of era, a visible and widespread discontinuity from the previous era is necessary, a clear and discontinuous evidence that leaves no ambiguity in the contexts of different disciplinary discourses. For disciplines like anthropology or history, a discontinuity might be generated by major collective events bringing transformations in the social conditions, as the Industrial revolution, or the Colombian encounter; on the contrary, natural sciences acknowledge discontinuities in the measure of quantities, as chemical markers in the strata of earth sediments, or the modified length of the nitrogen cycle. These definitions can't really converge to a single agreement yet (despite the increase in carbon sediments in the European rocks can rather easily dated back to the XIX Century and therefore connected with the industrial revolution); the implications of the different choices bear consequences both on political and ethical levels. A second implication is linked to the effective possibility of dealing with Anthropocene as a research topic, given the contradiction between its multidisciplinary character and the fragmented disciplinary scenario characterizing the academia worldwide. The possibilities of developing a multidisciplinary and cross-disciplinary academic curriculum have been explored during the Anthropocene Campus, realized in Berlin by the Max Planck Institute for the History of Science and the *Haus der Kulturen der Welt*, and presented in *Archivio Antropologico Mediterraneo*, XVII (2014), n.16 (1): 175-177.

² The long debate about the nature of time, the absolute or relative terms needed to refer to it as a quantity, its measurable or subjective nature, unfolds in science during the revolutions of the twentieth century paradigms. The scientists involved in the debate defend their controversial views referring to "experiments" and "experience", but their meaning of "experience" must be situated where they actually mean it, i.e. in laboratories and in protected settings, where an isolated piece of nature is asked to perform only partial behaviours, and it is then observed in separated fragments of evidence. The experimental setting organized by scientists for the study of time is thoroughly detached from human unstable interferences, with the aim of producing a robust, and non context-depending scientific evidence, but also with the consequence of separating the notion of time from any material, embodied, relational, practical implication.

³ Climate change is an immediate and serious threat to sustainable development and poverty eradication in many Pacific Island Countries like Kiribati. Due to their

geography and mid-ocean location they are at the front-line of impacting environmental climate change transformations. Yet these countries are amongst the least able to adapt and to respond, and the consequences they face are significantly disproportionate to their collective irrelevant contributions to greenhouse gases global emissions (<http://www.pacificclimatechange.net/>).

Kiribati Adaptation Program provides a powerful example of dialogue between different forms of knowledge necessary in the case of the, the emergencies posed to the Pacific nation by climate change. Roughly 103.000 people live in Kiribati's 33 atolls, high an average 6 meters above sea level. Half the population lives in the overcrowded capital South Tarawa. According to a World Bank report, Kiribati's capital will be 50 per cent inundated by mid-century unless significant adaptation programs are put into action. The raise of sea level means poisoning of groundwater, destruction of limited arable land, and spread of disease. Villagers, despite having little or no knowledge of climate change, are witnessing a shift: increasingly intrusive seas, stronger and less predictable winds, more intense heat; changes in the fishery season, shorter productive fishing terms. Raising of tide levels and more frequent storms and hottest season are increasingly recorded; two atolls disappeared in 1999.

Over the past few years, The Pacific Islands Forum Secretariat (PIFS, <http://www.forumsec.org/>) have continuously reaffirmed that climate change remains the single greatest threat to the livelihoods, security and well-being of the peoples of the Pacific. They stressed the critical and urgent need for financing adaptation strategies, to respond to the adaptation needs of its people already displaced or in danger of being displaced as a result of the detrimental impacts of climate change. Programs launched by the PIFS aim at improving water use and management via the installation of groundwater, roof rainwater harvesting systems, reducing water leakages and waste in existing systems, protecting water reserves, and improving long-term planning for local-level water management, to ensure cleaner, safer drinking water. The fight against coastal erosion is led by investing in protection measures, such as seawalls and mangrove planting at priority sites.

Forum Secretariat developed a multi-stakeholder approach to progress this work in collaboration with Pacific Islands Forum member countries, including UNDP, AusAID, EU, USAID, and World Bank. The approach focuses on efforts to: (i) identify relevant and appropriate climate change financing sources; (ii) effectively harness and use climate change resources data in an informed way and using strengthened country systems, wherever possible; (iii) address the necessary institutional as well as acute human capacity constraints to deal with climate change implications; and (iv) identify and/or strengthen delivery of climate change resources through proven modalities commensurate with absorptive capacities (<http://www.climatefundupdate.org/>).

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