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DOSSIER:

Performative Science – Reconciliation of Science and Humanities or the End of Philosophy?

INTRODUCTION

Whilst there exists a discourse on performativity within social sciences and the humanities for quite some time it is rather new to discuss performative aspects within the „hard“ sciences like physics, too, with Andy Pickering’s „Mangle of Practice“ being a seminal work in this context.¹ Pickering (and others) argues that the concept of performativity can fruitfully be applied to action theoretical considerations in the experimental process. Borrowing the notions of “context of discovery” and “context of justification” from Hans Reichenbach,² Pickering’s result might be accepted as an aspect within the context of discovery but incompatible with the context of justification. Karl Popper adopted Reichenbach’s classification in large and cemented the primacy of the context of justification (via falsification) although Charles S. Peirce a few decades before showed evidence that neither from deduction nor from induction, i.e., the two most important procedures of justification, emanates any new knowledge but rather from what he called abduction, which, in essence, is the very process of constructing new hypotheses.³ It appears plausible that from the modern perspective of the performative, abduction can be seen as an aspect of performativity although the relation to Peirce’s pragmatism has to be scrutinised. Hence, from this point of view, performativity is in essence a modern notion that brackets concepts of tacit knowledge, action theoretical considerations, and a variety of works that focus on “doing” and the role of being bodily involved in the process of understanding.

General systems theory that emerged in the beginning of the 20th century in the sequel of Wilhelm Dilthey’s famous discrimination between (scientific/objective) explanation and (hermeneutic/meaningful) understanding and, more specifically, its in a sense more radical branch cybernetics that emerged in the 1940s led to a change of paradigm that is increasingly transferred into both a more general epistemological background of science and to a considerable extend to a methodological framework

¹ Pickering (1995).

² Reichenbach (1935).

³ Cf. Wirth (2000). Note that Reichenbach himself used the rationalistic metaphor of an „induction machine“, *op. cit.* Reichenbach and Popper are counted to the neo-positivistic stream that aimed at replacing metaphysics seen as „speculative philosophy“ by a so-called „scientific philosophy.“ The latter notion, however, has already been used by Peirce.

in the humanities as well.⁴ Originally, the new paradigm behind systems theory and cybernetics has been called a constructivist perspective which in recent times serves as foundation of what is called a third culture, i.e., a blend of science and humanities.⁵

Pickering interprets the message that emanates from the constructivist cybernetic paradigm as a shift from the traditional scientific analytical approach to nature towards what may be called “designing truth.” An analytically derived model that explains nature is replaced by a constructed model that *a posteriori* finds instantiations in a variety of fields that are regarded to obey the same systemic relations. In this context, Pickering speaks of a “nonmodern” perspective and he concludes: “The nonmodern ontology is about performance, not representation.”⁶ Conceiving the performative as contrast to representationalism became commonplace, it seems. Apropos of nothing, it seems, epistemology has been married off to ontology. It is this categorical indifference that led Martin Heidegger to apprehend the end of philosophy, which explains the title of the dossier in hand. Nevertheless, it is exactly Heidegger who is frequently regarded as testimonial figure to justify the performative power of both epistemic things and works of art, like, e.g., in Barbara Bolts pleading to give performativity preference over representation.⁷ At least in phenomenological approaches like Bolt’s, performativity clearly goes beyond Peirce’s semiotic and pragmatic approach. It may be doubted, though, that this also holds for Pickering’s conception of performativity.

To come down to earth, with the dossier in hand we wish to stimulate a critical discourse on whether the meaning of performativity in science goes beyond sociological considerations or, more precisely, whether it can also become part of the context of justification. Of course, a strict separation of the context of justification from the subjective context of discovery has been doubted ever since. There is a broad consent that heuristics, intuition and tacit knowledge play important roles in gaining insight. Nevertheless, the “final product” of a research process is a text-based publication, which, in the ideal case, should have one and only one interpretation, i.e. should not the least be subject to hermeneutics. This “final product” passed through accepted procedures of falsification and proofs. It is thus regarded as objective knowledge.

In the arts, particularly in the performing arts, an a-logical or at least a non-propositional logical mode of understanding as an essential component of performativity is of equal or even higher rank as text-based semioticity (e.g., the libretto or score). A not exactly repeatable and ephemeral character is at the core of a substantial performance. The range of applications of the concept of performativity has in the recent decades gradually been extended from theatre, concerts, enactments, and performing arts, to fields like speech act theory, sociology, interactive media and so forth.

⁴ Cf. Diebner (2011) for a review.

⁵ Brockman (1996).

⁶ Pickering (2010).

⁷ Bolt (2004).

Within natural sciences and engineering, it recently become clear that the sheer complexity and the lack of analytical solutions of systems under investigation require new epistemic methods. Non-repeatable or contingent phenomena need performative practices to be understood.⁸ A historical investigation shows that this has been the core idea of systems theory that originated from philosophy of life. A research into complex systems is unthinkable without computer simulations, visualisations beyond simple statistical diagrams, and interactive media. With increasing frequency, sincerity provided, researchers have to admit that the essence of such performative approaches can no longer be reduced to formulas or texts but are nonetheless indispensable within the epistemic procedure. Comparable to the arts, the result of a research process is, so to say, an “installation” that has to be experienced in a performative way.

In the succession of Austin’s speech act theory and the thereby triggered performative turn the mode of „doing“ gained centre stage. No need to stress that art is subject of performativity, particularly, performing and dramatic art, as mentioned. Recently, however, typical conceptions from the arts like enactment, embodiment, to name but a view, find applications in different scientific areas – even in the „hard sciences“. Simultaneously, the label „art&science“ has recently penetrated cultural production and theories much above the historically long-term waxing and waning of the art-science relationship or divide, respectively. Systems theory and cybernetics, above all, fostered the art&science convergence substantially. Yet, it remains questionable whether the art&science movement is more than a dilution of both art and science.

The dossier is opened by **David Turnbull**’s contribution on “Performativity and Complex Adaptive Systems: Working with Multiple Narratives Across Knowledge Traditions.” His summary in the beginning of his paper on the history of the concept mentioning Austin and other pioneers is a good start. Starting out from ethnographic studies and the diversity of knowledge traditions, his main arguments are concerned with the question of whether one should better speak of “performativities” plural rather than once more forcing the Western view of how performativity is conceived upon non-Western cultures. In doing so, he attempts to – so to speak – reverse Pickering’s view in asking to what extent one can learn from studying the dynamic flexibility of adaptive complex systems to understand performativity. This puts an interesting new complexion on the inter-relation between complexity and performativity. His concrete examples circle around both the colonial as well as post-colonial periods. Maturana’s concept of autopoiesis and the notions of self-organisation and emergent processes play an important role in Turnbull’s deliberations. In his appealing approach toward performativity, Turnbull is aware that one should avoid the hyperbole of regarding everything as performative and to walk into the same trap as criticised from the performative stance: Yet another universalizing theory. Ironically, from a systemic point of view, such a takeover would structurally resemble a colonial takeover, i.e., a performative act. Turnbull’s concrete performative framework is based on a museum project which allows for “real difference and growth of cultural diversity.”

⁸ Diebner (2006).

Hans H. Diebner picks up Turnbull's indication of a critique and is going to discuss the threat of "takeover" in full length. An important aspect of performative science certainly is to burst the all-too-narrow corset of traditional scientific methodology in order to augment the explanatory property of science to a hermeneutic process of understanding. Such an approach is guided by the idea not to abstract science from the concrete life world. However, one has to confess that an escape from what Heidegger called machination (*Machenschaft*), i.e., to understand being (*Sein*) through that which exists (*Seiendes*) is still not in sight. To the contrary, the believe that one is, so to say, on the save side, in referring to performativity might even more blindfold concerning openness to being. The trend toward a supra-theoretical understanding of performativity may lead to an outwearing of art and philosophy, i.e., a takeover that may eventually even dilute cultural diversity. Diebner, therefore, suggests to pause for a moment and bethink of the tradition of phenomenology particularly in referring to Maurice Merleau-Ponty. His notion of ambiguity gains new ponderosity. Thus, performativity should first and foremost be understood as dwelling on and bearing with the gap in-between the cultures.

Nina Samuel, in her visual studies approach to mathematics, inaugurates us into the fascinating creative work of the French mathematician Henri Poincaré. He can be seen as chaos theoretician *avant la lettre* and father of complexity theory. His achievements around the turn of the 19th to the 20th century rest upon the performative power of the image. His struggles with the images are performative in a manifold and rather unexpected way. Poincaré found himself quite often in situations where his topological findings could be narrowed down by depicting limiting cases but the topological structure in question was un-depictable. The performative power in this case was unfolded by circling around the blank space which left him in a "creative" *horror vacui*. In addition, in many cases, neither strict mathematical proofs have been in sight. Samuel concludes that the mathematics of chaos and complexity has been – in essence – a picture theory from the beginning that rests upon performativity. Her contribution clearly shows, that a performative logic can definitely be located within the context of justification, too. Samuel's findings gain additional evidence through her comparisons of Poincaré's deliberations and drawings with utterances and publications of other researchers in the field.

Finally, **Vesna Milanovic** outlines a recent interdisciplinary research project "Engineering for Life" from a "third culture" stance, as she claims. Being both, a performance artist and scientist, she dedicatedly disclaims objections against art-science collaborations as being mere hogwash. In a number of health care and sports case scenarios she demonstrates how concrete and genuinely desired research agendas can be created through a collective improvisation of handicapped or otherwise affected persons moderated by performance professionals. Milanovic's approach links back to the aforementioned dependency of the production of knowledge on a specific social dispositif, in other words, on conditions induced by concrete life worlds. Although her paper, for the time being, leaves open the question of whether the performative

approach is suitable to contribute to science beyond “abduction”, i.e., beyond the creation of new hypotheses and research agendas, it yet stimulates a bracing view on art-science collaborations. Milanovic’s prime example of “re-embodiment science” gives a normative directive for “enhancing peoples lives” through a performative science.

We hope that the dossier in hand on performative science with its concrete examples from research practice as well as with its contributions to a theoretical discourse unfolds itself a performative power in that it furthers future discourse and research in the fields. Remains to express our sincere gratitude toward the authors for their invaluable work as well as the reviewers for their thorough evaluation of the papers.

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HANS H. DIEBNER

PERFORMATIVITY AND COMPLEX ADAPTIVE SYSTEMS: WORKING WITH MULTIPLE NARRATIVES ACROSS KNOWLEDGE TRADITIONS

DAVID TURNBULL*

ABSTRACT. The paper develops a performative account of the ways in which knowledge and space are co-produced as humans move, develop social networks, and extend their cognitive practices. Such an account enables alternative ways of conceiving what counts as knowledge and as modernity to be held in tension, thus allowing the emergent generative effects of the Argentinean philosopher Enrique Dussel's concept of 'transmodernity'. Working with differing knowledge traditions requires, as Walter Mignolo recommends, thinking "with, against and beyond the legacy of Western epistemology."

What is at issue is the capacity to move beyond the point of 'colonial difference' explored by Mignolo in which Western knowledge gets authorised as universal and the rest get classified as 'people without history'. Only then can we enable differing knowledge traditions to work together without subordinating them and absorbing their differences in the western panopticon.

This is not an easy task since the Western knowledge tradition in the form of science is hegemonic, and all other traditions are rendered as incommensurable, but to commensurate them is by definition to subordinate them and rob them of their cultural specificity. Equally, simply seeing them as different interpretations or different world views is too weak in the struggle for authority. To flourish, to have autonomy in the face of hegemony, indigenous knowledge traditions have to have an effective voice and construct their own identities. What is offered in this paper is a performative framework which is strong enough to destabilise the hegemony of western epistemology and generative enough to allow for real difference and the growth of cultural diversity.

Keywords: *Performativity/performative, complex adaptive systems/complexity theory, practices, multiple ontologies, ways of knowing, emergence*

This paper is focused on the ways in which knowledge and space are co-produced as humans move, assemble socio-technical networks, and extend their cognitive, material and semiotic practices. Such an account serves to open up alternative conceptions of what counts as knowledge and as modernity to be held in tension,

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thus allowing the emergent generative effects of the Argentinian philosopher Enrique Dussel's proposal 'transmodernity', or of the Belgian philosopher of science Isabelle Stengers' 'ecologies of practice' and 'cosmopolitics'¹ Working with differing knowledge traditions requires, as Walter Mignolo recommends, thinking "with, against and beyond the legacy of Western epistemology."²

What is at issue is the capacity to move beyond the point of 'colonial difference' explored by Mignolo in which Western knowledge gets authorised as universal and the rest get classified as beliefs of 'people without history'.³ Only then can we enable differing knowledge traditions to work together without subordinating them and absorbing their differences in the Western panopticon.

This is not an easy task since, on the one hand, the Western knowledge tradition in the form of science is hegemonic, and all other traditions are rendered as incommensurable, while to commensurate them is by definition to subordinate them and rob them of their cultural specificity. On the other hand, simply seeing them as different interpretations or different worldviews is too weak in the struggle for authority. To flourish, to have autonomy in the face of hegemony, indigenous knowledge traditions have to have both an effective voice and construct their own identities, whilst also having a space within which it is possible to performatively interact with other traditions⁴

To be strong enough to destabilise the hegemony of Western epistemology, and generative enough to allow for real difference and the growth of cultural diversity, within and between knowledge traditions in science and other cultures, it is necessary to move beyond the limits of representationalism.⁵ The basic premise of the paper is that an augmentation of performativity has these capacities. By way of an example of this approach the conclusion outlines a museum-based project that is developing ways in which multiple communities and institutions can work with multiple ontologies in tension with one another without a universal narrative of the past, of identity, of what counts as knowledge, space, time and causality.⁶

Chris Salter writing about performance and technology recently claimed 'everything is performative now'.⁷ There is some truth in that hyperbole, there has been a plethora of books filling the supposed theory gap left by the critiques of representationalism and the subsequent demise of postmodernism, all presenting a version of performativity. What is outlined here are some of the dimensions that could lead to a generalised theory of performativities that would serve to relate, but not commensurate, all knowledge traditions and ontologies Western and non-Western.

¹ Dussel (1993); Stengers (2011); Turnbull (2003).

² Delgado, Romero, et al. (2000) citing Mignolo (2000).

³ Wolf (1982); Mignolo (1995).

⁴ McNiven and Russell (2008).

⁵ Pickering (1992); Pickering (1995); Pickering (2009); Pickering and Guzick (2008); Turnbull (2003).

⁶ Boast, Bravo, and Srinivasen (2007).

⁷ Salter (2010) p. xxi.

This implies that such a theory could not be totalising, it would have to be multiplicitous, hence performativities plural. Some of the dimensions of performativity that can provide for that aim have already been firmly established in the sociology of scientific knowledge (SSK) and science studies, especially the emphasis on practice, the dissolution of the subject object distinction, the notion of co-production, and recognition of science's heterogeneity in method and ontology.⁸ The aim of enabling disparate knowledge traditions to work together and allowing the emergence of new, unanticipated, knowledge, requires two further dimensions. These two dimensions are linked through their concern with processes of becoming, of being organisms in constant dynamic interaction with the material world. One is the spatially embodied approach based in human movement suggested by Tim Ingold, Lesley Green and others.⁹ The other, first advanced by Humberto Maturana and Francisco Varela as autopoiesis, is that of self-organising systems, or complex adaptive systems.¹⁰ Taking all these dimensions together allows differing traditions to perform together creating new theatres of knowledge.¹¹

While there are widely differing understandings of performativity, the key ontological and epistemological claims are that there is no great divide between interior mental or cognitive states of mind, and an exterior material reality somehow mediated by or represented through symbolic systems, and hence no divide between primary and secondary qualities or between humans and things in terms of agency. Rather, ways of knowing the world are co-produced with our practices, our ways of being in, moving through and interacting with the world. This link between relational practices and 'doing' or performing the world is spelt out in John Law's exposition of enacting the social.

To study practices is therefore to undertake the analytical and empirical task of exploring possible patterns of relations, and how it is that these get assembled in particular locations. It is to treat the real as whatever it is that is being assembled, materially and semiotically in a scene of analytical interest. Realities, objects, subjects, materials and meanings, whatever form they take these are all explored as an effect of the relations that are assembling and doing them. Practices then, are assemblages of relations. Those assemblages do realities. Realities, including the incidental collateral realities, are inseparable from the patterning juxtapositions of practices.¹²

Performativity and practices come together with complex adaptive systems in sharing a coproductive constructivist account of reality in terms of agency, actions, enactments, and processes in interaction without invoking plans, rules, instructions, laws, or external space or time, everything is to be understood as an emergent effect of systemically connected interactions, where the system and the agents coproduce

⁸ Galison and Stump (1996); Latour (1993); Law (2004); Mol (2002); Diebner (2006).

⁹ Ingold (2000); Ingold (2011); Green (2009).

¹⁰ Maturana and Varela (1987).

¹¹ Turnbull (2002); Turnbull (2007).

¹² Law (2009).

each other. In addition much of what needs to be incorporated in performativity has until now been excluded as representational, for example language and narrative itself – a discursive representational practice that is, I argue, central to the development of networks and movement.¹³

It is in the sociology of scientific knowledge and its destabilisation of orthodox notions of knowledge and representation that performativity has had its most revolutionary impact. But it got its first and most important, though seemingly innocuous formulation, in linguistic philosophy by J.L. Austin who astutely defined a performative as ‘a doing that constitutes a being’, an activity that creates what it describes.¹⁴

The classic examples are statements such as ‘I pronounce you man and wife’, or ‘I apologise’. But a more telling colonial example of a performative utterance/act was that of Captain James Cook. During his first voyage of ‘discovery’ he sailed up the East coast of Australia, made his first landing at Botany Bay, and then moving to what is now Sydney Harbour. On reaching the tip of Queensland, he named and landed on Possession Island, just before sunset on Wednesday 22 August 1770, and performatively declaring the coast a British possession. In his journal he noted:

Notwithstand[ing] I had in the Name of His Majesty taken possession of several places upon this coast, I now once more hoisted English Colours and in the Name of His Majesty King George the Third took possession of the whole Eastern Coast by the name New South Wales, together with all the Bays, Harbours, Rivers, and Islands situate upon the said coast, after which we fired three Volleys of small Arms which were Answered by the like number from the Ship.

Ironically, the Australian government in 2001 rewrote the Migration Act redefining what counts as Australia for the purposes of migration by excising much territory including Possession Island. Then, in yet another performance on Aug 23 2008 a group of Kaurareg Aborigines landed, raised their flag, and successfully repossessed the island under the Native Title Act.

Since Austin it has become clear that performativity is not restricted to a special category of linguistic utterances. All statements, propositions, sentences, written or spoken are performative at least in the sense that they only have meaning in the context of other words, narratives and claims in the language. To understand the meaning of any utterance is simultaneously to give meaning by making connections, to respond is to perform as member of that linguistic community. Judith Butler gave important extension to the power of performativity in explaining gender roles, a woman, for example, is not an instance of an essential category, she both performs and is performed as a woman in a society that creates the category.¹⁵

¹³ Somers (1994); Marshall (2011).

¹⁴ Austin (1962).

¹⁵ Butler (1997).

Another equally important meaning of performative comes from the recognition that there is a profoundly important form of knowing that is not linguistic, does not come in the form of statements, propositions, laws or formulae, it is tacit, learned embodied skills and practices. Michael Polanyi's seemingly straightforward, but profound point, is that all knowledge is tacit or rooted in tacit knowledge and can only be moved, transmitted and reproduced, by doing, by being shown, by practicing.¹⁶ Science is not fundamentally a body of theory, but an interrelated field of practices that together constitute 'forms of life' or 'technoscientific worlds'.¹⁷

It is the turn to practice that brings performativity back to language. Though Austin came to recognise all statements are performative, for him language as a whole was constitutive, it had form structure, grammar and syntax that pre-existed any normal utterances. But for Mignolo one of the originary points of colonial difference was the formalisation of language by the colonising powers into an object with grammar and syntax.¹⁸ For example 'the British, as Lelyveld points out, "developed from their study of Indian languages not only practical advantage but an ideology of languages as separate, autonomous objects in the world, things that could be classified, arranged, and deployed as media of exchange"'.¹⁹ Mignolo finds a resolution in Maturana and Varela's practice-based notion of 'linguaging'. 'Language is not an object or capacity, something that human beings have, but an ongoing process that only exists in languaging'. 'Linguaging locates interaction among individuals, among human beings, instead of in pre-existing ideas'.²⁰ This performative understanding also underpins their foundational notion of autopoiesis which will come up again in the discussion of complex adaptive systems.

The linguist Alistair Pennycook in his recent book *Language as a Local Practice* develops a performative approach, arguing that languages are not systems of communication that pre-exist outside their enactment in a particular place.²¹ He displaces 'the notion of language as a system' that have 'their own supervening logic or rules', with 'a view of language as doing', 'a product of the deeply social and cultural activities in which people engage'.²² A view confirmed by recent research showing that there are no linguistic universals governing word order, either in a deep grammar ala Chomsky or in a language processing center ala Greenberg. The results suggest 'that cultural evolution has much more influence on language development than universal factors. Language structure is apparently not so much biologically determined as it is shaped by its ancestry'.²³ For Pennycook 'practices are not just things we do, but rather bundles of activities that are the central organisation of

¹⁶ Polanyi (1958).

¹⁷ Rouse (1987); Turnbull (2003).

¹⁸ Delgado, Romero, et al. (2000).

¹⁹ Lelyfeld (1993) p. 194 cited in Pennycook (2004) p5-6.

²⁰ Mignolo (2000) p. 253; Maturana and Varela (1987) p. 210.

²¹ Pennycook (2010). See also Robinson (2003).

²² Pennycook (2010), pp. 1, 2 & 13.

²³ Levinson (2011); Dunn, Greenhill, Levinson, and Gray (2011).

social life.’²⁴ But most importantly he points out that languages are local, spatial, and temporal, practices constructing locality and time. This destabilization of another point of colonial difference, allows for ‘multiple, heterogeneous, and uneven, temporalities and histories, that the dominant historical narrative often presenting itself as singular and linear, suppresses.’²⁵ Historicising linguistic practice and ideology in this way, provides for a performative understanding, making them sites where social and political processes are enacted and ‘history and temporality are the center of contestation’.²⁶

The third sense of performativity comes in part from psychology and in part from prehistory and anthropology, all of which are concerned with the origins of perception, cognition and language. Many of them recognise that there is a common problem, how to explain perception, cognition and language, without pre-empting the explanation by assuming a pre-wired capacity or a pre-existent structure. As; for example David Lewis-Williams does in explaining the origins of representation in rock art when he claims: ‘There must have been a socially accepted set of zoomorphic mental images before people began to make representational images of them’.²⁷

The psychologist James Gibson was one of the first to suggest that the brain is not a representational machine, rather we learn to perceive and represent in the process of moving around and probing our environment, in skilled bodily action. This performative understanding of seeing and knowing has been expanding across the social sciences; by Tim Ingold as a ‘dwelling perspective’ in anthropology, and as the ‘enactive theory’ of perception and cognition in psychology and in science studies.²⁸ In archaeology Lambros Malafouris has proposed a theory of ‘material engagement’ in which ‘seeing and perceiving are forms of ‘skillful interactive engagement’, forms of acting in the world, rather than forms of representing the world’.²⁹

This perspective again opens up multiplicitous ontologies in which:

things have a cognitive life because minds have a material life. Thus, very often, what we call an ‘object’ is part of what we call a ‘subject’. In short, things are us or can become us. Things have a cognitive life because intelligence exists primarily as an enactive relation between and among people and things, not as a within-intracranial representation.³⁰

To these basic understandings of reality as enacted practices and performances, has to be added the recognition that, while all knowledges, perceptions, meanings, understandings and practices are embodied, based, in actions, in the movement of our bodies, not all cultures perceive, understand, or coordinate our bodily movements

²⁴ Pennycook (2010), p. 7.

²⁵ Inoue (2004); Pennycook (2010), p74; Mignolo (2000), p. 205.

²⁶ Inoue (2004), p. 4.; Pennycook (2004).

²⁷ Lewis-Williams (2003), p. 266; See also Malafouris (2007); Thomas (1998).

²⁸ Ingold (2000); Noe (2004); Berthoz (2000); Cussins (2003); Chemero (2009); Law and Urry (2010).

²⁹ Malafouris (2007), p. 293.

³⁰ Malafouris and Renfrew (2010), p. 4.

in the same way. Western modes of understanding have over time become profoundly tilted towards privileging the visual – ‘seeing is believing’ and hence the tendency to representationalism.³¹ Other cultures give dominance to other sensory modalities. The Ongee on the Andaman Islands, for example, perform and understand spatiality, community and identity – an entire ontology, through smell, movement and dreams.

For the Ongee smell is the fundamental cosmological principle. Odour is the source of personal identity and the reason for living in society, a system of medicine and a system of communication; it determines temporal and spatial movements, it produces life and causes death. By controlling odour, the Ongee control their cosmos.³²

The Kaluli, in the dense tropical rainforest of Papua New Guinea, map, know and move in their landscape through the sounds of the forest. The calls of some 130 species of birds, sounds of frogs, cicadas, insects, streams, and waterfalls are ‘heard indexically as time of day, seasons of the year, vegetation cycles, migratory patterns, heights, and many other markers of place, as a fused human locus of time and space.’ ‘Place, sacred and sensible, is imaginatively coded in a cartography of songs and lamentations.’ The Kaluli, in Stephen Feld’s terms, have an acoustemology – a blend of acoustics and epistemology, meaning a concern for a completely different reality – one in which place, sound, and knowledge, together express a ‘poetic cartography’, a soundscape.³³

The Anlo-Ewe in Ghana also base their ontology in bodily movement, but articulate it as a sixth sense that provides understanding and gives moral dimension to the world. It’s the sense of proprioception, kinesthesia, of balance, a sense that goes largely unrecognised and unacknowledged in the West. [For the Anlo] ‘the body’s ways of knowing extends to culturally relative ways of moving and waking, so that the repertoire of more than fifty ‘ways to walk’, for instance, literally embodies socialisation and identity, status and well-being.³⁴

So far the focus has been on two Western scientific disciplines that have seemed profoundly structuralist and impervious to a performative understanding—cognitive neuroscience and linguistics. This section looks briefly at the science of genetics in the light of performativity because genetics has become a master narrative, sharing with neuroscience and linguistics a functionalist metaphysics that conceals both the inadequacy of their explanatory structures under the guise of information theory, and the attached presumption of form or plan.

³¹ Jay (1988); Crary (1990); Crary (2000).

³² Classen (1993) p. 126.

‘For the Ongees, movement alone defines and constructs space; space does not define and construct movement’, Pandya (1990) p. 793.

Ongee create identity and community through communal interpretations of dreams based on smell but their capacity for what they conceive as weaving a collective spider’s web has diminished with changed spatial arrangement of their houses and with differing employment. They say the webs they now weave are never complete. Pandya (2005).

³³ Feld, S. (1996).

³⁴ Geurts (2002).

We have all become imbued with idea that our genes can be read and decoded, and that they are the units of inheritance which shape our destinies. At the heart of this dominant narrative is the idea that genes are parcels of information, information that we can unpack by determining their function. This is to put the explanatory cart before the horse, because it is essentially claiming that the meaning of the genetic code pre-exists, or is somehow external to genes.³⁵ The deeply problematic nature of this view is concealed both by the technical facility we have developed in the lab for determining gene function, and also by the lack of an alternative conception of the processual character of the system.

Fairly straight forwardly, the functionalist account has advanced to the point where it is no longer valid. Genes are not simple units of inheritance, rather complex interacting sequences of genes are. Or as Eva Jablonka argues ‘It is the network of developmental interactions, rather than the gene, that is the focus of selection’.³⁶ Simple genetics has now been absorbed into epigenetics where genes are taken to operate in a complex of interaction of genes, proteins, and environmental factors that include cultural, social and political dimensions. While at the same time the base metaphor of a developmental tree or arborescent vertical lineage has been displaced by the emergence of other mechanisms of genetic inheritance and change that are no longer just horizontal as well as vertical. Gene expression may now be affected by free floating sections of micro RNA our food.³⁷ The base metaphor is now becoming that of the rhizome, the network and the complex adaptive system.³⁸

With these changes, an alternative ontology is starting to emerge; one in which genes are not just packets of information or instructions, but are active agents in complexly layered, scale dependent, co-productive, networks of interactions from the cell to the organism to the environment and back.³⁹ For example so-called chromosome painting shows that genes move in the nucleus of the cell and become functional as they position themselves at the centre. ‘The position of the gene is self-determined’, ‘entirely driven by the activity of the gene itself.’ So gene functions are directly related to position and movement and have to be explained as ‘self-organising’, but self-organising in interaction with other moving and locating entities in system.⁴⁰

This conforms with Rehmann-Sutter’s ‘model of organic practice’ in which:

an organism becomes what it is through practices. Doing, in a very basic sense, is primary for being an organism. Organisms *practice* what they are. ...the actual ‘meaning’ (information/effect) of the genome arises from its processes of interaction within the organism. The genetic information is not there before development starts as a prescriptive inscription on the chromosomes that needs only to be realised, transformed from a

³⁵ Griffiths (2001). Tim Ingold makes the same point in his masterly Ingold (2011).

³⁶ Jablonka and Lamb (2010), p. 139.

³⁷ Jabr (2011).

³⁸ Lawton (2009).

³⁹ Woese (2004); Oyama, Griffiths, et al. (2001); Sapp (2009).

⁴⁰ Mistell (2011).

one dimensional sequence to a three (four) dimensional being. What genes ‘do’ (bring about) depends to a great extent on the context of a particular cell and its place within the developing body. ‘Meaning’ is not provided by a static or eternal being as in classical ontology; it develops through practices.⁴¹

This conception of the meaning of genes being a consequence of practice/enactment provides a basis for a non-representational, performative genetics where ‘the genome is a “performative” code, one that produces the body in the very act of articulation’.⁴² Decentering genes in the evolutionary process, and the emergence of a new evolutionary synthesis is, at first cut, a very attractive proposition.⁴³ The evolutionary process is revealed as experimental, agentive web-like, processual and historical, very like a complex adaptive system and hence performative. However caution is required. Its another universalising synthesis which, as Mikulak points out, still captures and appropriates territory and imposes models of social relations.⁴⁴ What may save it from usurpation and dominance as a new paradigm is the concept of emergence, which entails the ceding of predictability and control, while the centrality of social relations requires constant proliferation of diverse and alternative ontologies and models.

So there is no great divide between science, technology and the arts, between intellectual, artistic and practical knowledge and expression, between mind and body, organism and the environment. But most profoundly there is no great divide between Western science and indigenous knowledge traditions once you acknowledge that all knowledges are local, produced by particular people in particular places using particular skills, and that knowledges are performative. Ways of knowing don’t consist in unified bodies of representations of an external fixed reality, rather they are in a constant state of becoming, based in action, in doing, in making, connecting, experimenting and adapting. Taken together this constellation of understandings of performativity underpins the sense of constructivist co-production that characterises the social studies of science approach to knowledge making. In the process of making knowledge, in developing, social, material and cognitive technologies, we shape the world and vice versa. As we move through the world we come to know it and transform it while at the same time the environment shapes us and our movements.

This performative understanding has reached a sort of self-exemplifying climax in sociology of science’s empirical analyses of the materialist world of market place economics which reveal in Michel Callon’s words that ‘economics... performs, shapes and formats the economy rather than observing how it functions.’⁴⁵ Callon, MacKenzie, and others demonstrate that the way economics describes the behaviour of the economy, the formulae and equations it uses to predict the behaviour

⁴¹ Rehmann-Sutter (2006) p. 329.

⁴² Sikes (2002) p. 163.

⁴³ Pigliucci and Muller (2010).

⁴⁴ Mikulak (2007). See also Roof (2007).

⁴⁵ Callon (2007).

of the market actually shapes that behaviour, but equally what Callon and Mackenzie show is that economics now, in turn, shapes the behaviour of economists. A reflexive and critical understanding with both epistemological and ontological implications that is fully embraced by the radical economists Julie Katherine Gibson-Graham who argue that the performativity of economics imposes on an analyst the requirement not just to imagine alternative economies to capitalism but other realities, other social worlds, other ways of knowing.

This vision of the performativity of knowledge, its implication in what it purports to describe, its productive power of ‘making’, has placed new responsibility on the shoulders of scholars– to recognize their constitutive role in the worlds that exist, and their power to bring new worlds into being.⁴⁶

A challenge which is echoed in Andy Pickering’s equally important examination of cybernetic research that also reveals its performative nature.⁴⁷ Pickering argues the representationalist ontology of modernity is one of enframing, controllability and knowability, and he challenges us to imagine an oppositional, performative, non-modern ontology of revealing and unknowability, of becoming and possibility.

This complex mix of performativities and reflexivities linking the ontological and the political in an exciting and challenging way leads to the key issues that companion the question of how to work with multiple and incommensurable knowledge traditions, of how to sustain cultural and biological diversity, and how to re-establish the commons.

The paper suggests that the possibility of answering these demands may lie within the body of thinking loosely labelled complexity theory and distributed systems that provide for resilience, sustainable diversity, autonomy and mobility, and that the bridge between distributed systems and complexity is performativity.

Complexity theory comes in a variety of guises including network theory and chaos theory, but at heart they all endeavour to explain how there is order in the universe, but especially how to explain how complex phenomena emerge from simple ones. How wet water is formed from non-wet hydrogen and oxygen, societies from individuals, life from inorganic materials, consciousness from groups of brain cells. From my perspective there are two broadly distinguishable approaches to complexity; one is conceived in terms of scale-independent systems which tend to be top-down, physicalist, hierarchical, universalist and representationalist in nature, the other is conceived in terms of emergence which tend to be interactionist, biological, heterarchical, multiplicitous and performative. So the distinction between understanding order in the universe from the point of view of physics and of self-organising systems is that it is one that is to be explained in terms of the playing out of physical laws, and in the other of biological processes. Two of the key differences

⁴⁶ Gibson-Graham (2008).

⁴⁷ Pickering (2010).

that distinguish them are fundamentally spatial and temporal. For the physicists the processes are independent of scale and time. For the biologists they are scale and time dependent; processes differ at different scales, they produce differing forms of spatiality and they are contingent, time dependent, irreversible and historical, what happens changes things. This biological conception of the universe as a continuous process of becoming is at heart performative and multiplicitous.

In common with an SSK view of the world a fundamental process in complex adaptive systems especially those inflected by Maturana and Varela is assemblage. In their view, life is a biological process of connection and interaction, whereby life or the system furthers itself. Assemblage or connection is both a form of territorialisation or spatial practice that produces multiple distinct wholes and is also a cognitive process. Cognition is thus the activity involved in the self-generation and self-perpetuation of networks; it is not a matter of knowing or representing an already independent existing world, but rather a continual ‘bringing forth of a world’ through the process of living. ‘To live is to know’.⁴⁸ For Maturana and Varela, process and structure are the basic phenomena of life. Life is a process of becoming and knowing; it is performative assemblage and movement. A view that is consonant with the recently emergent school of biosemiotics that sees life as a process of knowing crucially dependent on an interactive process of meaning-making. For Donald Favareau the universe is a performative effect of reading signs, signs of the actions of others (stigmergy): ‘our very biological world itself – comes into being not as a “pre-given” in the furniture of the universe, but as a locally organized, massively co-constructed, participant-fashioned *accomplishment* in that universe instead’.⁴⁹

None of this is to claim that the physicists are wrong and the biologists are right, truth and falsity can no longer be simply applied in the standard representationalist sense of correspondence with reality. Rather representationalism whether be it empiricist, realist or rationalist, needs to be seen as itself a performance of what Andy Pickering calls ‘modern ontology’, as a way of knowing.⁵⁰ Since, as Foucault argued, each episteme carries with it its own regime of truth, the only viable option is to set differing epistemes or ways of knowing in tension with one another enabling them to generate new possibilities of insight, truth and critical evaluation through being performed together.

It is performativity that brings together the biological, the epistemological and the ontological. Rather than get into detailed elaboration of complex adaptive systems and their analogies with ways of knowing, their performative commonalities are set out here in point form.

⁴⁸ Maturana and Varela (1987), p. 28; Capra (2003), p. 32.

⁴⁹ Favareau (2008). Stigmergy as signs of others is developed by Theraulaz and Bonabeau (1999); Marsh and Onof (2008); Susi and Ziemke (2001).

⁵⁰ Pickering (2010).

Table 1. Characterisation of complex adaptive systems including their functional and ontological dimensions

The overall capacity of such systems is for Assemblage, Connection and Movement with their own performative dynamic, but without any directionality. The following analytic divisions are of necessity somewhat arbitrary since all components of such systems are interactive and interdependent processes, but together they constitute the essential components.

COMPLEXITY

1. **Multiplicity**: there is both variability and diversity, within and of systems at every level allowing for massive redundancy, plasticity, and alternative possible paths.

2. **Spatiality**: there is an inherent topology, where locality matters, there are scale independent levels and autonomous modules whose spatial relations and interactions, co-produce further niches and spaces.

ADAPTIVITY

3. **Processuality**: The basic ontology is one of processes in continuous states of becoming, action and interaction, of being selected and reinforced as structures and entities, or abandoned as failures— natural experiments in action.

4. **Temporality**: the processes are biological and historical, profoundly inflected by the irreversibility of time and the contingency of events, which provide both the dynamic and the diversity.

SYSTEMATICITY

5. **Interactive connectivity**: There is no prewritten plan, map, logic, algorithm or laws, no direction or purpose. The structural organisation of the system is not preset or hierarchical, rather it is heterarchical emerging from the actions and interactions of autonomous, separate entities and their connections. The multiple parts are agentic in that they are in action, materially and semiotically doing work and making connections that create distinctions or discriminations as elements, agents, states, events, or processes in networks of spatial and temporal relations.

6. **The system is stigmergic**, its distributed parts (net)work as a collective though a capacity for tagging, marking signs, traces or trails produced by the actions of others, allowing sign storage, transfer, processing and the coordination of action, and hence the possibility of negative and positive feedback.

7. **Performative Emergence**: the system is performative and constructivist, in a continuous state of becoming. Its own connective activities produce systemic spatial and temporal effects and relations that are not in the capacity of the components. These emergent effects reflexively feedback into the components in a process of ecological co-production. The process whereby the system acquires features that permit it to discriminate, act upon, and respond to the environment, its own state and to other systems is in effect ‘emergent mapping’, and is crucially dependent on strategies or practices for balancing negative and positive feedback, practices which are themselves not preset but emergent.

Table 2. Ways of Knowing as Social Processes

Ways of Knowing are Performative: Ways of knowing are the product of coordinated human movement, actions, practices and protocols. It takes active work to transform the world into knowledges and they are embodied in people, their practices, relationships and in their tools, artefacts and all forms of technology especially modes of representation, communication, and mensuration.

Ways of knowing are Tacit, Practice-based, and Embodied: Ways of knowing are not just abstractions, representations, or information, they are skilled practices literally embodied in the coordinated movements of hands and eyes, but they vary considerably across cultures, depending which sensory modality is given prominence and how they are coordinated.

Ways of Knowing are Socially Co-produced and Emergent: In enacting our knowledges of the world we make ourselves our societies and the spaces we inhabit. In moving and acting together we perform knowledge spaces, we create trails, we know as we go through the cognitive and physical landscape, we are mapping, revealing and becoming.

Ways of Knowing are Local: They are situated, place-based, produced at particular sites by particular people, with particular skills, practices and tools in particular historical contexts.

Ways of Knowing are Spatial: Making connections, linking people, places and practices, produces knowledge spaces where trusted agents, significant sites, and traditions are woven together in multiplicitous particular topologies.

Ways of Knowing are Mobile, they Travel: Universality and unity, supposedly essential characteristics of knowledge are not in the nature of the knowledges themselves, but in the ways that have been developed for moving, circulating and assembling forms of knowledge.

Ways of Knowing are Narratological and Temporal: All ways of knowing are storied practices. Narratives order events, people, and activities, in space and time, in the process of creating meaning and dialogical exchange, they instantiate ontologies.

Ways of Knowing are Disunited and Multiple, Collective and Distributed: All ways of knowing including science and technology are disunified; they are multiplicitous, messy, motleys. There are multiple ways of knowing, not just knowledge singular. There are differing ontologies, methodologies and epistemologies both within and between cultures. Ways of knowing do not just inhere in individual minds; they are distributed, created, narrated, practiced and performed in webs of interaction with other people, with the environment, and with things.

Ways of knowing in all traditions are produced in flexible, contested and dynamic processes and practices, but their performativity and negotiated character is erased as they are re-presented as authorised, accredited, unified public knowledge.

There are then strong analogies between ways of knowing and the dynamics of complex adaptive systems.⁵¹ The social production and enactment of knowledges is performative collective work in which we shape ourselves and our environment and hence it is profoundly spatial with social, practical, epistemological and moral dimensions. The cognitive and social order co-produce one another and in so doing construct the kinds of mental and moral spaces we inhabit as knowledge producers. Knowledge and society do not merely interact or determine one another. They are performatively constitutive of one another. But ways of knowing, be they social or natural, or a combination of the two, do not form anything like permanently coherent wholes, they are complex, messy and multiple, evolving experiments in constant struggle negotiation and interaction in a changing environment.

In biology as in life, the only rule is ‘there are no rules’ except the ones we construct. Life is a cognitive process and its apparent coherence, despite the many ways our life experiences are fragmented, disjointed and disunited, is socially achieved through our telling stories, taking journeys, marking trails and making meaning through spatial and temporal ordering and coordinating of actions.⁵² Ken Baskin has made explicit the connection between complex adaptive systems, space and stories in his conception of ‘storied spaces’. For Baskin, ‘we human animals experience the world in terms of the stories that we believe tell us what “reality” is, stories that we ourselves co-create as we interact with others in our various social environments– families, organizations, professions, etc.– each of which functions as its own storied spaces... these storied spaces function as the human equivalent of complexity’s complex adaptive systems’.⁵³

John Holland was one of the first to develop a theory of complex adaptive systems. In his analysis tagging is the key mechanism for aggregation and boundary formation in such systems, enabling differentiation and classification.⁵⁴ Tagging, from a co-productive, performative perspective, is a joint effect of the movement of the agents in the system and the interactions between the system and the agents. Tags are the stigmergic signs of work, of action; they are names, labels, definitions, and indications of interest, value and concern. Connected together they form ‘cognitive trails’ that are both the effects and the components of a double mapping process in the co-production of knowledge and space.⁵⁵

⁵¹ Marsh and Onof (2008).

⁵² Turnbull (2002 b); Turnbull (2004); Briggs (1996); Law and Singleton (2000).

⁵³ Baskin (2008).

⁵⁴ Holland (1995), p. 14.

⁵⁵ The term cognitive trail is Adrian Cussins’ who argues that a ‘travelling account of understanding and representation should not opt for an epistemological grounding in thought or experience since much of our ‘intelligence in communicating and acting consists in our ability to *move between* alternative conceptualisations of a problem domain’. Cussins (1992), cited in Turnbull (2002).

Trails as Cussins points out are also artefacts. ‘Perhaps trails are the *first* artefacts’ Cussins, Adrian. *Norms, Networks and Trails: Relations between Different Topologies of Activity, Kinds of Normativity, and the New Weird Metaphysics of Actor Network Theory, and Some Cautions About the Contents of the Ethnographer’s Toolkit* 1999 [cited 21.9.5.].

For example, Ochs, Jacoby and Gonzales have looked at the ways a group of physicists work collaboratively in reaching an understanding of their complex masses of data, and have found that they take ‘embodied interpretive journeys’ through the representations they share with each other, and in the process they create an ‘intertextual space’.⁵⁶ Similarly we all make knowledge, our own understandings as we move through space. As Ingold suggests, ‘we know as we go’, knowledge is cultivated by moving along paths or trails.⁵⁷ ‘All knowing is like traveling, like a journey between parts of the matrix’.⁵⁸ In moving through space and in making meaning we are telling stories, making trails of connections while at the same time those stories and trails, terrestrial and mental are the spaces we inhabit.

A most telling illustration of the performative co-production of stories, trails and constructed spaces is provided by Claudio Aporta’s work on the Inuit for whom ‘moving is a way of living’. Despite the fact that they use no maps and their trails are ephemeral, vanishing with fresh snow each season, the Inuit have an enduring network of trails across the Canadian Arctic. A network that is enacted as stories and shapes their topographic understanding so powerfully that Aporta argues the storied trails are, in effect, places.

It is through the use of place names that the trails are often described, as each community is deeply knowledgeable of the place names of their region. The description of the trip usually takes place in the narrative of the journey (Aporta 2005)...most of what we know today as the Canadian Arctic should be understood as a network of trails, interconnecting Inuit settlements and other significant places...such trails should themselves be considered significant places, essential in the understanding of Inuit culture.

The narrative of a journey is not a mere literal description of the trail, but involves the story of the trip (and sometimes of different trips along the same route). Such narratives will include precise descriptions of the landscape and icescape, along with the memory of personal anecdotes. Place names, winds, and other spatial markers are constantly used to place the traveller within concrete horizons and to explain the direction of travel). The physical description of a trail (including such things as when a particular rock is seen approaching from the trail in a particular direction) is intertwined with stories such as how the traveller almost got lost, the particular hauling of the traveller’s father’s dogs, the presence and hunting of, caribou along the way, or the encountering of another traveller.⁵⁹

Storied spaces and complex adaptive systems are dynamic, dialogical and diverse ways of knowing and connecting that are in continuous development with emergent effects feeding back into our lives and our environment. Ultimately what emerges is that the diversity, mobility and distributed, non-hierarchical, dimensions of complex adaptive systems and ways of knowing are directly relevant to the issues of

⁵⁶ Ochs, Jacoby, and Gonzales (1994).

⁵⁷ Ingold (2000), pp. 228-9.

⁵⁸ Turnbull (1991).

⁵⁹ Aporta (2009); Aporta (2003); Aporta (2004); Aporta (2005).

autonomy, sustainability and the commons. Analysts looking to explain P2P networks, how termite colonies work, how to re-organise energy and water supply, how to create sustainable cities and socio-ecological networks, how to understand processes of diversity and speciation, and how to organize the commons, have all turned to bio-systems and resilience and especially to distributed systems and have found they have features in common.⁶⁰ Kevin Kelly for example in discussing P2P networks singles out: absence of imposed centralized control; autonomous subunits; high connectivity between the subunits; and webby nonlinear causality of peers influencing peers⁶¹. Which means that emergent effects of interaction allow the behaviour of each autonomous subunit to be known by all other units and to change the behaviour of the whole in response to changing circumstances. In turn this means the system is in continuous flux within given constraints and the resilience lies in its capacity to sustain diversity against a background of change.

Such systems are heterarchical and distributed. The concept of heterarchy, in contradistinction with hierarchy was first introduced by Warren McCulloch, an early cyberneticist.⁶² He was trying to build an artificially intelligent machine based on the idea that the human brain has no central control, just separate unranked autonomous components networked together that learn and adapt by doing and changing their relationships in interaction with other such heterarchical brains in a given historical context. In other words complex systems, including ecologies, cultures and heterogeneous social groups can all effectively work together once it is recognised that the aim should not just be to reach a common understanding, or create a unified body of knowledge, but to reinvent the commons in which our collective actions, our performances together sustain diversity, mobility, creativity, emergence, and autonomy, in what Andy Pickering aptly calls a ‘dance of agency’ and is beautifully illustrated by Ruairi Glynn’s *Performative Ecologies*.⁶³

But again there are inevitably caveats. As both Michael Mikulak and Stefan Helmreich warn, rhizomatic thinking is susceptible to takeover.⁶⁴ ‘The shifting configurations of (bio)power’ are ever ready to ‘capitalize on ecological understandings of relationality and kinship’.⁶⁵ Likewise it is important to be continuously aware that while ‘everything is performative’ this is not another universalizing theory, there are ever proliferating performativities.

By way of illustrating the practical possibilities of enabling differing knowledge traditions to work together in ways that are heterarchical distributed, and performative, this final section outlines the ‘Emergent Databases, Emergent Diversity’ project.⁶⁶

⁶⁰ Berkes and Folke (2002); Ostrom (1999).

⁶¹ Kelly (1994).

⁶² McCulloch (1945); Crumley (2005).

⁶³ Pickering (2010), *passim*.

⁶⁴ Helmreich (2003).

⁶⁵ Mikulak (2007).

⁶⁶ The project is now supported by an NSF grant titled ‘Increasing Stakeholders’ Participation in Distributed, Emergent Knowledge Networks’. The investigators include Robin Boast (Cambridge Museum of Anthropology and Archaeology), Jim Enoté (Zuni Museum), Ramesh Srinivasan (UCLA), David Turnbull (Melbourne University).

The project is acutely sensitive to the unequal power relations of exchanges that have beleaguered such endeavors as community or counter-mapping projects, where the end result has all too frequently been the interpolation of indigenous groups and the inequalities of power into the dominant spatial and scopes regimes.⁶⁷ At the same time the project is equally sensitive to the necessity of critique.⁶⁸ As the title suggests the project deliberately aims to provide a ‘transmodern’ Dusselian approach to working with differing traditions by holding them in tension rather than aiming for a greater synthesis. It does this by opening up the Cambridge museum’s database and allowing direct unmediated data to the participants, so that they control, interpret, and augment the data as they wish, creating a complex adaptive system where meanings arise through practices of interaction and performance.

‘Emergent Databases, Emergent Diversity’ is based in the reality that contemporary museums are faced with a profound postcolonial conundrum- what to do with their collections from cultures around the world. Should they repatriate them, or insist that a museum’s main mission is archival and conservation, or open up the collections to interpretation. Many museums have found that the technical capacities of IT, digitization and the Internet offer what seems to be an ideal ‘modern’ option covering all three alternatives—‘virtual repatriation’.⁶⁹ In this model the museum retains the objects, but creates a virtual community that can share and exchange stories, images and knowledge. Virtual repatriation, like community mapping, has generated considerable indigenous enthusiasm, it gives them greater access, power and control over their heritage and identity. However, it also serves to extend the reach of the museum and its assemblage capacity based in a unitary ontology, ultimately leaving the understanding of the collection in the hands of non-indigenous experts. ‘Emergent Databases, Emergent Diversity’, by contrast requires ceding of control by the museum. It requires the abandonment of a single unitary ontology. The museum is no longer the repository where all authoritative knowledge of the objects in its collection is unified in one universal systematic database. Instead it becomes a ‘theatre of knowledges’ where traditions are performed together, and practices are held in tension with one another, where new knowledges can emerge as Pickering suggests in a ‘nonmodern’ dance of agency.⁷⁰

The two main participants in the project are the people of the Zuni Pueblo in New Mexico and the Cambridge Museum of Archaeology and Anthropology. In addition the project has created an extended network of three Native American communities and five museums that include, the Museum of Northern Arizona, the Denver Art Museum and Museum of Nature & Science. The Cambridge Museum which has a considerable collection of Zuni materials, ceramics, jewelry, and fetishes has developed protocols that allows the Zuni Museum a direct data feed of their entire collection. This enables the Zuni with their own appointed cultural advisors

⁶⁷ Wainwright and Bryan (2009); Bryan, J (2009).

⁶⁸ Turnbull (2005); Green (2009 b).

⁶⁹ Houghton (2010).

⁷⁰ Turnbull (2002); Pickering (2009).

and elders to determine what should be displayed and what not. They can also ascribe descriptions and interpretations according to their own understandings and ontologies as well as contribute whatever stories or materials they like. In this way the separation between the people and their objects are largely dissolved. Practices and contexts, people and materials are reunited in their nonmodern hybrid complex of interactions and co-production. In addition decentralizing networks of interaction across multiple communities including archaeologist and museologists allows local ontologies held by each group to be shared in a manner that respects each local community's authorship as sovereign and informed. When the system is up and running it will be spread to all the participating museums allowing each community to view, annotate, mash-up, and describe the digital objects that are exposed, while also allowing the communities to upload digital materials of their own as they wish to their own local system. The proposal is not about temporary tagging of already stabilized digital museum objects, rather it is focused on creating a set of spaces of information sharing that not only respects local protocols and ontological sovereignties, but allows for the local ontologies and practices to be performed together. Most importantly setting these interactions up as a complex adaptive system makes emergent understandings possible. Letting multiple, separate ontologies interact in the creative tension of performance together enables the creation of new understandings, new ontologies, and the critique of hidden assumptions now made apparent.

The project is at heart political, a demand for a recognition of the multiplicity of ontologies against the ur-narrative of the West based on the universalising assumption that there can only be one ontology, that claimed to be revealed by modern Western science. The critical examination of that narrative by SSK has repeatedly revealed the concealed heterogeneity of Western science which, for example, has produced the varieties of complexity theory that have unleashed the possibility of multiple ontologies.⁷¹ At the same time the struggle for the recognition of 'subjugated knowledges' has taken on greater urgency as the new globalised neo-liberal order is imposing itself on the world privatizing and enclosing communal knowledge. 'Emergent Databases, Emergent Diversity' aims to provide an arena for multiplicity and the basis for a new cultural commons in which knowledges and practices are shared and openly accessible.

The launch of the fully operative stage of the project at Zuni in April 2012 will hopefully encourage all the participating communities and institutions to take up the challenge. But even more hopefully, re-imagining knowledge performatively will exemplify the power of holding differing knowledge traditions in tension rather than seeking unanimity and agreement. Out of that tension can emerge new knowledge, ways of rethinking our most cherished and unexamined assumptions and opportunities for what to do next, in conditions of radical uncertainty, not just with indigenous knowledges, but with other seemingly wicked problems modernity— climate change, population growth, and the inequitable distribution of depleting resources.

⁷¹ Ziman (2003).

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CÉZANNE'S VISION: CONFRONT THE SCIENCES WITH THE NATURE FROM WHICH THEY CAME

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ABSTRACT. Around the turn of the 19th to the 20th century general systems theory emerged from existentialistic streams of philosophy. These streams criticised the insufficiency of science to capture ontological categories concerning the life world. Systems theory was in the beginning guided by Dilthey's hermeneutic understanding that he contrasted with reductionistic scientific explanation. During the second half of the 20th century the proximity to phenomenology vanished, mainly through the influence of cybernetics. Systems theory evolved into a supradiscipline obeying a radical idealistic (constructivist) paradigm. Performative science tries to correct this departure of science from *Dasein* in taking a phenomenological stance guided by Heidegger, Merleau-Ponty and Nishida. The article examines the susceptibility of systems theory for reification in order not to walk into the same trap again. From an analysis of the state-of-the-art in systems theory I conclude that a revival of Cézanne's vision to confront the sciences with the nature from which they came is overdue. There is no patent remedy, though. An unease remains. Merleau-Ponty's ambiguity principle appears in a different light.

Keywords: *performativity, systems theory, fundamental ontology, hermeneutics*

Performative Understanding

The title is an indirect quotation of Cézanne as found in Merleau-Ponty's „Sense and Non-Sense“¹. It provides an apt paraphrase for performative science² in my conception. Cézanne's intention aimed at avoiding the dualistic split into sensation and judgement. However, as Merleau-Ponty concludes, „Cézanne could not convince by his arguments and preferred to paint instead.“³ Is this consequent on Cézanne's lack of eloquence or could it be that language is insufficient where artistic expression still works? One is inclined to say: Whereof one cannot speak, thereof one must pass over in silence and create art instead. In Merleau-Ponty's words, art adds value to philosophical reflections beyond linguistics, and, particularly, beyond propositional logic. Notwithstanding that we are back to an age-old philosophical issue, there is more dissent than consensus about it. Does it help us further to go again through the existing dialectics?

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¹ Merleau-Ponty (1964), p. 14.

² Diebner (2006).

³ Merleau-Ponty (1964), p. 13.

It is less a question of counting up quotations than of determining and expressing in concrete form this *phenomenology for ourselves* which has given a number of present-day readers the impression, on reading Husserl or Heidegger, not so much of encountering a new philosophy as of recognizing what they had been waiting for. Phenomenology is accessible only through a phenomenological method.⁴

I adhere to the maxim taken from Maurice Merleau-Ponty's „Phenomenology of Perception“ and do not cite but rather murmur in a jargon of authenticity with Heidegger and Merleau-Ponty and understand this murmur as part of a performative praxis because, among others, “Phenomenology can be practised and identified as a manner or style of thinking [...]”⁵

With that said, it is not art as such, on my reading of Merleau-Ponty, that first and foremost, despite its elusiveness, adds value to philosophical reflections. Yet, speaking of philosophical reflections, we request for at least a communicative basis that tries to dissolve the paradox that there are situations which cannot be communicated but only be understood by living them. Obviously, art and literature can accomplish that by creating an affective and empathic atmosphere that allows for such a performative mode of understanding (performativity). Merleau-Ponty's work, particularly “Sense and Non-Sense”, exhibits performativity in a twofold way: it uses art and literature as a source of philosophical reflection and unfolds itself a performative power based on literary aesthetics. The same holds for the work of Martin Heidegger⁶.

I proceed on the assumption that performativity can be accomplished by other practices, too. Philosophical practice can have a performative mode. I assume that a scientific practice can have it, too. Performativity is congeneric to a productive hermeneutics, yet, it weights apperception⁷ and its prestages stronger than usually in hermeneutics, with Heidegger being an exception⁸. Also Kitaro Nishida's “pure experience”⁹ plays an important role here, a Japanese phenomenology that has obviously been overlooked by both Heidegger and Merleau-Ponty. In taking up an Aristotelian concept I suggest to paraphrase Nishida's, Heidegger's, and Merleau-Ponty's utterances with a demand for putting more weight on orthopraxy (correct practice). This is how I understand “manner or style of thinking”. It follows a demand to scrutinize the privilege of both *orthos logos* and *ortho doxa*, which dominate both scientific as well as Western philosophical thinking. Eastern philosophy seems to rest more upon orthopraxy¹⁰,

⁴ Merleau-Ponty (1962), p. viii.

⁵ *Ibid.*

⁶ Rimpler (2008).

⁷ I use “apperception” to be the transitional process from the preconceptional perception of phenomena to their conscious awareness and their conceptional penetration.

⁸ Heidegger (1995).

⁹ Nishida (1989).

¹⁰ The notion of *eupraxia* is used as an ethical principle by Socrates, and contrasted with a *dyspraxia* (bad practice) by Aristotle. However, I refer to a meaning of orthopraxy that is more related to artistic practices (i.e. *techné*) and eudetic functions like empathy aesthetics (*Einfühlungsästhetik*). The full meaning might perhaps only be found in Japanese concepts like *iki* (a particular “style”); see Botz-Bornstein (2004). The later Heidegger dealt with *iki* and compared it with a particular kind of hermeneutic practice. A full discussion is beyond the scope of this article.

which has been, unfortunately, all too often spiritually transfigured to an *ortho doxa* in the West. The crucial question here is, even if one accepts a performative practice to irreducibly augment logical, argumentative, dialectic, and discursive philosophical considerations, whether such an augmentation is possible for scientific practices, too, or whether one is inclined to say: as far as this but no farther?

According to Merleau-Ponty, philosophy has all the time been a self-explanation of the philosophers, i.e., a phenomenology not only *for* ourselves but also *of* ourselves, which, however, should not be equalized with subjectivity. In fact, we are back at where we started: Cézanne's attempt to eschew the object-subject distinction. A scientist who starts with an object-subject split *ab initio* may shrug her shoulder: "Who cares?" Whether Merleau-Ponty's judgement on philosophy being the self-explanation of philosophers is significant or lacks any truth, might, from a scientific stance, be no more than an intra-philosophical controversy.

Systems Thinking

My critical investigation rests upon personal concernment about general systems theory and cybernetics, i.e., the area I grew up. Thus, the introduction and promotion of the concept of performative science has an normative and a self-critical impetus. However, the rationality claim of the "hard" sciences and the debate on what is good or bad science shows that scientific methodology inherently rested upon normative aspects all the time. Performative science shares a more explicit corrective with the more than 100 years old streams of philosophy of life and general systems theory, which, however, has to be scrutinised in what follows.

Originally, mainly typical cross domain disciplines have been involved in the so called "systems thinking"¹¹ like psychology, sociology, and biology. An inspection of the domain-dependent competing approaches within the disciplines like the explanatory versus the understanding approaches, i.e., the natural scientific versus the *geisteswissenschaftliche* approaches clearly shows that neither of them have been regarded as being mystic in itself, however, the attempts to bridge these approaches indeed have. A prominent example is the awkward concept of structural coupling as introduced by Humberto Maturana¹². Another example is embodiment, as discussed in the cognitive sciences and robotics¹³. Yet another somewhat elusive bridging is Otto Rössler's endophysics¹⁴. The list could be easily extended by further examples.

Recently, the rising environmental consciousness, the cross domain character of the cyberspace, and the need for systems integrations in many socio-ecological systems demand anew for more "systems thinking", which occasionally creates

¹¹ Emery (1969). „Systems thinking“ should perhaps not be measured against fundamental ontological questions like the Heideggerian “What is called thinking?”, even if the protagonists of system theory may not mind to do so. It is, though, much more than just a specific approach. After Kuhn one is inclined to call it a shift of paradigm.

¹² Maturana and Poerksen (2004).

¹³ Storch et al. (2007).

¹⁴ Rössler (1998).

conflicts with the “old” disciplines that charge the new approaches with mysticism¹⁵. Despite or rather because the renaissance of systems thinking we have to ask what is nowadays meant by this. Thus, we have to recall that general systems theory emerged in the beginning of the 20th century from life sciences and socio-psychological disciplines in order to take the peculiarity of life into account¹⁶. After World War II a similar cross-discipline, cybernetics, emerged from engineering, which shares crucial aspects with systems theory. For example, Norbert Wiener, very much like Ludwig von Bertalanffy, spoke of contingency of society and life in general¹⁷. They expressed their beliefs that contingency can be captured with the mathematics behind statistical mechanics, i.e., with probabilistic concepts. Ideas like Laplace’s or Maxwell’s demon gained new attention in order to cherish the illusion of determinism and, in principle, full knowability and, therefore, full explicability of the universe. Within the emerging systems sciences, these beliefs more and more made way for hermeneutic understanding. Performative science is also thought to acquire practices capable to cope with complexity beyond full explicability and analyticity in the traditional scientific self-conception.

In at least one respect cybernetics has been more radical from the beginning: control and communication in both the animal and the machine was thought to belong to one and the same domain, namely the operational toolbox of cybernetics, which is indeed its very definition¹⁸. On this understanding, it is only a matter of complexity to build machines with life-like characteristics. Also important for the further evolution of technology is the simultaneous rise of informatics¹⁹. Quickly cybernetics paired with information science evolved into a leading discipline although its (nominal) omnipresence faded out towards the end of the 20th century. The combination of cybernetics and informatics radically changed both the conditions of knowledge and the *dispositif* or enframing (*Gestell*) of ontology. It is hereby questionable whether ontology is still a proper notion at all, since thinking in the sense of Heidegger’s fundamental ontology has been completely stripped by its essence and garbled to a computational task.

Cybernetics has been seen as part of general systems theory by its pioneers²⁰. However, the techno-inspired cybernetics actually dominates systems thinking in the 21st century, even if a more differentiated terminology is used, including informatics, robotics, artificial intelligence, self-organising systems, to name but a few. These new fields are generalised under the heading of complex systems research. Cybernetics carried with it an increasing objectification of subject, dressed up in an epistemological concept called constructivism. It paved the way for transhumanism. However, the shift

¹⁵ Holzhey (2004).

¹⁶ For a historical review on systems theory please confer Bertalanffy (1969), Emery (1969), Gaines (1979).

¹⁷ Bertalanffy (1969), Wiener (1954).

¹⁸ Wiener (1999).

¹⁹ Shannon and Weaver (1949).

²⁰ Bertalanffy (1969).

from hermeneutics to constructivism is perhaps inherent in systems theory itself²¹. I pursue the question whether reification (*Verdinglichung*) is a predisposition of systems theory. If so, is the well-intended reconciliation of science and being-in-the-world destined to fail?

World at a Wire

General systems theory started with an almost transcendent vision to head for an holistic scientific methodology guided by phenomenological and hermeneutic streams. One driving force behind systems theory can be seen in Wilhelm Dilthey's distinction between understanding and explanatory psychology, which eventually led him to introduce the notion of *Geisteswissenschaften* (humanities without the arts) as distinct from *Naturwissenschaften* (natural sciences). He thus distinguished between (hermeneutic) understanding and (scientific) explanation. Dilthey also occasionally spoke of the primacy of *Geisteswissenschaften* with respect to natural sciences since the latter ultimately rest upon activity of mind, too. This has been taken literally by pioneers of systems theory. They considered themselves to be on the right track after the stunning success of *Gestalt* theory that promised to offer a reconciliation between phenomenology and psychology. A holistic scientific methodology was born with the intention even to account for *being-in-the-world*. One of the protagonists, Andras Angyal, formulated in 1941:

Dealing with relations and dealing with systems involve two different logical manipulations to which two psychologically quite different processes may correspond. In the recent past there has been much rather inconclusive discussion concerning the possibility of two different processes of knowing: explanation and understanding. I am referring here to discussion of the problem, *erklärende und verstehende Psychologie*. The difference between the two concepts [...] is probably that explanation refers to relational thinking, understanding to system thinking.²²

Yet, what we observe in our digitalised or cybernetised world is an approach towards what can be called a *noosphere* in following Marshall McLuhan²³. I diagnose the driving force behind it in techno-centric cybernetics. Artificial intelligence blesses us with context sensitive semantic and anticipating algorithms that are thought to resemble the hermeneutic circle.²⁴ There is talk of “computer understanding”, suggesting that *Existenzialien* reserved for human *Dasein* are obsolete.²⁵ Yet, in order not to shift complete fault to cybernetics, it has to be assumed that an initial vagueness of systems

²¹ Diebner (2010, 2011).

²² Angyal (1969).

²³ McLuhan (2002).

²⁴ Mallery et al. (1987). For a critical discussion also confer Diebner (2006a).

²⁵ Due to Heidegger, ontological categories are not applicable to human Being (*Dasein*). *Dasein* distinguishes itself from other beings in its very relation to Being expressed by *Existenzialien* rather than categories, which explains his notion of “fundamental ontology.” Most important here are the *Existenzialien* being-in-the-world and *Sorge*.

theory already contained a predisposition for all kind of contortions. Whatsoever, Tom Stonier raised the ontological status of information to the rank of energy and mass and spoke of a generalised equivalence principle.²⁶ His teleological conclusion that the universe, starting from a pure energetic state (big bang) and running through mixed states of mass, energy, and information, ultimately develops into a state of pure information strikingly reminds to the point omega, a final state of the universe that Pierre Teilhard de Chardin conceived as a sphere of pure thoughts²⁷.

Stonier's work has been received within a rather small community of the study of foundations of information science. Teilhard de Chardin's attempt to reconcile religion with science survived within a spiritual community only. However, we should face the fact that the ovation of digital media, the internet in particular, is the effective manifestation of exactly the according world view that we, with much apropos, call virtual reality. The corresponding philosophy is called posthumanism whose protagonists significantly match with those artists who consider themselves as scientists at the same time and vice versa. This has been anticipated by McLuhan in paraphrasing the noosphere with "technological brain for the world" that surrounds us.²⁸

The system theoretician Otto E. Rössler possibly is an exceptional case amongst scientists who astoundingly openly awaits a unification of Bertalanffy's systems theory and de Chardin's spiritual science and philosophy²⁹ on the evidence of the cyberspatial ontology:

In the electronic age, the "interface" between observer and object becomes amenable to artificial manipulation.³⁰

The price to be paid is the same as with any other constructivist explanation: the obtained reality is valid, not objectively but only as an interface-generated "illusion".³¹

Virtual reality receives the status of a simulation within the "big" simulation called consciousness, which is all that exists, according to Rössler:

[Descartes] famous 'cogito ergo sum' means 'I experience and hence my experiencing exists,' or equivalently, 'All that exists for me is my experiencing.' An even shorter paraphrase would be, 'There is nothing but consciousness.'³²

Media artists have a pronounced affinity for the apotheosis of cyberspace – literally a *theo techne* – which is why Rössler is held in high esteem in the new media community. This kind of thinking straightforwardly leads to a relativisation of reality

²⁶ Stonier (1990).

²⁷ Rabut (1963).

²⁸ McLuhan (2002), p. 32.

²⁹ Rössler (2007).

³⁰ Rössler (1998), p. 59.

³¹ *Ibid.*, p. 142.

³² Rössler (2004).

in the sense narrated in the famous 1999 movie “The Matrix”³³ or the 1964 novel “Simulacron-3” by Daniel F. Galouye³⁴, which has been filmed under the title “World at a Wire”³⁵ in 1973. Rössler quite frequently quotes these movies in the sense of a stimulating narrative supporting his thoughts³⁶.

Several novels before Simulacron-3 already addressed cybernetics as an instrument to misuse power (e.g. 1984, Brave New World). However, Simulacron-3 was, to my knowledge, the first novel that directly addressed the cybernetic tendency to equalise the ontology of signifier and signified, i.e., the model worlds and the modelled worlds. In cybernetics, the scientific approach radically changed into a constructive one. The models are no longer analytically derived from an investigation of the epistemic objects but rather precede them. Models find posterior “instantiations” in a variety of fields. World generation and an operational world conception seems to be the dictate of the 21st century. Ontology has been reduced to derived categories only. That what Aristotle called a “primary substance” (ousia) became expendable. This abuse of ontology is also reflected and even amplified in the modern usage of the notion “ontology” in information science, where a taxonomy of a database is meant only.

It is my hypothesis that the current Western world view is dominated by the cybernetically induced ontological indifference, which leads to an increasing social anomy or, so to speak, to the turning of *Dasein* into a farce, expressed through the indifference between fake and facts, being-in-the-world and role-play, medium and message, and so on. At least the internet is already best described as playground for *Possen* (farces or burlesques)³⁷. I refrain here from going into more detail and refer to an extensive discussion in Diebner (2010) instead. I want to mention, however, the rather early usage of the notion of virtual reality in the context of systems theory:

[...] Bei der fortschreitenden Analyse [wird] die zunächst naiv noch ganz greifbare Wirklichkeit immer weiter verflüchtigt und schließlich zu einer rein methodologischen Konstruktion [...], die sich nur noch indirekt aus der Deutung bestimmter Operationen erschließen läßt. [...] Erstens werden die Strukturen und Prozesse der Lebenswelt nicht als „die Wirklichkeit“, sondern nur als virtuelle Realität gedeutet; zweitens werden diese Zusammenhänge nicht mit dem Anspruch einer „objektiven Systematisierung“, sondern nur in Form von quasi-objektiven Systemen rekonstruiert. [...] Das Verfahren der Systemwissenschaften bezeichnet man daher am besten als Konstruktivismus.³⁸

³³ Wachowski and Wachowski (1999).

³⁴ Galouye (1964).

³⁵ Fassbinder (1973).

³⁶ Rössler (1998), p. 29.

³⁷ Baecker (2011).

³⁸ Händle und Jensen (1974).

Sciences of the Unknowable

Recently, Andrew Pickering pointed out a few ontological aspects on cybernetics that are relevant for the problem in hand. With respect to cybernetics, Pickering suggests to speak of “antidisciplinarity” rather than of “interdisciplinarity” and he also introduces the notion of “nonmodernism” to be contrasted with “modern sciences.” The latter

[...] presume a knowable world, of identifiable entities in specifiable interaction with one another, and they take it for granted that their job is to know them.³⁹

In contrast:

The nonmodern sciences, as I conceive them, presume a world that is ultimately not fully knowable – a world of endless unpredictable emergence and becoming. These are the sciences of the unknowable.⁴⁰

If interdisciplinarity is understood as a “joint venture” to combine knowledge from several disciplines to understand a segment of the world better than a single discipline is capable to, then cybernetics cannot be conceived as interdisciplinary. According to Pickering,

[...] cybernetics erupted across the disciplinary map: at one and the same time, cybernetics could be instantiated, so to speak, in all sorts of fields.⁴¹

To illustrate his thoughts, Pickering refers to Ross Ashby’s homeostat set-up, published in 1948⁴². The homeostat is an electromechanical device with complicated circuitry that unfolds its effects and appeal when being coupled with one or more other homeostats. Each homeostat can adapt its dynamical states depending on the momentary states of the others. A non-predictable dynamic pattern results that Pickering calls “performative interaction – a dance of agency.”⁴³

In fact, the homeostat and many other such complex artefacts found instantiations in almost all fields including the arts. Ashby suggested a homeostat arrangement as a basic assembly to emulate essential brain functions⁴⁴. It has also been used to approach the mechanisms of an organisation, and, most remarkable, it has several times been seen as a work of art with only minor modifications concerning the appearance⁴⁵. Pickering concludes: “[Ashby’s] cybernetics was, then, a theory of everything – or such was the claim.” I want to add, however, that it is not only the hubris of a theory of everything, which would in fact be a rather disciplinary and

³⁹ Pickering (2010b).

⁴⁰ *Ibid.*

⁴¹ *Ibid.*

⁴² Ashby (1957).

⁴³ Pickering (2010b).

⁴⁴ Ashby (1957).

⁴⁵ An example is found in Bird et al. (2007).

modern scientific expression, but much more the ontogenetic claim that makes cybernetics even superior to the arts, which is conform with Pickering's terminology of nonmodernism and antidisciplinarity.⁴⁶

Studying the abundant literature on the self-discovery of systems theory produces evidence that nonmodernism and antidisciplinarity are already included in the formulation of early systems theory and its constructivist paradigm. The term constructivism has been coined by George Herbert Mead in his sociological studies at the end of the 19th century and underwent then a gradual adaptation to become the rational behind systems theory. Also the relation to the traditional disciplines has been discussed and instead of antidiscipline the notion supradiscipline was used:

Supradisziplinär leistet sie auf diese Weise die Generalisierung und Vereinheitlichung bislang unverbundener einzelwissenschaftlicher Theorien, erleichtert die Orientierung in der Vielfalt theoretischer Modelle und erweist sich insofern als „allgemeine Modelltheorie“⁴⁷

Notwithstanding the naming, systems theory (including cybernetics) positioned itself somewhere in the *interstitium* of maths, humanities, engineering, and traditional applied scientific disciplines.

Cybernetics, primarily understood as synthesis of form that is not created out of a traditional field of knowledge in form of technology but that rather instantiates epistemic things in a variety of fields, explains why new media and cybernetic artists conceive themselves as scientists at the same time. The reverse is true, too. Several pioneers of cybernetics acted as artists as well⁴⁸. It remains to investigate the consequences this ontological indifference brings along.

What is the essence of this “new kind of science?” The convergence of cybernetics and the arts particularly manifests itself with respect to their emulation capabilities. I hesitate to use the more colloquial expression “simulation” because in a strict sense this is an otherwise occupied technical term. The traditional methods for model validations have been replaced by a kind of generalised Turing test, so to speak. Otherwise it would not be possible for one and the same cybernetic artefact to serve as an instantiation in a variety of disciplines. Since we do not have a chance to gain full knowledge neither of a sufficiently complex “natural” system nor of an artificial cybernetic system with emergent dynamics, according to the nonmodern antidisciplinary paradigm, all what we can do is to use a behaviouristic indistinguishability argument for model verification.

⁴⁶ Modernism in art and art history has to be distinguished from modernism in science. Modern art is often associated with both innovativeness and with a philosophical or discursive faculty. In this sense, the art and science convergence is a characteristic of modernism in the artistic avant-garde sense.

⁴⁷ Ropohl (1978), p. 45

⁴⁸ See, for example, the epochal cybernetic art exhibition „Cybernetic Serendipity“ by Reichardt (1968).

I conclude that the same argument holds for a prototypical design, too, and it is indeed increasingly frequently observed that the notion of model as representation of nature switches completely to the opposite meaning to be a model for designing nature accordingly (a particular kind of prototype), which again reminds to the practices of the arts. Artificial life, for example, is equally frequently found in science as in the arts, nowadays often called artistic research.

Therefore, cybernetics is not as much the task of well-trained scientists as that of ingenious alchemists and tinkerers (*bricoleur*). Also Pickering mentions, that nonmodern science is in part pre-modern science, i.e., alchemy. A systems researcher is certainly gifted with intuition to build artefacts with complex behaviour even if a complete comprehension in all details is out of sight. Of course, also a scientist in a traditional discipline is gifted with tacit knowledge to perform her experiments. The difference, though, is that her tacit knowledge does not play a role any longer when proceeding from the context of discovery to the context of justification.

What does all this have to do with performative science? A first somewhat naïve answer is, that this undeniably fascinating systemic or cybernetic thinking, which comes along with increasing reification (*Verdinglichung*), needs remedy. A human being and a machine are equally conceived as systems. I coined the notion of performative science roughly ten years ago to refer to a research practice and methodology that bursts the too narrow traditional methodological corset of science, thought to be not restricted to the context of discovery but that also includes the context of justification. The latter means, among others, to accept sensual verification methods based on, for example, a video proof or a sonification. Scientists here can learn a lot from artists. It entails that a research result may be published as a kind of work of art, an interactive installation, in a museum. Performative science is intended for both a recollection of the productive hermeneutic origin of systems sciences that starts from being-in-the-world as well as the consideration of the technological, scientific, and artistic state-of-the-art. It was in fact Andrew Pickering who in his epistemological studies first expressed the need to correct the mainstream modernist approach:

The argument was that mainstream modernist approaches to the history, philosophy and sociology of science systematically obscure the performative and emergent aspects of scientific practice that I refer to as dances of agency, and that what I called ‘eclectic interdisciplinarity’ can do nothing to remedy this situation. We therefore need what I called an antidisciplinary approach centred on the non-dualist and emergent – nonmodern – phenomena that characterise practice.⁴⁹

I agree with his diagnosis that performative aspects of scientific practice were and are still systematically obscured. I argued several times elsewhere that a grain of mysticism and alchemy is a good indicator for the presence of intuition, tacit knowledge, and other forms of pre-conceptual understanding and doing, in short:

⁴⁹ Pickering (2010b).

performativity. However, in recent years an unease sneaked up about the possibility to walk right into the trap of an endless loop of dialectics of enlightenment, i.e., the futile escape from a self-constructed totalitarian ideology, namely the holistic systems theory that even declares its artistic and performative practice to fall into its own subject area.⁵⁰

What aroused suspicion in Pickering's approach is related to my doubts expressed above, namely the obvious adaptability of "dance of agency" and related notions to different domains that merge into one and the same domain in Pickering's deliberations:

Above all, we should think of a multi-homeostat set-up as 'ontological theatre,' as staging for us a vision of the nonmodern ontology more generally. None of the homeostats in such a set-up knew anything in a representational sense about the others; each reacted and transformed itself in a performative interaction – a dance of agency, as I call it [...] – with the unpredictable becomings of the others.⁵¹

A performative scientific practice and the complex dynamics of arrays of electrical circuits are apprehended using the same categories. I wonder whether we here deal with a category mistake that also dominates posthuman philosophy. Again, *Existenzialien* seem to be obsolete.

Dance of Agency

I myself designed a reactive visualised live simulation of an array of coupled oscillators called "Liquid Perceptron" that can be "instantiated" as simplified brain model⁵². The particular design allows for a dance of agency with respect to the human (inter-)actor. In contrast to the operationally closed character of cybernetics I would not argue, however, that this kind of performative understanding is the quintessence of cybernetics and I would never argue, that the simulation itself performs a "dance of agency" in the same way as the human actor. It is, for me, the human being endowed with a real brain who interacts with the model brain and thereby casts light on how the human brain works. Performative science – with its residual unease – is thought to be much more guided by Heidegger's principle of *Sorge* in his analysis of (human) *Dasein*.

An increasing complexity with which science and the society has to deal with and the according development of proper mathematical tools and scientific concepts, fosters and necessitates also a performative practice. The new aspect hereby is the complexity of the model of complex systems in that sense, that the models themselves become new epistemic things. A specific complex system may, for example, according to comprehensible principles, either inductive or deductive, be best described by an array of coupled nonlinear differential equations. Now, the

⁵⁰ Confer Tschacher and Tröndle (2005) and Diebner (2005).

⁵¹ Pickering (2010b).

⁵² Diebner (2006), pp. 94-109.

resulting differential equation may lack a closed solution and may defy to be analytically apprehended without an numerical simulation. This gives the whole thing a holistic, self-organised and, with a grain of salt, a somehow lively character and entails experimental intuition to be understood. It also entails the need of new sensually based verification methods: video proof (through visualisation of the simulation results), auditory proof (through auditory displays), performative proof (through multi-sensory interactive strategies) and so on.

Up to here I am completely sympathetic with Pickering, although it should be mentioned that the fundamental philosophy behind these phenomena has been pronounced by protagonists of systems theory long before cybernetics. Angyal, for example, discussed the necessity to extend the philosophical *principia individuationis* to a general dimensional domain. At a save distance from singularities it works well to assume a space-time *a priori* to introduce a spatio-temporal metrics, although space-time is constituted by an arrangement of distributed objects. Likewise, for a complex system the dimensional domain is itself involved in the formation of the system and can no longer be abstracted from the system in form of an *a priori*. *Cum grano salis*, the supradisciplinary character of systems theory is itself a kind of generalised *principia individuationis*.

The differential equations can also be integrated by means of an analog computer as used for a few decades after WW II. In realising the circuitry of the analog computer as a stand-alone device we end up in a coupled array of homeostats. The new aspect compared to the description of a holistic system is its actual construction. If we finally took Pickering's deliberations on the ontology of such devices serious we had to agree also with Rössler who once opened an article of his: "The world is a partial differential equation."⁵³ This radically idealistic (constructivist) conclusion seems to be symptomatic for the cybernetics community. Here is where I no longer can follow.

Instruments of Information

The mention of holistic systems can be traced back to deliberations long before the control paradigm of cybernetics. With the homeostat and similar devices, Pickering used rather atypical examples. Nevertheless, these devices underline performative science as an appropriate practice (orthopraxy) to understand such systems, and he therefore concludes, "The nonmodern ontology is about performance, not representation."⁵⁴ However, he seems to overlook that phenomenology and fundamental ontology has been performative at least 100 years before this "nonmodern" insight and stimulated the formation of systems theory. Howsoever, it is even less understood that performativity can be detached from a human performer, which indicates a posthumanist view:

⁵³ Rössler et al. (1985).

⁵⁴ Pickering (2010b).

The whole 'posthumanist' wing of science and technology studies [...] can, in this sense, be understood as itself a nonmodern science, and Latour's attempts to forge links between posthumanist STS, politics and the arts dramatise its antidisciplinary aspects [...].⁵⁵

Here, the true essence of cybernetics comes to light. Cybernetics pretends to have closed the ontic-ontological gap, prominently expressed through second order cybernetics that eventually led to a completely self-referential programme that even contains a formalisation of ethics within the same domain⁵⁶. The reason why my arguments are based so explicitly on Pickering's paper should be seen in the subtle tipping point contained in his arguments, which familiarises the reader with a way of looking at cybernetics that they most likely throw Heidegger's diagnose to the wind:

No prophecy is necessary to recognise that the sciences now establishing themselves will soon be determined and steered by the new fundamental science which is called cybernetics. This science corresponds to the determination of man as an acting social being. For it is the theory of the steering of the possible planning and arrangement of human labour. Cybernetics transforms language into an exchange of news. The arts become regulated-regulating instruments of information.⁵⁷

Indeed, Pickering himself explicitly argued against Heidegger elsewhere.⁵⁸ Heidegger's fundamental ontology, Nishida's pure experience, and Merleau-Ponty's primacy of perception unfolded their sustainable relevance for my work only in the light of encounters with activities and writings of artists and scientists who either explicitly referred to cybernetics and systems theory or indirectly indicated a relationship to cybernetics, or the third culture, as it is occasionally called. The "dance of agency" – to speak with Pickering – of my own cybernetic products are included in these encounters. Thus, the "dance of agency" I myself performed in the play with these epistemic things eventually seeded my critical attitude, which can hardly be better summarised than by Heidegger's above quoted "prophecy." It is the last sentence of this quotation in particular that impressed me a lot, given that Gordon Pask's and other cybernetician's military conditioning machines have been presented as artworks in exhibitions only a couple of years later.⁵⁹

I proceed with a few remarks on Hegel in referring to Merleau-Ponty's deliberations. In chapter 5 of Merleau-Ponty's "Sense and Non-sense" entitled "Hegel's Existentialism"⁶⁰ he criticises that "Hegel's successors have placed more emphasis on what they reject of his heritage than on what they owe to him."⁶¹ According to

⁵⁵ *Ibid.*

⁵⁶ Foerster (1993).

⁵⁷ Heidegger (2007) p. 72.

⁵⁸ Pickering (2010a).

⁵⁹ Confer Reichhardt (1968) and Rosen (2008).

⁶⁰ Merleau-Ponty (1964), p. 63ff.

⁶¹ *Ibid.*, p. 63.

Merleau-Ponty, the fact that the first existentialist in the modern sense, Kierkegaard, set himself in opposition to Hegel because the latter treated history as the visible development of a logical system is a result of Kierkegaard's masking the early Hegel out. With respect to Hegel's "Phenomenology of Spirit", Merleau-Ponty tries to convince the reader that one can even speak of a "Hegelian existentialism":

What is certain in any case is that the *Phénoménologie de l'esprit* does not try to fit all history into a framework of pre-established logic but attempts to bring each doctrine and each era back to life and to let itself be guided by their internal logic with such impartiality that all concern with system seems forgotten. The introduction states that the philosopher should not put himself in the place of human experiences; his task is simply to collect and decipher these experiences as history makes them available.⁶²

It is my conjecture that the development from an early existentialistic enframed systems theory towards a theory that maps internal logic and impartiality (now called constructivism), as well as subjective degrees of belief and even moral imperatives to an external logic closely resembles the shift from the early to the later Hegel. Expecting the cybernetic achievements, particularly the internet, with a teleological impetus converging to a "palace of ideas", to absolute knowledge, and even to transhumanism appears to be inherent in the concept of a system, I suspect.

At this point, I cannot refrain from referring to Merleau-Ponty's Marxism. As James Miller substantiates in his study, Merleau-Ponty oscillated between phenomenology and the Hegelian absolute.⁶³ There is a striking similarity between systems theory/cybernetics and Marxism insofar as actual "instantiations" seem to provoke "counter-instantiations", to paraphrase the nested structure of (counter-) revolutions. Crux is the allegedly practical directive expressed by "Philosophers have hitherto only interpreted the world in various ways; the point is to change it", which is counteracted by a teleological or goal-oriented background. Heidegger once wondered on what basis the world should be changed if it were not sufficiently interpreted before. Meaningless actionism?

Howsoever, with the demand of change we arrived at a kind of hands-on philosophy or, if you wish, at a "philosophical engineering", as systems theory is conceived by its protagonists. Despite their orientation towards practical life the goals are: optimisation, stability, sustainability, and so on. This goal has not substantially been changed after the recognition of the existence of far from thermodynamic equilibrium systems like the homeostat. Thermodynamic equilibrium has merely been substituted by homeostasis, which is in essence a self-organised stable island far from thermodynamic equilibrium. This is thought to hold for ecosystems, brains, societies alike.

⁶² *Ibid.*, p. 65.

⁶³ Miller (1976).

Structural Coupling

I proceed with a few remarks on Maturana's autopoietic concept, which unfolded an enormous appeal in many fields that deal in some or the other way with complexity. Niklas Luhmann even proclaimed an autopoietic turn in sociology. Erich Jantsch applied the idea to the whole universe. Maturana, however, vehemently rejected not only the idea of an n^{th} order autopoietic system (composed of autopoietic systems), which would completely contradict the autopoiesis of its constituents. Only individual living systems, in Maturana's view, are autopoietic.

From the revealing book "From Being to Doing"⁶⁴ it becomes strikingly obvious that Maturana's deliberations are, most likely unwitting and, therefore, *post hoc* interpreted, attempted translations from the existentialistic coloured phenomenology of say Merleau-Ponty and others mixed with a semblance of monadology⁶⁵ to the biologists' language. Maturana saw his brainchild completely abused by most of the system theoretical applications. "They no longer speak of molecules but only of systems that they elevate to their new gods."⁶⁶ In his opinion, "the phenomena of one domain cannot be expressed in terms of the phenomena of another domain."⁶⁷ He instantiated the latter with an example that could stem from an essay by Merleau-Ponty:

Just look out the window for a moment. Over there, you see a loving couple, a young woman and a young man kissing each other. What is happening there? My answer would be: Whatever happens there happens in the domain of human relations. Naturally you can point out that in such exchanges of tenderness hormones and neurotransmitters are involved; no doubt we can speak of systemic processes in both organisms. All that would be correct, but [...] the loving tender relation that the two of them are living cannot be reduced to hormones, neurotransmitters and systemic processes.⁶⁸

And he added, those who "promote their [...] network theology and begin to worship systems or networks, they are thinking and arguing in a reductionist way."⁶⁹ To understand what is going on when those who "worship" systems, networks, and constructivism substantiate this very worship with the aid of Maturana's autopoiesis is perhaps the crux of the problem. Very much like the shift from the existentialistic to the idealistic Hegel I regard the role of the mutation of Maturana's existentialistic autopoiesis into a self-justification of constructivism and cybernetics as clue for the departure of general systems theory from being-in-the-world.

⁶⁴ Maturana and Poerksen (2004).

⁶⁵ The concept of „structural coupling“ comes very close to Leibniz' deliberations on „pre-established harmony.“

⁶⁶ Maturana and Poerksen (2004) p. 110.

⁶⁷ *Ibid.*, p. 110.

⁶⁸ *Ibid.*, p. 110.

⁶⁹ *Ibid.*, p. 110.

A crucial role is played by Maturana's notion of structural coupling, which has been adopted by Luhmann and others to gain a central role in system theoretical approaches. Like the monads that don't have windows to interact with the physical world (*res extensa*) but are rather related to it via the pre-established harmony, the autopoietic domain of the brain's internal logic and the external world are coupled by a "soundless and unperceived" structural coupling, obeying the "law" that "only a miracle could invalidate structural determinism"⁷⁰. It is thus a pre-established metaphysical relation. Maturana even accused his long-term colleague, Francisco Varela, of abusing his ideas, for he tried to derive a mathematical description of structural coupling. Paradoxically, the concept serves for many system theoreticians as a necessary and sufficient condition for constructivism. Yet, Maturana vehemently denied to be a constructivist: "I do not consider myself a representative of constructivism, even if I am called a constructivist over and over again."⁷¹

Maturana's autopoiesis counts to the most peculiar concepts. It is a scientific concept, or such is the originator's claim. He insists on having derived a biological theory. It contains nonfalsifiable parts and it hardly exhibits operational capabilities, though. It has been used to refine other fields of system theoretical research, though interpreted in turn by Maturana as misuse if not abuse. According to the creator, it is no philosophical discourse either. Nevertheless, I am inclined to explain the attractive effect of autopoiesis on the broad public with its "scientifically" labelled categorical imperative. The same holds, by the way, for Heinz von Foerster's "KybernEthik"⁷². In the same way, "systemic thinking" is oftentimes used in a moralising manner.

Again, this kind of scientifically justified moral imperative has been motif behind the decades older systems theory. Brian Gaines, one of the co-founders of the 1954 established Society for General Systems Research, wrote in 1979:

[Systems theory] is also foundational in the extreme and hence philosophical but differs from philosophy in that philosophers are not expected to make things work. [...] Systems theory is a form of philosophical engineering. On these grounds I would certainly claim Plato's Republic as an outstanding example of early work on general systems theory as distinct from philosophy.⁷³

A few lines later he quotes from the society's anniversary speech in 1979 by Richard Ericson:

I deeply believe that this society has now thrust upon it a kind of moral imperative to focus efforts on the utilization of general systems concepts and conceptualizations by policy-forming executives, administrators, and managers in all kinds of large-scale organizations.⁷⁴

⁷⁰ *Ibid.*, p. 81.

⁷¹ *Ibid.*, p. 34.

⁷² Foerster (1993).

⁷³ Gaines (1979).

⁷⁴ *Ibid.*

Ludwig von Bertalanffy is even more direct:

Especially the gap between natural and social sciences, or, to use the more expressive German terms, of Natur- und Geisteswissenschaften, is greatly diminished, not in the sense of a reduction of the latter to biological conceptions but in the sense of structural similarities.⁷⁵

Furthermore:

If, therefore, we would have a well-developed science of human society and a corresponding technology, it would be the way out of the chaos and impending destruction of our present world. This seems to be plausible and is, in fact, but a modern version of Plato's precept that only if the rulers are philosophers, humanity will be saved.⁷⁶

Now compare this with the blurb of Pickering's book "The cybernetic brain", where it is stated that we need an "imaginative model of open-ended experimentation in stark opposition to the modern urge to achieve domination over nature and each other". Note that the very same argument is repeated over and over again in the media art community: Art conceived as rescuer. Cybernetics conceived as art. Needless to go through the chain of arguments further.

In this context it is worth to recall that cybernetics has been exploited from the end of World War II on by the US government and the CIA to construct and control a "better" society as an answer to the Bolshevik threat⁷⁷. Shortly afterwards, the GDR author Georg Klaus presented cybernetics as a rigorous mathematical derivation of Historical Materialism⁷⁸. Cybernetics has also been used in the Chilean CyberSyn project to "design freedom."⁷⁹ The susceptibility for ideologisation is completely comprehensible, for cybernetics can be "instantiated" in all kind of fields, including "social engineering". A moral claim for systems theory/cybernetics in such a presumptuous way entails its *reductio ad absurdum*. Another critical trend is the increasing outwearing (*Vernutzung*) of art.⁸⁰

Remarkably, some 15 years after CyberSyn, project manager Fernando Flores called for a halt of a pure operational cybernetics. Together with Terry Winograd he suddenly advocated a hermeneutic perspective and Heidegger's fundamental ontology within systems theory in the book "Understanding Computers and Cognition – A New Foundation for Design"⁸¹, as if hermeneutics never were the fundamental characteristic of systems theory. Unfortunately, with his hermeneutic-based "understanding computer" – an interesting play with the double meaning of the computer that understands and

⁷⁵ Bertalanffy (1969). p. 87.

⁷⁶ *Ibid.*, p. 52.

⁷⁷ Confer Diebner (2009) for a discussion.

⁷⁸ Klaus (1972).

⁷⁹ Medina (2006).

⁸⁰ Please confer Diebner (2008, 2009, 2010, 2011).

⁸¹ Winograd and Flores (1999).

the computer as carrier of our models and simulations that itself became an epistemic thing to be understood – he set the foundations to operationalise hermeneutics to create an understanding computer⁸². As a result, one risks to get scorn in our posthuman-minded society when hermeneutics as a human effort to understand is invoked. What we actually observe is that posthumanism is virtually already in operation for years. The disastrous impact of automatised decisions that not even allow for a human intervention, and other anomalies, like wishing-machines in form of so called artificial intelligence, which actually are reifications, are sold as veritable individualisation and for our own good. Actually, they reduce humans to “nodding-through” beings.

The weak point is, how the link of the physical agency of the human users via a symbolic representation in the machines with the mental domain or even with consciousness is interpreted. From a non-materialistic point of view the legitimisation of the symbolic level created through physical interfaces as an essential representation of the human user is a reification (*Verdinglichung*). Even worse, these techniques are even sold as a resolution of the object-subject split. Indeed, the subject vanishes behind the object, the split is – retroactively! – annihilated. *Dasein*, from where we started, became expendable.

Remarkably, the engineers in turn have to deal with another reification problem, too. To link the symbolic world back to a physical one is a persistent problem in robotics. From the engineering point of view the connection of the top-down approach of artificial intelligence to the bottom-up approach in artificial life is a puzzling problem. Note, this problem bears a striking resemblance with Maturana’s structural coupling problem, although one should not set it equal. Of course, as long as the mechanism of the symbol manipulation is more or less open to our judgement, and as long as human beings are the last link in the chain of the decision making process, such an operational hermeneutics (combination of technological information processing with the human faculty of understanding) can definitely work to our advantage.

It seems that cyberphile media artists cultivated in their avant-gardist self conception a rather absurd antagonistic strategy to face the instrumentalisation that all too often emanates from cybernetics. Cybernetics in turn exploits this parasymphathetic agency as an innovative power. Metaphorically speaking, an autoimmune deficiency sets in, as a result of blurring the ontological domain of the arts with the ontic domain of cybernetics. In other words, the cybernetic world view carried along a human made additional *Seinsvergessenheit* (being-forgottiness) and what I elsewhere called *Kunstvergessenheit* (art-forgottiness)⁸³. Lutz Dammbeck expects an increasing self-amplifying actionism within a closed cybernetic circuit⁸⁴, which I called dialectic endless loop to refer to the obvious parallel between cybernetics and Hegel’s dialectics.

⁸² Mallery et al. (1987).

⁸³ Diebner (2009).

⁸⁴ Dammbeck (2007). See also Diebner (2009, 2010) for an extensive discussion.

Feeling of Unease

Time to head for a (provisional) conclusion. For this purpose, I refer to concrete system theoretical problems for which I regard performative science to be almost indispensable: Dynamical modelling based on nonlinear differential equations. Differential equations are abstract mathematical models of dynamical systems. Until the end of the 19th century it was thought that it is only a matter of advances in mathematics that the solutions of dynamical systems relevant for the description of nature can be calculated and written down as an analytic function.⁸⁵ The function can then be used to predict future states.

However, most nonlinear differential equations lack of closed solutions. They have to be solved by running iteratively through all previous values. In a certain sense, one has to actively count and run through all intermediate states until one reaches the time for which the state is desired to be known. A closed solution, to the contrary, can be used to directly set in the time at which we want to know the state of the system. It is easy to imagine that a human being is at a loss here. Thanks to the computer we seem to be rescued. But at what price? The solution is given not as a function but as a column of figures instead that we usually visualise as a graph. Analytical tools available for closed solutions became useless. Still worse, due to nonlinearity we not only had to sacrifice closed solutions, we also know about the sensitivity of the solutions on initial conditions so that a bunch of basic epistemic principles in science had to be reformed. Robustness and validity of computational solutions are both under close scrutiny and subject to new forms of tacit knowledge of computational modelling. Nonlinear systems express uncertainty including the uncertainty how to deal with and to interpret them properly.

A full explanation had to yield to another form of understanding – to repeat once more – a hermeneutic understanding. Many years after the introduction of nonlinear systems they are still subject to open questions. In order to make the varying but analytically⁸⁶ inaccessible features of the phase space⁸⁷, and the trajectory therein, accessible to the senses, I developed numerous strategies to colour the computed trajectory (solution of the differential equation) accordingly and to design interfaces to interact with live simulation of the dynamics. In other words, I performed a dance of agency, completely in line with Pickering's deliberations. The "mangle of practice" included haptic interfaces to really feel the forces acting upon the variables and the mapping of the so called stable and unstable manifolds in phase space onto gravitational and centrifugal forces acting upon the researcher in order to provide an experiential context. The latter is intensified by an immersion via suitable

⁸⁵ Like sine, cosine, or a superposition of sine and cosine functions or exponential functions, and so forth.

⁸⁶ In a strict mathematical sense.

⁸⁷ Phase space is an abstract space with the variables of the dynamical systems as coordinates. Characteristics of dynamical systems are reflected accordingly in phase space. The systems trajectory resides in phase space.

interface technologies. It is possible to zoom into the dynamical system until being attached to the momentary system's state. As the state moves through phase space along the trajectory in the course of time the spectator gets a feeling like on a very complex meandering roller coaster. As an homage to Otto Rössler, I called this setting an endochaos, because in this interpretation endophysics is definitely meaningful. In this way, I got more and more familiar with the complex dynamics, and in a few cases I gained insight even in an explicable way⁸⁸.

Here I want to refer again to orthopraxy, which reminds me to the oftentimes observed lifelong devotion of artists to details, occasionally even in a rather obsessive way. Orthopraxy is understood as a detail-oriented practice that even inspects the spillover of traditional goal-oriented (following *orthos logos* and *ortho doxa*) research practice. A further noticeable performative practice is sonification. It is amazing that chaos research pioneer Rössler himself for the first time transposed a chaotic dynamic into sound published 1976 in a documentary film⁸⁹. There is not the slightest doubt that a deep understanding resulted from such an acoustic display, although it is partially impossible to translate the results in facts and figures necessary for a publication in a standard scientific journal. To have a chance to participate in this understanding, the complete interactive installation together with the sonification should be experienced as a media work of art in a museum, for example.

What does this have to do with cybernetics? Of course nothing. It has to do with a paradigm shift as it emanated around the turn of the 19th to 20th century from existentialistic influenced scientists that eventually gathered within a new discipline called systems theory. I am still conform with Pickering's deliberations to call it an antidiscipline. Systems theory, however, has from the beginning been susceptible to be misinterpreted in all kind of directions and, therefore, subject to be twisted in its meaning right around. It is my conviction – and I hope to have supplied evidence – that this “change of heart” has been amplified by cybernetic thinking. In a narratively formulated introduction to media theory, Nils Rölller metaphorically compared the cybernetic idea with the story of Moby Dick⁹⁰. Captain Ahab, the cybernetician, who believed to have everything under control and thought to be better endowed than non-cyberneticians to chase truth – the White Whale – based on the advantage of cybernetics eventually perished with Moby Dick. It may well be that the above comparison with Marxism is stretched too far. However, the “philosophical engineering” has so striking similarity with the demand to better change the world than to interpret it, that it appears mandatory to check systems theory and even more cybernetics whether it has itself laid the trap of the endless dialectical loop of enlightenment. Merleau-Ponty struggled with the tension between phenomenology and Marxism. As he pointed out several times, existence is accompanied by an intrinsic ambiguity.

⁸⁸ Diebner (2006), pp. 26-29.

⁸⁹ Confer Rössler (1997), where he once more reported in a fascinating way his sonification.

⁹⁰ Rölller (2005).

Maturana is a supreme example of a scientist who performs a balancing act along a thin line between an existential (performative) and an epistemic (semiotic) domain. However, his approach seems to lack operational applicability. It remains in a qualitative domain. I notice similarity with performative science, a kind of suspension between the poles. Performativity should not be seen as opposed to semioticity or to an operational instruction, but rather as vital component that emerges when the libretto or the operational instruction is performed. To support understanding (beyond the libretto/laws of nature), performativity should be amplified rather than suppressed.

My vision behind performative science is to re-strengthen the cross domain aspect laid out in early systems theory without the futile attempt to let one domain dominate over the other or even to completely project one domain into the other as is the case in “third culture.” The tendency of Taylorisation of social phenomena, i.e. the projection of the socio-cultural domain into the scientific domain, has been enhanced by cybernetics, which is the crucial difference between systems theory and cybernetics. Systems theory, however, missed to clearly show an accessible path. Performative science is a human centred approach that takes the ambiguity of Dasein as expressed by Merleau-Ponty serious and tries to work out a sound basis for performative practices to deal with this ambiguity. In Heidegger’s words: “There is no bridge here – only the leap.”⁹¹ A critical study of Pickering’s work is invaluable in this context, if *critical* is emphasised.

The emergence of “the real” starts with thethetic function of pure experience (Nishida) or, likewise, through the active dimension of perception (Merleau-Ponty) or, likewise, through an *Ereignis* (enowning) (Heidegger) out from a oneness, which leaves us with the well known inconsistencies or intrinsic ambiguity that we try to come to grips with through grinding and tedious dialectics. Dualism is of course the harshest way to deal with reality through the object-subject split. The later Hegel started to ignore the real and the constructivist branch of systems theory, especially cybernetics, completely got rid with the real at all.

Now we use concepts like systems to construct something that can be, according to pure convention and habituation, called reality⁹², but which in fact is a noosphere or a logosphere. The loop has been operationally closed and systems are now absurdly conceived to bring forth enowning, that is how I interpret Pickering’s “ontological theatre”, when being seen as characteristic of an epistemic thing by itself. Likewise, artistic practice is conceived as ontological theatre by him. Here I completely agree, as long as there is talk of an irreducible performing artist and/or a spectator. This is the very beginning where I proceeded from. However, when nowadays even an artist (in his self-conception) and, of course, cybernetician at the same time (in his self-conception), like Paul Brown tries to build a drawbot⁹³ who’s “work

⁹¹ Heidegger (1968), p. 8.

⁹² In the German speaking area Wirklichkeit is used to refer to a contingent construction instead of Realität, which is declared to a meaningless metaphysical notion by the constructivists.

⁹³ Brown et al. (2007).

of art” contains no longer any trace to the work of art of the creator of the drawbot but is judged as autonomous by experts, then we either deal with a constructivist (purely idealistic) cybernetic act, or with a deconstructivist act upon cybernetics. Either way is no more and no less than the next level dialectic endless loop, a superordinate supra theory, which Jahrhaus convincingly made evident to already exist as media theory.⁹⁴ What remains from ontological theatre is an everyday experience of the dramatic genre of farce or burlesque that we increasingly observe. Art forgottenness results.

Since almost everything can now be declared as art, and, since an ethic-free space is conceded to art, therefore, everything gets the label “veritable”, we have, as a system-compatible consequence, to abandon ethics at all. The general argument goes like this: The best decision (including ethics) is based on the best available evidence. The best available evidence is supplied by cybernetics. Thus, cybernetics is of highest moral integrity. Heidegger proved to be right, at least in his judgement concerning cybernetics and the instrumentalised arts. The constructivist paradigm not only explains why art and science closed ranks but it also explains why a scientist – and, as a matter of fact, also artists – definitely should care about Merleau-Ponty’s judgement and Cézanne’s vision. Actually, the revival of this vision is more important than ever because sense of sensation has been pushed back in favour of “sense-less” judgement. Performative science has an normative impetus, too. It sounds like an antinomy to what I have said respecting systems sciences. Perhaps it is. However, the intention is to claim for modesty in this context. Neither systems theory/cybernetics nor performative science constitute a moral imperative. That is all I have to say.

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⁹⁴ Jahrhaus (2001).

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HENRI POINCARÉ UND DER CHAOTISCHE WIRBELSTURM DER ERKENNTNIS: ZUR PERFORMANZ MATHEMATISCHEN DENKENS

NINA SAMUEL*

ABSTRACT. Henri Poincaré and the Chaotic Whirlwind of Knowledge: on Performance of Mathematical Thinking. The importance of visualizations for mathematical and physical research in nonlinear dynamics that became known in the 1980ies under the buzzword of ‘chaos theory’ can hardly be doubted. This paper, however, focuses on the role of imagery in the work one of the uncontested founders of this field in the 19th century: Henri Poincaré. Grappling with the complex interdependency of drawings, mental imagery and verbal metaphors, it argues that the caveats against images as well as the concurrent search for ‘missing’ images are crucial moments to approach and understand both Poincaré’s usage of imagery and their meaning for his own thinking and the invention of basic concepts in nonlinear science, i.e. the homoclinic point. Poincaré’s philosophical writings contain elements of a pictorial epistemology that are discussed with regard to his last unpublished paper. The essay concludes that nonlinear science already had been an ‘image science’ long before the age of digital computers.

Keywords: *Kunst und Wissenschaft, Chaos, Chaotische Dynamik, Bilderserie, Leerstelle, Zeichnung, Mathematik, Geometrie, Henri Poincaré, Etienne-Jules Marey, visuelles Denken, Bildwissenschaft, Erkenntnistheorie*

Das Zögern vor dem Bild als Urszene der Bildgeschichte des Chaos

Zwei schneckenförmige Gebilde präsentieren sich dem Betrachter (Abb. 1), bei denen nicht auf den ersten Blick einsichtig ist, worum es sich handelt.¹ Sie unterscheiden sich durch die mit den Buchstaben AA_1 sowie BB_1 gekennzeichneten Abschnitte, die auf jeweils verschiedene Weise zueinander in Beziehung stehen. Vier Hypothesen begleiten die Zeichnungen in einer Veröffentlichung des französischen Mathematikers, Physikers und Philosophen Henri Poincaré von 1890. Entweder solle die Konstruktion derart angeordnet sein, dass die vier Seiten des Vierecks AA_1BB_1 außer den Ecken keine Punkte gemeinsam haben, sich also nicht kreuzen. Dies zeige

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¹ Dies spricht ein übergreifendes Thema bei mathematischen Bildern an: außerhalb des Fachdiskurses erschließen sie sich mangels intersubjektiver Qualitäten in der Regel nicht.

die linke Abbildung. Rechts daneben ist die Variante zu sehen, in der es zu einer Überschneidung der Teilstücke AB und A_1B_1 in Punkt D komme. Diese beiden Möglichkeiten und eine dritte schließt der Text unter Angabe verschiedener mathematischer Begründungen aus und folgert, dass die einzig korrekte Lösung eine Kreuzung der Kurvenstücke AA_1 und BB_1 beinhalten müsse.² Gerade diese, als einzig mögliche Variante ausgewiesene Hypothese wurde jedoch nicht als Zeichnung realisiert.

Bei den beiden Zeichnungen handelt es sich um die ersten beiden Abbildungen aus Poincarés Schrift *Sur le problème des trois corps et les équations de la dynamique*.³ Poincaré hatte zwei Jahre zuvor mit dem Versuch begonnen, die von dem schwedischen Mathematiker Gösta Mittag-Leffler gestellte Frage zum n -Körper-Problem der Himmelsmechanik zu beantworten. Behandelt wurde die Stabilität des Sonnensystems: wie verhalten sich die Bahnen dreier Körper unter ihrem gravitativen Einfluss zueinander? Während die durch Differentialgleichungen beschriebenen Bahnen von Erde und Sonne bereits von Isaac Newton und Leonhard Euler gelöst worden waren, die dabei die Keplerschen Ellipsen fanden, waren Newton und zahlreiche andere aber an der Berechnung der Bahnen von drei oder mehr Körpern gescheitert. Diese auch als „Mondproblem“ bekannte Frage schrieb der schwedische König Oskar II. als mathematisches Preisrätsel anlässlich seines 60. Geburtstags aus.⁴

Poincarés Lösungsvorschlag sollte bereits mit dem Preis ausgezeichnet werden, als Teile der Jury Einwände anmeldeten. Unklar erschien ihnen die topologische Struktur bestimmter Kurvenverläufe, die in den eingangs beschriebenen Hypothesen behandelt wurden.⁵ Bestürzt von einem bald darauf von ihm selber eingestandenen Denkfehler erklärte sich Poincaré einverstanden, den Preis aberkennen zu lassen, erhielt dann aber von Mittag-Leffler die Möglichkeit zugesichert, seine Lösung innerhalb von zwei Monaten zu überarbeiten. Poincaré nutzte diese Chance und begann unter Hochdruck zu arbeiten. In dieser kurzen Zeit lieferte er die erste mathematische Beschreibung chaotischer Bewegungen in dynamischen Systemen, die er als „doppelt asymptotische Lösungen“ bezeichnete.⁶

² Poincaré 1890, 86–88. Vgl. Poincaré 1952, 329. Auch in der vierten Hypothese kreuzen sich die Kurven nicht selbst. Vgl. Barrow-Green 1997, 90–91.

³ Abb. in: Poincaré 1890, 86. Die Bilder befinden sich im Kapitel zu den invarianten Integralen.

⁴ Einschlägig zu Poincaré und der Geschichte des Dreikörperproblems siehe Barrow-Green 1997, zu den historischen Hintergründen v.a. 14-28, zum Wettbewerb v.a. 49-70. Die preisgekrönte Lösung sollte in den angesehenen *Acta Mathematica* veröffentlicht werden, die Mittag-Leffler mit herausgab.

⁵ „In essence, he failed to take proper account of the exact geometric nature of a particular curve, and it was in correcting this mistake that he was forced to make dramatic changes in the geometric description of his later results“, Barrow-Green 1997, 83.

⁶ „Doppelt-asymptotische Lösungen“ werden heute „homo- und heterokline Orbits“ genannt (Holmes 2007, 4). Zur Entdeckung des Fehlers durch Edvard Phragmén vgl. Barrow-Green 1997, 67-70, zu den mathematischen Hintergründen des Fehlers in seinem Kapitel zu invarianten Integralen, ebd. 83-91, zu den „doppelt asymptotischen Bahnen“, ebd. 118. Vgl. Poincaré in der Einleitung seines publizierten Lösungsvorschlags, wo er u.a. auf seinen Fehler und die doppelten Asymptoten eingeht: Poincaré 1952, 236f.

Die Mathematikhistorikerin June Barrow-Green rekonstruierte über hundert Jahre später die bei Poincaré in seinem ersten Manuskript ausgesparte Zeichnung (Abb. 2).⁷ Sein Fehler, diesen Kurvenverlauf nicht einkalkuliert zu haben, so folgerte sie, mag ihm aufgrund der damals existenten theoretischen Vorannahmen unterlaufen sein, die den von ihm zuerst gewählten Lösungsweg präfigurierten.⁸ Mag die hier dargestellte geschwungene Verflechtung im oberen Teil des Kreises auf den ersten Blick vielleicht schlicht und harmlos wirken, so barg das Ersinnen dieser Form den erkenntnistheoretischen Sprengstoff, der im Folgenden ein Auslöser für seine Entdeckungen werden sollte.

Neben dem bereits bekannten periodischen und asymptotischen Verhalten charakterisierte Poincaré mit dem Begriff der doppelten Asymptote eben jenen Kreuzungsverlauf zweier invarianter Kurven, die nicht geschlossen sind, sich aber doch auf komplexe Weise unendlich oft schneiden: „[L]es courbes en trait plain, intersections des surfaces asymptotiques avec $y_1 = 0$, sont-elles aussi des courbes fermées? [...] Je vais montrer sur un exemple simple qu'il n'en est pas ainsi.“⁹ In der Endfassung seines preisgekrönten Texts von 1890 räumte Poincaré seinem unerwarteten Ergebnis überraschenderweise keine gesonderte Bedeutung ein – mehr noch, er erwähnte das neu entdeckte, komplizierte Verhalten in geradezu auffälliger Beiläufigkeit.¹⁰ Im Gegensatz dazu schien in einem Brief an Mittag-Leffler hingegen auf, wie tiefgreifend verstört ihn seine eigene Entdeckung zurückgelassen haben muss: “But the consequence of this error are more serious than I first thought. [...] What is true is that if both sides of this surface are considered [...] they intersect along an infinite number of asymptotic trajectories (and moreover that their distance becomes infinitely small). [...] I will not conceal from you the distress this discovery has caused me.”¹¹

Dass Poincaré die Tragweite seines Ergebnisses erspürt haben muss, wird aber nicht nur in dem Kontrast seiner Behandlung des Phänomens zwischen dem publizierten Text und dem persönlichen Schreiben an Mittag-Leffler erkennbar, sondern gerade durch das fehlende Bild: Es ist die visuelle Leerstelle, in der sich seine Betroffenheit Raum verschaffte. Als habe er dies selber durch die dem Text beigelegten Zeichnungen in subtiler Weise offenbaren wollen, zeichnete er auch in dem fundamental neuen, nach der Korrektur eingefügten Kapitel seines Artikels, in dem er die besagte doppelt asymptotische Lösung einführte, nur das grundlegende Strukturproblem, die globale Anordnung der beiden eng nebeneinander verlaufenden Bahnen, nicht jedoch die verschlungene, lokale Art und Weise der Verflechtung zwischen A und A' und B und B' (Abb. 3).¹² Zugespitzt gesagt, verbarg sich in der gepunkteten Linie zwischen A' und B' eine Art bildnerische Lücke des Entsetzens:

⁷ Barrow-Green 1997, 91.

⁸ Ebd.

⁹ Poincaré 1952, 438.

¹⁰ Barrow-Green 1997, 122.

¹¹ Poincaré am 01.12.1889 in einem Brief an Mittag-Leffler, nach Ebd., 119.

¹² Abb. in Poincaré 1890, 220. Sowie auch in: Barrow-Green 1997, 115.

Poincaré zeichnete zwei Mannigfaltigkeiten, die eine chaotische Bewegung des Systems letztlich eher errahnen lassen, als dass sie ihren genauen Verlauf festschreiben.¹³ Aber obwohl das Bild an den entscheidenden Stellen keine sich überschneidenden Kurven zeigt, so impliziert es doch die Existenz solcher Kurven: Poincaré hat hier im Bild bereits etwas errahnt, was er analytisch noch gar nicht korrekt nachgewiesen hatte.¹⁴ Das Bild hat hier also zunächst eine der Erkenntnis vorgängige Funktion.

Diese implizite Erkenntnis führt Poincaré schließlich am Ende des dritten und letzten Bandes seines zwischen 1892 und 1899 verfassten Hauptwerks *Les Méthodes Nouvelles de la Mécanique Céleste* weiter aus.¹⁵ Die in Abb. 3 bereits zu errahnde Struktur nennt er hier erstmals einen homoklinen Punkt.¹⁶ Muss die zum Punkt gehörige Bewegung zwar nicht komplex sein, so tritt durch die Existenz eines solchen Punktes aber eine höchst komplexe dynamische Gesamtstruktur in Erscheinung, die durch eine Bewegungsfolge aus wiederholtem Dehnen und Zusammenfallen gekennzeichnet ist. Von Poincaré selbst sind keine Zeichnungen bekannt, die einen solchen Punkt in seiner ganzen dynamischen Konsequenz explizieren.¹⁷ Dies zeigt ein Spannungsverhältnis, in dem das Bild eine zweifache Position innehat: Bilder können an verschiedenen Stellen des Erkenntnisprozesses auftauchen; sie können beim Denken sowohl eine vor- als auch eine nachgängige Funktion einnehmen. Hätte Poincaré den homoklinen Punkt tatsächlich zeichnen wollen, so hätte er eine gedankliche und darstellerische Herausforderung annehmen müssen: wie nämlich setzt man Kurven¹⁸ ins Bild, die sich zwischen den Punkten A und A' unendlich oft schneiden, während die Flächenstücke, die ihre Bögen einschließen, dabei trotzdem den immer gleichen Flächeninhalt aufweisen. Die Frage lautete: Wie also bildet man das Unendliche auf dem Endlichen ab?¹⁹ Dies ist eine der Grundproblematiken aller Bilder, die im Zusammenhang mit dem Chaos stehen.

¹³ Philip Holmes, Korrespondenz, 23.11.2009: "This figure, while not actually showing intersecting curves, implies the existence of intersections corresponding to homoclinic points."

¹⁴ Zu der besonderen Form „impliziten Wissens“ (Michel Polanyi) in der Zeichnung, hier anhand eines Beispiels aus dem Bereich der Zoologie aufgezeigt: Wittmann 2008.

¹⁵ Im dritten Band von „*Les Méthodes Nouvelles de la Mécanique Céleste*“ (1899) finden sich recht viele Zeichnungen solcher Kurven, also von invarianten Integralen, abgedruckt in: Poincaré 1993, 3:882–885.

¹⁶ Barrow-Green 1997, 118, 161f. Das Wort „homoklin“ verwendet Poincaré erstmals 1899, vgl. Poincaré 1987, 3:384.

¹⁷ Diese tauchen erst bei Melnikov 1963 und dann bei Smale 1967 auf (vgl. Melnikov 1963; Smale 1967).

¹⁸ Zum Gebrauch der Begriffe: Mannigfaltigkeit, Kurve und Linie sind mathematische Objekte, mit Bahn, Trajektorie und Orbit sind Bewegungen von Teilchen bzw. Punkten im Phasenraum gemeint. Letztere sind zunächst jedes für sich kontinuierliche eindimensionale Gebilde. Die Begriffe Bahn, Trajektorie und Orbit werden in dieser Arbeit als Synonyma gebraucht, ebenso wie Kurve und Linie.

¹⁹ Poincaré hätte unendlich viele gleich große Teilstücke in einer endlichen Gesamtfläche unterbringen müssen. Natürlich lässt sich das Unendliche an sich niemals zeichnen. Nachdem der Punkt mit Stephen Smale aber etwa ab 1960/61 zu einem bewiesenen mathematischen Konzept geworden war, wurde es plötzlich problemlos möglich, ihn auch auf diese schematisierte und „endliche“ Weise ins Bild zu setzen (vgl. Smale 1967).

Bildgeschichtlich war die Entdeckung dieses Punktes der Moment, in dem Poincaré die Darstellungsmittel erneut zu versagen schienen.²⁰ Im dritten Band seiner Schrift schilderte er das erstaunte Zurückweichen seines eigenen Auges vor seiner Entdeckung:

„Wenn man versucht, die Figur darzustellen, die durch diese beiden Kurven und deren unendlich vielen Schnittpunkte, die jeweils einer doppelt asymptotischen Lösung entsprechen, gebildet wird, so formen diese Schnittpunkte eine Art Gitterwerk, ein Gewebe, ein Netz mit unendlich dichten Maschen; keine dieser Kurven schneidet sich selbst, sondern muss sich auf eine sehr komplexe Weise auf sich selbst zusammenfalten, um unendlich oft alle Maschen dieses Netzes zu schneiden. Von der Komplexität dieser Figur, die ich nicht einmal zu zeichnen versuche, muss man bestürzt sein. Nichts erscheint besser geeignet, uns eine Vorstellung von der Komplexität des Dreikörperproblems zu geben [...]“²¹

Poincarés Formulierung könnte auf den ersten Blick als ein ikonoklastisches Moment bezeichnet werden, das den Beginn der Bildgeschichte des Chaos markiert – das erstaunte Aussetzen des Zeichenstifts, oder zumindest sein kurzzeitiges Innehalten. Seine Schilderung ist aber insofern aufschlussreich und geht darüber hinaus, als sie neben dem Zögern vor der Zeichnung auch eine Begeisterung für die entdeckte Form erkennen lässt. Erst beschreibt er die in Frage stehende Struktur auf eine derartig plastische und ausführliche Weise („so formen diese Schnittpunkte eine Art Gitterwerk, ein Gewebe, ein Netz mit unendlich dichten Maschen“), dass der Leser eigentlich schon ein Bild vor Augen hat und kündigt sogar an, man sei von ihr auch sehr erstaunt – dann schwenkt er aber plötzlich um und hebt hervor, dass er genau deswegen eine Darstellung gar nicht erst wagen würde („die ich nicht einmal zu zeichnen versuche“). Es bleibt der Spekulation überlassen, ob eine solche Formulierung nicht sogar mit Sicherheit darauf schließen lässt, dass Poincaré im Vorfeld versucht haben muss, eine Zeichnung anzufertigen. Vielleicht hatte er bereits eine Zeichnung angefertigt, war jedoch unzufrieden und zögerte deswegen nun, sie abzubilden?

Es gibt Indizien, die für diese These sprechen. Sein ausführlich thematisiertes Zweifeln vor der Darstellbarkeit ist insbesondere bemerkenswert, da von anderen seiner Forschungsinteressen durchaus umfangreiche Skizzen erhalten sind. Aus der Zeit seiner Ausbildung an der *École Polytechnique* und der Bergbauhochschule *École des Mines* dokumentieren von Zeichnungen überbordende Notizhefte seine ingenieurwissenschaftlichen Studien von Maschinen und Generatoren, sowie geologische Karten und Querschnitte.²² Auch wenn in diesen Skizzen keine über-

²⁰ Das Zögern vor dem Bild auf der Suche nach dem homoklinen Punkt findet somit in mindestens zwei Etappen statt, deren erste das Fehlen der entscheidenden Zeichnung im Jahr 1890 war, als Poincaré die komplizierte Struktur des Punktes jedoch bereits erahnte.

²¹ Poincaré 1987, 3:389. Übersetzung und Hervorhebung v. d. Verf.

²² Roy 1954. Er fertigte die Skizzen aus der Zeit der *École des Mines* anlässlich einer Forschungsreise von 1878 nach Österreich-Ungarn und Skandinavien an. Skizzen aus seiner Studienzeit der *École Polytechnique* sind abgedruckt in Miller 1984, 238. Zu Poincarés Bilderdenken auf der Basis dieser Notizbücher steht eine monographische Untersuchung noch aus.

mäßige zeichnerische Begabung erkennbar ist, zeigen sie eine selbstbewusste und durchaus geübte Strichführung, mit der Poincaré die Beschaffenheit der Gesteine in eine Kombination aus Schraffur und Zickzacklinien übersetzte. Während es zu weit gehen würde, in der skizzierten Morphologie seiner Steine bereits eben die Hybridform aus Gewebe und Netz zu sehen, die er etwa ein Jahrzehnt später als Grundform des Chaos beschreiben sollte, macht sein zeichnerisches Werk im Gebiet der Naturwissenschaften das Fehlen seines mathematischen Bildes umso eindrücklicher.

Sein Bericht fördert damit einen inneren Widerspruch zu Tage: In der einerseits getroffenen Entscheidung, etwas nicht zu zeichnen und dem Umstand, das Undarstellbare aber trotzdem ausführlich zu beschreiben – sowie die Unmöglichkeit der Darstellung an sich noch hervorzuheben – werden zwei widerstrebende Kräfte sichtbar, oder, so könnte man auch sagen, eine „Zone der Unbestimmtheit zwischen Ja und Nein“ tritt zu Tage.²³ Es wird ein Moment der Reflexion und des Zweifels freigelegt, der als ambivalente Haltung dem Bild gegenüber zwischen Scheu und Drang oszilliert.

Vielleicht mag Poincarés Zaudern, seine entscheidende mathematische Zeichnung zu veröffentlichen, auch mit der von ihm bereits erspürten, tief greifenden Konsequenz seiner Entdeckung für die Berechenbarkeit des Weltenlaufs erklärlich sein, die er etwas später in seinem 1908 veröffentlichten Werk *Science et Méthode* in dem Kapitel zum Zufall präzise formulierte:

„Eine sehr kleine Ursache, die für uns unbemerkt bleibt, bewirkt einen beträchtlichen Effekt, den wir unbedingt bemerken müssen, und dann sagen wir, dass dieser Effekt vom Zufall abhängt. Würden wir die Gesetze der Natur und den Zustand des Universums für einen gewissen Zeitpunkt genau kennen, so könnten wir den Zustand dieses Universums für irgendeinen späteren Zeitpunkt genau voraussagen. Aber selbst wenn die Naturgesetze für uns kein Geheimnis mehr enthielten, können wir doch den Anfangszustand immer nur näherungsweise kennen. [...] [E]s kann der Fall eintreten, dass kleine Unterschiede in den Anfangsbedingungen große Unterschiede in den späteren Erscheinungen bedingen; ein kleiner Irrtum in den ersten kann einen außerordentlich großen Irrtum für die letzteren nach sich ziehen.“²⁴

Das Zitat wurde berühmt weil Poincaré damit – und lange vor der Prägung des Begriffes des deterministischen Chaos – eine seiner bekanntesten Eigenschaften erfasst hatte: ihre sensible Abhängigkeit von den Ausgangsbedingungen. Die Beziehung von Ursache und Wirkung wurde zwar nicht obsolet, aber in neuer Weise auf den

²³ Das Zaudern „[unterbricht] Handlungsketten und wirkt als Zäsur, es potenzialisiert die Aktion, führt in eine Zone der Unbestimmtheit zwischen Ja und Nein, exponiert eine unauflöbliche problematische Struktur und eröffnet eine Zwischen-Zeit, in der sich die Kontingenz des Geschehens artikuliert“, Vogl 2008, 57.

²⁴ Poincaré 2003, 53. Im französischen Original wird die Auffälligkeit der durch die kleine Wirkung ausgelösten großen Effekte durch die Verwendung der doppelten Verneinung noch zusätzlich betont: „un effet considérable que nous ne pouvons pas ne pas voir“ („Nicht-Sehen ist nicht möglich“), vgl. Poincaré 1999b, 62.

Prüfstand gestellt: es war vielmehr von einer ‚schwachen Kausalität‘ auszugehen.²⁵ Vorhersagbarkeit dynamischer Vorgänge war in der Theorie idealisierter Modelle damit noch immer möglich, nur machte die Komplexität der Welt selber einen Strich durch die Rechnung, da sie sich unter Berücksichtigung aller wirkenden Kräfte nicht auf endliche Nachkommastellen reduzieren ließ.

In der Geschichte von Poincarés Entdeckung macht sich in exemplarischer Weise der grundlegende Konflikt des Sehens bemerkbar, der sich am Ende des 19. Jahrhunderts in den mathematisch operierenden Wissenschaften herausbildet. Das Sehen in der Mathematik zeigt sich hier als mindestens dreigeteiltes Phänomen: einmal kann es sich als Zeichnung auf dem Papier (hier: in einer Publikation) manifestieren, weiterhin als innere Vergegenwärtigung von Form, im Sinne einer erschauten Form, drittens – und im engen Zusammenhang damit – aber auch als Sprachbild.²⁶ Das Bildliche tritt dabei als etwas in Erscheinung, das die intuitive Erkenntnis mathematischer Theorien fördert, sowie es in gleichem Maße die Mühsal aufzeigt, ein bereits gefundenes Vorstellungsbild tatsächlich aufs Papier zu bringen. Sich etwas vorstellen zu können, es innerlich zu sehen bzw. es sprachlich erfasst zu haben, befindet sich demzufolge in einem Widerstreit mit dem Vollzug der Darstellung. Derartige Paradoxien belegen, in welch spannungsvoller Verflechtung sich Abstraktion und Anschauung in diesem Gebiet befinden.²⁷ Eine Grundverfasstheit wissenschaftlicher Bildproduktion kündigt sich an, die Peter Galison einmal in aller Kürze auf den Punkt gebracht hat: „We must have images, we cannot have images.“²⁸ Dies war am Ende

²⁵ Dies hat auch philosophische Reflexionen über das Verhältnis von Chaos und Ordnung befördert, vgl. Kanitschneider 1994. Historisch hat Pierre-Simon Laplace das Prinzip der „gleichen“ Kausalität zuerst namentlich genannt. Das würde der ominösen Bezeichnung „schwache Kausalität“ entsprechen. Im Laufe der Physikgeschichte wandelte sich dieses Prinzip stillschweigend in das Prinzip der „ähnlichen“ Kausalität, was also der starken Kausalität entspräche. Erst Poincaré kehrte wieder zu dem historisch früheren Prinzip der gleichen Kausalität zurück, vgl. Argyris, Faust, und Haase 1995, 15–24. Allerdings hatte auch der schottische Physiker James Clerk Maxwell bereits 1873 eine ähnliche Feststellung bezüglich kleiner Ursachen und großer Wirkungen getätigt (Ekeland 1988, 67). Direkt im Anschluss an das oben stehende Zitat erwähnte Poincaré das Beispiel der Meteorologie und nahm damit geradezu visionär die erst um 1960 von Edward Lorenz experimentell gewonnene Entdeckung voraus, die dieser dann 1972 prominent formulierte, vgl. Lorenz 1972, in: Lorenz 1995, 181–184.

²⁶ In der dichten und poetischen Schilderung der Beschaffenheit eines homoklinen Punkts taucht neben der Frage nach einer zeichnerischen Darstellung auch die sprachlich-metaphorische und damit mentale Imaginationskraft als Quelle für mathematisches Denken auf. Diese Trias wäre durch die Möglichkeiten dreidimensionaler mathematischer Modelle zu ergänzen, die im Falle von Poincarés Entdeckung des homoklinen Punkts jedoch unerwähnt bleiben.

²⁷ Abstraktion steht für die Seite des Konzepts, der Theorie, des Begriffs; Anschauung für die Seite des Bildlichen, das sich aber in vielfältiger Ausprägung zeigen kann und nicht unbedingt immer ein Bild auf dem Papier sein muss. Ohne semiotisch zu argumentieren, favorisiert dieser Artikel einen Bildbegriff, wie ihn der Philosoph John Michael Krois, basierend auf einer Lektüre von Charles Peirce, formulierte: „Alles Sinnliche ist ikonisch. [...] Bilder müssen nicht einmal sichtbar sein!“, Krois 2006, 179. Dies geht von der Annahme aus, dass ein solcher Bildbegriff gerade für die Mathematik fruchtbar ist, in der Vorstellungsbilder eine besondere Rolle spielen. Auch blinde Mathematiker können geometrisch denken und sogar perspektivisch zeichnen, vgl. Ebd., 185.

²⁸ Galison 2002, 300.

des 19. Jahrhunderts nicht nur in der mathematischen Physik der Fall. Etwa zeitgleich manifestierte sich auch in ganz elementaren Bereichen der Mathematik und der Geometrie ein Zwiespalt zwischen mathematischen Begriffen und Bildlichkeit.²⁹

Besser sehen: Vom Gedankenexperiment zur Bilderserie

“I see a confused mass.”

Jacques Hadamard

Zur Erklärung seiner mathematischen Arbeitsweise erläutert der Mathematiker Jacques Hadamard, wie sich vor seinem inneren Auge parallel zu den in Formeln vollzogenen Schritten geistige Bilder einstellen würden. Bei dem von ihm geführten Beweis, dass es Primzahlen gäbe, die größer als 11 sind, lautete sein erster Schritt beispielsweise: “I consider all primes from 2 to 11, say 2, 3, 5, 7, 11.” Für die Tätigkeit seines Denkens sei dies gleichbedeutend mit: “I see a confused mass.”³⁰ Beim letzten Schritt, der abschließenden Lösung, stände ihm dann vor Augen: “I see a place somewhere between the confused mass and the first point.”³¹ Die mentalen Zwischenschritte – also der Weg von der erscheinenden „konfusen Masse“ bis zum Punkt vor dieser Masse – seien als dynamisch sich entwickelnde Bildfolgen vorzustellen, als Bewegtbilder. Explizit weist Hadamard darauf hin, dass sowohl Sprache als auch Algebra seinem mathematischen Nachdenken mehr als fern lägen, und dies vor allem sobald es kompliziert werde. Dann nämlich leite ihn nur das Bildliche zur Lösung: “I insist that words are totally absent from my mind when I really think and [...] it is also essential to emphasize that I behave in this way not only about words but even about algebraic signs. I use them when dealing with easy calculations; but whenever the matter looks more difficult, they become too heavy a baggage for me. I use concrete representations, but of a quite different nature [...] spots of an undefined form, no precise shape being necessary for me to think of spots lying inside or outside each other.”³² In der Formulierung von „undefinierten Flecken“ einer sprachlich nicht genauer fassbaren Form enthüllt sich die höhere Mathematik für ihn als ein Gedankenexperiment mit Bildern. Die Bildwelt, von der hier die Rede ist, scheint jedoch intersubjektiv nur schwer zu vermitteln.

Hadamards Selbstzeugnis der Rolle einer bildlich vonstatten gehenden inneren Vergegenwärtigung während des mathematischen Denkens ist an sich schon bemerkenswert genug.³³ Darüber hinaus stellt er aber auch eine der Grundsatzfragen:

²⁹ Cf. Volkert 1986; Volkert 1987; Mehrtens 1990; Heintz 1993; Samuel 2007, 300-305.

³⁰ Hadamard 1954, 76f.

³¹ Ebd.

³² Ebd., 75f. Er vergleicht dies ebd. mit einer Gedankentechnik von Leonhard Euler, der sich allgemeine Ideen als Kreise vorgestellt hätte.

³³ Eine monographische Untersuchung des vielschichtigen metaphorischen Gebrauchs des Terms „Bild“ im Werk Hadamards ist ein Desiderat der Forschung. An dieser Stelle sollen seine Zeugnisse zunächst den Anlass bilden, auf die analytische Funktion bildlicher Vorstellungskraft für das mathematische Denken hinzuweisen.

Welche Rolle spielen diese in Worten kaum präzise zu fassenden, vagen inneren Bilder für den Erkenntnisprozess, die vollbrachte Beweisführung? In seinen Worten als offene Frage vorgetragen: “What may be the use of such a strange and cloudy imagery?”³⁴

Mathematisches Denken wurde häufig im Zusammenhang mit Entwicklungen ausgeprägt, die im Bildlichen gegründet waren. Es gibt Darstellungs- und Bildtechniken, die es leiten und der von Hadamard angesprochenen intersubjektiven Vagheit eine Richtung geben können. Die Einführung der Koordinatengeometrie durch Pierre de Fermat und René Descartes im 17. Jahrhundert war beispielsweise eine solche grundlegende Erfindung.³⁵ Die von ihnen erdachte Methode der Versinnlichung von Gleichungen „[öffnete] die Tür für neue Bilder der Mathematik“.³⁶ Es muss demnach keineswegs die Einführung eines neuen technischen Instruments sein, um eine neue Art mathematischer Bildlichkeit ins Leben zu rufen. Gleichsam bedeutet der alleinige Umstand, ein neues mathematisches Denkbild zu entwerfen, aber auch nicht das Ende eines Zweifels vor dem Bild: Abstraktion und Anschauung können weiterhin in einem Spannungsverhältnis stehen; und vielmehr noch, ein Verlust dieser Spannung mag dem mathematischen Denken sogar hinderlich sein. Descartes' eigene Ambivalenz dem Bildlichen gegenüber scheint darüber Aufschluss zu geben. Die Mathematiker Borwein und Jorgensen bezeichneten seine Erfindung als Möglichkeit mathematisch besser zu sehen: “to see better mathematically”.³⁷ Trotzdem, so berichtete Hadamard, nahm er eine zwiespältige Haltung ein: Während er auf der einen Seite die Kraft der Imagination betonte und selbst nutzte, misstraute er ihr zugleich und strebte mit seinen Bemühungen der Algebraisierung der Geometrie eine ‚umfassende Eliminierung der Anschauung‘ aus der Wissenschaft an.³⁸ Die Pendelbewegung aus Scheu und Drang angesichts des Potentials der Sinnlichkeit scheint nicht in eine Phase des Stillstands übergehen zu dürfen. In diesem Sinne könnte man die Reibungsflächen zwischen Bild und Begriff auch zu einem Motor des mathematischen Denkens bestimmen.

Wie bereits beschrieben, kannte auch Henri Poincaré die Anstrengung, mathematische Vorstellungen in Darstellungen zu überführen. Trotzdem ist gerade ihm ein „besseres Sehen“ im Bereich der Theorie dynamischer Systeme maßgeblich zu verdanken: Er entwickelte grundlegende Neuerungen für ihre Betrachtungsweise, die bis in die Ära der computergraphischen Sichtbarmachungen dynamischer Gleichungen relevant blieben.

Doch zurück zur Urszene von Poincarés Zögern vor dem Bild. Fest steht bereits, dass das Bildliche für ihn eine besondere Rolle gespielt haben muss. Denn wäre die Frage nach der zeichnerischen Darstellbarkeit unbedeutend gewesen, hätte

³⁴ Hadamard 1954, 77.

³⁵ Zu Descartes vgl. Krämer 1989. Pierre de Fermat und René Descartes entwickelten die Koordinatengeometrie unabhängig voneinander, vgl. Rottmann 2007, 290–294.

³⁶ Ebd.

³⁷ Borwein und Jorgenson 2001, 897.

³⁸ Hadamard 1954, 87. Vgl. Descartes 1969.

Poincaré ihre Unmöglichkeit nicht so pointiert artikuliert und ausführlich geschildert. Es drängt sich daher die Frage auf, warum das Bildliche überhaupt zur Debatte stand und auf welche Weise es dem mathematischen Sehen erschlossen wurde.

Als Poincaré am 16. Januar 1903 eingeladen worden war, am Ende einer präsidentialen Amtsperiode vor dem Nobelpreiskomitee der *Société française de physique* eine Festansprache zu halten, berichtete er der gespannten Zuhörerschaft als Abschluss und Höhepunkt seiner Rede von der umfassenden Bedeutung, die das Studium der Physik inzwischen in vielerlei Disziplinen eingenommen hätte: Physiologie, Optik, Stereoskopie, Medizin und Chemie, in all diesen Wissenschaften spielten neueste physikalische Kenntnisse und Ergebnisse eine zentrale Rolle.³⁹ Ein vorzügliches Beispiel für die Bedeutung der Physik seien die jüngsten fotografischen Experimente des Physiologen Etienne-Jules Marey, die dieser zwischen 1899 und 1901 von Luftströmungen und Rauchschwaden vorgenommen hatte.⁴⁰ Warum nahm Poincaré auf das bildnerische Werk des Physiologen Bezug und räumte ihm eine herausgehobene Stellung ein, indem er ihn sogar namentlich erwähnte?

Es ist davon auszugehen, dass Poincaré und Marey sich kannten. Sie waren nicht nur Zeitgenossen, sondern auch an benachbarten Pariser Institutionen tätig. Während Poincaré als Ordinarius für theoretische Physik an der Sorbonne über die mathematische Berechenbarkeit der sich im luftleeren Raum bewegenden Planeten nachsann – oder über ihre Undarstellbarkeit – richtete der am Collège de France tätige, vierundzwanzig Jahre ältere und bereits arrivierte Marey seinen Blick auf Flugkörper, die ihre Bahnen deutlich näher am menschlichen Betrachterstandpunkt ziehen: Vögel. Mit dem Ziel, den „ungeklärten Mechanismus des Fliegens“⁴¹ zu enträtseln, begann er zu Beginn der achtziger Jahre des 19. Jahrhunderts, fotografische serielle Aufnahmen dieser sich durch lebendige Eigendynamik im Raum der Erdatmosphäre bewegenden Flugkörper anzufertigen (Abb. 4).⁴²

Mit Hilfe besonders empfindlicher Fotomaterialien und schneller Kamera-verschlüsse gelang es ihm, auf ein und derselben Fotoplatte eine Reihe nacheinander abfolgender Bewegungszustände eines Tieres zu fixieren, die er 1887 in *Le mécanisme des vols des oiseaux éclairé par la chronophotographie* publizierte. Bei dieser von ihm als „Erziehung des Auges“⁴³ bezeichneten Methode der Serienfotografie wurde eine sichtbare und allgemein vertraute Erscheinung der Natur in eine nun befremdlich

³⁹ Poincaré 2007, 403.

⁴⁰ Zu Mareys Luftbildern vgl. Didi-Huberman und Mannoni 2004. Es ist darüber hinaus naheliegend, dass Poincaré auch die Versuche ballistischer Momentfotografie kannte, die etwa zeitgleich mit Marey von dem Physiker Ernst Mach durchgeführt wurden, vgl. Hoffmann 2002. Zu Mareys Entwicklung einer graphischen Methode in Physiologie und Medizin vgl. Marey 1878; für einen umfassenden Überblick über sein Werk siehe Braun 1992.

⁴¹ Marey 1887, 2. Übersetzung v. d. Verf.

⁴² Zur Entwicklung der Chronofotografie bei Marey vgl. Mannoni 2002, 264–268; Zglinicki 1979b; Zglinicki 1979a.

⁴³ Marey in *Le Mouvement*, zit. n. Geimer 2010, 268f.

wirkende Repräsentationsform überführt, „um dem Auge damit die eigenartigen Zustände einzeln zu offenbaren, die es sonst nicht erfassen könne und die aus künstlerischen Darstellungen von Vögeln nicht bekannt seien“.⁴⁴ In den Worten des Kunsthistorikers Peter Geimer war das Ziel dieser erzieherischen Maßnahme des Sehsinns die „Gewöhnung an das Unwahrscheinliche“.⁴⁵ Es gab zu dieser Zeit offenkundig das disziplinenübergreifende Bestreben, Bewegung von Körpern im Raum in neuen Bildformen zu erfassen.⁴⁶ Das Auge musste sich dabei nicht nur auf ein neues Sehen einstellen, sondern die gewonnenen Erkenntnisse sollten ebenfalls mit den Mitteln des mathematischen Kalküls untersucht werden.⁴⁷

Als Poincaré in seiner Festansprache auf Marey Bezug nahm, kam er nur auf die Diffusion physikalischen Wissens in die Physiologie zu sprechen. Unerwähnt blieb dabei eine mögliche Rückkopplung physiologischer Experimentallogik in seine eigene Wissenschaft. Doch worin sollten diese möglicherweise bestehen? Angesichts der Unterschiedlichkeit ihrer Gegenstände und Disziplinen ist es nicht verwunderlich, dass auf den ersten Blick nur Differenzen zwischen der Vorgehensweise des Physiologen und des Physikers ins Auge fallen. Handelt es sich doch auf der einen Seite um die Fotografie eines generell sichtbaren Phänomens und auf der anderen um grundsätzlich unsichtbare, abstrakt-mathematische und idealisierte Gedankenexperimente, die überhaupt erst in eine Form der Anschaulichkeit überführt werden mussten. Dass Poincaré und Marey trotz aller Unterschiede mehr als eine reine Zeitgenossenschaft verbindet, liegt in der Art und Weise begründet, in der Poincaré die Untersuchungsmethode dynamischer Systeme grundlegend neu dachte.

Poincarés Schnitte: Von der Bewegung zum Bild

Es ist in diesem Zusammenhang bedeutsam, das hier wirksame Verhältnis von Bewegung und Bild zu klären. Bewegung (Dynamik) und ein Bild davon (Figur) sind zunächst etwas sehr Verschiedenes. Dies wird beispielsweise an dem Vergleich der realen Bewegung eines Planeten und deren Darstellung als Ellipse deutlich. Indem man ein Repräsentationsverhältnis unterstellt, setzt man die beiden zuerst in ein Bezugssystem. Dass dieser Bezug nicht über Ähnlichkeit hergestellt werden muss, hatte schon Leibniz postuliert.⁴⁸ Repräsentationen bezeichnen jede Art von Stellvertreterfunktionen: Sie vergegenwärtigen eine Sache oder einen Sachverhalt

⁴⁴ Marey 1887, 4f.

⁴⁵ Geimer 2010, 268.

⁴⁶ Mareys Bildlogik war Bestandteil eines größeren kulturellen Netzes und steht in einem medienhistorischen Zusammenhang mit der Frühzeit der Entwicklung des Films und Techniken wie der Stroboskopie. Einen Überblick über fotografische Experimente zur Erfassung von Bewegung bietet die Sammlung Werner Nekes, siehe Dewitz und Nekes 2002.

⁴⁷ Auch Marey stellte in seinem Artikel zum Vogelflug physikalische Berechnungen zur Masse der Vogelkörper an, vgl. Marey 1887, 9.

⁴⁸ Vgl. Ritter 1992.

durch etwas anderes oder durch einen Teil ihrer selbst. Geht man von dieser Minimalbestimmung einer Repräsentation aus – etwas im weitesten Sinne ‚präsent zu machen‘ – wird auf der einen Seite die diffuse Offenheit des Begriffs sowie auf der anderen seine Abhängigkeit von der in jedem Fall neu zu klärenden Frage der Referenz erkennbar.⁴⁹ Handelt es sich nun um die Verknüpfung zwischen kontinuierlich bewegten Planeten und ihrer Verbildlichung, kann der Repräsentationsvorgang mit Blick auf die Geschichte der Astronomie als Aushandlungsprozess zwischen konkreten (und notwendigerweise diskreten) Beobachtungsdaten und der Konstruktion eines Modells beschrieben werden, das neben der gelungenen empirischen Verankerung auch ästhetischen Kriterien genügen musste. Dies gilt auch und gerade für kosmologische Konzepte, die unser Bild vom Universum in fundamentaler Weise geprägt haben, so wie die Gesetze Johannes Keplers, von denen das erste besagt, dass die Planeten sich nicht in Kreisen, sondern in elliptischen Bahnen um die Sonne bewegen. Seine Entscheidung für die Ellipse statt des Kreises als Generator der Gestirnsbewegungen war keineswegs nur vom Zusammenspiel aus Empirie und Kalkül beeinflusst, sondern auch von ästhetischen Vorannahmen und Präferenzen.⁵⁰ Keplers Schaffen war aber auch schon in der Zeit vor der Entdeckung seiner Gesetze ein herausragendes Beispiel für die Beeinflussung des ‚Wahren‘ durch das ‚Schöne‘: in seinem 1596 veröffentlichten *Mysterium Cosmographicum* zeigte er sich geradezu besessen von der Idee, dass die damals bekannten fünf Planeten nach den Gesetzmäßigkeiten der fünf vollkommen symmetrischen („platonischen“) Körper um die Sonne herum organisiert seien, auch wenn seine Argumentationslinie eher mystisch-ästhetisch als analytisch motiviert war.⁵¹

Während Kepler die Evidenzen des Kalküls mit den von ihm bevorzugten Geometrien in Übereinstimmung zu bringen suchte (und dies auch selbstbewusst darstellte⁵²), scheint der Fall bei Poincaré ein umgekehrter zu sein: er war im Zuge seiner Berechnungen einer Bildform auf der Spur, an die er sich sowohl sprachlich als auch zeichnerisch nur tastend heranwagte – und die darüber hinaus auch ästhetisch eine Besonderheit war: Was sich in seiner Beschreibung unaufhörlich „auf sich selbst zusammenfaltete“ und damit einem „Gitterwerk, Gewebe, Netz mit unendlich dichten Maschen“⁵³ glich, hatte in der Geschichte kosmologisch bedeut-

⁴⁹ Zur Diskussion des Repräsentationsbegriffs in der Wissenschaftsgeschichte und seiner Unschärfe siehe Hagner 1997. Hagner gründet seine Kritik auf die Verwendung des Begriffs in Lynch und Woolgar 1990. Zum „Dilemma der Repräsentation“ und dem alternativen Term „Sichtbarmachung“ vgl. Rheinberger 2001, z.B. 57.

⁵⁰ Bredekamp 2001, 185. Vgl. dazu grundlegend die Ausführungen zum Wechselspiel von ästhetischer Präferenz und astronomischer Forschung bei Galileo Galilei und Johannes Kepler: Panofsky 1956.

⁵¹ Koestler 1980, 247–267. Der Untertitel des Werks heißt bezeichnenderweise „Weltgeheimnis“. Weiterführend zu Ästhetik und astronomischer Forschung im digitalen Zeitalter vgl. Lynch und Edgerton 1988.

⁵² Vgl. die Abbildung der von ihm imaginierten Sphären des Universums in Koestler 1980, 250.

⁵³ Vgl. Fn. 21.

samer Formen kaum Vorbilder.⁵⁴ Eine denkwürdige Ausnahme stellt Gottfried Wilhelm Leibniz dar, der die Falte zum Grundmodell seiner Philosophie sowie seiner Vorstellung vom Kosmos erklärt hatte,⁵⁵ doch tritt der von ihm aufgerufene Tuch- oder Stoffcharakter des Kosmos bei Poincaré zugunsten einer gitterartigen Netzstruktur eher in den Hintergrund; auch resultierte die Auseinandersetzung mit der Falte bei Leibniz nicht in einem Zurückschrecken vor dem Bild.⁵⁶

Nähert man sich dem Werk Poincarés jedoch von einer konzeptionellen Seite erneut an, weicht der zunächst durch die fehlende Abbildung ausgelöste Eindruck eines zögerlichen Umgangs mit Bildern. Sein Versuch, sich von der aus seiner Beschreibung resultierenden Komplexität der Organisation wechselseitig wirksamer Kräfte im Wortsinne ‚ein Bild zu machen‘ – und sie damit auch erneut beherrschbar zu machen – erforderte neue analytische Methoden und eine neue geometrische Betrachtungsweise, die von Poincaré angeregt wurde. Inwiefern seine homokline Faltung als morphologischer Generator für dieses Grundprinzip des Chaos bezeichnet werden kann, wird begreiflich, wenn einige Bedingungen physikalischer Repräsentation von Dynamik geklärt sind.

Kontinuierliche dynamische Systeme wie die Planetenbahnen werden durch Differentialgleichungen beschrieben, die das Änderungsverhalten von Größen zueinander erfassen. Im Gegensatz zur Geschichte des dreidimensionalen Raums, in dem die Gesetze der Gravitation wirken, handelt es sich bei dem speziellen Repräsentationsraum, in dem Poincaré die Himmelsmechanik untersuchte, um einen nichtphysikalischen, mathematischen Raum, der dem sehr nahe kam, was im 20. Jahrhundert mit dem Begriff des Phasenraums (Zustandsraums) systematisch erfasst wurde.⁵⁷ Der Phasenraum bildet in gleichem Maße die Voraussetzung, dynamische Systeme überhaupt räumlich denken zu können, sowie auch den Grund für ihre prinzipielle

⁵⁴ In Arthur Koestlers Geschichte der Astronomie finden sich beispielsweise neben den ‚vollkommenen platonischen Körpern‘ und den Ellipsen von Kepler auch die Beschreibung des Kreises als ästhetisches Paradigma (Platon), verschachtelte Sphären (Eudoxos) und Räder in Rädern (Ptolemäus), siehe Koestler 1980, 55f, 62–68, 247–253, 315–317. Angesichts Poincarés zwischen Netz- und Gewebestruktur oszillierender Beschreibung fühlt man sich spontan an die frühe Mediengeschichte des Computers erinnert („Lochkartenweberei“), siehe Schneider 2007. Als weiterer Bezugspunkt kämen die topologischen Muster von Texturen und Geweben in Frage, die am Ende des 18. Jahrhunderts entworfen wurden und ihren Ursprung in der Graphentheorie hatten, vgl. Velminski 2008, 153, sowie Abb. auf 154.

⁵⁵ Vgl. Bredekamp 2004, 14–17.

⁵⁶ Dies wird beim Blick auf sein bildnerisches Gesamtwerk deutlich, siehe Bredekamp 2004.

⁵⁷ Zur Geschichte des Konzepts des Phasenraums vgl. Findley 1927. Heutige Mathematiker betrachten Poincarés Arbeiten bereits als ein Denken im Sinne des Phasenraums, vgl. Furstenberg 1981, 211. Vgl. auch Stewart und Thompson 1986, 1. Vgl. ferner die wissenschaftshistorische Studie von David Aubin und Dahan Dalmedico: „Poincaré forged the elements of a qualitative, geometric analysis making it possible [...] to know the general look of the solutions, i.e., to know their phase portraits and state global results,“ Aubin und Dalmedico 2002, 279. Da Poincarés Arbeiten entscheidende Grundlagen für das Konzept des Phasenraums des 20. Jahrhunderts gelegt haben, soll die Historizität des Begriffes mitgedacht werden, wenn auch im Folgenden von „Phasenraum“ in Bezug auf Poincaré die Rede ist.

Unanschaulichkeit: Als Konstruktion aus der Relation von Ort und Impuls beschrieben, kann er, je nach den Freiheitsgraden des Systems (den Variablen der Differentialgleichungen) eine beliebig hohe Dimensionalität haben, die bis ins 19. Jahrhundert jedoch immer geradzahlig sein musste. Die Dimensionen sind dabei als ‚Werkzeuge‘ zu denken, um die Dynamik abzubilden; eine Reduktion der Dimensionen unter Symmetriegesichtspunkten diene der Vereinfachung der Rechnungen.⁵⁸

Die Lösung einer Differentialgleichung heißt bei einem dynamischen System Trajektorie. Man kann sie sich als Kurve vorstellen, die unter dem Einwirken der Dynamik durchlaufen wird: von einem bestimmten Zustand (Punkt im Raum) als Ausgangsbedingung des Systems ausgehend, kann ihr Verlauf präzise bestimmt werden.⁵⁹ Jeder einzelne Punkt, der Teil einer solchen Trajektorie ist, steht für einen exakten Wert und stellt somit einen exakt definierten Zustand des zu untersuchenden Systems dar. Die räumliche Anordnung der Trajektorien unterscheidet sich in Systemen, die ein chaotisches Verhalten ausprägen, grundlegend von den bisher bekannten Modellen. Hierin liegt die Erklärung für die Grundbestimmung des deterministischen Chaos, seiner sensiblen Abhängigkeit von den Ausgangsbedingungen, sowie gleichermaßen die Bedeutung von Poincarés Studie zum Dreikörperproblem. Anschaulich erklärt kann festgehalten werden: Das von ihm beschriebene homokline Maschenwerk erzeugt eine derart intrikate dynamische Struktur, dass sich die infinitesimal, also unendlich kleinen, unterschiedlichen „räumlichen Startpunkte“ der potentiellen Entwicklungsbahn eines dynamischen Systems stark einander annähern; und so führt jede noch so kleine Differenz ihrer Ausgangspunkte dazu, dass sie bereits zu einer anderen Trajektorie gehören und das System mithin einen fundamental differenten Verlauf nehmen muss. Dieses Ergebnis ‚bedrohte‘ Keplers Ellipsen: Das einfache periodische Verhalten in Gestalt seiner geschlossenen Ellipsen konnte nur noch dann auftreten, wenn kein dritter Planet in die Anordnung hinzutrat. Sobald jedoch ein ‚störender‘ dritter Planet das Kräfteverhältnis beeinflusst, sind die Bahnen nicht mehr geschlossen, sondern es gibt verschiedene Möglichkeiten für ihr Verhalten: Sie können immer noch regulär sein (quasiperiodisch), oder auch nicht – und damit das Verhalten aufweisen, das man chaotisch nennt.

Um den Verlauf der verschiedenen Bahnen, die ein dynamisches System einnehmen kann, zu klären, entwickelte Poincaré eine geometrisch gedachte Strategie zur Reduktion von Information. Der erste Schritt in diese Richtung war schon vor Poincaré bekannt und eine Methode der klassischen Mechanik: man braucht in dem mehrdimensionalen Raum dynamischer Repräsentation generell nur eine Untermenge zu betrachten. Das aber wäre immer noch jenseits der Intuition eines normalen Menschen. Um dieser entgegenzukommen, transformierte Poincaré den Phasenraum

⁵⁸ Die Geradzahligkeit ist darauf zurückzuführen, dass zunächst nur mechanische Probleme untersucht wurden, deren Zustände gleich viele Geschwindigkeits- wie Ortskomponenten besitzen.

⁵⁹ Es sind zwei unterschiedliche Möglichkeiten der Beschreibung dynamischer Systeme zu unterscheiden: Differentialgleichungen für kontinuierliche Systeme und eine diskrete (punktweise) Beschreibung durch iterierte Abbildungen, vgl. Stewart und Thompson 1993, 230. Zunächst geht es nur um kontinuierliche dynamische Systeme.

gedanklich-konzeptionell in ein bildgebendes Werkzeug, oder anders ausgedrückt: er erweiterte die Möglichkeiten des Phasenraums im Sinne eines Bildwerkzeugs. Seine weit tragende Idee war die folgende: man lege in den dynamischen Repräsentationsraum eine Schnittfläche und betrachte nur die Schnittpunkte der Bahn des Planeten mit dieser Fläche (Abb. 5). Diese Zeichnung wurde von Francis C. Moon erst etwa hundert Jahre später als erklärendes Schema von Poincarés Einfall publiziert.⁶⁰ Sie zeigt die Technik, die man später dem Erfinder zu Ehren einen „Poincaré-Schnitt“ nannte. Zu sehen sind hier die kontinuierlichen und spiralförmigen Trajektorien, die scheinbar von einer solchen zweidimensionalen Fläche durchschnitten werden. Jedes der dabei entstehenden Bilder weist ähnliche, aber doch unterschiedliche Muster auf. Hatten Poincarés Vorgänger bislang vor allem die lokalen Eigenschaften eines einzelnen Funktionspunktes im Phasenraum untersucht, so war es Poincarés Verdienst, durch diese Idee die globalen Eigenschaften der Funktion – also ihr Verhalten auf der gesamten Ebene – in den Blick zu nehmen.⁶¹ Poincaré kann damit als der erste Physiker bezeichnet werden, der dynamische Systeme von ihrer inneren Bildstruktur zu verstehen versuchte. Durch seinen Schnitt wurde aus dem mathematischen Phasenraum ein bildnerischer Raum, eine Fläche.

Poincarés Methode anhand einer Zeichnung des 20. Jahrhunderts zu erklären, ist ein bewusster Anachronismus, der auf zweierlei hinweisen soll: einmal auf die Nachhaltigkeit von Poincarés Verfahrensweise für die gesamte spätere Forschung auf dem Gebiet der dynamischen Systeme, zum anderen auf die Tatsache, dass Poincaré durch seine Idee das Zerlegen einer einzigen dynamischen Repräsentation in beliebig viele Einzelbilder bzw. Einzelsequenzen ermöglichte. Die Medientechnik, mit deren Hilfe sein Vorgehen im 20. Jahrhundert seine volle Bildmächtigkeit erhielt, hat sich in dieser Darstellung von 1980 von Francis C. Moon gleichsam mit ins Bild gesetzt: der Digitalcomputer, auf dessen Monitoren hier bereits die Einzelsequenzen abgebildet erscheinen. Die Rechtecke umschreiben gleichermaßen die Zahlenebene sowie den Ort der Repräsentation numerischer Approximation auf einem Bildschirm.⁶² Der Computer ermöglichte schließlich auch die Reanimation von Poincarés Einzelsequenzen eines dynamischen Geschehens: chaotische Dynamiken konnten durch den Computer als filmische Bewegungsfolgen sichtbar gemacht werden. An dieser Stelle des medialen Vorgriffs bietet sich paradoxerweise eine erneute Rückschau zu den Experimenten Mareys an, der seine abstrakten und befremdlich wirkenden Repräsentationen des Vogelflugs anschließend ebenfalls wieder zu einer

⁶⁰ In seinem Artikel stellte Moon der schematischen Zeichnung experimentelle Resultate von Computern gegenüber, die er als „seltsamen Attraktoren“ bezeichnet, vgl. Moon 1980, 494.

⁶¹ “Poincaré’s approach was radically different. He looked beyond the confines of a local analysis and brought a global perspective to the problem, undertaking a qualitative study of the function in the whole plane” (Barrow-Green 1997, 30). Poincaré hat den Phasenraum sozusagen qualitativ als Vektorfeld weiterentwickelt: “Poincaré wanted to study how points move about in phase space in the same way that an observer might try to describe the surface of a fluid in motion, namely by sketching lots of streamlines” (Goroff 1993, 37).

⁶² Poincarés Methode führte in Kombination mit der neuen Medientechnik der computergraphischen Visualisierungen dynamischer Gleichungen zu einer wahren Bildexplosion.

kontinuierlichen Bewegungsfolge zusammensetzen suchte. Er bediente sich dazu eines optischen Gerätes, das im 19. Jahrhundert als Wundertrommel oder Zootrop bekannt geworden war (Abb. 6). Der Betrachter blickte durch eine mit Schlitzen versehene Trommel. Wurde diese in Rotation versetzt, führte die Trägheit des Auges dazu, dass sich die im Inneren montierten einzelnen Vogelskulpturen nach Maßgabe der Drehgeschwindigkeit in die Illusion einer kontinuierlichen Bewegungsfolge verwandelten: Im Blick des Betrachters fügten sich die fragmentierten Ausschnitte erneut zusammen. Der Vorteil dieses Vorläufers der Kinematographie sei es, so notierte Marey, dass sich die zuvor sequenzierte Bewegung des Vogels nun in beliebiger Geschwindigkeit vorführen lasse und sich dadurch erfassen ließe, was auch bei der aufmerksamsten Beobachtung dem bloßen Auge niemals zugänglich sei.⁶³

In Poincarés *Science et Méthode* findet sich eine Formulierung, in der er seine Methode zu reflektieren scheint und sie gleichzeitig in einen Bezug zum Unvermögen der menschlichen Physis setzt. Der Komplexität sich wechselseitig beeinflussender Ereignisse, die man als Zufall bezeichnet, sei nur beizukommen, wenn man den Fokus der Betrachtung auf kleine Teilstücke lege: „Unsere Schwäche gestattet es uns nicht, das ganze Universum zu umfassen, und nötigt uns, es in einzelne Scheiben zu schneiden.“⁶⁴ Damit beschreibt er in vortrefflicher Weise sein geometrisches Vorgehen, das als analytische Methode Einsatz findet: Erst durch eine ‚scheibchenweise‘ vorgenommene Aufbereitung komplexer Dynamik kann dem menschlichen Fassungsvermögen nachgeholfen und eine Betrachtung überhaupt erst möglich werden.

Anhand von Zeichnungen, in denen er einzelne solcher Schnitte „durch das Universum“ zeigt, lässt sich der Abstraktionsgrad der Bilder gut nachvollziehen (Abb. 7). Sie sind zunächst aus Punkten und Linien zusammengesetzt. Während die gepunkteten und durchgezogenen Kurven und Kreise jene Stellen markieren, an denen die Trajektorie die „Bildfläche“ durchstoßen hat, verweisen „leere Stellen“ bereits auf eines der zentralen Darstellungsprobleme dynamischer Systeme: Um überhaupt ein Bild der unübersichtlichen und komplizierten Strukturen im Phasenraum zu erzeugen, ist man gezwungen, nur eine bestimmte Auswahl von Bahnen – eine ausschnittshafte Selektion – darzustellen. Dies setzt bereits eine vorgeschaltete Fragestellung – bzw. einen Fokus – dessen voraus, was man überhaupt in dem Bild sehen möchte. Diese Voreingenommenheit in Bezug auf das, was man sehen möchte, fand zur Zeit Poincarés in der Wahl der zu untersuchenden Formeln seinen Ausdruck, so wie es im 20. Jahrhundert zusätzlich und maßgeblich von der direkten Interaktion

⁶³ „...et se rendre compte en un instant de ce que l’observation la plus attentive du vol des oiseaux ne permettrait pas de saisir,” Marey 1887, 7f.

⁶⁴ Poincaré 1999b, 68. Übersetzung v. d. Verf., da die deutsche Übersetzung hier ungenau ist, da sie „découper en tranches“ mit „in Abschnitte zerlegen“ wiedergibt, vgl. Poincaré 2003, 59. Poincaré beschreibt in der vorangehenden Passage die Sukzession von Zufallsereignissen, die sich auf fatale Weise kreuzen: Ein Mann geht eine Straße entlang und wird von einem zufällig herabfallenden Dachziegel erschlagen: „Von den Wirkungen dieser wechselseitigen Beeinflussung sagen wir dann, sie seien dem Zufall zuzuschreiben“ (Ebd.).

mit dem Bild bestimmt wurde, dessen Entstehung nun auf dem Monitor beobachtet werden konnte.⁶⁵ Da jede Stelle im Bild prinzipiell als Anfangspunkt einer Trajektorie gesehen werden kann, würde sich das Bild ohne diese notwendige Selektion in eine gänzlich schwarze Fläche verwandeln.

Dass Poincaré auch insgesamt ein entschieden bildlich und geometrisch orientierter Denker war, hatten schon die Schriften bewiesen, die er vor seiner Beschäftigung mit dem Dreikörperproblem angefertigt hatte: Zwischen 1881 und 1886 entwickelte er seine „qualitative Methode“, mit der man Funktionen hinsichtlich ihrer Ausgangssituation, also des Startpunkts ihrer Bewegung, untersuchen konnte.⁶⁶ Poincarés Methode wurde in den Folgejahren derart einflussreich unter seinen Zeitgenossen, dass es bald als gleichbedeutend angesehen wurde, eine Trajektorie in einem Phasenraum darzustellen oder eine Differentialgleichung zu lösen: „Trajektorie“ und „Lösung“ wurden zu austauschbaren Begriffen.⁶⁷ Diese Idee wurde zu einer bedeutsamen Grundlage für die anschließende Erfindung der algebraischen Topologie und zu einer weiteren theoretischen Grundlage der Erforschung komplexer Systeme.⁶⁸ Die Essenz seiner neuen qualitativen Methode spitzte er gut zwanzig Jahre später in einer berühmt gewordenen Rede über die *Zukunft der Mathematik* auf dem Mathematikerkongress in Rom zu: „Was wir aber immer leisten können, oder vielmehr: zu leisten versuchen müssen, das ist sozusagen die *qualitative* Lösung des Problems, d.h. die Bestimmung der Kurve, welche die gesuchte Funktion darstellt, in ihrer allgemeinen Gestalt [frz.: *la forme générale*].“⁶⁹ Poincarés gesamte Vorgehensweise kann als Entscheidung für das Bild beschrieben werden: Er dachte in Kurven und weniger in Formeln.⁷⁰ Zugespitzt gesagt, seine qualitative Denkweise war eine neue Bildtechnik und von der Suche nach einer „allgemeinen Form“

⁶⁵ Dies bedeutet aber nicht, dass die Untersuchung dynamischer Systeme mit dem Computer willkürlich wäre. Hier scheint die Natur des Systems die Wahl des Bildausschnitts maßgeblich zu bestimmen, die darüber entscheidet, was zu den wesentlichen Bildelementen bestimmt wird.

⁶⁶ Der erste Teil von dreien: Poincaré 1881. Zur Poincarés Entwicklung der qualitativen Methode siehe Gilain 1991; Barrow-Green 1997, 29–41; Hirsch 1984, 17–23; Goroff 1993, 35–40. Die Geometrisierung des Phasenraums begann jedoch schon vor der Entdeckung chaotischer Phänomene. So fand die Idee, Bewegung geometrisch zu untersuchen schon in der Klassischen Mechanik Anwendung. Kepler benutzte dafür beispielsweise die Abhandlungen über Kegelschnitte von Apollinius' von Perga, vgl. Ekeland 1988, 108.

⁶⁷ Goroff 1993, 37.

⁶⁸ Ab 1892 publizierte Poincaré im Gebiet der *Analysis situs* und begründete die algebraische Topologie (Gilain 1991, 236). Vgl. auch Scholz 1980.

⁶⁹ Poincaré 2003, 30. Kursiv im Original. Vgl. das französische Original: „[C]’est de résoudre le problème qualitativement pour ainsi dire, c’est-à-dire de chercher à connaître la forme générale de la courbe qui représente la fonction inconnue.“ Poincaré 1909, 173.

⁷⁰ „Ces théorèmes ont été présentés sous une forme géométrique qui avait à mes yeux l’avantage de mieux faire comprendre la gènese de mes idées ...“, Poincaré 1889, zit.n. Barrow-Green 1997, 83, Fn.166. Vgl. Ebd., 30: “thinking of the solutions in terms of curves rather than functions, and it was this that marked a departure from the work of his predecessors [...]”. Ebenso Goroff 1993, 9. Goroff weist diese Entwicklung auch unter Berücksichtigung von Poincarés Wahl von Artikelüberschriften nach. Vgl. ebenso Ekeland 1988, 34–48, v.a. 35.

getrieben.⁷¹ Die Mathematik des Chaos war damit schon vor Benoît Mandelbrot eine Bildwissenschaft.

Ohne Kenntnisse der Darstellungskonventionen der Physik lassen sich die „allgemeinen Formen“ in Poincarés Bildern jedoch nicht entziffern. Es sind Spezialkenntnisse und Erfahrung erforderlich, um die Bilder lesen zu können. Seine Bilder dienen insofern auch einer „Erziehung des Auges“⁷² im Sinne Mareys, da ein Erlernen der Lesbarkeit solcher abstrakter und für den ungeschulten Blick befremdlicher „Schnitte durch das Universum“ hier die notwendige Voraussetzung wird, um eine „Schwäche des Menschen“ zu überwinden. Sowohl Marey als auch Poincaré fertigten in einem weiteren Sinne Bewegungsstudien an, deren visuelles Ergebnis präzisen Voreinstellungen unterworfen war, auch wenn der ‚Schauplatz‘ des Geschehens einmal innerhalb eines Phasenraums, das andere Mal in der Luft der Erdatmosphäre zu verorten war: auf der einen Seite musste Poincaré seine mathematischen Parameter so günstig wie möglich wählen, um die gesuchten Schnittpunkte der Trajektorien zum Vorschein zu bringen, auf der anderen Seite musste Marey Einstellungen wie Fokusebene und Belichtungszeit geschickt einsetzen, um die Bahn der Vögel in Szene zu setzen. Beide applizierten eine sequentielle Bildlogik auf ein jeweils unterschiedliches dynamisches Geschehen und verfolgten dabei das Ziel der Erfassbarkeit für ein unbewaffnetes Auge und die intuitive Seite des Erkennens. Skalpell und Mikroskop waren für Poincaré bevorzugte Vergleichsinstrumente, um das Vorgehen der mathematischen Logik zu charakterisieren: die Stärke der Analysis als Werkzeug, wie sie in ihrer griechischen Etymologie festgeschrieben sei, trage die Bedeutung von Zerteilung oder Auflösung.⁷³ Mit seiner Idee, ‚Bildschnitte‘ in den Phasenraum zu legen, machte er das Prinzip einer Zergliederung nun der Intuition zugänglich, die dadurch ihrerseits zum Mittel der Analyse werden konnte: Mit dem Poincaré-Schnitt als Skalpell seziierte er Bewegung gleichsam chirurgisch und gemäß seiner Erfahrungswerte mit den Mitteln einer bildnerisch geprägten Denkweise.

Für dieses Erkennen war die Verfremdung des Darstellungsgegenstands eine notwendige Bedingung. In der Sphäre des Fotografischen prägte Walter Benjamin für diesen Effekt den Ausdruck des „Optisch-Unbewussten“: „Es ist ja eine andere Natur, welche zur Kamera als welche zum Auge spricht; anders vor allem so, dass an die Stelle eines vom Menschen mit Bewusstsein durchwirkten Raums ein unbewußt durchwirkter tritt. [...] Die Photographie mit ihren Hilfsmitteln: Zeitlupen, Vergrößerungen erschließt sie ihm.“⁷⁴ Im Reich der Physik wurden Poincarés Schnitte

⁷¹ Das bildnerische Denken und die Leistung der Sinne in Poincarés Werk stark zu machen, soll nicht implizieren, dass er die Logik nicht anerkannte. Er sieht sie als gleichberechtigte Methode der Erkenntnis. Ob ein Mathematiker eher der Intuition oder der Logik zuneigte, war Poincaré zufolge eine angeborene Qualität, vgl. Poincaré 1999a, 27–29.

⁷² Marey in *Le Mouvement*, zit. n. Geimer 2010, 268f.

⁷³ „En Mathématiques, la logique s’appelle *Analyse* et analyse veut dire *division, dissection*. Elle ne peut donc avoir d’autre outil que le scalpel et le microscope,” Poincaré 1999a, 37. „Mathematische Logik“ bezieht sich auf Poincarés Verständnis einer Logik mathematischer Praxis.

⁷⁴ Benjamin 1977, 371. Zur Analyse des „Optisch-Unbewussten“ in der Fotografie siehe Geimer 2010, 301–351.

zu Mikroskopien der Zeit, die einen gänzlich neuen Blick auf Naturphänomene und die Frage ihrer Berechenbarkeit erlaubten. Formen der Zeit wurden zu Anordnungen und Neuordnungen im Raum. Etwas Unsichtbares wurde sichtbar gemacht, auch wenn sich der Abstraktionsgrad in hohem Maße unterscheidet. Denn natürlich ist die Bewegung von Planeten der menschlichen Beobachtung auf ganz andere Weise entzogen als ein Vogelflug. Einmal entsteht daraus eine Verfremdung von etwas eigentlich Bekanntem, das andere Mal eine Veranschaulichung von etwas fundamental Unanschaulichem – einem mathematischen Gedankenmodell.

Der Vergleich zwischen Marey und Poincaré soll daher nicht überstrapaziert oder zu weit getrieben werden. Physik ist nicht Kino ist nicht Physik. So unterschiedlich ihre Untersuchungsgegenstände und ihre ‚Aufzeichnungsmethoden‘ waren, so ähnlich ist der Grundgedanke: Trotzdem war in Poincarés gedanklichem Modell, seiner neuen Imaginationstechnik für ein ‚besseres mathematisches Sehen‘, ein solches kinematographisches oder sequentielles Bilddenken – die Logik eines solchen ‚Bewegungsformenkinos‘ – angelegt. Dass dabei von Poincaré selbst nach heutigem Kenntnisstand keine schematischen Überblicksdarstellungen solcher Schnitte durch das dynamische Geschehen überliefert sind, will nicht heißen, dass es sie gar nicht gegeben hätte.⁷⁵ Auch seine Publikationstätigkeit muss vor dem Hintergrund der – auch schon vor den formalistischen Bourbakisten in abgemilderter Form herrschenden – französischen Tradition gesehen werden, die Dinge eher in Formeln und Worten auszudrücken.⁷⁶ Um es mit den Worten des Physikers Peter Richter zu sagen, der im 20. Jahrhundert maßgeblich an der Popularisierung der Bilder des Chaos beteiligt war: „Seine Texte machen deutlich genug, dass er ganz sicher viele Skizzen an Tafel oder auf Schmierpapier erstellt und damit versucht hat, sich Sachverhalte klarzumachen. Ich bin überzeugt, dass man solche Bilder in Poincarés Papierkorb finden würde.“⁷⁷

Ein Blick in Poincarés Papierkorb: Von der Bilderserie zur Erkenntnis

*“Now there are not only successes but also failures,
and the reason for failures would be at least as important to know.”⁷⁸*

Jacques Hadamard

Hätte die Faltung des homoklinen Punktes Poincarés Augensinn nicht derart in Aufruhr versetzt und wäre ihm die Zeichnung seiner Ansicht nach gelungen, ist anzunehmen, dass er sie, ebenso wie die ersten beiden Kurven (Abb. 1) in seinem

⁷⁵ Auch unter den Zeichnungen in Descartes’ *Géométrie* ist kein kartesisches Koordinatensystem zu finden, wie man es sich heute vorstellt, vgl. dazu Rottmann 2007, 293. Trotzdem entwickelte er, in vergleichbarer Weise wie Poincaré, das entscheidende Dispositiv, das spätere Bilder ermöglichte. Zudem weist dieser Umstand auf die grundlegende Schwierigkeit der Untersuchung von Bildern aus diesem Bereich hin, die meist nur als „Endprodukte“ in einer publizierten Form zugänglich sind.

⁷⁶ Zum Programm der bilderfeindlichen Bourbakisten vgl. Dieudonné 1972, 8; Bourbaki 1974.

⁷⁷ Peter Richter, Korrespondenz vom 26.09.2010.

⁷⁸ Hadamard 1954, 10.

Artikel *Sur le problème des trois corps* veröffentlicht hätte. Es handelte sich bei den Darstellungen vom Beginn also um ein wissenschaftliches Bildgenre, das für die Augen einer Fachöffentlichkeit bestimmt war. Was für Bilder aber hätte man in seinem Papierkorb gefunden?

Die Abb. 8 ist eine historische Ausnahme und gibt eine mögliche Antwort darauf. Die Bilder sind während seiner mathematischen Arbeit entstanden. In einer Abfolge von vierzehn Skizzen, die Poincaré in zwei Spalten auf ein Blatt setzte, versuchte er, eine topologische Fragestellung, einen Sonderfall des Dreikörperproblems, zu lösen.⁷⁹ In einer Anordnung aus Wiederholung und Variation erprobte er auf der Seite zeichnerisch vierzehn verschiedene Anordnungen von Schlaufen, Wellenformen, Geraden und Kurven, sowie ihre Kombinationsmöglichkeiten und Durchdringungen. Das Blatt ist dem Bereich der Produktion von Mathematik zuzuordnen und dokumentiert Prozesse des Nachdenkens, die der Lösung eines Problems vorangehen können. In diesem Fall hat Poincaré die Lösung jedoch niemals finden können.⁸⁰

Als *Letztes Geometrisches Theorem* bekannt geworden, sollte es aufgrund seines frühen Todes im Jahr 1912 das letzte mathematische Problem sein, dem er sich widmen konnte; er hinterließ es als unvollständiges Manuskript und graphisches Testament. Kurz vor seinem Lebensende wandte er sich in einem Brief an Giovanni Battista Guccia, einen Verleger mathematischer Periodika, und notierte in missmutiger Tonlage zu dem Blatt: „Was mich beschämt, ist der Umstand, dass ich gezwungen bin, derart viele Figuren einzusetzen [...]“⁸¹ Es ist also offenbar die Vielzahl der Zeichnungen, die ihn unbefriedigt zurückließen und zum Hadern brachten. Es stellt sich damit die Frage, ob hier an seinem Lebensende erneut der Zwiespalt aus Scheu und Drang vor dem Bild aufscheint – das Zögern also, etwas darzustellen, was der Kopf zwar längst durchdacht hatte, die Hand aber nicht in Einklang mit den Gedanken bringen konnte.

Um sich dieser Frage anzunähern, lohnt es, Poincarés Abhandlung über mathematische Entdeckungen in Augenschein zu nehmen. Dort schildert er, mit welcher plötzlichen Kraft sich die Erkenntnis in Form eines Einsichtssprunges vollziehen könne. Er beschreibt dies eindrücklich anhand seiner eigenen Erinnerungen an Entdeckungen im Zusammenhang mit den automorphen Funktionen: „[D]ie Gedanken überstürzten sich förmlich; ich fühlte ordentlich, wie sie sich stießen und

⁷⁹ „Sur un théorème de Géométrie“, 1911/1912, vgl. Goroff 1993, 84–87. Es handelt sich um das sog. „restricted three body problem“.

⁸⁰ George David Birkhoff hat das Theorem ein Jahr später bewiesen, vgl. Birkhoff 1913, 18. Zu Birkhoffs Weiterführung der Gedanken Poincarés vgl. Barrow-Green 1997, 209–218. Birkhoff machte sich v.a. um die Untersuchung von Poincarés „homoclinic tangle“ verdient und 1927 bewies er die Existenz von unendlich vielen periodischen Orbits, zusätzlich zur Existenz der unendlich vielen homoklinen Punkte (Diacu und Holmes 1996, 54). Poincarés *Les Méthodes nouvelles* und Birkhoffs *Dynamical Systems* gelten als die zwei Gründungsschriften der modernen Theorie Dynamischer Systeme (Goroff 1993, 88).

⁸¹ Poincaré in einem Brief vom 9. Dezember 1911 an den Verleger mathematischer Schriften Giovanni Battista Guccia, zit. n. Ebd., 86. Übersetzung v. d. Verf. Guccia publizierte 1912 schließlich eine Fassung des Manuskripts, in dem vierundzwanzig gezeichnete Sonderfälle zu finden sind. Poincarés einleitende Worte künden erneut von seiner tiefen Unzufriedenheit: „Niemand zuvor habe ich ein derart unvollendetes Werk der Öffentlichkeit präsentiert“, Poincaré 1912, 375. Übersetzung v. d. Verf.

drängten, bis sich endlich zwei von ihnen aneinander klammerten und eine feste Kombination bildeten. [... Und] als ich den Fuß auf das Trittbrett setzte, kam mir, ohne dass meine Gedanken irgendwie darauf vorbereitet waren, die Idee [...]. Damals konnte ich das nicht verifizieren [...], und doch hatte ich die volle Gewissheit von der Richtigkeit meiner Idee.“⁸² Die Erkenntnis brach demnach über ihn herein, nachdem sich die Gedanken zuvor in einer Situation des Aufruhrs befunden und miteinander gerungen hatten, einer Karambolage gleich, bis sie sich förmlich ineinander verzahnten. Der letzte Satz seines Buches *Der Wert der Wissenschaft* erinnert an diese Entdeckungsszenerie: „Der Gedanke ist nur ein Blitz inmitten einer langen Nacht. Aber dieser Blitz ist alles.“⁸³ Die Plötzlichkeit, mit der die entscheidende Idee schließlich zur Gewissheit wurde, setzte mit der Heftigkeit einer Urgewalt ein.

Von Interesse ist nun aber weniger Poincarés Fortschreibung einer Geschichte des kreativen Denkens in Form genialischer Geistesblitze, als es die verschiedenen Phasen der Erkenntnis sind, die er feststellt.⁸⁴ Die hier beschriebene „plötzliche Erleuchtung“ („illumination subite“)⁸⁵ könnte sich nämlich nur einstellen, so betont Poincaré, wenn vorher eine wichtige Bedingung erfüllt worden sei: „Wenn man an einer schwierigen Frage arbeitet, so kommt man oft bei Beginn der Arbeit nicht recht vorwärts; dann gönnt man sich eine kürzere oder längere Ruhepause und setzt sich darauf wieder an seinen Arbeitstisch.“⁸⁶ Die Ruhe allein genügt aber noch nicht, denn insgesamt müsse der Geist mindestens drei Phasen durchlaufen haben: erst eine bewusste des Nachdenkens, gefolgt von der absolut notwendigen Pause, in der nur noch das Unbewusste arbeitet, dann wieder eine anschließende Denkphase.⁸⁷

Die Abfolge dieser Phasen ist deswegen dringend erforderlich, da das Entscheidende des Erkenntnisprozesses mitnichten in der Situation einer klaren, bewussten Reflexion passiere, sondern vielmehr während der Phase der unbewussten geistigen Tätigkeit, der Pause also, deren Verfasstheit er folgendermaßen beschreibt: „Wie kommt es, dass unter den tausend Produkten unserer unbewussten Tätigkeit einige dazu berufen sind, die Schwelle zu überschreiten, während andere draußen bleiben müssen? [...D]ie bevorzugten unbewussten Erscheinungen, welche befähigt sind, ins

⁸² Poincaré 2003, 41–44, hier: 42. Es ging bei seiner Entdeckung um die Fuchschen Funktionen, cf. Fricke und Klein 1897, 1.

⁸³ Im frz. Original mit noch stärkerer Emphase: „Mais c’est cet éclair qui est tout“, Poincaré 1999a, 187. Vgl. die weiterführenden Ausführungen zum „Blitz“ in Mehrtens 1990, 233–236.

⁸⁴ Die plötzliche Erkenntnis als Geistesblitz scheint ein geläufiger Topos der Mathematik zu sein. Auch Felix Klein wiederholt diese Art der Entdeckungsgeschichte in seiner eigenen Erzählung zum Grenzkreistheorem: in einer stürmischen Nacht „stand plötzlich um 2 ½ Uhr das Grenzkreistheorem [...] vor mir“ (nach Gerbracht 2010, 101.). Vgl. Gauss: „By the grace of God. Like a sudden flash of lightning...“; sowie Helmholtz, der die plötzlichen Einsichtssprünge „happy ideas“ nannte, nach Hadamard 1954, 34. Man könnte vermutlich eine Kulturgeschichte der mathematischen Geistesblitze schreiben. Plötzlichkeit als Zeitmodus ästhetischer Phänomene und Wahrnehmungsgewissheit wird aus einer literaturwissenschaftlichen Perspektive diskutiert in Bohrer 1981.

⁸⁵ Poincaré 2003, 43; Poincaré 1999b, 50.

⁸⁶ Poincaré 2003, 43f.

⁸⁷ Hadamard setzt diese Ruhepause der zweiten Stufe von Wallas’ fünfstufigem Modell kreativen Denkens gleich: der Inkubationsphase (Hadamard 1954, 16; preparation, incubation, intimation, illumination, verification, nach: Wallas 1926).

Bewusstsein zu treten, sind diejenigen, welche unsere Sensibilität direkt oder indirekt am tiefsten beeinflussen. Mit Verwunderung wird man [dies] bemerken [...]. Aber man wird es verstehen, wenn man sich das Gefühl für die mathematische Schönheit vergegenwärtigt, das Gefühl für die Harmonie der Zahlen und Formen, für die geometrische Eleganz. Das ist ein wahrhaft ästhetisches Gefühl, welches allen wirklichen Mathematikern bekannt ist; dabei ist in der Tat Sensibilität im Spiele.⁸⁸

Der Filter, der bestimme, was nach der unbewussten Phase wieder ins Bewusstsein gelange, sei demnach ein ästhetisch gesteuertes Vermögen, und die Auswahl relevanter Gedanken erfolgt nach Kriterien von Harmonie und Proportion. Dass Mathematiker aus ihrer Arbeit eine ästhetische Befriedigung gewinnen und ihre Produkte nach Kriterien der Schönheit bewerten, ist eine häufig formulierte Idee, die die Mathematik historisch immer wieder in die Nähe der Kunst gerückt hat.⁸⁹ Poincaré gibt dieser Idee jedoch eine ganz eigene Prägung, die in seiner detaillierten Charakterisierung der verschiedenen Phasen der Erkenntnis zu sehen ist.

Poincaré zufolge müsse man sich diese drei Phasen der Erkenntnis als drei unterschiedliche Zustandsformen der von Epikur beschriebenen „hakenförmigen Atome“ vorstellen.⁹⁰ Ruht der Verstand, befinden sich die Atome ebenfalls im völligen Stillstand, so als seien sie unbeweglich an einer Wand aufgehängt. Fängt man nun an zu denken, nimmt man einige der Wandelemente herab und versucht sie neu zu ordnen – dies allerdings zumeist noch ohne Erfolg. Dann, in der Phase, in der das Unbewußte am Werk ist und der Verstand nur scheinbar ruht, passiert das Ausschlaggebende: „[D]ann lösen sich einige dieser Atome von der Wand los und setzen sich in Bewegung. Sie durchfurchen den Raum [...], in dem sie eingeschlossen sind, nach allen Richtungen hin, etwa wie ein Schwarm von Mücken oder, wenn man einen gelehrteren Vergleich vorzieht, wie die Gasmoleküle in der kinetischen Gastheorie. Ihre gegenseitigen Zusammenstöße können dann neue Kombinationen hervorbringen.“⁹¹ Die von der Wand gelösten Atome „durchpflügen“ nun also förmlich den Raum in alle Richtungen: Der ästhetische Sinn, der zur mathematischen Erkenntnis führt, wird bestimmt als eine kaum zu kontrollierende Dynamik der Rekombination von Elementen im Flug – vergleichbar einem Tanz von Insekten. Erkenntnis offenbart sich einem Wirbelsturm gleich. Integraler Bestandteil des Prozesses der Kreation ist dabei einerseits die freie Bewegung, andererseits die stets mitgedachte Möglichkeit der produktiven Zerstörung – wenn die Ideen nämlich im Flug miteinander kollidieren und daraus Neues entsteht.⁹² Erst nach dieser Phase des Wirbelsturms kann die Phase mathematischer Einsicht beim bewussten Denken gelingen.

⁸⁸ Poincaré 2003, 46.

⁸⁹ Eines der bekanntesten Zitate diesbezüglich stammt von Godfrey Harold Hardy: “Beauty is the first test: there is no permanent place in the world for ugly mathematics,” Hardy 1956, 2027.

⁹⁰ Poincaré 2003, 48. Zur Eidola-Theorie bei Epikur vgl. Franz 1999, 267–278.

⁹¹ Poincaré 2003, 48.

⁹² Vgl. zum Prinzip der produktiven Zerstörung auch Bredekamp 2008. Poincaré erklärte in seiner Beschreibung damit nicht nur Denkprozesse selbst auf physikalische Weise, sondern nahm außerdem in sonderbarer Manier spätere karikierende Beschreibungen chaotischer Bewegung vorweg, vgl.: „[Der Planet fährt] gleich einer wahnsinnigen Stubenfliege im Kraftfeld der beiden ‚Sonnen‘ herum.“, Richter, Dullin, und Peitgen 1994, 6.

Jacques Hadamard gründete seine Überlegungen zu einer Psychologie mathematischer Erkenntnis ebenfalls auf die Berichte Poincarés, geht jedoch nicht auf diese materialistische Prägung seiner Theorie ein.⁹³ Poincaré selbst griff auf die Parallele zu Epikur aus einem Erklärungsnotstand heraus zurück, der zugleich belegt, wie ernst ihm die Parallelisierung von mathematischer Erkenntnis und tanzenden Atomen war: Er umrahmt sein Gleichnis zwar mit der Entschuldigung, dass es etwas ungeschliffen („grossière“) sei, und trotzdem, so betont er, sei es letztlich die einzige Möglichkeit, wirklich angemessen zu beschreiben, was er auszudrücken versuche: „ich kann sonst meine Gedanken nicht gut verständlich machen.“⁹⁴

Es entzieht sich der Kenntnis der Nachwelt, wie viele wirbelsturmartige, rekombinierende Phasen Poincarés Verstand bereits über das Skizzenblatt seines *Letzten Geometrischen Theorems* (Abb. 8) hinwegwehen ließ, bekannt ist nur, dass es in diesem Fall zu keiner „plötzlichen Erleuchtung“ kam.⁹⁵ Der Grundvorgang von Entdeckung sei die Selektion,⁹⁶ so Poincaré und Hadamard einstimmig, doch genau diese scheint im Falle der auf dem Blatt befindlichen Einzelbilder nicht zu einem befriedigenden Ergebnis gekommen zu sein. Es taucht an seinem Lebensende also eine zweite und gänzlich anders motivierte Zerrissenheit dem Bild gegenüber auf als die eingangs beschriebene, die ihn von der Publikation einer Zeichnung des homoklinen Punkts abhielt. Vielmehr deutet die Bilderfülle des Blattes auf das grundlegende erkenntnistheoretische Problem: „Was mich beschämt, ist der Umstand, dass ich gezwungen bin, derart viele Figuren einzusetzen, weil ich mich nicht imstande sah, eine generelle Regel zu finden, sondern stattdessen nur einzelne Lösungen angehäuft habe.“⁹⁷ Diese speziellen Lösungsmöglichkeiten hatte Poincaré in den vierzehn Skizzen seines Manuskripts festgehalten.

Das nun vollständig wiedergegebene Zitat Poincarés enthüllt: Die Aufgabe des mathematischen Denkens wäre es demnach nicht nur gewesen, aus den Einzelbildern eins auszuwählen, sondern in ihnen das Allgemeine, die universelle Gesetzmäßigkeit zu erkennen und zu extrahieren: eine Synthese herzustellen. Erkenntnis, so könnte man ergänzen, erschöpft sich demzufolge nicht in der Selektion, sondern lässt sich als synthetisierender Vorgang bestimmen, als deren Antriebsmotor die Skizzen auszumachen sind.

Die Bedeutung dieses Befunds erschließt sich mit Hilfe einer kurzen Rückschau. Es ist nun möglich, die zu Beginn getroffene Dreiteilung der verschiedenen Ausprägungen des Sehens in der Mathematik zu erweitern: zunächst gab es die Bilder,

⁹³ Die epikureische Prägung von Poincarés Erkenntnistheorie scheint bisher nicht hinreichend gewürdigt. Hadamards unterschlägt den wirbelsturmartigen Charakter des ästhetischen Vermögens (Hadamard 1954, 29-32), obwohl er interessanterweise in einer Fußnote den Philologen Max Müller zitiert, der auf die Etymologie von „Cogito“ hinweist, was auch „to shake ideas“ bedeuten könne, Hadamard 1954, 29. Vgl. ebenso zu Poincarés drei Stufen der Erkenntnis, erneut ohne Hinweis auf Epikur: Papert 1981, v.a. 109–110.

⁹⁴ Poincaré 2003, 49; für das frz. Original siehe Poincaré 1999b, 54f.

⁹⁵ Vgl. Fn. 80.

⁹⁶ „Erfinden heißt ausscheiden, kurz gesagt: auswählen,“ Poincaré 2003, 40. Hadamard 1954 wiederholt diesen Satz auf S. 30: „Invention is discernment, choice.“

⁹⁷ Poincaré nach Goroff 1993, 86. Übersetzung v. d. Verf.

die einer Fachöffentlichkeit eine Entdeckung oder einen Beweis ‚zu sehen geben‘ sollten (Abb. 1 und 3).⁹⁸ Sie bilden einen vorläufigen Endpunkt innerhalb eines Denkprozesses, da sie für fremde Augen gleichsam autorisiert und für diesen Zweck gestaltet wurden. In dem untersuchten Fall Poincarés war jedoch vor allem das fehlende Bild das entscheidende, dessen Gestalt sich in seinem Sprachbild, in der überlieferten Beschreibung des ‚auf sich selbst zurückfaltenden Gitterwerks‘ erhielt.⁹⁹ Kaum davon zu trennen sind die inneren Vergegenwärtigungen, die intersubjektive Bildwelt, die Hadamard als das Sehen „undefinierter Flecken“ beschrieb.¹⁰⁰ Sie entziehen sich notwendigerweise einer Analyse, doch lassen sich vereinzelt Momente ausmachen, in denen Spuren dieses inneren Hantierens mit Formen sichtbar werden: dies ist die Bedeutung von Poincarés unvollendeten *Letzten Geometrischen Theorems*. Jede einzelne der Skizzen könnte in diesem Sinne als eines der „hakenförmigen Atome“¹⁰¹ des Denkens bezeichnet werden, die durch die Rekombination zahlloser Möglichkeiten während der Phase des ‚Wirbelsturms‘ entstanden und nur ins Bewusstsein dringen konnten, da sie jene „besondere ästhetische Sensibilität“¹⁰² des Mathematikers zu befriedigen wussten, von der Poincaré Zeugnis ablegte. Sie sind demnach das Ergebnis dessen, was Poincaré als Selektion bezeichnet¹⁰³, und folgen den Kriterien von Harmonie und Schönheit, die entscheiden, welche der zahllosen Möglichkeiten sich als sichtbare auf dem Blatt konkretisieren. Anhand der Manuskriptseite lässt sich daher die erste der vier in dieser Arbeit aufzuzeigenden Formen mathematischer Erkenntnis bestimmen: einzelne Skizzen nebeneinander zum vergleichenden Betrachten angeordnet, können eine analytische Funktion zur Synthese besitzen.

Wenn dieser Schritt jedoch nicht gelang, kann die Bilderreihe ebenso als materialisierter Denkkonflikt zum Symbol der Niedergeschlagenheit mutieren: Das Scheitern an seinem *Theorem* findet seinen Ausdruck gerade in der Variabilität der Serie, der Simultaneität der Zeichnungen. Die einzelnen Skizzen fungieren hier als das Exemplarische, das Partikulare, als Beispiele von etwas Übergeordnetem – einem Gesetz oder einer Regel, die noch gefunden werden muss. Die Bewegung der Linien und Schlaufen auf dem Manuskriptblatt können in diesem Sinne als die suchenden Bewegungen des mathematischen Geistes verstanden werden, der jedoch zu keiner Übereinkunft kam. Ihr Nebeneinander bedeutet keine Ruhe, sondern Rastlosigkeit – und wird mithin zum Zeichen von Ratlosigkeit. Stagniert die mathematische Reflexion in diesem Stadium der Bildsequenz, des graphischen Erprobens und Durchspielens von Einzelfallbeispielen, ist die analytische Arbeit nicht vollbracht, und es stellt sich Missmut ein. Poincarés Betrübnis rührte genau daher:

⁹⁸ Zum Begriff des „Zu-Sehen-Gebens“ vgl. Schade und Wenk 2005.

⁹⁹ Vgl. Fn. 21.

¹⁰⁰ Vgl. Fn. 32.

¹⁰¹ Vgl. Fn. 90.

¹⁰² Poincaré 2003, 47.

¹⁰³ Ebd., 40. Vgl. Fn. 96.

dass der Sprung des zwischen den einzelnen Bildern oszillierenden Geistes auf die Ebene der Generalisierung nicht gelungen war. Zwar benötigt der Verstand die Einzelbilder um den Wirbelsturm in Gang zu setzen, wenn er sich in ihnen jedoch verfängt oder sich von ihnen nicht lösen kann, kann dies für die Erkenntnis dramatische Folgen haben.

Poincarés Vermögen „ästhetischer Sensibilität“,¹⁰⁴ das in der Pflicht steht, den Sprung zur Synthese der Einzelercheinungen zu leisten, kann demnach zweifach bestimmt werden: erstens als Schönheitssinn, der als Filter im Sinne eines „äußerst feinen Siebes“¹⁰⁵ zu verstehen ist, zweitens als Interaktion des Denkens mit konkreten sinnlichen Erscheinungen, hier den Skizzen. Damit kann Poincarés Theorie mathematischer Erkenntnis als eine ästhetische Bildtheorie im doppelten Sinne bezeichnet werden.¹⁰⁶

Ein zögernder Geist ist der zu vollbringenden Syntheseleistung dabei nicht unbedingt zuträglich. Vielleicht war Poincaré bei seinem Studium der Werke Epikurs auch darauf aufmerksam geworden, dass man den antiken Begründer eines maßvollen Hedonismus auch als den „Philosophen gegen das Zaudern und Zögern“ bezeichnen könnte: „Geboren sind wir nur einmal; zweimal ist es nicht mehr möglich, geboren zu werden. [...] Das Leben geht unter Zaudern verloren, und jeder einzelne von uns stirbt in seiner Unrast.“¹⁰⁷ Im Erfolgsfall jedoch extrahiert der Schönheitssinn die mathematisch gültige Form der Erkenntnis aus den wirbelnden Einzelercheinungen.

Dass Poincarés Arbeit an der „Ordnung der Zeit“ und damit die Entstehung der modernen Physik am Beginn des 20. Jahrhunderts nur als Teil eines größeren lebensweltlichen und materiellen Zusammenhangs verstanden werden kann, hat bereits Peter Galison dargestellt.¹⁰⁸ Nun kann hinzugefügt werden, dass dabei neben mathematischen, physikalischen, technischen und philosophischen Fragestellungen auch bildtheoretische eine Rolle spielten. Die Stärkung von Sinnlichkeit und Imaginationskraft als Erkenntnismethode – oder zugespitzt gesagt: eine „Erziehung des Auges“ im Angesicht des wirbelsturmartigen Chaos – war der entscheidende Beitrag Henri Poincarés zu Beginn der Bildgeschichte der Dynamischen Systeme.¹⁰⁹

Ein mathematisches Konzept kann mit der Anschauung als materialistisch geprägte Synthese von Einzelercheinungen zusammenfinden, ausgelöst durch die Fähigkeit zur blitzartigen, ästhetisch gesteuerten Intuition. Dass den Bildern dabei eine analytische Funktion der Synthese zukommt, trifft sich mit dem Befund, dass

¹⁰⁴ Ebd., 47.

¹⁰⁵ Ebd.

¹⁰⁶ Die Formulierung „ästhetische Bildtheorie“ ist somit der Versuch, beide Aspekte der mathematischen Erkenntnisfindung bei Poincaré zu umfassen: einmal die Seite der „aisthesis“ (gr.) im Sinne einer „Wahrnehmung“ von Harmonien, die nicht auf Bilder allein bezogen sein muss (die Schönheit als Sieb), sowie zweitens die konkret sinnlichen Bilder: die Skizzen als Suche nach der allgemeingültigen Form.

¹⁰⁷ Epikur 1980, 83.

¹⁰⁸ Galison 2003.

¹⁰⁹ Dieses Ergebnis versteht sich als eine der vier Möglichkeiten, wie ein mathematisches Konzept und die Anschauung in diesem Forschungsgebiet zusammenfinden können. Für die weiteren Möglichkeiten vgl. Samuel 2011.

die Intuition für ihn eine herausgehobene Rolle spielt: „Die mathematische Wissenschaft nimmt, indem sie streng wird, den Charakter des Künstlichen an, der alle Welt befremdet; sie vergisst ihren historischen Ursprung; man sieht, wie Fragen gelöst werden können, man sieht aber nicht mehr, wie und warum sie gestellt wurden. Das beweist uns, dass die Logik nicht genügt, dass die demonstrative Wissenschaft nicht die ganze Wissenschaft ist, und dass die Intuition ihre Rolle als Ergänzung, ich möchte sagen als Gegengewicht oder als Gegengift, beibehalten muss.“¹¹⁰ Die mathematische *inventio* kann somit zum Prozess der Anschauung bestimmt werden.¹¹¹ Poincaré spricht der Logik darüber hinaus sogar beim mathematischen Beweisverfahren selbst die Alleinherrschaft ab.¹¹² Hier scheint eine notwendige Bedingung für die mathematische Erkenntnis herauf: „Die Regeln [...] lassen sich mehr fühlen als formulieren.“¹¹³ Die Phantasie tritt als Antidot neben die Alleinherrschaft des Kalküls.

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¹¹⁰ Poincaré, *Der Wert der Wissenschaft*, Leipzig 1906, 18, zit. n. Werner 2001, 44.

¹¹¹ Vgl. Ebd.

¹¹² Poincaré 2003, 217. Poincaré positioniert sich insgesamt anti-logizistisch. Zum Begriff der Intuition bei Poincaré vgl. Mehrtens 1990, 238–246.

¹¹³ Poincaré 2003, 45.

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ABBILDUNGEN

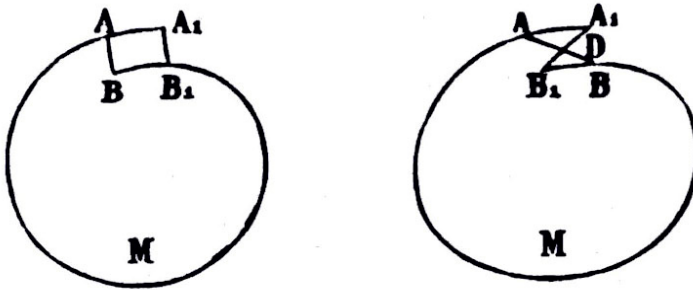


Abb. 1: Henri Poincaré: Zeichnungen aus dem Artikel *Sur le problème des trois corps et les équations de la dynamique*, 1890, 84.

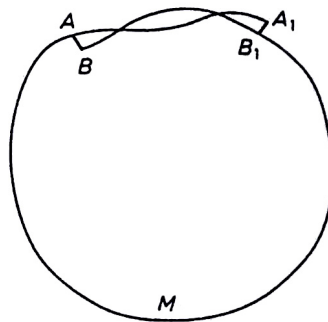


Abb. 2: Henri Poincarés fehlende Zeichnung, nach June Barrow-Green 1997, 91.

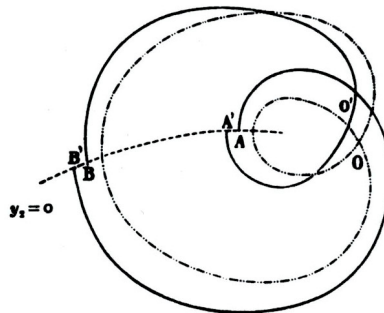


Abb. 3: Henri Poincaré: Zeichnung aus dem Artikel *Sur le problème des trois corps et les équations de la dynamique*, 1890, 220.

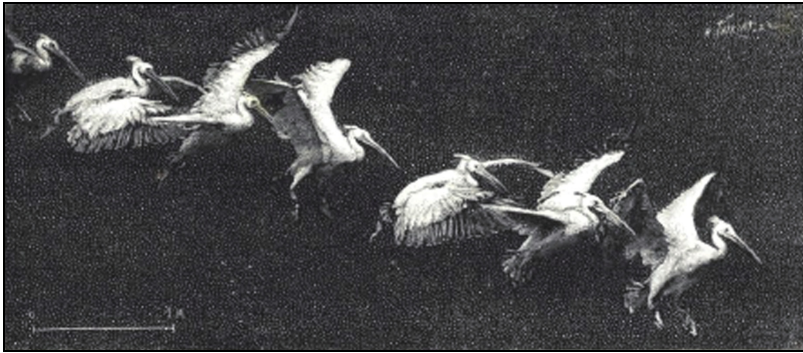


Abb. 4: Etienne-Jules Marey: „Pélican. Vol transversa descendant. 10 images par seconde”, aus: *Le mécanisme des vols des oiseaux éclairé par la chronphotographie*, Chronofotografie, 1887.

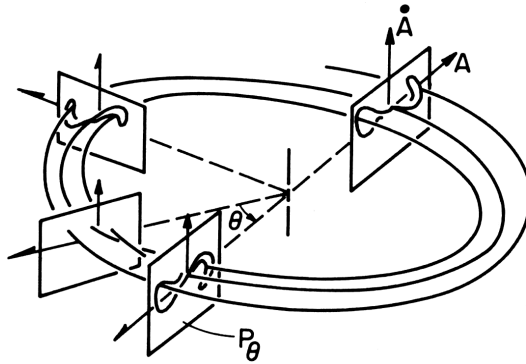


Abb. 5: Francis C. Moon, “Proposed structure of a strange attractor”, Zeichnung von Poincaré-Schnitten. Aus: Moon 1980, 494.

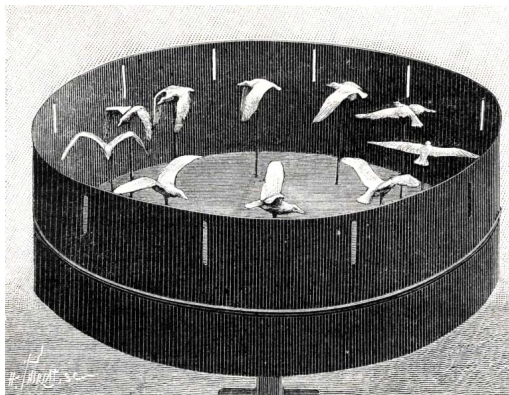


Abb. 6: Etienne-Jules Marey: „Zootrope dans lequel sont disposées 10 images en relief”, aus: *Le mécanisme des vols des oiseaux éclairé par la chronphotographie*, 1887.

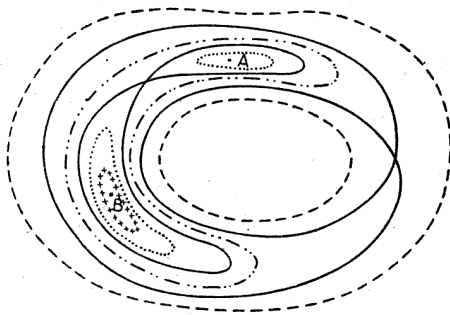


Abb. 7: Henri Poincaré, Zeichnung von einem Schnitt durch einen Phasenraum, aus dem Artikel *Sur le problème des trois corps et les équations de la dynamique*, 1890, 195.

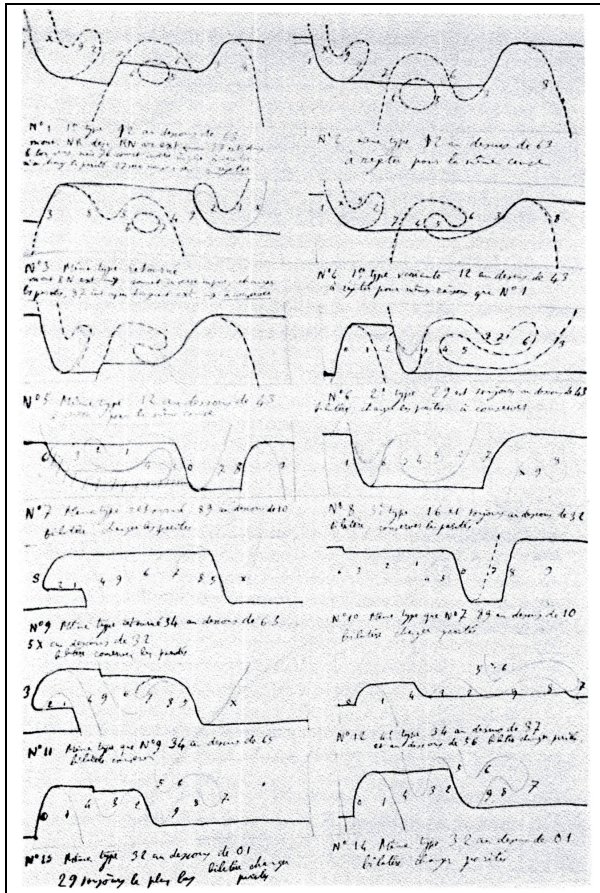


Abb. 8: Henri Poincaré, Manuskriptseite für sein „Last Geometric Theorem“, 1911/12. Aus: Goroff 1993, 85.

RE-EMBODYING SCIENCE – CORPOREAL SCIENCE IN *ENHANCING PEOPLES' LIVES - ENGINEERING FOR LIFE*

VESNA MILANOVIC*

ABSTRACT. In 2009 I entered the interdisciplinary collaborative world through the *Engineering for Life (EfL) - Enhancing Peoples' Lives* project at Sheffield Hallam University, UK, funded by the Engineering and Physical Sciences Research Council under the 'Bridging the Gap' initiative. As a Research Fellow and a research coordinator my role in the scheme was to contribute to the creation and development of multidisciplinary research networks and innovative multidisciplinary projects, as well as to reflect upon ongoing interdisciplinary collaborations. Being a dance scholar and practitioner, as well as a biologist, I was interested in the 'third culture', performative science and the theory and practice of interdisciplinarity including all the debates and reactions it raises. The paper discusses the model applied by the EfL in order to generate some novel interdisciplinary research ideas, focusing particularly on their development through the different performance techniques explored during the Ideas generator or Sandpit events.

Keywords: *performance, performativity, health care, interdisciplinarity, art-science collaboration*

Everything starts from impossible exchange. The uncertainty of the world lies in the fact that it has no equivalent anywhere; it cannot be exchanged for anything. The uncertainty of thought lies in the fact that it cannot be exchanged either for truth or for reality. Is it thought which tips the world over into uncertainty, or the other way round? This in itself is part of the uncertainty.¹

Introduction

My body aches while I try to write this paper. My left shoulder, elbow is in pain. My eyes losing focus, legs are stiff. I feel stiffness in my body while I write this scientific paper. I change positions as my tries to avoid this pain. The blood flows, dizziness, ankles and wrists hurt.

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¹ Baudrillard (2001), p. 3. Baudrillard's work cuts across the disciplines and promotes cross-disciplinary thought. Baudrillard continues this line of thought in his 1999 text *Impossible Exchange* (2001). In three parts containing a series of short essays, Baudrillard first develops his concept of an 'impossible exchange' between concepts and the world, theory and reality, and subject and object. He attacks philosophical attempts to capture reality, arguing for incommensurability between concepts and their objects, systems of thought and the world. For Baudrillard, the latter always elude capture by the former, thus philosophy is an 'impossible exchange' in which it is impossible to grasp the truth of the world, to attain certainty, to establish a foundation for philosophy, and/or produce a defensible philosophical system.

Baudrillard's thought of 'impossible exchange' resonates between concepts and the world, theory and reality, subject and object, and I expand this to art and science; corporeal and abstract. In this paper I argue that there is no fixed point between the arts and science, culture and real life, between the physical performance material and the abstract concepts of science, rather some kind of the 'impossible exchange'.

I was engaged in the interdisciplinary collaboration, between theory and practice, neither science nor art, in the realm of uncertainty of creation. In this arena of interdisciplinary research, I have worked for some years both as a performance practitioner and scholar, having a PhD in Dance studies and being a dancer and choreographer in contemporary dance, but also being trained as a scientist, with BSc in Molecular biology and physiology.

My role in the Engineering for Life project was to establish and coordinate the research networks among Sheffield Hallam University (SHU) academic staff, but also to reflect back, through this research on the interdisciplinary collaboration. The *Engineering for Life* project at SHU was funded by the Engineering and Physical Science Research Council as part of the 'Bridging the Gap initiative' in United Kingdom from 2009-2012. A key strategy of the project was to promote an active dialogue within the SHU research community, to foster mutual understanding and then build on this understanding to either tackle old problems in new ways, or to identify entirely new paradigms, research strategies and technologies. The research network created multidisciplinary teams to find pioneering ways to 'enhance peoples' lives, in particular focusing on specific themes, e.g. Rehabilitation and assisted living; Sport, Physical activity and Medicine and Sustainability.

The *Engineering for Life* (EfL) was based around the following research institutes:

- Materials and Engineering Research Institute (MERI)
- Art and Design Research Institute (ADRC)
- Centre for Sport and Exercise Science Research (CSESr)
- Biomedical Research Institute (BMRC)
- Communication and Computing Research Institute (C3RI)

In order to stimulate creative thinking and novel ideas we applied innovative and creative methods, which involved setting up multidisciplinary teams and generating ideas through a number of creative workshops and events: three "Ideas Generator (IG) events" (later called "Sandpit events"), fifteen "Research cafes", three "Field Labs, and a number of Informal conversations along with various platforms for online discussion.

This paper reflects on the first and second stages of the project in terms of creative processes, focusing on performance intervention and the strategies applied, e.g. devising, improvisation and still images. It reflects more the process of making, generating and creating of some novel research ideas among multidisciplinary teams.

In 2009, I entered the interdisciplinary collaborative world through this project as a Research Fellow and a coordinator in order to contribute to the creation and development of multidisciplinary research networks and innovative multidisciplinary projects. Being a dance scholar and practitioner, as well as a scientist I was interested

in Arts/Science intersection, the division of body and mind and all debates and reactions it raises. The questions regarding the art-science collaborations, the emerging field of the 'third culture'², corporeality in science, limitations, restrictions and benefits of these collaborations suddenly became alive through this research. Having been involved in a collaborative practice between artists, scientists and engineers, I have attempted to give multiple voices to these important issues of new shifts in performing arts and interdisciplinary studies.

What is the 'third culture'?

During the time of the project, I followed up some interesting debates on arts/science intersection and emerging 'third culture'.³ C.P. Snow (1967) wrote about the division of the 'two cultures'- literary intellectuals on the one hand, and scientists on the other. Although Snow hoped for the emergence of a 'third culture' that would bridge the gap, it is only recently, at the beginning of the twenty first century, that the intellectual landscape has begun to change.

John Brockman (1995) in his book 'The Third Culture' introduced both artists and scientists as key figures of the third culture. Arthur Miller, Professor of the History of Science and a physicist himself, argues in his lecture *Art & Science: 'The Coming of a Third culture'* that art and science collaboration and impossible exchange among artists and scientists, reflecting new ArtSci works. The 'Third culture' debate has continued into the 21st century with authors such as Roger Malina (2011) and Leblond (2011) debating it's importance.

At Engineering for Life project we are in the process of creating the 'third culture' at SHU, where arts, science and engineering come together in practice, and are trying to establish this 'third culture' among SHU academics. At present I can only describe the model we have developed, the process of creating, performative science in action, experimenting, and generating ideas as a work in progress, or emerging collaborative creative practice. Science will never become art nor art science, but the body of knowledge they inherit and expanding this to collaborative thinking could have enormous impacts in new concepts and idea formation.

How to generate an interdisciplinary proposals around the themes of human health and human lives?

² The influential British novelist and science administrator C. P. Snow, who had been trained as a natural scientist, published a lecture delivered in Cambridge University in 1959 titled "The Two Cultures." The lecture and the fifty-one-page book that followed provoked heated discussion because of its brash dismissal of the humanities as an intellectual mission lacking in rigour and unable to contribute to the welfare of those living in economically underdeveloped regions. Not surprisingly, humanists resented Snow's allegations that world peace and prosperity would profit from training more scientists and engineers and fewer historians, philosophers, and literary critics. Cf Kagan 2009.

³ "The Coming of a Third Culture." "I predict," Miller says, "that in the future art and science – the traditional 'two cultures' that still often eye each other warily – will fuse to form a 'third culture'." He continues: "interdisciplinarity will become a discipline and art and science as we know them will disappear. Aesthetics and art itself will be redefined." See: artsciencelabs.posterous.com/arthur-i-miller-talk-le-laboratoire-on-nov-21.

Ideas Generators/Sandpit events

The first challenge we experienced in EfL was regarding the development of interdisciplinary ideas and themes. The primary concern was in terms of where to start and how to be innovative and creative in science, arts and engineering collaborations. During the project life, I participated and observed the three Ideas Generator (IG) events which took place between 2009 - 2012 and, for the purpose of this paper, have focused on one of them: Sport, Physical Activity and Medicine, on the 15th and 16th of June 2010. The second Sandpit event which is of interest to this paper was facilitated by *Left Luggage Creative Training and Facilitation*, led by Valerie Holland, a facilitator with a background in social drama, had the same aim and criteria as the previous IG event, namely the generation of ideas that would grow into projects for which EfL would provide seed corn funding. One way to help scientists and artists in our practices was to introduce some performance strategies and interventions. The funded projects needed to fulfil the following criteria:

- it has to be a multidisciplinary project
- it has to be innovative
- it has to enhance the life of people

Science in Action – Act One:

Applying performing strategies: Frozen images, Tableaux and the Process of devising

The attendees included artists, scientists, engineers, health and well-being and human sciences staff from the five research centres at the heart of the programme: Materials and Engineering (MERI), Art and Design (ADRC), Sport and Exercise Science (CSER), Biomedical (BMRC), Communication and Computing (C3RI) – in addition to representatives from Health and Social Care (HSC) and the Public Health Hub who reflected the wider interest, due to the theme. They were joined by five Principal Investigators and myself, the Coordinator.

In order to start this creative process *Left Luggage* used a number of social drama and performance tools, e.g. frozen images, tableaux and the process of devising in order to generate innovative ideas for the projects in a short time. The process of devising is a term which stems from the physical theatre or dance interventions and represents the collective creative process without the presence of an outside director or choreographer. The participants themselves choreograph or direct the piece through a collaborative process. Tableaux is a way to show an idea using the body, without words or movement. Still and frozen images are both a form of tableaux. With frozen image, the action in a play or scene is frozen, as in a photograph or video frame. Still images, on the other hand, require individuals or groups to create new shapes with their body, rather than freeze existing action. Using this approach, in our case the facilitator asked people to create groups of a maximum of six with at least one person from each of the three different centres. Each group was then asked to create a frozen image.

The main concern for scientists, artists and engineers in our IG event was that they were not used to using drama or performance tools in order to present research ideas using only their bodies, costume or props. The idea of tableaux was not very familiar among scientists or artists, as there was not anyone, apart from myself, that had partaken in performing arts. At first scholars were confused since their concepts are more in the intellectual and less in the physical realm and thus are not used to performative strategies. The short instruction from facilitator gave the groups a freedom to find their own way and express their own research ideas. Uneasy at first and finding it difficult to understand, both the scientists and artists looked indecisive as to how to use their bodies, costumes, props and gestures. At the end of ten minutes, however, they appeared brave enough to step out of their comfort zones, and the majority of them have developed frozen/still images - tableaux. Without any words or movement, using only their bodies and gestures to form still images, as symbolic images grasping their research ideas, it seemed as kind of iconic thought, a message frozen and then projected towards the audience. The audience formed of the rest of participants, researchers and academics, were allowed to associate what those images represent. The groups stepped out on the stage, one by one. Still bodies and frozen group images speaking for the science and arts.

The audience made associations in order to guess what the idea behind the frozen image is. The first Tableaux represented a person with bandage on arm whilst another person was helping him. The second Tableaux showed a woman with yellow bandage on her breast representing some kind of a cancer survivor, with one of the scientists wearing a life jacket. The audience continued to associate, linking the still images with possible actions, grasping the meaning that is the closest one to the ideas that lay behind them. The third tableaux represented people on boat with a leader at the front and somebody at the back providing community, support, rehabilitation. The fourth group represented a person with sugar on his stomach; the audience associated this with obesity, a poor diet, diabetes, death and so on. A number of frozen images continued to be interpreted by the imaginative audience. How to interpret these images and not to be banal, but to respond in some academic way? How to recognise the research ideas behind it? The process continued with the expanded exercise.

Science in Action – Act Two:

Contextualising frozen images and slowly transferring these into scientific research problem

Gradually expanding the process to the second stage, the facilitator suggested a task of creating public advertisements. She instructed the scholars to write down some of the ideas conceived in the previous exercise. Spread on the floor, the ideas written on paper looked like a pool of collective research thoughts, fragmented sentences or phrases, like corn-seeds of possible project ideas. Still concepts, these research ideas started to crystalise on paper. Research ideas created in a creative

process, ideas spreading through the space, caught from the imagination and creation and translated into more formal and scientific terms. Out of tableaux, arranged physical bodies through the space and stillness, abstract concepts of science, arts and engineering were coming to life.

At this point researchers were allowed to present verbally some of their research ideas. The process led again to a group presentation, for example; the group that used the boat in the previous exercise articulated their idea of cancer rehabilitation through physical activities, specifically rowing and so on. The group also wanted to create a media vehicle to film this process and share them with those who don't know about the access to these activities. This group needed someone to help them redefine Physical activities, an engineer. This idea led to a project later on named "Paddling a Dragon."⁴

The second group which presented the idea of women suffering from breast cancer, wanted to immobilize the breast tissue by applying sport bra technology to radiotherapy. The concept behind the project was to design a breast support that can be individually adapted; something that allows measurement of the breast size to minimize side effects of radiotherapy but for this they needed someone in 3D imaging. This idea led into the project "Support4All."⁵

The process continued with each group, where researchers managed to refine and crystallise research ideas generated from the first tableaux or a still image. Again, giving an example, the third group generated an idea focused on the interactions between molecules which could be used in disorders like Alzheimer disease. Here, a sport scientist, as well as a Scientist/Biologist, needed to be involved to visualize these interactions leading to the development of the project "Visualising the interaction of proteins in biological membranes for diagnosis of diseases."⁶

Science in Action – Act Three:

Imaginative audience feedback: fans, builders and funders

In the final exercise those that were not presenting their ideas partook in the role of playing an 'Imaginative audiencerepresenting fans, builders and funders. The purpose of this exercise was to help the process of defining the research questions for the future proposals. The specific task for fans was to look only for the positive aspects of the proposal. Secondly, The builders' task was to give constructive and supportive suggestions. Finally the funders were expected to approach the proposal with the eyes of an investor. In my view, this process was very important in terms of defining and challenging the research questions and ideas, highlighting the positive aspects whilst also drawing attention to possible problems and pitfalls. The

⁴ See: research.shu.ac.uk/engineering-for-life/paddling-dragon.html

⁵ See: research.shu.ac.uk/engineering-for-life/support-4-all.html

⁶ See: research.shu.ac.uk/engineering-for-life/proteins-membranes-diagnosis.html

process articulated views on different aspects of the same problem, filtered through the eyes of a different discipline. Through this multidisciplinary approach, problems could be tackled through different perspectives. It was fascinating to see how this interaction with the audience (choir) and their feedback, constructively influenced the ideas complementing the basic skeletons of research proposals. Therefore, I personally feel that this exercise was of great value and generated important feedback for the previously conceived research ideas.

The Audience/Choir response:

Firstly we come to the group with the visualising proteins idea – ‘Toxic Pig’ Problem: group of diseases – same toxic mechanisms’. The fans responded positively in the way that they liked the fact that it’s ‘tested on synthetic membranes rather than a full cell environment as it is more controllable’. Builders came out with the comment that ‘despite the fact that they can see the wide application of this study, they prefer to keep it focused. Specificity should be the goal to make this work–to mimic the real membrane’. Funders responded with some queries; ‘what alternative technology is there? How many different diseases can be treated? How long before you could get it to market?’

This is just one of the examples, but the same process continued with all teams. The exercise incorporating the imaginative audience proved to be extremely useful in the further development of ideas and proposals. The process was well documented, so that the researchers could take the feedback and integrate some of these questions within their proposals later on, during the writing up period.

With this regard, from the first stage and frozen images, to verbalising and publicly presenting ideas to the imaginative audience and receiving feedback, the bulk of the process was completed. The main ideas and the project titles were recorded. The session was closed with the creation of a list of working titles, the project leaders and the teams.

The intensive process of developing and writing up the proposals in an academic way took part in the next two weeks with my continuous help in terms of discussing and redefining, focusing on objectives, milestones and outcomes of the future projects, but also with the help of mentors (one PI devoted to each of the teams, with more specialist expertise). Further discussion, reading, refining, exploring and writing up research ideas took part in the following two weeks. The application forms consisted of the two page proposals with all the necessary details including finances, timescales, milestones and objectives etc. At the end of the process the twenty proposals were submitted to be assessed by the members of the executive board which had the task of selecting the projects to be funded.

Twenty proposals were submitted, only seven were awarded funding.⁷

⁷ See: research.shu.ac.uk/engineering-for-life/

Finale: Awarded Projects

Support, Positioning and Organ Registration during Breast Cancer Radiation Therapy: SUPPORT 4 All

Lead applicant - Dr. Heidi Probst (CHSCR)

Team - Dr. John Hart (CSER), Prof Marcos Rodrigues (CCRC), Lisa Radford (CSER)

Breast cancer affects a substantial proportion of the population. Current radiotherapy approaches require precision accuracy to avoid long term side effects. The methods for positioning and immobilizing the breast are inadequate given increased complexity of the radiotherapy approaches used. This study hopes to devise a novel solution for safer breast radiotherapy and to improve the dignity and comfort of treatment for women.

Arty Sciency Sporty Art

Lead applicant - Dr. John Hart (CSER)

Second applicant - Julie Westerman (ADRC)

Scientist and artist collaborations have the ability to stimulate new thinking in audiences and provide a new dimension to public engagement. The presence of art in our public space is acknowledged to have a transformative effect in the public's perception of place and space; it provides an interpretation and reflection of events and inspires new readings and insights into the world around us. Art creates a forum that makes it possible to engage the public in ways not possible by conventional discussion of the science. This project intends to use sport as a gateway into art and science, capitalising on the different languages and visualisation of the different areas.

Using Mobile Technology in Tackling Maternal Obesity

Lead applicant - Dr. Hora Soltani (CHSCR)

Team - Prof Andrew Dearden (CCRC), Dr. Sally Atkinson (CCRC), Dr. Penny Furness (Nursing & Midwifery), Mrs. Fazilatur Rahman (ADRC), Dr. Madelynne Arden (Health Psychologist from D&S), Lindsey Reece (CSER), Dr. Kerry McSeveny (CCRC)

Obesity in pregnancy is associated with an increased risk of maternal and neonatal death. It has a negative impact on women's experiences as well as being a significant burden on the NHS by increasing risk of complications during pregnancy and birth.

Mobile technologies (e.g. text messaging) have been shown to be successful in other areas of health promotion such as diet improvement, smoking cessation and diabetes management. This has not been evaluated in the pregnant population. This feasibility study is aimed to identify factors that should be considered in designing a platform for bespoke self management mentoring and support to help women with obesity in pregnancy.

CROWD (Controlled Release from Open Wound Dressings)

Lead applicant - Dr. Neil Bricklebank (BMRC)

Team - Prof Chris Breen (MERI), Ms Louise Freeman-Parry (Dept of Biosciences), Dr. Keith Miller (BMRC)

Wound infection is a common problem affecting up to 20% of hospital patients and can cause significant morbidity and mortality. This project aims to reduce this statistic and the inconvenience attached to regular hospital visits. It will also reduce the significant drain on NHS resources by delivering a new kind of wound dressings which require less regular contact with health care professionals and higher levels of sanitisation.

Hydro-Delivery for the Back

Lead applicant - Dr. Christine Le Maitre (BMRC)

Second applicant - Dr. Chris Sammon (MERI)

Lower back pain affects a large percent of the population at some point in their lives and nearly 5 million working days were lost as a result of back pain in 2003-04. This study aims to develop a new delivery system which can inhibit disc degeneration and stimulate regeneration for a more permanent solution to this problem than already exists.⁸

Conclusions

In the article and playful synopsis, I have presented the process of creation and ideas generating in the Engineering for Life project, 2009-2012 and highlighted an Arts/Science/Engineering collaborative practice as a work in progress. In our case study, especially during the second IG event, the performing arts tools served as a catalyst in the process of ideas generating, with a number of interdisciplinary research proposals being formed through creative processes. The academics who participated were from different disciplines e.g. Biomedical science, Bioscience, Sport engineering, Fine arts and Design, Media arts, Materials engineering, Computing and communications, Health and Wellbeing and so on. The event described in the paper was facilitated by a social drama specialist.

During the second IG, the Efl applied some of the performance interventions and strategies to engage corporeal or embodied science in a creative devising process, using tableaux and frozen images, leading to the generation of some novel ideas. These research ideas were conceptualised further using the performative physical material and later integrated within the research concepts. The process represents the 'reverse process', from physical to psychological, from body to mind, from performing arts to science which to some extent resonate with Baudrillard's 'impossible exchange', between performing arts and science, between the embodied physical material and abstract concepts of science.

To conclude, the creative processes as catalysts in the framework of the Efl project proved to be very successful in creating an active multidisciplinary ethos through a wide range of events which have involved 260 academic participants from across the University. In particular, it has created a culture in which staff from different

⁸ www.theengineer.co.uk/news/hydrogel-injections-could-ease-lower-back-pain/1006845.article

research centres work together as colleagues, undertaking new and innovative research which lies outside the boundaries within which they have traditionally worked. The ‘sandpit’ or ‘ideas generating’ events created 70 new proposals of which the total of 23 projects were funded (at ~ £10k). Five projects were taken to the next level of development through funds up to £50k from the second Feasibility Account. More details of projects can be found on our website where the diversity of the research which has been supported is very clear.⁹

Funds have been awarded for the most innovative projects which were judged to possess the greatest potential for (i) long term impact on research outcomes (ii) the ability to attract external funding (iii) engagement with industry and (iv) the creation of new IP.

In this regard, going back to Baudrillard and the ‘impossible exchange’, but also to Malina’s and Miller’s arguments and the importance of the art-science movement and its potential value both to science and the emerging culture of the future, I argue that the EfL made a shift among SHU academic culture, a kind of ‘impossible exchange’. The EfL has made a substantial impact engaging a large number of the research centres and academics, changing the university ethos and culture, and possibly leading to the emergence of ‘third culture’ academics and PhD students.

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⁹ research.shu.ac.uk/engineering-for-life/

ON A DEMOCRATIC FUTURE: NIETZSCHE, DERRIDA, AND DEMOCRACY TO COME

MATTHEW P. BENNETT*

ABSTRACT. In this paper I analyse and critically assess Jacques Derrida's political reading of Nietzsche. Derrida's reading of Nietzsche's multiple styles and their ramifications for how we read philosophical texts is well known. But Derrida also maintained that Nietzsche's addresses to an unknown future readership evidenced a democratic aspect to Nietzsche's work. Derrida's is a heretofore unexamined interpretation, and in this paper I aim to show that his emphasis on the democratic style of Nietzsche's writing raises different questions about the kind of political values that support Nietzsche's critique of modernity. I argue that Derrida's reading merits discussion, particularly in virtue of its intriguing account of what it means to experience the future democratically. However, I think Derrida's reading has its own exegetical and philosophical problems. In sections one and two I explain why Derrida thought that Nietzsche's hopes for the future of Europe constitute a democratic comportment; in section three I show how this reading of Nietzsche can be defended against a philosophical objection to its plausibility; and in section four I suggest exegetical reasons for questioning Derrida's interpretation. I will end by drawing on Nietzsche's work to raise an objection to the political quietism of democracy to come.

Keywords: *Nietzsche, Derrida, democracy to come, messianism*

Some accounts of Nietzsche would have us believe that his work was unequivocally anti-democratic. We are told by some that Nietzsche's anti-egalitarianism, elitism, aristocratism, and distaste for nineteenth-century democratic politics are wholly incompatible with pro-democratic political theory.¹ Relatively recent study of Nietzsche has countered this orthodox understanding of his political views. Readers such as Lawrence Hatab, David Owen, Mark Warren, and William Connolly have made a variety of attempts to argue that some contemporary democratic theory is

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¹ See, for example: Fredrick Appel, *Nietzsche Contra Democracy* (Ithaca, NY: Cornell University Press, 1999); Don Dombowsky, 'A Response to Alan D. Schrift's "Nietzsche For Democracy?"', *Nietzsche-Studien* 29 (2000); and Herman W. Siemens, 'Nietzsche's Critique of Democracy (1870-1886)', *The Journal of Nietzsche Studies* 38 (2009).

compatible with and perhaps even supported by Nietzsche's work.² These readings have added to an emerging body of literature that addresses a broader range of political issues raised by Nietzsche;³ we might say that now more than ever before Anglo-American Nietzsche scholarship not only accepts Nietzsche as a significant figure in moral theory, but also as a possible contributor to political philosophy.

Debate over the democratic credentials of Nietzsche's philosophy has tended to focus on his potentially conflicting themes of an emancipating pluralism on the one hand, and domination, hierarchy and 'healthy aristocracy' on the other (see for instance *Beyond Good and Evil* §258). Those who write of a democratic Nietzsche will locate democratic thought in his resistance to the dogmatism of 'universal' values. They will argue that Nietzsche's perspectivism, insofar as it insists on a multiplicity of values and truths engaged in agonistic debate, is a democratic philosophy. Conversely, those who have argued against the validity of a democratic Nietzsche have emphasised his anti-egalitarianism, claiming that Nietzsche's belief in the difference in worth between individuals is irreconcilable with democratic principles of equality.⁴

In this paper I aim to reconstruct Derrida's position on this issue. Derrida's account of Nietzsche has the virtue of acknowledging the themes emphasised by both pro- and anti-democratic Nietzsche interpretations, while avoiding their problems. Derrida's contribution to the issue of Nietzsche's potential for democratic thought is to reflect on how Nietzsche oriented himself to his contemporary culture and in particular how he did this with a certain attitude toward the future of this culture. Derrida's reading of Nietzsche ultimately lead him to claim that Nietzsche's orientation toward the future is characteristically democratic. I hope to explain what Derrida

² See William E. Connolly, *Political Theory and Modernity* (Oxford: Blackwell, 2002); Lawrence J. Hatab, *A Nietzschean Defense of Democracy: an Experiment in Postmodern Politics* (Chicago: Open Court, 1995); David Owen, *Nietzsche, Politics and Modernity: a Critique of Liberal Reason* (London: Sage, 1995); Alan D. Schrift, 'Nietzsche for Democracy?' *Nietzsche-Studien* 29 (2000); Alan D. Schrift, 'Nietzschean Agonism and the Subject of Radical Democracy' *Selected Studies in Phenomenology and Existential Philosophy* 27 (2001); and Mark E. Warren, *Nietzsche and Political Thought* (Cambridge, Mass.: MIT Press, 1988).

³ The development of this area of the literature is perhaps best reflected in two recent publications from Peter Sedgwick (*Nietzsche: the Key Concepts*, (New York: Routledge, 2009)), and Frank Cameron and Don Dombowsky (*Political Writings of Friedrich Nietzsche* (Palgrave Macmillan, 2008)). It is not insignificant that Sedgwick has saw fit to include a section on Nietzsche's politics, in which he addresses among other interpretations the recent surge in readings that propose a democratic Nietzsche. Nor can we ignore Cameron and Dombowsky's decision to publish a whole anthology dedicated solely to offering a primer to those interested in Nietzsche political thought (a primer which also includes a chapter devoted to Nietzsche's thought on democracy). See also Keith Ansell-Pearson, *Nietzsche Contra Rousseau: Nietzsche's Moral and Political Thought* (Cambridge: Cambridge University Press, 1991); Keith Ansell-Pearson, *An Introduction to Nietzsche as Political Thinker: the Perfect Nihilist* (Cambridge: Cambridge University Press, 1994); Tamsin Shaw, *Nietzsche's Political Skepticism* (Princeton, NJ: Princeton University Press, 2007); Tracy B. Strong, *Friedrich Nietzsche and the Politics of Transfiguration* (Urbana: University of Illinois Press, 2000).

⁴ This is not to say that authors who have taken these positions have been blind to the motivating factors of their opponents. Hatab, for instance, is at pains to explain how Nietzsche's repudiation of 'substantive equality' and 'equal regard' could be compatible with a democratic position.

meant by this and in doing so both contribute to a debate in Nietzsche scholarship and, more broadly, explore what it might mean to take up a democratic orientation toward the future, at least in line with Derrida's analysis of democracy.

I also aim to show that while Derrida offers a new of reading Nietzsche as democratic, this reading is subject to equally new criticisms, which expose new reasons for dismissing the idea that Nietzsche would endorse democratic values. In the final section of this paper I will consider an objection to Derrida's reading that raises problems both for Derrida's exegesis and for his philosophy. The objection is that Nietzsche would refute the motivational capacity of an indiscriminate openness to the future. Insofar as this objection highlights incompatibility between Derrida's democratic orientation to the future and Nietzsche's philosophy, it challenges Derrida as a reader of Nietzsche; insofar as it constitutes an objection to 'democracy to come' *per se*, it challenges the value of thinking about the future democratically.

I

Derrida's account of the democratic aspect of Nietzsche took its most explicit form in 'Nietzsche and the Machine', an interview with Derrida concerning his publications on Nietzsche. Conducted in 1993, the interview precedes the publication of *Politics of Friendship*, *Spectres of Marx* and *Rogues*, publications which would comprise Derrida's more influential studies of democracy. Asked how his own critique of the history of philosophy situates him in relation to Nietzsche's critique of democracy, Derrida responds by saying 'I do not consider Nietzsche to be an *enemy of democracy in general*'.⁵

This is not a unique position; Nietzsche scholars who have argued for a 'democratic Nietzsche' have found it necessary to narrow the scope of Nietzsche's anti-democratic sentiments in order to leave room for theories of democracy compatible with Nietzsche.⁶ However Derrida adds that 'Nietzsche critiques a particular form of democracy in the name of "a democracy to come"'.⁷ In other words, Derrida claimed that Nietzsche would have endorsed Derrida's own analyses of democracy that followed in the 90s and the beginning of the 21st century; Derrida's critique of extant concepts of democracy apparently echoes Nietzsche's. But what would it mean

⁵ Jacques Derrida, *Negotiations: Interventions and Interviews, 1971-2001*, trans. Elizabeth Rottenberg (Stanford, CA: Stanford University Press, 2002).

⁶ See especially Hatab (1995), chapter 3.

⁷ *Prima facie* this is a hyperbolic and reductive comment typical of Derrida's more accessible yet nevertheless often simplistic statements that can be found in interviews such as this. However it would appear that the suggestion that Nietzsche wrote in the name of a democracy to come is not exclusive to 'Nietzsche and the Machine'. In light of this interview, closer inspection of Derrida's political writings reveals that this claim is consistent with related scattered comments found throughout Derrida's discussion of Nietzsche in, for example, *Politiques de l'amitié* (Paris: Editions Galiléé, 1994). Rather than simply an isolated comment in an obscure interview, I hope to show throughout this paper that Derrida's claims about Nietzsche's critique of democracy resonate with a view that he held at least from the late 80s.

for either Derrida or Nietzsche to adopt this critical position? Let us take for example Derrida's analysis of sovereignty in *Rogues*. According to Derrida, democratic sovereignty has a problematic role in democratic states insofar as its legitimating moment – polling day – is always at a distance from the moment in which a legitimate government exercises its power. For Derrida, this highlights the need for democratic authorities to perpetually repeat the process by which they come by that authority; an elected party can only have a temporary claim to power in a democracy, and at the very least must have another electoral mandate after a term, meaning that even an elected body cannot have the 'last word' in democratic politics.⁸ Derrida's phrase 'democracy to come' refers to that feature of democracy that denies anyone the last word and requires that democratic politics remain on ongoing process.⁹ Thus to say that Derrida, or Nietzsche, are critical of democracy in the name of a democracy to come, is to say that they are critical of the values championed under the name democracy in defence of the unending process that constitutes 'democracy to come'. Derrida's claim is, then, that Nietzsche defends the value of unending revision, and that this is a democratic value.

This claim in the 'Nietzsche and the Machine' interview is coupled with a claim about how Nietzsche understands his place in history and in particular his relation to the future of Europe. Nietzsche's orientation toward the future, we are told, is of a particular, 'messianic' kind, and it is this feature of Nietzsche's work that Derrida takes to be democratic.¹⁰ What, then, does Derrida mean when he claims that Nietzsche's work is 'messianic'? To be messianic is to refuse to think of the future in terms of a finite set of possibilities, each with a pre-determinable character ('I don't know for sure if it will happen, but if it does I know what it will look like') and each with calculable probabilities. To be messianic is to hope for an unanticipated different future state of affairs;¹¹ this attitude affirms a transformation that alters

⁸ Hence Derrida's obsession with taking turns and rounds of voting in the earlier sections of *Voyous* (Paris: Editions Galiléé, 2003); see in particular *Rogues*, trans. Pascale-Anne Brault and Michael Naas (Stanford, CA: Stanford University Press, 2005), 6-41.

⁹ For Derrida, this is an observation about what it is for something to be democratic, and thus extends not only to the legitimate authority of an elected party but also the legitimacy of the election process and more broadly the structure of a democratic state. In other words, for the process to be democratic in the same way that a party is democratically elected, that process must also be constantly open to revision. It is the broad scope of Derrida's claims about what it is for something to be democratic that gives him the resources for an account of *inter alia* a democratic orientation to the future. (I am grateful to Peter Dews for raising this issue).

¹⁰ 'The messianic is heterogeneous to messianism in the precise sense that the messianic is indeterminable. Messianism will saturate the absence of horizon by turning it into a horizon. Not only would I want to show this through a fairly abstract analysis...but less abstract, more immediately, I would want to show the difference in, for example, the *tone* of Nietzsche, which is prophetic and messianic.' *Negotiations*, 227.

¹¹ See *ibid.*: 'all the predicates that seem to me to make up the concept of messianicity – annunciation of an unpredictable future, relation to the other, affirmation, promise, revolution, justice, and so on'. Cf. *Donner la Mort* (Paris: Editions Galiléé, 1993) translated by David Willis as *The Gift of Death* (Chicago: University of Chicago Press, 1995), 54: 'We tremble in that strange repetition that ties an irrefutable past... to a future that cannot be anticipated; anticipated but unpredictable; *apprehended*, but, and this is why there is a future, *apprehended* precisely *as* unforeseeable, unpredictable; approached *as* unapproachable.'

our situation or circumstances in a way that is not only unpredictable (in the way that the roll of dice is not predictable with certainty beyond a probability of 0.16) but that is presently indeterminable and unintelligible. In other words, our thought would be messianic were it to value and affirm changes that we believe cannot be understood until they take place.

It is tempting to think of unintelligible change as “authentic” simply in the sense that it is a more radical change, but Derrida seems to have something else in mind. The kind of future that a messianic Nietzsche hopes for is in Derrida’s words ‘the very condition of the future constituting messianism [hope for a future we can understand before it happens]’.¹² Thus Derrida maintains that Nietzsche, as a messianic thinker, is concerned with a kind of future that is more fundamental to our experience of change than those changes that are intelligible before they occur. I take Derrida’s suggestion here to be that our regular ability to distinguish a finite set of future possibilities is made possible by more fundamental changes in the way we see the world; changes in the way we think, feel, experience and behave. We might distinguish on the one hand the transition from die-in-hand to rolled-a-6 (intelligible change), from on the other hand the transition from an experience of a six sided stone as just that, to ‘discovering’ that if we number these sides then we can base complex games on how this stone lands when I throw it.¹³ The range of things I can foresee happening with a six-sided stone will be characterised by how I experience it; if I understand it simply as a stone, then I might predict that one day it might be used to build a small house, or put together with other small stones in a bag to fashion some kind of blunt instrument or weight. If I undergo a change in the way I experience this object, I no longer experience it with this set of possibilities but with others (the range of numbers I might roll in the context of a game). In short, the set of possibilities intelligible to me is conditioned by the more radical changes that have already happened to the way the world appears to me. The important point to make here is that while I understand the stone as just a stone, ‘rolling a 6’ cannot make sense to me; such an event is unpredictable not because I am not sure that it will happen, but I because I do not even know what it would mean for it to happen.¹⁴

¹² *Negotiations*, 227: ‘The messianic concerns a notion of the future that precedes – is the very condition of – the future constituting messianism.’

¹³ The word “discover” might of course imply that using a six sided stone as a die constitutes the realisation of a potential of the stone. This would be eschewed by Derrida for a number of reasons; but for the purposes of this discussion, it should be enough to say that the kind of fundamental change that Derrida is concerned with must be in principle unintelligible before it occurs. Talking of this in terms of the realisation of a potential can be misleading, insofar as it may imply that “rolling a 6” has in principle been intelligible for as long as six sided stones have existed, and in turn intelligible for as long as there has been matter that could have potentially taken the form of a six sided stone. This would run contrary to Derrida’s insistence that such a possibility is not ever-present. My thanks go to Steve Gormley for raising this.

¹⁴ This alludes to an interesting question about history that would follow from this way of thinking about change over time: while the “stone-is-just-a-stone individual” (SI) could not understand the possibilities involved in rolling a die, could the “dice individual”(DI) know and understand the possibilities available to SI? If we maintain an Hegelian view of history, in which previous ways of understanding are subsumed under subsequent ways, it appears that DI might be able to retrospectively understand the

The messianic tone of Derrida's Nietzsche consists of an affirmation of this more profoundly different, unpredictable future, if by affirmation we mean valuing this kind of future over the manageable possibilities that constitute our usual understanding of the passage of time. In other words, Derrida's Nietzsche sees fundamental change in the way I experience the world as the proper object of orientation for those of us who wish to consider the future. Whereas for most, thinking about the future involves thinking about that which will happen "next Wednesday", "in an hour", or "after the baby is born",¹⁵ Derrida's Nietzsche will maintain that comporting oneself towards the future requires a comportment towards that which lies outside the set of currently intelligible possibilities.

But what does it mean to describe this orientation to the future as democratic? As outlined briefly above, Derrida's notion of democracy to come refers to what he believes to be the open-ended character of democracy; democracy in practice requires that we perpetually revisit our political decisions to establish new electoral mandates, and so a final decision, a last word, is never found in a democracy worthy of the name. In accordance with this analysis of democracy, to espouse democratic values, or to have a democratic attitude, is for Derrida to appreciate the value of this open-ended process and the importance of a practice that resists the attraction of having the last word or coming to a conclusion. If our hopes for the future are informed by this democratic value, we will affirm radical changes in the way we think and hope for a future that poses challenges to our decisions.¹⁶

Moreover, this democratic attitude would value the kind of transformation over time that would change the very possibilities open to us. This might be captured in the simple accommodation of change through a perpetual revisiting of an electoral mandate; but in a more profound sense, Derrida maintains that being democratic means

possibilities for SI. One might then argue that there is an epistemological asymmetry to history; SI cannot understand DI, whereas DI can understand SI. Alternatively, one might argue that an alteration to the way I experience an object requires not only this narrow alteration, but an upheaval to the environment in which that object appears and perhaps a total change in the way I understand the world. If I undergo such a radical transformation in my understanding, then it would seem that this necessitates a complete rewrite of history; "stone" is reinterpreted in terms of what I experience as a die, and becomes "potential die" or "stone before we used it as a die". We might then argue that this reinterpretation makes DI's understanding of the historical uses of "potential dice" incommensurable with SI's understanding, making it impossible for DI to understand the possibilities available to SI.

¹⁵ Thus discursive understanding of time is not here restricted to time understood as the ticking hands of a clock. To conceive of a usual conception of time so narrowly would not, I believe, be very helpful; we undeniably structure a large part of our lives using a calendar and a watch, but we also structure our lives using less calculable temporal events, such as the birth of a child ("we'll spend more time with our family once the baby is born"), the changing of governments ("our lives started to deteriorate when the coalition took office") or the loss of a certain amount of weight ("when I reach my 'target weight' I'll change my diet").

¹⁶ Cf. Rogues, 91: "The *to* of the "to come" wavers between imperative injunction (call or performative) and the patient *perhaps* of messianicity (nonperformative exposure to what comes, to what can always not come or has already come)." It is no coincidence, I think, that we here see Derrida reference the '*perhaps*' that constitutes so much of his discussion of Nietzsche in *Politiques de l'amitié*.

valuing an unforeseen moment when we rethink or reappraise what possibilities are intelligible to us. In this latter sense, Derrida describes an attitude that affirms an upheaval of the way we experience the world. And according to Derrida, this attitude towards the future, when rendered as a political regime, has its closest approximation in a democracy. Put more succinctly, the Derridean democratic attitude towards the future would be a political articulation of the messianic attitude toward the future that we have discussed above. And if Derrida is right about Nietzsche's 'messianic tone', then he may have good reason for maintaining that Nietzsche evidences a democratic orientation toward the future.

II

We can give more content to this notion of a democratic attitude to the future by looking at the way Derrida thinks this attitude is manifest in Nietzsche's work. In 'Nietzsche and the Machine' Derrida lists a number of works that he maintains exhibit a 'messianic tone'; he finds such a tone in, for instance, the following passage from *Ecce Homo*:

Seeing that before long I must confront humanity with the most difficult demand that has ever been made of it, it seems indispensable to me to say *who I am*. Really, one should know it, for I have not left myself 'without testimony'. But the disproportion between the greatness of my task and the *smallness* of my contemporaries has found expression in the fact that one has neither heard nor even seen me. I live on my own credit¹⁷

Nietzsche claims that his own era has failed to understand him and that as a result of this he has had to live on his own credit. The understanding that Nietzsche seeks, the understanding he seems to need as some sort of fiscal endorsement, backing or funding (credit), has come from no-one but himself. According to Derrida, Nietzsche needs this credit for 'His own identity – the one he means to declare and which, being so out of proportion with his contemporaries, has nothing to do with what they know by this name'.¹⁸ In other words, at the time Nietzsche writes *Ecce Homo*, the only reader who has understood him has been Nietzsche himself. This identity has been endorsed and supported (economically or otherwise) only by Nietzsche; it is not 'by right of some contract drawn up with his contemporaries'. This leads Derrida to claim that the contract that ensures the support needed for Nietzsche's identity is the 'unheard-of contract he has drawn up with himself'.¹⁹

¹⁷ Friedrich Nietzsche *Ecce Homo* trans. R.J. Hollingdale (London: Penguin, [1908] 2004), 3.

¹⁸ Jacques Derrida, *L'oreille de l'autre: Otobiographies, transferts, traductions* (Montreal: VLB Editeur, 1982) translated by Christie McDonald as *The Ear of the Other: Otobiography, transference, translation* (Lincoln, NB: University of Nebraska Press, 1988), 8.

¹⁹ *Ibid.*

Nietzsche's contemporaries have failed to act either as his creditor (unable to properly understand and invest themselves in engaging with Nietzsche's texts) or as his debtor (i.e. have been unable to properly learn from and be indebted to Nietzsche's texts). We could say that the credit agreement that Nietzsche draws up lacks a countersignature, as Derrida implies in *Politics of Friendship*:

my [Nietzsche's] readers to come, who will be my readers only if you become new philosophers – that is, if you know how to read me – in other words, if you can think what I write in my stead, and if you know how to countersign in advance or how to prepare yourself to countersign²⁰

Derrida describes the figures capable of reading (and properly comprehending) Nietzsche's text as those who are able to countersign the contract that constitutes Nietzsche's work. Nietzsche's texts, along the lines of this reading, are effectively open contracts, a kind of blank cheque, signed by the author and awaiting the countersignature of a coming 'new philosopher' capable of properly understanding (investing in, perhaps acknowledging a debt to) Nietzsche's thought.²¹ In other words, and according to Derrida's reading, Nietzsche's works go beyond the comprehension of Nietzsche's contemporaries and effectively address themselves to a future, 'new philosopher'. This philosopher of the future is the figure who will be capable of comprehending, learning from and countersigning Nietzsche's contract. Until then, Nietzsche must live on his own credit.

How does Nietzsche's address to a future readership manifest a democratic attitude toward the future? Nietzsche undoubtedly desired a radical change in his contemporary culture. For Derrida, the cultural revolution Nietzsche desired is radical insofar as it alters the horizon of intelligible possibilities available to Nietzsche and his contemporaries. Thus for Nietzsche's comportment to his readership to be messianic, his intended readership would have to be deferred to an era after a radical change in European culture. Most importantly, the full details of this change itself and the set of intelligible possibilities that is available to these profoundly different 'new philosophers' would have to be unintelligible to Nietzsche at the time of writing; the right readers are located beyond what is presently within his capacity to understand.

If we recall the die example used above, we could say that just as experiencing a stone as just a stone means that I cannot understand the possibility 'rolling a 6', so Nietzsche cannot understand the possibilities available to his future readership.

²⁰ *Politics of Friendship*, 41. I have stipulated that 'my readers to come' are Nietzsche's readers; however, while it is clear that Derrida wishes to assert this of Nietzsche and how Nietzsche perceives his readership, there may be an argument for claiming that Derrida too understands his audience in a similar way. If this were the case, statements about 'my readers to come' may well refer to both Derrida and Derrida's Nietzsche.

²¹ As Derrida points out, not only is *Ecce Homo*'s preface signed nominally (F.N.) but the work is further signed with a date: 'The page is dated. To date is to sign.' (*The Ear of the Other*, 11). As per the usual format of a contract, Nietzsche not only signs but also dates his work.

And to take up a ‘messianic attitude’ in this context would be to value precisely this kind of reader. If Derrida is to attribute this kind of attitude to Nietzsche, he must locate it in exactly the kind of open-ended style that his open contract metaphor is designed to underline; if Derrida’s Nietzsche had anticipated the kind of reader he affirms, it would be inconsistent to maintain that this same Nietzsche is ‘messianic’.

Derrida’s focus on Nietzsche’s credit metaphor is clearly underpinned by a distinctive way of understanding the cultural revolution that Nietzsche called a ‘revaluation of values.’ According to Derrida the philosophers of the future who Nietzsche awaits are different not only in the sense that they cognitively evaluate the world in a significantly different way (they maintain a morality or table of values sufficiently different from a Christian- or slave-morality) but in the sense that the very set of future possibilities that are intelligible to them are fundamentally different *and unintelligible to Nietzsche himself*. The range of possibilities that they are able to consider is wholly distinct from the set of possibilities that Nietzsche himself can understand. Affirming the arrival of such a radically different generation would mean affirming a way of understanding the world and its possibilities that Nietzsche himself could not at the time of writing take up.²² In other words, affirming such a different generation would amount to hoping for the arrival of a way of being in the world that is not open to being understood by preceding generations.

III

This leads us to a particular problem for Derrida’s reading of Nietzsche. The problem concerns whether one can ever write in a way that addresses such a radically different future readership. If the messianic tone of Nietzsche’s untimely writing is supposed to *address* a readership yet to come, wouldn’t this require that Nietzsche transcend his era to share in the mode of thought found in the philosophers of the future? Does communicability between Nietzsche and his future readers presuppose some common linguistic or conceptual elements between writer and reader? And if this were the case, would this not require that Nietzsche anticipate that which, according to Derrida, precludes anticipation? In this section I will deal exclusively with this problem and Derrida’s answer to this problem. In the final section (IV), I will raise concerns that I believe Derrida’s reading of Nietzsche does not address.

This problem, as I understand it, hinges on whether we claim that Nietzsche needs to share a way of thinking with his readership. If Nietzsche is to address himself to a certain kind of reader, must Nietzsche share some discursive content or

²² And possibly a way of understanding that Nietzsche would never be able to take up. One might legitimately ask of Derrida whether the profound change he associates with a democratic attitude toward the future can be located within a lifetime. In other words, can Nietzsche (or anyone) experience such a change to the possibilities he has available to his understanding, and affirm a profoundly different “Nietzsche”, or does his connection with his own history of contemporary culture require him to affirm a whole other generation – a problem Nietzsche himself was very aware of in considering the possibility of being ‘untimely’?

form – perhaps a shared semantics or grammar – with that kind of reader? If we answer yes, then there would seem to be something incongruous about claiming that Nietzsche both endorses a way of thinking that is wholly different to anything he can presently understand, and that he shares in this way of thinking. Derrida will claim that Nietzsche need not and indeed does not share a way of thinking with those future readers he values above his contemporaries. Rather, Derrida maintains that Nietzsche's proper reader must in each case be singular, relating to Nietzsche's work in a unique way.

Derrida raised analogous concerns in his analysis of philosophies of friendship. According to Derrida, Nietzsche had questioned this tradition by challenging the value of a bond between similar persons and raising the possibility of an alternative mode of friendship.²³ Nietzsche's critique engenders a very different approach to friendship that is not based on commonality, shared interests or characteristics, or even proximity. Thus Derrida maintains that Nietzsche's 'friends' are those unpredictable readers of the future we have discussed in relation to Nietzsche's open contract.

For Derrida, Nietzsche's readers are 'friends of solitude' who engage in a friendship 'without common measure, reciprocity or equality'.²⁴ The inversion of the alleged canonical understanding of friendship here is I think clear enough; Derrida's Nietzsche values those who co-exist in a way that maintains their interpersonal disparity rather than those who come together as a result of their common perspective.²⁵ However, as Derrida quite rightly notes, a collection of individuals who hold nothing in common and who evade proximity, equality, and mutuality would seem to undermine all that we would usually associate with the bonds of friendship, and perhaps has little right to claim even a radically different application of the word 'friendship'.²⁶ What alternative notion could retain a bond of friendship, love, or community while endorsing solitude and distance? And similarly: in what sense could Nietzsche address himself to a readership with which he has nothing in common?

The notion of a community without a bond of similarity, fraternity, consanguinity, or compatriotism is, as Derrida acknowledges, worryingly close to an untenable contradiction. This notion, which Derrida refers to as a 'community without community,' comes under much scrutiny in *Politics of Friendship* as he examines the possibility of an alternative way of constructing social bonds that would accommodate 'friends of

²³ *Politics of Friendship*, 27.

²⁴ *Politics of Friendship*, 35.

²⁵ Cf. Friedrich Nietzsche, *Sämtliche Werke: Kritische Studeinausgabe in 15 Bänden* Edited by Giorgio Colli andazzino Montinari (Berlin: Walter de Gruyter, 1980), 9:3 [98], 1880 (my translation): 'The more the feeling of unity with others gains the upper hand, the more people become uniform, and the more all differences are seen as immoral. This is needed to create the sand of humanity: all very equal, very small, very round, very amicable, very boring. Christianity and democracy more than anything have driven man to being sand.'

²⁶ 'Why still call this 'friendship' except in a misuse of language and a diversion of a semantic tradition?'; *Politics of Friendship*, 35.

solitude'.²⁷ It will pay us to spend a little time considering this phrase 'community without community' and its importance in Derrida's study of friendship before returning to the problem at hand (we will see that Derrida's answer to the questions I raised at the beginning of this section is inextricable from his understanding of a 'community without community').

Derrida owes the phrase 'community without community' to Georges Bataille, who addressed an absence of communitarian thought felt by many French intellectuals of the time.²⁸ Picked up later by Jean-Luc Nancy's *The Inoperative Community* and adopted once more by Maurice Blanchot in *The Unavowable Community* (which was no less a response to Nancy's work than to Bataille), the phrase signified for Bataille a profound dissatisfaction with contemporary political groups and resonates with an ever increasing demand for a seemingly impossible non-institutionalised community. Blanchot recognises that this frustration was partly a reaction to the established notion of reciprocity in social relations. In Blanchot's words, the shortcomings of a 'Same with Same' model of the communal bond reflected a need to incorporate the possibility of 'the Other as irreducible' in interpersonal relations. For Blanchot this raises difficult questions for communist philosophy in particular; the challenge for communism as Blanchot sees it is to reconcile communism and individualism, an interrelation of contradictory sentiments of 'absolute immanence' (the homogenous masses dissolved into work) and an individual's 'inalienable rights'. The question that Blanchot thus addresses is whether we can think of a community that does not undermine the individuality of the 'irreducible Other'.²⁹

Blanchot's discussion of community was in part a response to Jean-Luc Nancy's *The Inoperative Community*, which was itself inspired by Bataille. *The Inoperative Community* identifies a nostalgic desire in the 'community without community' theme; this nostalgia, for Nancy, pines for something that has been effaced by institutionalised versions of companionship (political parties, for instance). Nancy's use of the word 'community' refers to this element of our communal experience that is damaged or covered over by institutional delineation or legislation of communal bonds (the determination, for example, of the conditions of entry into a certain community). In an effort to dissociate his theory of community from traditional thought on the nature of community, Nancy suggests that community can be understood as being, insofar as it is not reducible to a totality of entities (and certainly not the enumeration of individuals in a group) or to an individual entity (what Blanchot calls 'a supra-individuality').³⁰ In this sense, community is for Nancy a relational space that precedes

²⁷ *Politics of Friendship*, 47n.15.

²⁸ For more on this, see Pierre Joris' preface in Maurice Blanchot *La Communauté inavouable* (Paris: Minuit, 1984) translated by Pierre Joris as *The Unavowable Community* (Barrytown: Station Hill Press, 1988), xv-xx.

²⁹ Blanchot (1988), 2-3.

³⁰ See Jean-Luc Nancy *La Communauté désœuvrée* (Paris: Christian Bourgois, 1983) translated by Peter Connor as *The Inoperative Community* (Minneapolis, MN: University of Minnesota Press, 1991), 7.

our articulation of what we think is shared in a community. According to Nancy, different cultures and societies have attempted to understand this primordial origin of communal experience through a certain hegemonic narrative. Nancy calls this form of story-telling ‘myth’. For Nancy, myth has historically engendered the conceptual reflexivity of our societies and has led us to believe that we have understood what constitutes the bonds of our communities. For Nancy, however, community is that which always exceeds our attempts to explain our communal origins; community takes shape not in myth itself but in the interruptions of myth, or rather in the instances when we find that the constitutional delineation of the conditions of our community becomes questionable.³¹

An important caveat for Nancy’s appropriation of the term ‘community’ is his rejection of the term ‘individuality’ in favour of ‘singularity’.³² For Nancy, community concerns singularity and precedes the intersubjective bonds that connect individuals. In a similar sense, Blanchot’s account of ‘the Other’ as singular individual incommensurable with a homogenous collective demands respect for the irreducibility of singularity. Finally, Derrida brings this issue of singularity to bear on our models of friendship, our models of democratic social interaction, and our models of the relation between author and reader. Blanchot’s ‘irreducible Other’, in the context of the disparity between communism and individualism, and Nancy’s inoperative community, contingent not on a myth of common origin but on the deconstruction of this myth, are both attempts to understand the problems that singularity raises for a model or paradigm of community.

Returning to the problem raised in this section: how would Derrida explain Nietzsche’s ability to address himself to a radically different readership? The problem arises when we want to communicate content in the form of a book or essay to a reader who cannot share my way of thinking. If we discuss this with particular regard to a cultural revolution that would constitute the ‘revaluation of values’, a revolution Nietzsche associates with ‘coming philosophers’,³³ we could say that Derrida’s Nietzsche faces a problem if he intends to prescribe to these future philosophers certain ways of proceeding with this revolution. If I ask or demand that you perform X, X being one of a set of possibilities available to you, then we must share a mutual understanding of X i.e. X must be within both my range and your range of intelligible possibilities. As discussed above, this kind of mutual understanding is not the kind of relation that Derrida sees in Nietzsche’s addresses to future readers.

This would, I suggest, be a problem for Derrida’s reading if he claimed that Nietzsche both valued an unanticipated readership and addressed prescriptions to this readership. However, while the former is central to his reading – indeed, it is

³¹ Nancy (1991), 43-70.

³² Nancy (1991), 6-7.

³³ See Friedrich Nietzsche, *Jenseits von Gut und Böse* translated by Walter Kaufmann as *Beyond Good and Evil* (New York: Vintage, [1886] 1989), §2.

that which Derrida thinks makes Nietzsche democratic – the latter is not a part of Derrida’s interpretation; Derrida’s Nietzsche does not prescribe substantive guidance to his readers to come. The task that Derrida faces thus becomes elucidating an alternative way in which Nietzsche, or any author, could orient himself to future readers. This is I believe the problem that occupied Derrida’s treatment of Nietzsche in *Politics of Friendship* and led him to consider what a ‘community without community’ would be. Derrida’s answer, inspired by Bataille, Blanchot and Nancy, is that one can value that which is unique to a person, and that one can do this through hoping for moments when our established conditions for joining our community are challenged. In the words of the tradition in which Derrida places himself, one can value ‘singularity’ or ‘the Other’ rather than principles that determine the sufficient conditions for being my friend.

Analogous to this analysis of community or friendship, Derrida will assert of Nietzsche that his alternative to the bond of commonality between writer and reader is to value readers who read his works an irreducibly unique way. The ‘friends of solitude’ that Derrida identifies as Nietzsche’s intended readers are said to be valued not for their capacity to understand Nietzsche’s work in the way Nietzsche himself did, but for their capacity for relating in a singular way to the content of Nietzsche’s writing. If Derrida’s reading of Nietzsche is accurate – an exegetical issue to which I will turn in the final section – then Nietzsche does not require a common understanding between himself and his awaited readers. Instead, Derrida’s Nietzsche values those readers who will appropriate his thought in a way that breaks with traditional reception of his work – singular readings that challenge paradigmatic accounts of Nietzsche’s thought. According to Derrida, Nietzsche’s intended readers, equated in *Politics of Friendship* with his ‘friends of solitude’, are sufficiently unique to remain heterogeneous to models of how-to-read-Nietzsche, even a model that may have originated with Nietzsche himself.³⁴ Derrida’s Nietzsche, then, is not so much concerned with the successful communication of content as he is with the way he his read, and whether his readers are singular in their appreciation of his work.

With Derrida’s full account of Nietzsche’s readership in view, I want to return to Derrida’s claim that Nietzsche is democratic. I explained in section one that Derrida thinks that Nietzsche is democratic insofar as he values perpetual revision of our way of viewing the world and appreciates the importance of resisting having the last word in philosophical, political or moral discussion. More specifically, Derrida thinks that Nietzsche’s comportment to the future is democratic insofar as it affirms such radical cultural transformation that Nietzsche cannot himself prescribe those changes in advance; being democratic, for Derrida, means hoping for a time when not only our decisions are revised but the very possibilities that are open to us have altered.

³⁴ They are ‘friends of solitude’ in the sense that they cannot be accurately grouped together with other readers – they stand alone.

This orientation to the future, for Derrida, is evidenced in the way Nietzsche thinks of his readership. Derrida's Nietzsche intends to be read by those new philosophers who exceed Nietzsche's present understanding; Nietzsche affirms a reader who not only has a different philosophical or moral perspective, but has a transformed range of possible interpretations of his work at her disposal. For Derrida, Nietzsche's orientation to his readers is such that Nietzsche resists having the last word on his own work, and that he affirms interpretations that challenge established conventions regarding the meaning of Nietzsche's writing. In short, Derrida maintains that Nietzsche has a characteristically democratic orientation to the future reception of his critique of modern Europe.

IV

My aim in this paper has been to reconstruct a reading of Nietzsche offered by Derrida in order to understand a) his novel interpretation of the political implications of Nietzsche's critique of modernity b) what it would mean for Nietzsche, or indeed anyone, to have a democratic orientation to the future and c) how such a thing might be possible for an author addressing future readers. Most of this paper has been dedicated to explaining Derrida's contribution regarding a) and b). With regards to c), I have addressed one potential problem with valuing a radically different reader and suggested that Derrida has an answer to this problem. What I have not done is argued that Derrida's reading of Nietzsche is accurate. I have concerns about his reading that have kept me from doing this, and I want to explain these concerns in this final section. These concerns will also point to a fourth issue which I also have not yet dealt with in this paper: d) whether a democratic orientation to the future (at least how Derrida describes it) might be valuable.

Derrida's reading of Nietzsche and democracy has the benefit of incorporating the virtues of other democratic readings of Nietzsche without facing the same problems as those readings. Others who read Nietzsche as democratic emphasise his resistance to dogmatic law with universal applicability; it is important to Nietzsche that individuals are not dissolved into a homogeneous mass or 'herd,' and accordingly that our ethical codes do not erode the singularity of creative individuals. But this alone does not warrant reading Nietzsche as democratic, as the liberation of great individuals from a herd mentality is not only possible in a democracy. We might say that pluralism is an underdetermined inference from Nietzsche's objection to herd homogeneity. In fact, Nietzsche claims that great individuals have been supported by hierarchical societies, suggesting that an aristocratic 'pathos of distance' has been necessary to the development of an ethic of self-overcoming that drives the cultivation of creative individuals (*Beyond Good and Evil* §257). Nietzsche's resistance to social homogeneity appears to lead him more in the direction of aristocracy than democratic pluralism.

Derrida's own version of this reading acknowledges this same worry about homogeneity in Nietzsche. But Derrida's Nietzsche responds to modern herd mentality not by advocating a democratic pluralism, but by affirming singular future readers

of his work. Derrida's Nietzsche is not democratic in virtue of his support for a pluralistic society, but is democratic in virtue of his support for heterogeneity in the future of Europe. In this way Derrida's reading is able to locate democratic values in Nietzsche's style and hopes for the future, and incorporates Nietzsche's valorisation of individuality, while avoiding the underdetermination problem facing those who infer pluralism from Nietzsche's valorisation of individuality.

However, Nietzsche's claim that social hierarchy is indispensable to strong or healthy culture is potentially a difficult problem for those, including Derrida, who want to read any democratic sentiment in Nietzsche. Many of those who have reacted critically to the pro-democratic Nietzsche literature have drawn attention to Nietzsche's anti-egalitarianism, particularly Nietzsche's lament of the decline of pre-modern aristocratic orders of rank.³⁵ Any reading of Nietzsche as democratic must undoubtedly account for these strong anti-egalitarian sentiments. The question we must ask of Derrida is whether the form of egalitarianism entailed by a democracy to come (that which Derrida ascribes to Nietzsche) contradicts Nietzsche's objections to the levelling instincts of modern egalitarianism.

Derrida's democracy to come does entail a particular kind of equality. If Derrida is right, then Nietzsche foregoes attempts to determine in advance what constitutes a good and a bad reading of him. If he were to do otherwise, according to Derrida's reading, then he would fail to genuinely affirm the value of singular interpretations yet to come – he would be making proscriptions, and running into the problem highlighted in section IV. This refusal to evaluate in advance constitutes a particular mode of egalitarianism. However, this kind of egalitarianism is distinct from the homogenising equality that Nietzsche objected to. Derrida's critique of Nancy in *Rogues* explicitly states the former's commitment to a distinct mode of equality:

As soon as everyone...is equally (*homoiōs*) free, equality becomes an integral part of freedom and is thus no longer calculable. This equality in freedom no longer has anything to do with numerical equality or equality according to worth, proportion of *logos*. It is itself incalculable and incommensurable equality; it is the unconditional condition of freedom, its sharing, if you will.³⁶

Derrida distinguishes the equality that affirms singularity from an equality that renders individuals calculable. The latter is understood as an equality in virtue of a common measure, a metric applicable to all by which we can calculate the worth of individuals; we are equal insofar as we are allotted the same value according to this common metric. The version of equality that Derrida repudiates is also the kind of equality that Nietzsche criticises in his best known anti-egalitarian passages. Nietzsche's distaste for the "democratization of Europe" focuses on the homogenising effect of the dissolution of middle age chivalric or aristocratic orders. In *Beyond Good and Evil* §242, for example, Nietzsche tells us 'Europeans are becoming more similar to each other' as they become 'increasingly independent of any *determinate* milieu.' Nietzsche's problem with this is not with equality per se, but with an equality

³⁵ See for instance Thomas Hurka, 'Nietzsche: Perfectionist' in *Nietzsche and Morality* ed. Brian Leiter and Neil Sinhababu (Oxford: Oxford University Press).

³⁶ Rogues, 49.

that brings with it a herd mentality and precludes the development of the kind of great individuals he finds in ‘healthy aristocracies’. Derrida would no doubt agree that there is something wrong with herd-like equality, either among friends or among a political community. There is no disagreement between Derrida and Nietzsche with regard to this kind of equality.

The same cannot be said, however, for the kind of egalitarianism that is integral to democracy to come. This alternative notion of equality might best be understood as a negatively defined equality; rather than ascribing a positive equal value to all, the egalitarianism of democracy to come foregoes evaluative comparison between individuals, and thereby precludes positive statements of inequality (X is less valuable than Y). In a word, we could say that the democratic orientation endorsed by Derrida is *indiscriminate* with regards to that which is yet to come. To determine in advance our trajectory into the future, to discriminate between better and worse ways of proceeding, would according to Derrida introduce a future horizon that shuts out singular possibilities. And to do this would, for Derrida, be undemocratic.

This indiscriminate hope for any future change is, I submit, not something that Nietzsche would endorse. As mentioned above, the value of hierarchy in Nietzsche (most often discussed in terms of Nietzsche’s supposedly aristocratic politics) has often been cited against attempts to ‘democratise’ Nietzsche. The significance of hierarchy for Nietzsche can of course be read in many ways, and presents itself in a number of forms in Nietzsche’s later works. One such way is a hierarchy of drives internal to the ‘soul’; having one drive ‘come out on top’ in order to dominate all others impulses and inclinations internal to the self can above all else be a strong motivation to activity.³⁷

The question of what conditions help motivate creative activity is undoubtedly of great importance to Nietzsche. With his contemporaries’ foundational belief systems ebbing away, much of Nietzsche’s late concerns are preoccupied with what he sees as the miserably insufficient attempts of modernity to continue in a positive and constructive way. Neither the utilitarianism of the ‘last man’ (among others, according

³⁷ In the same way that, as suggested in Nietzsche’s earlier work, a pluralistic culture can only be a strong culture when under an overarching and unifying principle. This is especially prominent in his account of Wagner’s development as a cultural revolutionary capable of reviving tragedy and uniting the future of Germany under a *Gesamtkunstwerk*. See Friedrich Nietzsche *Unzeitgemasse Betrachtungen IV* translated by R.J. Hollingdale as *Untimely Meditations IV* (Cambridge: Cambridge University Press, [1876] 1997); for an account of Wagner’s philosophical influence on Nietzsche’s early hopes for a unified culture, see Julian Young ‘Richard Wagner and the Birth of *The Birth of Tragedy*’, *International Journal of Philosophical Studies*, 16:2 (2008), 217-45; and for an example of Nietzsche’s mature articulation of this sentiment, see Nietzsche [1886], §260. Nietzsche’s account of unifying a pluralistic culture through an overarching principle bears much resemblance to his celebration of unified individuals. For recent discussion of this theme in Nietzsche see Ken Gemes ‘Nietzsche on Free Will, Autonomy, and the Sovereign Individual’, in *Nietzsche on Freedom and Autonomy* ed. Ken Gemes and Simon May (Oxford: Oxford University Press, 2009), Paul Katsafanas ‘The Concept of Unified Agency in Nietzsche, Plato and Schiller,’ *Journal of the History of Philosophy* (forthcoming), Simon May ‘Nietzsche and the Free Self’ in *Nietzsche on Freedom and Autonomy* and Robert Pippin ‘How to Overcome Oneself: Nietzsche on Freedom’ in *Nietzsche on Freedom and Autonomy*.

to Nietzsche, Mill) nor the pessimism of the nihilist (among others, Schopenhauer), suffice as reactions to the collapse of a theologically grounded ethical horizon. These two ways of proceeding lack an urgent desire for upheaval, transformation and improvement precluded either by the conservatism of the last man (maximising one's happiness in accordance with currently available petty pursuits) or the resignation of the nihilist (improvement is not possible).

The problem with the messianic attitude of democracy to come is that it cannot give the normative grounds for actively transforming the current situation; it lacks, we might say, the capacity to motivate present action. Hope for a radically different future can at best motivate me to clear the ground for a cultural revolution, but gives me no guidance as to how to actively involve myself in this revolution.³⁸ Derrida will insist that the democracy to come places an urgent demand to act on us, and at times is at pains to deny a quietistic effect of deconstruction.³⁹ Derrida may well be warranted in thinking this, but it is not the case that Nietzsche would agree, and by extension it is not the case that Nietzsche himself thinks that a democratic attitude toward the future is the right response to modern nihilism.

Nietzsche's emphasis on the value of hierarchy, and the decline of social hierarchy, suggests to us that a lack of discrimination is precisely what is nihilistic about late modernity. If the death of God means a dearth of normative authority, and with it the absence of cultural distinctions between right and wrong or good and bad, then for Nietzsche an indiscriminate hope for the future is no more than a symptom of late modernity's lack of normativity. In short, Derrida's democracy to come would for Nietzsche be just another symptom of modern nihilism; doing no more than hoping for something different is a manifestation of nihilism, not the way Nietzsche wants us to respond to it.

Derrida does appreciate the bind that Nietzsche himself is in. Nietzsche is aware that he is a product of his own time to some extent; his strong desire to be untimely (take, for instance, the way in which Nietzsche takes pride in being misunderstood in by his contemporaries) speaks to Nietzsche's frustration with the fact that he is writing in a time of decadence and cannot help but be somehow sullied by this. Nietzsche's problem then is that he could not trust his own revaluation of values. This cultural revolution must be left to those who have made a clean break

³⁸ This criticism of messianism will be familiar to those who have charged Marxism with the same problem. Marxists have repeatedly tussled over whether Marx's teleological theory of history asks us to prepare for a proletarian revolution, or bring it about ourselves. In other words, do we hope for a future so different to our own that we would sully it by involving ourselves in its creation? Or does the creation of communism require action in the present to realise that future?

³⁹ 'My pointed reference to urgency is meant to suggest that in the necessarily finite time of politics and thus of democracy, the democracy to come certainly does not mean the right to defer, even if it be in the name of some regulative Idea, the experience or even less the injunction of democracy... The to-come of democracy is also, though without presence, the *hic et nunc* of urgency, of the injunction as absolute urgency. Even when democracy makes one wait or makes one wait for it,' *Rogues*, 29.

from late modern nihilism. Derrida's reading acknowledge that Nietzsche can do no more than wait and hope for those who have made this clean break. But the problem with Derrida is that he has turned this messianic hope – for Nietzsche, the only option in an era of degeneration and empty values – into something valuable in itself. This is, I submit, where Derrida and Nietzsche disagree on the value of democracy.⁴⁰

⁴⁰ For comments and suggestions I am grateful to Pete Bloom, Steve Gormley, David McNeill and Peter Dews.

WRITING AND TYPOGRAPHY. RHYTHM, TYPE, AND THE MATERIALITY OF THE LETTER

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ABSTRACT. In spite of the various approaches discussing deconstruction and textuality, the notable contributions trying to connect text theories and a typographic thinking are nevertheless limited to a few names only, without consolidating a purely philosophical position regarding this subject. It is only by an intimate archaeology of the text that we can unveil the structures and constructions that form a text's reading grid, and it is only in the rhythm of a text's separations and interruptions that we can fully trace and understand the double movement of imitation and identification that characterizes every text. Inside a text, rhythm is actually the binding link. It marks an inscription and takes place from inside the structures of a text. Whilst the subject's access to itself can only take place *by writing*, the history of writing is itself the subject of a prevailing uniformization and standardization. Writing is no longer understood as *technics*, but as "technology", and as such it objectivizes the norms of its own constitution and contributes to the spread of knowledge *as power*. Typography is more than a manner of "representing" the text; it is a technological and "political" instrument used to standardize the languages into an universal "grammar" and "officialize" the cultures. But if writing is *lucrative* in the sense of *an act of interpretation*, the analysis of its construction can also reveal its tensions, its abstractions and dilemmas, its repetitions and narrations, and the possibility to turn writing into an act of resistance.

Keywords: *typography, writing, Derrida, deconstruction, grammatization, rhythm*

Introduction

Words have always been over-exposed in the contemporaneity, in order to be related to the *typological* necessities of the various discourses. The force of each meaning can only be revealed through an intimate archaeology of the text, by emphasizing the separations and "interruptions" of the text, the ineluctability of the text's exposure. Because reflection is always posterior to the time of writing, the traces of the meaning must be read in the "rests" and "residua" of the text, in its *appendices*, by operating what Jacques Derrida calls an intervention-lecture, as a possibility of opening up the letter and confessing to its actual typographic traces. We must evaluate the conceptual and graphic ways of typing the letter, in order to better understand

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typography not only in terms of *print*, but also as *typography* in the sense given by Philippe Lacoue-Labarthe, that is as separation of *the subject of enunciation* from *the subject of writing*.¹ This separation inherits the difference used by Saussure and the theory of enunciation, and it is also a version of the ontological difference, that is the difference between beings and being, between all that exists and the very existence of what exists. From this perspective, it is only this separation that makes possible the passage from the (de-)constitution of the “subject” to the (re-)composition of a text, to a (re-)composition *through* the text. (Re-)composition refers here to what Derrida calls *deciphering*, not as a philosophical “method” or “criticism”, but as a *maneuver strategy*², as an operability and transfer of the meaning that can be traced in the materiality and materialization of the text *as* text. This way, we can also observe the way the text *resists* its own reading, the way it is constituted around what Derrida calls “the sensitive point in a reading, the point of incomprehension that organizes it”³. This so-called point of incomprehension is at the same time the *spectre* that haunts every typography of the text, as well as the subject’s own typography. The *resistance* of the text, as resistance of the text itself, is constituted around the *materiality* of the letter and the manner whereby the letter hosts each relation it keeps, and this is also its weakness, since the letter is not only the vehicle of a meaning, subject, or “*esprit*”, but also an *idol*, an automatized meaning operator.

The importance of the subject in this context refers to the necessity of tracing not only the deconstructive principles which might be applied in the typographic thinking, but also the principles inherent to any attempt to emphasize and *expose* the essence of what the letter and the text actually are and how they relate. For that purpose, I think it is very important to build theoretical and practical bridges between the deconstructive theories and the contemporary theories on writing and typography, so as to clearly outline both the principles discussed by Jacques Derrida or Philippe Lacoue-Labarthe, and the “applied” theories of some letter and text designers and critics, such as Gerrit Noordzij, Rick Poynor or Ellen Lupton. The more general stake of this discourse is to articulate the form of the word both in what it offers *for seeing* and *for reading*, and in the manner it silently relates to the content of history itself, the content of politics, thinking, technological and artistic innovation. And in doing so, one might be able to further study the way the characters and letters relate to the philosophical thinking, to the changing technologies, to social customs and artistic movements, culminating in a philosophical approach on *writing* as a form and manner of using the written word. The implicit consideration underlying this article is that the text is constituted as *materiality*, and that the letter represents *the material potential* of

¹ Philippe Lacoue-Labarthe – *Typography. Mimesis, Philosophy, Politics*, trans. by Christopher Fynsk, Harvard University Press, Cambridge, London, 1989 (*Le sujet de la philosophie. Typographies I*, coll. “La Philosophie en effet”, Aubier-Flammarion, Paris, 1979).

² See Jacques Derrida – “Introduction: Desistance”, in Philippe Lacoue-Labarthe – *Typography. Mimesis, Philosophy, Politics*, pp. 10-14.

³ Id. – *ibid.*, p. 14.

structuring the sense of writing. In other words, the accent falls on studying the materiality of the letter as an *avant la lettre* (Lacan), and on the manner the letter itself and its construction make possible *the exposure* of any reading grid, understood as both “unmasking” of the reading, therefore as *evidence* and *testimonial*, and as “excavation”, “archaeology” (Foucault), and “developing” of the reading grid. Like this, the preserver of Being (Heidegger) becomes “hunter” of signs (Lacoue-Labarthe), and the *subject* itself is but the vector of cultural and conventional signs. In this sense, Derrida’s discussion around the idea of *copyright* in Searle⁴, in other words the re-interpretation, in a different key, of a *convention*, belongs to the “deciphering” and “exposure” of the possibilities to mark the permanent and successive inscriptions in the letter of a text and, implicitly, in the *corpus* they edify.

The irreducibility of the typographic structure. Derrida’s *rhythmo-typy*

One of the starting points for this approach is the relation between the (de-)constitution or the “loss” of the subject (Lacoue-Labarthe) and what Derrida calls *desistance*, in other words, *the ineluctable*⁵ which forbids the subject to be a subject and preordains it to *scenarios*. These scenarios mark the *fictionable* character of the subject and forbid its access to itself in the absence of a *supplement* of a model. The supplement is not only a *surplus* here, but specially a *complement* “attached” to the subject. Every subject is “disabled” not only before any decision, but even before being the subject of a reflection, of an action or a passion. The subject already manifests an open gap and is constantly “on its tracks”. It is not accidental at all that Lacoue-Labarthe’s *Typographies*⁶ begin by a *predestination* of philosophy to madness, because this “weakness” of the subject already supposes a form of “desertion” and “loss” – the subject “deserts” its own dissolution, the defeat of the subject *as* subject. “The subject” as such is lost in the movement caused by this “weakness” asking for “the hunting of signs” and “*is nothing other than* the formation of this movement”⁷. “The subject” is hunting its own signs, its own testimonials, it makes proof and *confesses* to its own *evidence*. On the other hand, both writing and typography reproduce and generate a dominant mimetology, a *mimesis* understood as idealized repetition, where “the subject” seems to be constrained to a defensive carried through a double movement of imitation and identification, marked by *adequacy*, *similarity*, *semblance*, *accuracy*, *exactitude* or *evidence*, all of which are the marks of our own way of writing (ourselves) and of inscribing ourselves *as* subjects.

There is an irreducibility of every typographic structure, as the “subject” is crossed from the very beginning by a multiple and anonymous discourse. The condition of identification is precisely *the impossibility* of this identification, *the gap* that calls for

⁴ Jacques Derrida – “Signature, événement, contexte”, in *Limited Inc.*, trad. par Elisabeth Weber, Galilée, Paris, 1990, pp. 16-51.

⁵ Jacques Derrida – “Introduction: Desistance”, pp. 1-6.

⁶ Id. – *ibid.*, p. 16.

⁷ Id. – *ibid.*, footnote 9, pp. 16-17.

repetition, spacing, rhythm, contrast, which comes back to the idea of repercussion, resonance, echo, reverberance, or what Derrida calls a *written* rhythmo-typy that permanently prescribes our character, our typology, “before” any specular reflexivity or auto(bio)graphic “discourse”.⁸ The motif of the rhythm lies deep within the “power” of deconstruction, because it binds together more possibilities, as the rhythm is “the spaced repetition of a percussion, the inscriptive force of a spacing”⁹, and does not belong neither to the visible nor to the “spectacular” figuration. For Derrida, the *rhythmotypical* or *typorhythmical* structures must remain outside the order of the sensible. Rhythm belongs to *inscription* and “character”. In the absence of a “proper image” with which we could identify ourselves, there is no essence of the imaginary, no unity or stability of the figural, but only the *compulsion* to repeat, to *write* and *re-write*. On the other hand, to write the way things are being written in reverts to a *self-writing*, to *signing* your own *desistence*, to the recurrence of the failure, which translates an inhibition understood not as paralysis, but as *pre-scription* of the obligation to repeat the same gesture. The repetition assumes the auto(bio)graphic *narration*, searching for the sense in the caesura of the rhythm or what we could call *the arrhythmias of the sense*.

The world of today seems to be marked by hyper-subjectification, by the automated acceleration, by the digitalization of the letter, in other words, by the transformation of the letter into a network of computational applications, where typography becomes a form of encoding or program to which we have an intermediate access, and where the virtual letter represents the typography of the computational, a serial aspect devoid of any authentic inscription. Therefore, the letter must find the space *between* once again, it must find the *laterality*, the *periphery*, the *marge*, the *abstraction*, where the materiality of the individual writing can still keep its distance towards the monumentalisms of the collectivity. The letter must engage and even “contaminate”¹⁰ so as to re-generate the typographic space in the guise of a *barrage*, an *adversity*. The letter thus becomes a “workshop”, a “building site”, or even what R. E. Somol calls a *dummy text*. It is not accidental that the text where Derrida responds to Searle¹¹ “omits” the letters “a”, “b” and “c” from the title; what is actually absent is the *convention* for the “alphabet”, in other words *the typographic convention upon the disposal, superposition and imposition of the letters*, through a gesture of “*parenthesizing*”, of opening the pure presence and emphasizing the writing as condition of a *suppressed memory*. Therefore, aspects that relate to the *stroke* of the letter, the *orientation* of the word, or the *consolidation* of contrasts must not be seen only conceptually, but also formally, offering the possibility of theorizing the

⁸ Id. – *ibid.*, p. 31.

⁹ Id. – *ibid.*, p. 32.

¹⁰ I am using Andrew Mitchell’s suggestion as expressed in “Contamination, Essence, and Decomposition: Heidegger and Derrida”, in David Pettigrew and François Raffoul (eds.) – *French Interpretations of Heidegger. An Exceptional Reception*, State University of New York Press, Albany, 2008, pp. 131-150.

¹¹ Jacques Derrida – *Limited Inc.*, pp. 61-197.

various types of typographic systematizations of the letter and the text. An example here could be, in a coherent research of the *rhythmotypies*, the studying of the typographic systems (axial, radial, dilatational, modular, transitional, bilateral, etc.) in relation to an analytical research upon writing and to a circumscription of the cultural, social, and political frames where it takes place, as writing is always tributary to a political, social, and thinking system characteristic to a period that thus spaces itself from its own history and institutes *writing* as a proof of the ineluctability whereby we seek to constitute ourselves as subjects.

In *Of Grammatology*, Derrida says that “the value of a system of language or writing cannot be measured in terms of intuition, of the clear and distinct character of the idea, of the object’s presence into evidence. The system must itself be *deciphered*.”¹² Every word must *adjust* and *interfere* with the course of things, by producing *the reversed sense* of interpretation, tributary to a pharmacology whereby history itself escapes itself¹³, by creating the *breaches* of a self-(de-)constitution. Because reading is a physical process, the subversion of the dominant readings can also be achieved through what writing can determine as *map*, by mapping the regions of possible sense, as both writing and geography are systems where the individual is a point, a well-defined element, where “I” is both the linguistic person and the actual place of a presence that loses, dissimulates, and disseminates itself. Derrida was to underline this aspect in another register, by bringing together the notions of *typology* and *topology* – the effects of need upon the form of a language, and the nativity of that language, the origin of languages and the difference between languages must be considered *together*.¹⁴

For Derrida, writing is an active form of knowledge which is *interrupted*, “betrayed”, and even *suspended* by the breath of life. The work of deconstruction does not take place from outside these structures, but from inside them. By operating from the inside, by feeding itself on the strategic and economic resources of its subversion, deconstruction is always triggered and sustained by its own effort.¹⁵ The “betrayal” of writing is life itself, because life threatens breathing, the spirit, and history as the spirit’s relation to itself at the same time. Life is the end, it is the finitude, and it is also its own paralysis, because by “immobilizing the spiritual creation through the repetition of the letter”, through commentary or exegesis, by being isolated into a limited environment, it becomes the principle of death itself and the difference inherent to the becoming of being.¹⁶ Writing invades, it overcharges and stresses the speech, and it transforms the memory, the knowledge, and the spirit. The repetition

¹² Jacques Derrida – *Of Grammatology*, Romanian translation by Bogdan Ghiu, Tact, Cluj-Napoca, 2009, p. 96.

¹³ See chapter “History: cure or poison?”, in Paul Ricoeur – *Memory, History, Oblivion*, Romanian translation by Ilie Gyurcsik and Margareta Gyurcsik, Amarcord, Timișoara, 2001, pp. 171-175.

¹⁴ Jacques Derrida – *Of Grammatology*, p. 230.

¹⁵ Id. – *ibid.*, p. 45.

¹⁶ Id. – *ibid.*, p. 47.

of the letter is the revival of the idea of death, it is the uninterrupted *destitution* of the self, the threat and the imminence of a death instance. And writing becomes the *deferment* of this instance.

Because every memory system functions as a form of writing, typography is but one of the “manners” whereby the language repetitions take place. In fact, the attack operated and *instrumented* by deconstruction upon the neutrality of signs is the same one present in the consumerist mythologies of Barthes, the institutional archaeologies of Foucault, or the situationist aesthetics of Baudrillard. The postmodern typography, just like deconstruction itself, involves the disintegration of the text, the *pulverization* of the compact block whereby the disciplines are edified. The ordering of disciplines, the continuous *normation* and *grammatization* of the languages must be interrupted precisely through the *scriptural destitution* of the motifs, by annulling the dominant ideologies that institute the normativity of sciences. Deconstruction is not a *style*, a *manner*, but an *attitude*. It does not define itself in relation to a construct, but in relation to the construct’s inherent *dilemma*.

Yet there is a *graphic* operation that defines the writing’s ability to *undermine* history. Along with the disintegration of the text through the progressive extensions of the spaces between lines and words, or, on the contrary, through the forced annulment of these spaces and the superposition of elements, *the footnote* becomes the main text in many cases. The footnote is no longer just an indication, but a parallel history which undermines the history (of the text) and destitutes the textuality. As the history (of the text) is being undermined by the footnote, *history itself becomes a footnote*. The expositive “surplus” comes *before* the description and the enunciation. The footnote is the original enunciation, it reminds us of an anteriority that can only be understood as *trace*, it leads *beyond* the present condition of the textuality. History takes place *below*, and in doing so it undermines its own present and destitutes the authority of its own presence.

For Derrida, the interiority of speech is based on the existence of exterior and empty representations of the alphabet. What deconstruction reveals is that speech is characterized by the same failure in the “transparent” reflection of the reality, by the same *inner void*¹⁷. The phoenic writing is not only a *secondary reflection* of the language, but also the *symptom* of the language’s own *lack of presence*. This is why, for Derrida, as well as for a large part of the postmodern typographic thinking, the constitutive element of the alphabet is not the letter, but the spacing and the punctuations, that is to say the elements imposing *the rhythm of writing*. Even though it is made of letters, the discourse manifests and *phenomenalizes* itself by the agency of additions and appendices, associate phenomena, punctuation and framing elements. The “discourse” of the letter is not only its “shape”, but also its *spacing*, which is never relative to the letter, but to what puts the letter in various relations. The margins, for

¹⁷ See Jacques Derrida – *La voix et le phénomène. Introduction au problème du signe dans la phénoménologie de Husserl*, coll. Epiméthée, P.U.F., Paris, 1989.

example, are constructions that are a positive, supporting element and a negative, separating, differentiating distance at the same time. The *substance* of typography does not reside in the alphabet as such, which institutes the *generic* shapes of characters and their *conventional* usage, but in the visual framing and the *specific* graphic shapes that *materialize* the system of writing¹⁸. Typography engrafts the writing and takes place *on the edge of* writing. It represents a *marginal* and *peripheral* construction whereby writing deconstitutes itself and becomes *material*. Writing is *desistent*, inevitable and ineluctable precisely through this *materialization*, through the incessant objectification of its spacing and repetition.

Derrida's *Glas*¹⁹ is not only a reflection upon the textual and literary nature of writing, operated through a self-deconstruction process and a *philosophical collage*, but also a graphic manner of de-structuring the text so as to allow for Derrida's own signature. The idea of signature, which will then be revived in *Limited Inc.*, turns out to be essential in the *economy* of writing, as it is the only form of writing that avoids the dichotomies of representation. From a typographic point of view, the book is designed as a series of parallel texts, imagined as collage-dialogue, where the various typographic characters and the various forms of alignment, framing, and exposure suggest the (absent) voices and the heterogeneous manners of (in-)scription. The additions and juxtapositions become the author's *deliberate strategy* of *staging* and *undermining* the intrusion of visual forms into the verbal content, the invasion of "ideas" and "autobiography" through notations, pauses, differences. In *Glas*, the text becomes a field of letters where typography is a performing medium meant to emphasize the absence of writing and signature, the *laterality* of the sense, the *marginality* of the openings. From the perspective of its typographic concept (realized by the famous designer Richard Eckersley), Derrida's book opposes two conflicting perspectives: on the one hand, a series of structures designed to be the *neutral* frames for the dominant textual figures, and, on the other hand, various patterns of typographic constructions designed to be the active fields that *ignore* the conventional hierarchies²⁰. *Glas* does not only reveal *the construction of writing*, but also *the ubicuity of the normative sign systems*, and Derrida deconstructs by emphasizing the repetition, the fragmentation that characterizes any writing, as *endemic* forms of human expression. After *Glas*, Richard Eckersley designs Avital Ronell's *The Telephone Book*, a book discussing the concept of the telephone in relation to its effects upon society. An exponent of the postmodern generation inspired by the philosophical works of Derrida devoted to language, Eckersley annuls the typographic preconceptions and exploits the material for its own *graphic* and *plastic* qualities before representing it as a *vector of communication*. The designer – who has, by this time, become a critic himself – deconstructs the collage of anecdotes and philosophical reflections, by laying them out as variations

¹⁸ A similar argument can be found in Ellen Lupton and Abbott Miller – *Design Writing Research. Writing on Graphic Design*, Phaidon, London and New York, 2008, pp. 11-23.

¹⁹ Jacques Derrida – *Glas*, Galilée, Paris, 1974.

²⁰ See Ellen Lupton and Abbott Miller – *Design Writing Research*, p. 20.

in pagination. The principles and the materials refer to the context of the telephone usage, to a situation of communication, to a conception that the text itself unveils. The paragraphs are many times suddenly interrupted, some pages are left blank, and the disparities are deliberately marked.

There is a common feature of all these works, and that's the graphic and conceptual insistence on the idea of *contrast* and *rhythm*. If writing is contrast, it is *rhythm* at the same time. Furthermore, the contrasts can only be established through the rhythm²¹. Wherever Western culture insists on writing as a means of thematizing the identity (of a "state", for example), this identity is tributary to the various *rhythmologies* that articulate it. Whether we're looking at the typographic character as decoration or as an element of the alphabet's flexibility, as a functional sign in the regularity or irregularity of the construction and reading grids, as an exponent of some well defined or aleatory forms of expression, as an idea or as a program, the spacing of the typographic character belongs to a rhythm.

The rhythm in typography

For Gerrit Noordzij²², the (written) word is made of white and black shapes that form into a rhythmic unity. If the rhythm and the contrast imposed by these shapes is a weak one, then the word is poorly formed (and as a consequence, poorly represented); and if the rhythm is absent, there is no *word*, even though the letters disposed on the surface of the paper are "scattered" according to a "proper" sequence²³. In everyday language, rhythm represents *the regularity in intervals of time*: "The intervals are not really equal in size and the same in form, but equal in value, equivalent. Rhythm in writing is not a temporal structure but a spatial matter – the intervals have length, but also breadth."²⁴

Noordzij adverts to the fact that *disturbing the rhythm will enhance the accessibility of the minuscule*, which owes its shape to the rhythmic flow of the line²⁵. For Noordzij, the middle ages begin with "the invention of the word" and end with "the invention of typography" understood as writing with prefabricated letters²⁶. The middle ages could be defined as a process for the consolidation of the word, that comes to a close by turning the Western world toward "the humanistic propaganda" of

²¹ For a technical description of the rhythmology of writing, see Emil Ruder – *Typographie / Typography. A Manual of Design*, VII-th edition revisited, Niggli Verlag, Sulgen, 2002, pp. 185-198, as well as Robert Bringhurst – *The Elements of Typographic Style*, second edition, Hartley & Marks Publishers, Vancouver, 1997, pp. 25-44.

²² Gerrit Noordzij – *The Stroke. Theory of Writing*, translated by Peter Enneson, Hyphen Press, London, 2005, republished in 2009.

²³ Id. – *ibid.*, p. 41.

²⁴ Id. – *ibid.*, p. 41.

²⁵ Id. – *ibid.*, p. 45.

²⁶ Id. – *ibid.*, p. 49.

the image-word at the beginning of the middle ages.²⁷ The technic used by the mediaeval writers is to place the letters as close as possible to one another, by tracing the interior shapes of the letters as small as possible so as to maintain the rhythm of writing unchanged, a fact which implies the considerable contraction of the letters: “With his invention of typography, the mediaeval scribe has relieved us of the need to write well and that has alienated us from the word. And in the end his chasing after a perfect rhythm lapsed into uniformity, because the narrowing of letters led to interior shapes that were not only equivalent, they became identical and the humanists could justifiably call this barbaric – gothic.”²⁸ Beyond Noordzij’s declared anti-humanism, based on the refusal of “the historiographic falsification” operated by the official culture of the Western world, a short conclusion can be drawn: the history of writing ends where the uniformization of writing starts to prevail. Writing loses its own identity, its own imprint, as well as the style of its *stroke*. It becomes an integral part of a system designed to regularize and grammatize the languages²⁹. There is a strong connection between the theory of writing formulated by Noordzij and the analyses carried out by Bernard Stiegler. The history of writing ends where the uniformization of writing and the uniformization of circulation languages comes to prevail. Writing is no longer understood as *technics*, but as “technology”, as it objectivizes the norms of its own constitution and contributes to the spread of knowledge *as power*.

There are two distinctive features of writing, regardless of a history of writing – writing is both functional and decorative. The functional and decorative character of writing then translate a series of languages which, in a series of symbols and signs defined as distinct conventions with an universal character, allow for the *decoding* of writing and the message. The symbol does not relate only to a certain symbolism, to a “metaphorical practice” that would denounce a history or a narration, but also to the signifying force of its own sign, which is inscriptive and inscribed at the same time, and whereby the sense or parts of the sense are activated and become manifest.

Yet there is no history of writing – writing begins as logography, where the “sign” replaces the word; it continues as a syllabic form, where the “sign” replaces the syllable; and it ends in its phonetical form, where the “sign” replaces a sound³⁰.

²⁷ Id. – *ibid.*, p. 50.

²⁸ Id. – *ibid.*, p. 53.

²⁹ See chapter “Psychopower, grammatization, and Christianity” in Bernard Stiegler – *Prendre soin. 1. De la jeunesse et des générations*, Flammarion, Paris, 2008, pp. 248-256, for a critical discussion of the process of grammatization, in tight connection to the idea of a general Grammer. In fact, this is one of the first direct “attacks” on Foucault. Stiegler accuses that for those who are interested in a history of the print, Foucault’s analyses on *the book* are disappointing, since this “retentional device” is not discussed according to its *material* technicality, nor to its intellectual *production* technicality. Moreover, Foucault seems to ignore the way the scriptural condition transforms, in the industrial society, by contributing to *the new stage of grammatization*.

³⁰ I thus resume the arguments presented by Gerrit Noordzij in *The Stroke. Theory of Writing*, specially those on page 47.

We never relate to the *sign* as such, but to its meaning, and it is not writing that suffers change, but the régime of sense we attach to it. The history of writing would therefore be only “a schematization of the evolution of spelling”³¹. The exposure and paradigmatic changes of the reading grid throughout the entire history represent manners of *grammatization* of the languages³², which in time denote not only the efficiency and performance of *reading*, but also the political normativization of the *corpora*. There is a constant movement of re-adjusting the typographic practices, marking a certain movement of history itself, whose perpetual recoil upon itself produces signs with altered sense. For example, the fact that the Greek parchments are written in a manner so alien to the modern typographers, where text columns do not show punctuation signs nor spaces between words, and where the pauses are marked by a subscription line (the Greek *paragraphos*) and by inserting a small white space, will be continued, starting with “the decline” of modernism and the start of post-structuralism, yet this restart is marked by the changed sense of the signs, by re-interpreting the (written) history. Until late in the Christian era, the Roman writing was made exclusively of capitals, specially in architecture writings, dominated by the “rustic capitals”³³, yet these capitals were actually interrupting *the rhythm* of writing. As Noordzij notes, the fundamentals underlying the rhythmic bond of writing are not present in the case of capitals, and the text written in capitals is not made of *lines* and *words*, but of *letters*.³⁴ According to Noordzij, “the invention of reading consists in the interruption of the rhythmic integrity of the line”.³⁵ It is here that a series of technical considerations interfere, imposing the criteria for the ordering and normativization of writing which will transform the Latin into a “political” and “aesthetic” norm³⁶.

Along with the apparition of the uncial, marked by the scriptural elegance aligned to the fall and rise of the pen; along with the instauration of the written artifact, in the IV-th century, by passing from the rolled parchment to the *codex*, we witness, gradually, a paradigmatic change of the ordering and *grammatization* manners: the paragraphs start to be punctuated by large capitals and projected at the edge of the page, even though the rest of the text is still written in a compact and uniform manner until the end of the IX-th century; the lower-case is introduced, where each letter is formed *separately* and is *separated* from the rest of the letters through the

³¹ Id. – *ibid.*, p. 47.

³² In the sense given to this process by Bernard Stiegler in *Prendre soin. 1. De la jeunesse et des générations*, Flammarion, Paris, 2008, pp. 183-189, and specially pp. 248-256.

³³ See Font. *The Sourcebook*, Black Dog Publishing, London, 2008, p. 20.

³⁴ Gerrit Noordzij – *The Stroke*, pp. 44-45.

³⁵ Id. – *ibid.*, p. 45.

³⁶ From a *political* point of view, the Latin is used as a standard for the normativization of the Western languages (the entire argument can be read in Bernard Stiegler – *Prendre soin*, pp. 232-235 and pp. 248-256); from an *aesthetic* point of view, the Latin continues to be, in the opinion of most font designers, the language in which the characters “look best” (see Gerrit Noordzij – *The Stroke*, p. 82).

white space of the page; along with *Historia Naturalis*, we see the first fusion between capitals and lower-cases in a comprehensive system of writing; the letters are given, starting with the XII-th century, an increasingly angular aspect, giving birth to the Gothic writing; the XV-th century brings the Venetian lower-case, *the italics*, considered until today one of the most clear and legible forms of writing ever invented; the “Roman” letter also appears now, which will be perfected in Venice and then used for the printing press, and which will know significant variations in the Netherlands, Germany, Spain, or France, where the letters become much thinner and edify what is being called a “continental” approach of the writing stylistic.³⁷

For Noordzij however, the maintenance of the *equilibrium* within the white shapes of the letters makes all the difference that emphasizes the various constructions of the type characters³⁸. The relation between *shape* and *counter-shape*, which in the case of writing is the relation between the white of the page and the black of the letter, underlies our perception, marking the clarity of a relation which otherwise is not *manifest*.³⁹ This is where Noordzij counters an entire tradition in the interpretation of writing. If, in the majority of studies, the accent falls on *the black of the letter*, writing is first of all defined, for Noordzij, by *the white of the word*: “Writing rests on the relative proportions of the white in the word. (...) The white of the word is the only thing all the various kinds of writing have in common”⁴⁰ and, as such, it is *the basis of writing*. In other words, it is not the sign as such that *represents*, but the white space surrounding it; it is not the word as such that exposes the sense, but its spacing throughout the white space of the page – “Wherever typography concerns itself only with the black shapes of the prefabricated letters printable on paper, the academic study of writing is coerced into separating the consideration of handwriting from a history of type.”⁴¹ In Noordzij’s opinion, this fact actually undermines the Western civilisation, by reason of an improper differentiation of the disciplines of writing, culminating not only in the confusion that paleographers have searched to perpetuate by the juxtaposition of the black “threads” of the contemporary handwriting and the black “shapes” of the (ancient) handwriting, but also in a “historiographic falsification” which has finally led to a perspective where the typographic letter and the informal handwriting are autonomous, and in the accent shifted on *the black of the letter* that de-identifies entire disciplines such as psychology, art history, mathematics, linguistic sciences, etc.⁴² In fact, Noordzij separates in his analysis the aesthetic or

³⁷ See *Font. The Sourcebook*, pp. 16-25. For an intimate analysis of the evolution of writing and printing in Venice, as well as the subsequent developments inside the European space, please refer to the excellent work signed by E. P. Goldschmidt – *The Printed Book of the Renaissance. Three Lectures on Type, Illustration and Ornament*, Cambridge University Press, New York, 1950, reprinted in 2010, pp. 1-26.

³⁸ Gerrit Noordzij – *The Stroke*, p. 14.

³⁹ Id. – *ibid.*, p. 15.

⁴⁰ Id. – *ibid.*, p. 15.

⁴¹ Id. – *ibid.*, p. 16.

⁴² Id. – *ibid.*, p. 18.

ideological conditions from what the properties of shapes determine or should determine⁴³, by emphasizing *the nature of contrast* established with the writing.

By reason of the paradox whereby the white shapes determine the place and circumscribe the space of the black shapes of the letter, but the white shapes are given by the black shapes, the original manifestation of writing, as *tracing* of the black shapes, lies in *the stroke* of the letter – “A stroke is the uninterrupted trace of an implement on the writing plane. The stroke begins with the *imprint* of an implement.”⁴⁴ What we call the *identity* of a trace can only be acknowledged in relation to the extremities of this trace, marking *the stroke* of the letter. The entire method of analysis is revealed here: if the original manifestation of writing lies in its *stroke*, the unique difference is given by the aspect of this stroke, by the accentuation or, on the contrary, by the scumbling of the *contrast* established between the thick and the thin lines that is marked by the tracing of words.⁴⁵ What the word actually *transcribes* is *the contrast* that the *tracing* of the word establishes in relation to its own spacing *in /* on the white space where it becomes manifest. This contrast underlies any writing typology, and it determines the spacing of any text. Therefore, if we are to extrapolate Noordzij’s remarks, we could say that the history of writing and, consequently, the history of the West is constituted as *a history of the contrast*. History is contrast, history is *the contrast*.

The contrast of writing can be operated, according to Noordzij, in only three ways: through *translation*, *rotation*, and *expansion*, defined as follows: *translation* represents the contrast resulted from “changes in the direction of the stroke alone, because the size of the counterpoint is constant and the orientation of the counterpoint is constant”, a way of writing characterizing the antiquity and the middle ages; *rotation* represents the contrast of the stroke resulted not only from “changes in the direction of the stroke, but also from changes in the orientation of the counterpoint. The size of the counterpoint is constant.”, a way of writing characterizing mannerism; and *expansion* represents the contrast resulted from “changes in the size of the counterpoint. The orientation of the counterpoint is constant.”, a way of writing characterizing romanticism⁴⁶. One of Noordzij’s most debatable remarks is that the middle ages represent the authentic renaissance. Following an analysis regarding the drawing of characters in the classic period, the middle ages, and classicism, and observing the way the middle ages keep the distinctive features of the antiquity regarding the writing of characters, Noordzij claims that the entire mediaeval culture has kept the classic principle of the antiquity unaltered, with classicism being the current that separates from the old principles so as to orient toward an utopia that would propose it as the authentic antiquity. By separating itself from the *authentic* culture, the *official* culture operates a mutation with double sense: on the

⁴³ Id. – *ibid.*, p. 9.

⁴⁴ Id. – *ibid.*, p. 20.

⁴⁵ Id. – *ibid.*, p. 26.

⁴⁶ Id. – *ibid.*, pp. 26-27.

one hand, this mutation represents a *historical rupture*; on the other hand, this rupture is felt in the gap established between society and “the cultural life”, contributing to what Noordzij calls “the mightiest institution of western civilization”⁴⁷. In other words, classicism seems to be rediscovering the classical, when in fact it only disrupts its perspective, consolidating mannerism as the true landmark of the western civilisation⁴⁸. The *technical* interpretation of the variations in the writing of characters is offered by Noordzij: “Expansion is only possible in the portion of the stroke that lies on a path at right angles to the axis of the pen. The thickenings are all parallel as long as the orientation of the pen is fixed. In every other area, the stroke is thin. Where the stroke is thin, the distinction between upstroke and downstroke loses its meaning. The difference between roman and cursive rests only on an interpretation of the tradition. The stroke of the broad-nibbed pen is the only norm for the pointed flexible pen. This applies even more for the ballpoint pen.”⁴⁹ It is this (wrong) *interpretation* that will re-orient the (written) western culture, it is here that the essential rupture takes place, and which will determine the radical reinterpretation of the representation and writing traditions. But writing is contrast⁵⁰. The authentic differences are not given by the various forms that could be culturally circumscribed and grammaticized, but rather by the spacing of writing. The accent does not fall on the clear shape or the contour of the shape, but on the contrast created through the spacing of the words.

Writing has also been the instrument used for the constitution of the *imagined communities*. In his work, *Imagined Communities. Reflections on the Origin and Spread of Nationalism*⁵¹, Benedict Anderson discusses the three elements which contributed to the edification of nationalisms: the print, the museum, and the census. This short deflection will help me discuss the social implications related to the evolution of writing and printing technology, being an *exposure* of the official culture at the same time. Anderson’s starting point is that contemporary western thinking is alien to the sacred languages of the big global communities, since it is not able to conceive *the non-arbitrariness of the sign*. The “emanations of reality” are, for the western culture, the “aleatory fabricated representations” of the language signs⁵². From this perspective, the ontological *reality* cannot be reflected but through a unique and privileged system of re-presentation. If the books in Latin start to slowly vanish after 1640, as the publication of books is no longer “an international enterprise”, the decline of Latin in the western culture represents part of a longer process whereby sacred communities gathered around the old sacred languages have been fragmented,

⁴⁷ Id. – *ibid.*, p. 69.

⁴⁸ Id. – *ibid.*, p. 72.

⁴⁹ Id. – *ibid.*, p. 70.

⁵⁰ For a technical analysis of the contrast in writing, see also Emil Ruder – *Typographie / Typography. A Manual of Design*, pp. 131-142.

⁵¹ Benedict Anderson – *Imagined Communities. Reflections on the Origin and Spread of Nationalism*, Verso, London & New York, 1991, pp. 1-46.

⁵² Id. – *ibid.*, p. 14.

pluralized and territorialized⁵³. New technical means of re-presentation are invented, but these do not represent the communities as such, but rather the *type* of imagined community that actually constitutes a nation⁵⁴. Knowledge through print goes hand in hand with reproductibility and dissemination, yet Europe does not know a background *unity*. The universality of Latin was never the correspondent of an universal political system, as no sovereign could monopolize the Latin and transform it into an unique state language, and the religious authority of Latin never had a true political analog⁵⁵.

Yet the infusion of Latin is crucial under another aspect, underlined in Bernard Stiegler's analyses⁵⁶, as Latin represents the basis of the possibility to *grammatize* the languages, the possibility of language *normativization* which orders and (de-)structures the possibility of any self-constitution of the languages. As stated by Anderson, the diversity of spoken languages in Europe before the invention of print has been very large, but few have been the dialects suitable for the print. *Print-capitalism* is, in Anderson's opinion, the frame that offers stability to language: it represents an "image" of the antiquity underlying the subjective idea of nation, and it is the creator of *languages-of-power* at the same time⁵⁷. The interaction between capitalism, the printing technologies, and the human linguistic diversity is essential because it creates the possibility of new forms of imagined communities, ensuring the conditions of the modern nation⁵⁸.

According to Lyotard however, "the states are not the control courts for the general process of the new telegraphic breaching [*frayage*]", where breaching represents the seriation of some elements with coordinating and ordinating function⁵⁹. If, in the history of writing and print, the state has been more or less *circulated* by the agency of the "technological" and linguistic alliance, it can no longer be the control court for the way the *grammatized* language underlying the consolidation of nations and states spaces its own writing. Tele-graphy is, for Lyotard, writing distantly, and writing becomes, in this new "economy", less the carrier of a message than the instrumental vehicle of *an impossible (in-)scription*. The contemporary tele-graphies annul the "initial" reception defining the *aesthetics* in the philosophical tradition, because they relativize and become independent of the place and time of their "initial" reception. Tele-graphy loses the in-scription, the legibility, the spacing of the sense, yet it keeps *the sign* of events, by *producing* it as available memory which can be

⁵³ Id. – *ibid.*, p. 19.

⁵⁴ Id. – *ibid.*, pp. 24-25. The novel and the newspaper are the privileged mediums where this conversion from an immediate representation to an imagined re-presentation takes place, starting with the XVIII-th century.

⁵⁵ Id. – *ibid.*, pp. 40-41.

⁵⁶ Bernard Stiegler – *Prendre soin*, pp. 248-256.

⁵⁷ Benedict Anderson – *Imagined Communities*, pp. 44-45.

⁵⁸ Id. – *ibid.*, pp. 45-46.

⁵⁹ Jean-François Lyotard – "Logos and *téchne*, or Telegraphy", in *The Inhuman. Reflections on time*, Romanian translation by Ciprian Mihali, Idea, Cluj-Napoca, 2002, pp. 47-56.

permanently (re-)presented and brought up-to-date, in the absence of the sign itself. The technical spacing loses the “imprint” of an authentic *stroke*. This is not only the fulfilment of a *téchnologos* which has always been present in the western *logos*, and which would define what Habermas and, in a different sense, Bernard Stiegler call a “technoscience”, but also an over-saturation. How could we talk today about a *sense horizon*, when writing becomes a stressed writing in the plan of mediums?

Writing has known a profound movement of mechanization, not only from a historical point of view⁶⁰, but also from the perspective of a *stylistic consciousness*. If Art Nouveau represented a reaction against the industrialization taking place at the end of the XIX-th century, an idea also present among the Dadaists, whose “typographic philosophy” is a radical one, rejecting all that meant the useless conventions of the capitals and the punctuation signs, the Futurists were to embrace the idea of typographic mechanization, by violating every established rule of the “good practice”, and by superposing characters of various dimensions and descriptions. In his famous manifests, Marinetti suggested that letters and words should be taken away from their usual place inside the sentences, generating radicalized and “autonomous” expressive elements⁶¹. In fact, Marinetti’s poetics regard a *functional metaphorization*, as well as the institution of an *analogical régime* of life, a “telegraphic” régime dictated by an “economical instancy”. The word separates from the syntax, therefore writing separates from the order of its disposal; it exposes the phraseological *rest*, words that are not “wired” by any syntactic thread⁶². It is precisely this syntactic and imaginary rupture that allows for the access “into the essence of *matter*” (my emphasis). It allows for another stylistic *materiality*, not very far, though in a different register, from what A. Sandberg calls a “*morphological freedom*”⁶³, which determines the permutational condition of the reference frames and systems. In other words, the only syntactic “property” would be that of becoming *unproper* ourselves, so as to gain on that obsession of the ego denounced by Marinetti, by building “intuitive” constructions based on “the infinite molecular life that must combine, in the work of art, with the spectacles and dramas of the big infinite, because this fusion constitutes the integral synthesis of life”⁶⁴. The annulment of the syntax supposes an intuitive construction that reclaims an *organical* condition of existence, another stage of *materiality*.

⁶⁰ For the historical process of the mechanization of writing, see *Font. The Sourcebook*, pp. 116-127. For the relation between art and the stylistic consciousness of the times, from Bauhaus to the first parameterizations of writing, see *Font. The Sourcebook*, pp. 138-163.

⁶¹ See Filippo Tommaso Marinetti – “The destruction of the syntax. Wireless imagination. Free words”, in *Futurist Manifesto*, Romanian translation by Emilia David Drogoreanu, Art, Bucharest, 2009, pp. 111-120.

⁶² Id. – *ibid.*, p. 115.

⁶³ A. Sandberg – *Morphological Freedom: Why We Not Just Want It, but Need It*, TransVision Conference, Berlin, June 22-24, 2001, text available at: <http://www.nada.kth.se/~asa/Texts/MorphologicalFreedom.htm> (last accessed on April 21, 2011).

⁶⁴ Filippo Tommaso Marinetti – *Futurist Manifesto*, p. 116.

Marinetti then emphasizes the typographic condition that defines futurism, by stating that *the revolution* is “pointed against the so-called typographic harmony of the page”, and is meant “to double the expressive force of the words”. Marinetti’s “new orthography”, that he also calls “freely expressive”, is based on an “instinctive deformation of the words” corresponding to “our natural predilection for onomatopoeia”⁶⁵. This *aesthetics of imitation* is yet an imitation that annuls the conventions, by de-structuring, destabilizing, and de-constituting *the sediments* of language. Marinetti’s discourse thus separates from the discourses of the period. The dominant obsession for a perfectly geminated form and functionality was to be found among the Bauhaus artists and theoreticians who, acknowledging the dishumanizing influence of mass production, were looking for the perfect re-presentation of information.

In proportion as the technology of producing characters has achieved the transition from the industrial processes dependent on various devices to the democratized world of the digital print, the creative and critical perspectives have varied, due to the fact that the history of writing has evolved into a practical imperative, reaching the stage where the design of characters now examines its own relation to history, specially since letters and means have become mass cultural products. The “measurable” value of fonts, one of the imperatives of the XX-th century, is now the materialization of one of the modernist ideals of progressive improvement, where history itself is adapted and restored only so as to be *re-instituted* and re-used with a shifted sense – the *positivation* of history⁶⁶. What postmodernism announced from the beginning becomes evident only *after* the canonization of the current, being the proof of the historic redundancy to which the critical initiatives of the XX-th century are fated. History is searching to be *re-positivated*, by means of divergence and the speculative, expressing pluralism through mutable forms and edifying the instability of the present. As letter design draws away from the *written* aspect of the characters, it also becomes the object of critical debates underlying the cultural subversion whereby society seeks to re-invent itself. Typography becomes a “political” instrument, the intended expression of a new ideology, which does not relate only to an aesthetics of distinction, but also to social and political aspects inherent to the various engraftments in the substratum of society. Writing is not only a “creative” activity, it becomes *lucrative* in the sense of *an act of interpretation*, generating its own hermeneutics based on the textual reconstruction of the extremes that compose it.

If Noordzij was right, and the cultural “authenticity” has been lost due to the “officialization” of culture, then through the *normativization* and *grammatization* of languages, postmodernism institutes the paradox and the ambiguity, and contributes

⁶⁵ Id. – *ibid.*, pp. 118-120.

⁶⁶ In this sense, see the analyses carried on by Christopher Butler in *Postmodernism. A Very Short Introduction*, Oxford University Press, New York, 2002, for the chapters “New Ways of Seeing the World” (pp. 13-43) and “The culture of postmodernism” (pp. 62-109), and also Fredric Jameson – *Postmodernism, or The Cultural Logic of Capitalism*, Duke University Press, Durham, NC, 1991, for the tight connection between postmodernism and capitalism, and the logics of the new cultural strategies.

to the sabotage and subversion of history, a fact which is increasingly manifest in the new scriptural vision, meant to decompose and de-constitute the fundamentals of visuality⁶⁷. Along with postmodernism, the paradox of “authenticity” becomes the conflicting strategy of engaging the historical models, which starts from questioning the “official” narrations and alternative readings of history so as to create new *characteriologies* devoid of a historical precedent. The figure of the scribe, as an actor involved in keeping the tradition, becomes the figure of the *bricoleur*⁶⁸, who reclaims the levels of interpretation by interfering directly with the content of history, by emphasizing the complexity and depth of the letter as cultural artifact, and by undermining the materialization of the great narrations through the materiality of the letter and the text.

Writing as resistance

The “technical” self-writing represents the only way the subject can appropriate the consciousness of a becoming. Sabotaged by the “technological” fate of writing, which obliges to a selfless writing, the subject becomes a *tele-graphic subject*. Yet the subject’s access to itself, which involves a gesture of *effraction* at all times, cannot take place but *by writing*. Lyotard already said that “the language-memory involves unknown properties of habitude: the indication of what retains (through its symbolic transcription), the recursivity (the combination of signs is infinite, starting from simple generative rules, from its “grammar”), and the self-reference (the linguistic signs can be noted through linguistic signs: the metalanguage).”⁶⁹ He continues by saying that language structures must be thought in terms of some “exclusion operators” and that *téchnologos* as such, which defines the dominant condition of the West, “opens its world of what has been excluded through its own constitution”⁷⁰. The subject has access to itself by means of *anamnesis*: it spaces itself unto itself⁷¹, and as such it meets “the obligation” of a re-orientation toward the transparent mirror, through a gesture of breakage, *effraction*, and re-instituent violence. Writing becomes “the anamnesis of what was not inscribed” and only as such it represents the *atechnological* condition whereby we can inscribe into “the

⁶⁷ For a complete history and an excellent critical approach of the relation between postmodernism and visuality at the end of the XX-th century, see Rick Poynor – *No More Rules. Graphic Design and Postmodernism*, Laurence King Publishing, London, 2003, specially for the chapters “Deconstruction” (pp. 38-69) and “Opposition” (pp. 148-171).

⁶⁸ One of the most complex works focusing on the idea of *bricolage* is the recent work signed by Marielle Magliozzi – *Art brut, architectures marginales. Un art du bricolage*, L’Écarlate / L’Harmattan, 2008. Even though the work discusses raw art and the marginal architectures, it contains an excellent critical apparatus regarding the image of the *bricoleur*.

⁶⁹ Jean-François Lyotard – *The Inhuman*, p. 51.

⁷⁰ Id. – *ibid.*, p. 52.

⁷¹ For this movement *relative* to itself and the question of memory, see Paul Ricoeur – *Memory, History, Oblivion*, specially for chapters “The phenomenological sketch of memory” (pp. 37-62) and “Recall and image” (pp. 62-74).

white of the paper”⁷². As *anamnesis* and continuous passage, writing becomes the only form of *resistance* against the “cunning programs and the massive telegrams” that define the *grammatized* condition of today’s society.

The alternative of writing is *the permanent writing*, the uninterrupted re-writing, the re-assumption of the style whereby we acquire the technics needed to trace the contrast and to mark the rhythm. The alternative of writing is the uninterrupted fragmentary, the assumption of the impossible writing that marks the rupture, the refusal, *the dispersal* (Maurice Blanchot), the dissolution, the continuous *de-fragmentation* of writing, the *disintegration* of conventions, precisely through the *political* retaking of the space of the page, where writing can manifest the *subversion* of the self, the subliminal play of letters, the subversive retreat toward the periphery. In this way, by playing with the imagined power of the marges, the radicality of writing can accomplish the political radicality of a change. The rhythm of writing must first of all be the rhythm of an abstraction, the erasure of traces through writing, *as* writing.

Writing must institute the condition of *embezzlement* and reactivate the body and the character of the letter, that is to oppose the past to the present, as a continuous self-confrontation of a presence that escapes itself: “Réactiver le corps de la letter, c’est faire jouer le passé contre le présent”⁷³. Instead of the “ancient” transcendence, writing must institute *the absolute reality*, by searching, inside its own typography, for an image of writing that it can lay *outside* the text. Against the dominant ideologies, writing must institute and provoke, it must bestir the interferences between “image” and text, so as to produce “*effractions of the frame*”⁷⁴. Or, from this perspective, the only gesture in condition to produce *the effraction of the frame* is the *signature*⁷⁵, which avoids the dichotomies of representation and keeps itself *outside* the trace and the code, between *writing* and *scribble*. The signature is, by definition, an *autographic* individual mark which *authorizes*, singularizes, and forbids any representation⁷⁶; it is a permanent *re-inscription*. Not lastly, a written signature “involves, by definition, the actual or empirical non-presence of the signer” – the deconstruction operates the double gesture here, *the double writing*, by practicing a *subversion* of the classic oppositions, *as well as* a general *shift* of the system⁷⁷. It is the uncontrolled associations of writing that allow us to *draw away the sense*, it is the objective anchorage in the illusions of the referential, the fragilization and disintegration of the identity of figures that brings us closer to the objective resolution of the figural process. An *authentic* writing obliges to an active reading, where the subject becomes aware of its involvement in a symbolic order in front of which it must assume “the imaginary crystallizations”⁷⁸.

⁷² Jean-François Lyotard – *The Inhuman*, pp. 55-56.

⁷³ Michel Thévoz – *Détournement d’écriture*, coll. “Critique”, Les Éditions de minuit, Paris, 1989, p. 113.

⁷⁴ Id. – *ibid.*, p. 114.

⁷⁵ See Jacques Derrida – “Signature. Événement. Contexte”, in *Limited Inc.*, pp. 15-51.

⁷⁶ See Michel Thévoz – *Détournement d’écriture*, pp. 114-115.

⁷⁷ Jacques Derrida – “Signature. Événement. Contexte”, in *Limited Inc.*, p. 48.

⁷⁸ Michel Thévoz – *Détournement d’écriture*, p. 89.

The alternative of writing, its *refusal*, must be the *straining* of the universe, the sub-tending of the textuality and the destructuring of the cross-dichotomies between real and imaginary, visible and mental, image and sign, description and generalization, explicit formulation and tacit omission, the centrifugal energy of the text and its closed shape. It must polarize *on the inside, from the inside*, through repetition, as a moment of oscillation. And like this, it must repeat itself and therefore bring back the imminence of a death instance. Which is always just another *loop*...

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“MINIMAL EMBODIMENT” AND ITS IMPLICATIONS IN THE SHAPING OF SELFHOOD

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ABSTRACT. The notion of “minimal self” has been discussed in the phenomenological paradigm by Dan Zahavi and it is basically understood as a pre-reflective and basic awareness of our experiences. Selfhood and its constitution are associated in this perspective with awareness. The present paper discusses the constitution of this “minimal” aspect in relation to embodiment and it shows how disruptions in embodiment render present this “minimality” and other essential aspects of selfhood.

Very often, we ignore the presence of our bodies. They are forms of our *being-in-the-world* which are taken for granted. As Drew Leder argues, we are reminded of their important functions when our body schemas are replaced in their “I can” by their counterpart: the “I cannot”. I argue in the following that the “minimal” body becomes thematic when we experience disruptions or distortions in the body schema. Instead of stressing the role of consciousness in the individualization of “selfhood”, I defend a position in which selfhood is shaped by forms of embodiment and body processes.

Keywords: *minimal self, minimal embodiment, body schema, disability, illness*

One of the notions so often debated in the contemporary research on subjectivity is selfhood. The phenomenological philosophical tradition is obviously very rich in providing extensive material for the analysis of this concept. Yet, phenomenology is only one of the perspectives that can help delineate such a complex issue. Complementary approaches from other disciplines, such as biology, neurosciences, developmental psychology or social sciences at large insist on other aspects that are substantial for the constitution and definition of the self. This covers a different range of perspectives, highlighting hypostases through which subjectivity and correlatively the self/selfhood become manifest¹.

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¹ I use the two terms, „subjectivity“ and „selfhood“ interchangeably, an equivalence which has been clearly defined in a recent paper by Dan Zahavi, *The Experiential Self: Objections and Clarifications*, in M. Siderits, E. Thompson, D. Zahavi (eds.): *Self, no self? Perspectives from Analytical, Phenomenological & Indian Traditions*. Oxford: Oxford University Press, 2011, 56-78, esp. p. 60: “[...] the self is defined as the very subjectivity of experience, and is not taken to be something that exists independently of, or in separation from, the experiential flow.”

It is necessary to mention these orientations precisely because some of them challenge substantially the Husserlian “idealistic” orientation, stressing different aspects such as our biological or neurological background (Thompson 2001; Depraz & Varella). These orientations contribute in different manners to the delineation of subjectivity and selfhood. Other approaches focus on an enactive element (Gallagher, 2005; Gallagher & Myahara, 2011 in press), and they represent one of the main challenges that the phenomenological research has to face in its struggle to claim the realm of subjectivity as the fundamental background for its legitimacy. In contemporary debates, the enactive approach draws attention mostly on the emergence of selfhood as being primarily realized in and through embodied relations with other human beings and with the surrounding environment. Its main source of argumentation is the phenomenology of Maurice Merleau-Ponty.

My position, in as far as the definition of selfhood is concerned, takes as a focal point the body. It is already known in the phenomenological community that long before Maurice Merleau-Ponty developed his detailed philosophical program in the *Phénoménologie de la perception* (1945), Edmund Husserl dedicated many writings to the foundational role that the body has in the acknowledgement of subjectivity. This restates an important issue on selfhood (Husserl, 1952; Husserl, 1973). However, Husserl’s insights aimed most often at stressing the role of consciousness (and more specifically of the transcendently reduced subjective sphere) in order to give account for the signifying potential that subjectivity entails. This perspective is equally prolific for the analysis of selfhood. But as many of Husserl’s followers and critics have long shown (i.e. Martin Heidegger, Maurice Merleau-Ponty, Alfred Schütz, Jean-Paul Sartre, to recall only the most known), the transcendental program that Husserl developed, did not do enough justice to our corporeal substratum. The body has a very important status in the attempt to define selfhood and Husserl recognizes this fundamental quality that the body displays. He also credits the body’s quality of being an essential element in the realization of intersubjective relations. Yet, the Husserlian investigations remain highly concerned with the definition of the phenomenological reduction and the body remains a subsidiary element to this other more constant interest.

On the other hand, the French phenomenological tradition distances itself from a perspective which favours the primacy of the transcendental consciousness. In French phenomenology, we assist to a radical paradigmatic reversal in as far as the role of the body is considered, in particular in the work of Maurice Merleau-Ponty. It concerns to a lesser extent such orientations as that of Michel Henry or Jean-Paul Sartre, even if one can also find in their work important issues that defend corporeity (Henry, 1965; Sartre, 1943). In what follows, I am interested in stressing more specifically the heritage of the Merleau-Pontyan orientation, because Merleau-Ponty remains the phenomenologist who constantly highlighted the principle-position that the body has in as far as it is considered as a “lived body” (*Leib*). His revision of the Husserlian paradigm in this respect is particularly clarified in the project he

defends in *Phénoménologie de la perception* (1945) and his phenomenology, in contrast to the orientations of Sartre and Henry, privileges clearly the body and the corporeity as indispensable principles for the foundation of phenomenology. I shall argue therefore in favour of a selfhood that should be primarily conceived not in terms of reflection or awareness at the level of consciousness, but rather in terms of *affection* and *awareness* at the level of corporeality.

In my analysis I shall focus on the phenomenological heritage of Maurice Merleau-Ponty. I will accordingly consider three main points in the definition of selfhood. In a first step, I will emphasize a recent perspective, which is that of Dan Zahavi, who develops the notion of “minimal self” and show its importance for the definition of subjectivity and selfhood. I will further proceed with a re-evaluation of this concept in the frame of a phenomenology of the body, using in a first step Merleau-Ponty’s analysis of the notions of living body (*corps propre*), “body schema” and operative intentionality. In a last part of my paper I shall evoke the unjustly ignored perspective that has become lately the phenomenology of disability, orientation known mostly in connection to Drew Leder’s work. Given this conceptual background, I intend to re-evaluate the status of the body schematism in its relation to pain and body severe affections. I will conclude with a definition of selfhood in terms of “minimal embodiment”.

Presupposing a “Minimal Selfhood”

The notion of “minimal selfhood” was coined by Dan Zahavi in his well known work *Subjectivity and Selfhood* (2005). Relying on the phenomenological heritage in its most encompassing understanding, Zahavi discusses a series of definitions of self, giving predilection to a combination of two dimensions: the *experiential* (which is essential for the phenomenological insight) and the *narrative*. Despite the Ricoeurian turn which stresses the latter, I think that the former is of a particular importance for the description of the *background* which justifies selfhood. In order to circumscribe the experiential dimension of the self, Zahavi proposes the notion of “minimal self or core self” (2005: 106). So that we may understand this minimality, we need to refrain from considering the self as being something separated from our experiences. The self or selfhood emerges in experiences and is in its turn indispensable for their manifestation. The self is consequently experiential. In addition, Zahavi connects selfhood to the idea of self-giveness, a characteristic that serves him the purpose of theorizing the “minimality” of selfhood. He supports this argument referring partly to Michel Henry’s writings as well as to those of Merleau-Ponty. The “minimal self”, he says, is “the one constituted by the very self-giveness of experience” (Zahavi, 2005: 125); it is the “first personal givenness that characterizes our experiential life” (ibid.) and further it “is not something that stands opposed to the stream of consciousness, but is rather, immersed in conscious life; it is an integral part of its structure” (ibid., 125).

As one can easily see, a first aspect that is highlighted in this definition is consciousness. Selfhood is a matter of awareness, an awareness which gives more credit to consciousness than to our bodily display. In a later definition of the “minimal selfhood”, Zahavi mentions an additional characteristic. This is the “*perspectival ownership*”, a term which he borrows from Miri Albahari (Zahavi, 2009: 557). Thus, he claims, “there is subjectivity of experience and experiential selfhood, not only when I realize that *I* am perceiving a candle, but whenever there is perspectival ownership, whenever there is first-personal presence or manifestation of experience. It is this *pre-reflective sense of self* which provides the experiential grounding for any subsequent self-ascription, reflective appropriation and thematic self-identification” (ibid. 562). The *perspectival ownership* seems to represent, at least in a first step, a guarantee for the minimality of selfhood.

This element is essential because it postulates a conception of selfhood as being connected to a pre-reflective stance of consciousness. Experience, its congruence and directedness involve many levels and these levels need to be considered altogether, since each of them contributes in different degrees to the constitution of subjectivity. Consequently if one attempts to elaborate the concept of self or selfhood, one needs to favour a broader understanding and overcome the Cartesian position, which gives pre-eminence to reflection as the grounding principle for the constitution of self/selfhood. The greatest part of our experiential life happens in the background of the reflective level of consciousness. We can never have a full grasp of the complexity of all our experiences. One needs therefore to separate between levels of experiencing and to pay a particular attention to those layers and aspects of our pre-reflective life which motivate the very direction of reflexivity. Experience is correlated to self-consciousness and to awareness. There is though a primordial sphere which represents the pre-reflective field par excellence and this sphere is that of our body.

Now let’s take a closer look at Zahavi’s definition of selfhood, which he further refines in connection to embodiment. A significative characteristic which he stresses and which has a fundamental role for the discussion of this topic is “the invariant dimension of first-personal givenness throughout the multitude of changing experiences” (2005: 132). No matter how we live different experiences, the experiential flow is constitutive for our identity as being thus and not otherwise, as being that specific unity of experience, which each of us lives in a particular manner and which therefore differentiates us from others and makes us unique. Otherwise, says Zahavi, “it would be impossible to account for these more explicit forms of self-ascription, where we recognize an experience as being our own, if it wasn’t for the fact that our experiential life is fundamentally characterized by a first-person perspective and by the primitive and minimal form of self-reference it entails” (2009: 562).

The definition in terms of flow, recalls the Husserlian presuppositions on the constitution of internal time consciousness, to which Zahavi remains very close (Zahavi, 2011a). Yet, even though temporality is a basic factor in the delineation of our personalized experiences and it is doubtlessly a necessary condition for the establishment of the “minimality” of experience, it is not a sufficient condition to properly answer

the complex issue of such a topic. The unity and invariance of our experiential life, in as far as it is understood in terms of “for-me” and “to me” do not presuppose only a diminished level of reflexivity, a level which represents “a condition of possibility for the more articulated forms of conceptual self-consciousness” (Zahavi, 2009: 562); this unity starts at the level of embodiment; it starts with what Husserl named “*fungierende Intentionalität*” (functioning intentionality) and with corporeality – *Leiblichkeit*. This experiential sphere precedes any other form of directedness and ensures further both the minimal condition for our being the unity of our experiences, and the connectedness of the human being to the world and to other subjects, the latter aspect being not less significant for the definition of selfhood.

Zahavi is aware of the role of the body in the constitution of selfhood. He stresses this constantly in his texts (Zahavi, 2004; Zahavi, 2005; Zahavi, 2009). Nevertheless, despite the attention he grants to the “corporeal turn” in phenomenology, his conception of self remains basically defined in relation to “awareness” (Zahavi, 2004; Zahavi, 2005). I will briefly sketch his position on embodiment and I will then propose an alternative understanding of selfhood in terms of what I call “minimal embodiment”.

In a first understanding of the body as one of the principles which is responsible for the givenness of our experiences, Zahavi stresses once more the idea of “perspectival ownership” yet this time relying on Sartre and Merleau-Ponty’s conceptions of the body. Thus, the body is not a perspectivally given object, it is precisely “that which allows me to perceive objects perspectivally” (2005: 205). The body is consequently that field which ensures the unity of my experiences, in their primordial and unmediated givennes. Despite this seizing of the body’s significance in the constitution of the minimal selfhood and of the opinion according to which selfhood is conceived as something which is not disembodied, Zahavi’s position remains basically focused on “awareness”. I think that despite our being aware of different levels of experience, much of the congruency of our selfhood comes from the pre-reflective experience which is not only located at the level of a pre-consciousness, but at the level of our corporeal display. In what follows, I shall give reasons for this thesis, stressing in particular the role of the Merleau-Pontyan concept of “body schema” in the processes of our individuation.

How can one postulate a minimality of selfhood in phenomenological terms, eluding the famous discrepancy between body and mind? The phenomenological conception which stresses the centrality of the body, does not start with the Merleau-Pontyan writings, as I earlier mentioned, even though it is Merleau-Ponty who explicitly acknowledged a philosophical program in which the Cartesian duality between mind and body needs to be overcome. He also operates a reversal of Husserl’s phenomenological initial program defending a view in which the real purpose of the phenomenological analysis should be the revelation of our anchorage in the world (1945: XV-XVI) and of our bodily nature.

Husserl himself realized that the body represents that element without which neither the constitution, nor any genesis is conceivable. He stresses this idea in particular in his second volume of *Ideas* and in the *Cartesian Meditations* and calls attention to the fact that the body is not only the genuine organ of perception, but in as far as the body is understood as *Leib* (animated body/ living body) and not as *Körper* (organic body), the body is a centre of orientation (Husserl, 1952: §41). The body opens our inscription in the world and inscribes us in the world; it discloses us and at the same time, it allows us to accept the different strata of mundanity as being disclosed to us. By its centrality and focalizing quality, it ensures the first minimality that confirms us as subjects.

The idea of orientation, which is discussed by Husserl in relation to the constitution of space, is of a particular importance in a first characterization of the “minimal self”. Space provides on the one hand the possibility of identification, of the subjective institution under the form of a *Nullpunkt*. On the other hand, space is also the milieu in which we define ourselves as trajectories and therefore as and through movement, a quality which recalls the intentional drive and the manifestation of the body as a directing instance. The acquaintedness of our experiences in the mode of what Zahavi names “first-personal givenness” (2005: 146) starts, in my view, at the level of this living body, of the *Leib*. And it is this level that needs to be emphasized when defending the project of a “minimal self”. The *Leib* is the first unity of our experiences before they may be associated with any other form of congruency at the level of reflexivity. Thus if we postulate a first level in which selfhood occurs, this is represented by the pre-reflectiveness of corporeality.

A further minimalist account: from the living body to the body schema

Before engaging in a further definition of selfhood, which I shall basically consider in relation to the concept of the *body schema*, let me turn once more to the definition of the *living body*. Merleau-Ponty recuperates this concept from the late Husserlian writings and constructs a substantial part of his *Phenomenology of Perception* trying to develop a new perspective that focuses on this term. What Husserl names *Leib* (1950: §44, 90) – translated in French as *corps propre*, in English as *own body/ living body* – is not connected to the organicity and naturality of our corporeal status in its bruteness (*Körper*) but to our being a specific unity, of our being a specific originary sphere. According to Husserl (1950: § 44), the I reigns (*schaltet*) in her body and she can directly experience her organs. The fact that I touch with my hands and that I see with my eyes creates a false distance to my own body, in the sense that despite the feeling that I can experience my hands and my eyes as “external” objects, I am these body parts. My body belongs to my sphere of “ownness” and it defines my existence as being differentiated from other human beings as well as from other beings simpliciter.

Husserl also speaks in his description of the own body of *kinaesthetic* sensations (1952: §36), a concept also extensively discussed by Merleau-Ponty, especially in his *Phénoménologie de la perception* (109 ff). These sensations have a double quality, in that they refer to the following case: I experience my hand as touching me but also it is I who is the experiencer of the touching. This double sidedness of the perceptive experience testifies further of what Husserl names “I can” (MC: §44). The “I can” sustains the potentiality of experience and is identified at the level of the living body. The Merleau-Pontyan philosophy of the body undertakes this analysis of the double sensations and it radicalizes the status of the own body. Merleau-Ponty (before stressing more clearly the ontological aspect of corporeality) evokes in a first step a function of knowledge that the body entails, a sort of “reflection” (PP: 109) that the body exercises upon itself and that equals partly a form of primordial habituality (PP: 107). He also says that this habituality is related to a form of “presence without distance” (PP: 113). In short this refers to a form of primordial directedness which precedes and overrides the reflective consciousness, because it designates precisely that basic level of experience, its outmost primordial givennes. Merleau-Ponty says the following: “being a consciousness or better said being an *experience*, is to inherently communicate with the world, with the body and with the others; it means being with them rather than being besides them” (PP: 113). The primordial moment of experiencing passes in the Merleau-Pontyan view before the reflective and cogitative quality of the subjective consciousness. It is anchored in a deeper configuration which is that of corporeality. In his late writings he would call this overencompassing form of corporeality, *flesh – la chair* (Merleau-Ponty, 1964).

The Merleau-Pontyan project is therefore significant for a definition of selfhood in terms of minimal embodiment. Moreover, Merleau-Ponty does not resituate only the status of the own body; he gives predilection to the presence of this specific form of intentionality, previously mentioned: the “operative intentionality” (*fungierende Intentionalität*). Actually his project in the *Phénoménologie de la perception* announces from the preface the return to the genetic phenomenology, for which the operative intentionality is one of the key concepts (Merleau-Ponty, 1945: XIII). This form of intentionality is fundamentally oriented and justified at the level of corporeity. It is the sphere where selfhood experiences itself and the surrounding world in a primordial manner. What is to be noted in the Merleau-Pontyan view, is that he does not completely renounce to the presence of subjectivity, despite his adoption of a critical position towards Husserl’s phenomenology. But, unlike Husserl, he does not transform it into a transcendental principle that polarizes any meaning constitution and that becomes the pivotal point for a definition of selfhood. He associates it constantly to corporeity, as well as to a worldly and to an intersubjective presence. It is in this relational configuration that corporeality is justified in our experiential stances as a primordial level.

Corporeality is constitutive for selfhood, and displays the same characteristics as the *kinaesthetic perceptions*, mentioned above. That is it grants at the same time the ownness and the originarity of experience to a specific subjective unit, and it guarantees the originarity of different levels of experience which connects this

subjective unit, the self, to the world. The corporeal nature should be understood thus as at the same time joining us, objectifying us in the world and thorough the world and as a guarantee for our most unique and personal experiencing. To feel warm or cold, to be in pain or to feel relaxed are examples of some untranslatable moments in which our body concentrates around us and in which the world may concentrate around us. However, such experiences may also open us to specific moments of mundanity and thus they consecrate us as a model of “touching-and being touched”. It is because of the kinaesthetic quality of our bodies that such transitions and primary experiences may belong to us.

A challenging concept that is significant for a phenomenological analysis of the minimal primacy of experiencing, is that of the *body schema*. Similarly to the operative intentionality, the body schema had a very controversial history, a history which is not only reduced to the phenomenological field proper because this is a concept that first was discussed in neurology. Initially elaborated in the beginning of the 20th century by Henry Head, this concept strongly influences the phenomenological perspective on embodiment, in particular that of Merleau-Ponty. It was extensively discussed recently by Shaun Gallagher (Gallagher, 2005; Gallagher & Zahavi, 2008). Why is the body schema fundamental for a discussion on the minimality of selfhood? First because it gives good reasons to reverse the primacy of reflexivity in the constitution and institution of meaning and second because it re-orientates the investigation towards the possibilities entailed by the body. In short it is perhaps the best concept that accounts for the body as a condition of possibility for our experiences, and that concentrates and justifies the mineness of our experiential life.

In the Merleau-Pontyan view, the body schema is related to the idea of habituality and motility. It has an enveloping function that ensures the coherence of the body. Merleau-Ponty designates such a function of unifying, with the expression “body draw” (*dessin du corps*) (PP: 115). Further, the body schema is a “unique law” and it refers to the idea that “a spatial and temporal unity, the intersensorial or sensori-motile unity of the body is so to say *de jure*” (PP: 115-116). This unity precedes the experiential contents that occur during our life-time. Such a status grants the body schema the quality of a principle that justifies a minimal congruence. This first layer that is manifest in terms of law, of an experiential regularity and that precedes the significative moments identified at more sophisticated levels of the reflective consciousness advances another argument for my thesis of “minimal embodiment”. The body schema should though not be understood as a limit or as a limitation of the reality that our body displays. “The body schema is dynamic” (PP: 116), as Merleau-Ponty puts it. This means that through it, the body occurs as a “posture in order to attain some actual or possible task” (*ibid.*). Given this property, the body schema introduces a differentiation in spatiality, in the sense that, contrary to the objects in the surrounding environment, it does not represent a spatiality of *position*, but a spatiality of *situation* (*ibid.*). The spatiality of *situation*, recalls the above mentioned concept of “perspectival ownership”, discussed by Zahavi, even though he does

that in relation to the idea of awareness. Yet, the spatiality example highlights that the body also provides the “ubiquitous dimension of first-personal givenness in the multitude of changing experiences” (Zahavi 2009: 563) and not only the inner time consciousness. In the thesis that I advance, I do not criticize Dan Zahavi’s position. I think his defence of a minimality of selfhood is central for the phenomenological paradigm (and not only, given the recent development of neurosciences). What I propose, is an alternative view in which the “core self” is not justified only by a temporal congruence of the experiential flow, but also by our being a spatial centrality, through which, as De Preester claims (2008: 139) “the *Körper* is mapped onto the *Leib* (and receives the latter’s status)”.

The body schema is an important argument for the defence of a “minimal embodiment” because it constantly affirms the centrality of the living body, the subject-body. If the living body becomes a centre of living, this is realized already on the background of the unity ensured by the body schema. And if the *Leib* has a dual nature, as I previously discussed, this is also rooted in a deeper quality, reflected by the body schema. It is due to the kinaesthetic quality of the body schema that the living body is *touchant-touche* and *voyant-vu*. This dichotomy of the living body is acquainted by the double quality of the body schema in joining and separating at the same time the body and the world. The body schema provides us our first moments of experiential coherence and it is also “a manner to express that my body is to the world” (PP: 117). It is a pure articulation of what Husserl termed in the *Cartesian Meditations* as “I can”.

A-typical body schemas

What happens though in those moments when we experience dysfunctions at the level of the corporeal habitualities that ensure the organization of our body congruency? The legacy of Merleau-Ponty is particularly significant for underling this aspect; however this remains despite his explicit position against reflexivity still connected to consciousness, even if the status of consciousness does not hold the same function as that of in the Husserlian approach. The important element to be recalled when considering anomalies in the functioning of the body schema is that the body schema is translated into body habits; without it our posture in the world and our position in space and in the world in general would not be possible. The body schema is also a guarantee for the taken-for-granted-ness of our corporeal status. In what we usually term ‘normal state’, that is the state in which we do not experience any dysfunctions or malfunctions of our body, the “body schema” operates at a tacit level. It is actually an automatic function of the body, of which – and this is important to emphasize – *we are not always aware* of. We do not think and we do not always realize all our postural changes or organic processes. Such a constant state of tension and conscious directedness would certainly solicit much too much our attention. Yet, there are situations when the body schema becomes strongly explicit.

One of those moments when the body schema and the living body leave their usual muteness, is when we experience different forms of pain, of disease or severe motility impairments. A first phenomenological account of such experiences was, not long ago, given by the American philosopher Drew Leder (1990). According to him, we experience our body as disappearing “from explicit awareness” (1990: 25). We do not question its functioning, until some disorder occurs. What I term “minimal embodiment” refers to this subversive configuration, which is a condition *sine qua non* for our experiences. One of the moments when it becomes evident, is for instance in a state of pain or when we corporeally suffer/ we are disabled. We realize this minimality as being ours, precisely because extreme experiences as pain, severe disease states cannot be translatable and shared. Even though, communication about such states remains partly possible, the complete seizure of the complexity of what one feels when in pain or when disabled, cannot be realized. Certainly, corporeity is a characteristic that joins us to the others and to the surrounding world. However, what I understand as “minimal embodiment” represents that characteristic that makes us be precisely “that body” that has “those experiences” and not others.

In such critical moments, that what both Husserl and Merleau-Ponty termed as “I can” in order to underline the possibilities that characterize the life of our living body, is transposed into what Leder names “I cannot” (1990: 48). I do not use this term with the initial meaning that Leder gives to it. For Leder, the “I cannot” refers to “a foreignness of the inner body ... to a structure of personal inability” and more precisely to the fact that “I cannot act from my inner organs in the way I do from my surface musculature” (*ibid.*, 48). For the purpose of my discussion, the “I cannot” refers to those moments which defy the ‘normality’/ ‘habituality’ of the “I can” and which by this contrastive position makes the “minimal embodiment” emerge from its silence. When experiencing pain or other forms of bodily disability, and in particular those that concern very explicitly motility, such as the different cases of paralysis or of cerebral palsy, the “minimal embodiment” suffers a “transposal”. It overcomes its initial tacit and unquestioned status and it becomes transparent. This transposal, recalls partly the principles of the phenomenological reduction defended by the Husserlian program, in the sense that a level of the experience which is taken-for-granted is bracketed in order to achieve a minimal structure that justifies the realization of meaning at the experiential level. Except that in the case of disease or of motility impairments, those fundamental structures and principles which are responsible for the configuration of meaning are not identified anymore at the level of the transcendently reduced consciousness, but at the level of the laws that render our corporeal existence possible. It is at this point that the analysis developed by Merleau-Ponty does more justice to the idea of minimality of selfhood, in as far as this minimality is conceived as that unifying experiential pole, as the summa of all body habits, which could be tentatively superposed to the existence of the body schema.

Why is the example of pain and of disability important for the defence of a “minimal embodiment”? Are they not alternative structures of our bodily institution in the world? What is in the end their relation to the body schema? A first aspect, that draws attention in this context, is that pain and disability call to evidence those configurations which we experience most often as “dys-appearing”, as Leder argues (1990: 83-92). He associates this feature to the Heideggerian concept of *Vorhandenheit* (readiness-to-hand) (Heidegger [1927] 2001: §9). As long as we are not affected by illness or by some biological dysfunctions, our experience of embodiment is framed in a “normality” that we share with other bodies. What one may call a “normal” body is a primary presence. It is a pole that concentrates all the “I can”s. Yet the case of the “I can” that suffers a change and becomes an “I cannot” or an “I no longer can” (Leder, 1990: 83) which is typical for illness or body dysfunctions, may awake in a different manner our relation and objectivation of the body minimality. Let me put it in another way: the mineness of my body receives more evidence in those moments in which its regular functions are challenged and sometimes completely blocked.

Consider for example the case of impairments and of diseases in relation to the situation in which the person who suffers has not had the impairing experience before. This is central when it comes to understand how the minimal embodiment can become evident: for any person who suffers an accident or a sudden pain, the body disruptions recall a former state of congruency and thus of dys-appearance or “ignorance” of the minimal embodiment. In the case of the persons who are disabled born, the situation is more complicated, because what for a former abled becomes “disability”, for a disabled-born, this disability belongs already to the dispositions that her body has. The dimension of the “I no longer can” experienced by the “abled” who becomes “disabled” may not exist, in this second case. However, this does not mean that persons, who are disabled born, do not have a “minimal embodiment”. They too, may suffer of pains and different other malfunctions. However in their case, their body schema institutes a sort of a double difference with the body schema of an able person, a double “I cannot”. What is important to retain from these two situations is the idea that corporeality is present as absent in the greatest part of our experiences, but when it comes to the acknowledgement of the minimal embodiment, this occurs with more accuracy in the moment in which the experiential unity of the bodily regularity, is awoken by a bodily dysfunction.

The experience of our “minimal embodiment” is facilitated by moments of bodily disruption, in which our living body and its body schematism lets appear what most often remains tacit. Disease or pain reframe our body inscription in the world and necessarily our relations to other fellow beings. They represent an important element for the constitution of selfhood, because they recall that the “normality” of the body even if it may remain correlated to the presence of other subjects, appears “as the ubiquitous dimension of first-personal givenness in the multitude of changing experiences” (Zahavi, 2009: 563). For sure, this does not mean that persons who are born with different forms of handicap cannot experience their “minimal embodiment”.

Even if you cannot move, you can experience pain for instance, or have difficulties temporarily when breathing or swallowing food. These are also moments that challenge a certain habituality that the subject develops. The “minimal embodiment” occurs precisely in a more obvious manner, in those moments when our body suffers, when it is disturbed in its day-to-day rules of living.

Considering the place and the functions of the “minimal embodiment” draws attention to our relation to space and to the places we inhabit. It revises also the conception on the primary forms of sedimentation in our experiences, which allow us to be corporeal projects and worldly projects. The minimality of the body becomes obvious in situations when the background drawing (*the body schema*) is disturbed. Experiences such as pain, illness or severe bodily impairments render the minimality of the body thematic and cast a new light on the phenomenological understanding of selfhood. If there is a primary unity of experience upon which one can postulate the presence of selfhood, this is at the level of the body. Pain and disease disturb this unity and impose sometimes new ways of understanding subjectivity and selfhood. They are a possibility to reorient our experiences and to establish new ways of being in our connection to other fellow beings and to the world, and reveal ignored aspects about the status of selfhood. In a discussion on minimal embodiment, corporeal disturbances are essential precisely because they recall that the first instance of congruency that polarizes our experiences is not the minnerness present at the levels of the acts of consciousness, but the mineness that our body, as living body (*Leib*) institutes.

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ETHICAL CHALLENGES OF THE CONCEPT OF “SAVIOR SIBLING”. A SYSTEMATIC REVIEW¹

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ABSTRACT. The paper discusses the complexities of the issue of „savior sibling”, by analyzing it at the intersection of transplantation ethics and reproductive ethics. With the advance in bone marrow transplantation and stem cells transplantation, more life threatening diseases are starting to be cured. Recently, more and more news about children specifically conceived to help an elder sibling are spreading. Although this new technique brings hope to traumatized parents, it is not without ethical and sometimes legal controversies. If the embryo of the child is selected after IVF in order to make it as compatible as possible with the sick relative, several bioethicists have raised the issue of the dangerous vicinity of the prospect of „designer babies” – i.e., children expressly conceived with a view for a special characteristic that was desired by their parents. From a Kantian deontological-oriented perspective, the future child is desired not as much as an end in itself, but rather, and more importantly, as mere means for a greater end – that of eliminating the disease of another person. From a utilitarian perspective, the future child is not only good in itself, thus producing happiness for her parents, but increases the overall quantity of happiness by saving the life of his sibling.

Keywords: *transplantation ethics, reproductive ethics, savior sibling, Kantianism, utilitarianism*

Introduction

Recent findings in transplant medicine have resulted in successful treatment of life-threatening diseases affecting children (different types of leukemia or anemia) through stem cells and/or bone marrow transplant. However, the recurrent main issue continues to be that of the donor/receiver compatibility. Statistics show that,

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although the number of voluntary bone marrow donors is raising, the probability of a successful match between unrelated donors remains low, and even a match with one's relatives is still improbable – studies quoting a likelihood of 15% (Devolder 2005: 582). The literature testified the appearance of a new term, that of a „savior sibling”: a sibling expressly conceived (either naturally, or using the assisted reproductive technologies (ART) in order to be a successful match for the ill sibling³. There are usually two types of transplantation for which the savior siblings can be used: transplant from the umbilical cord blood (for which only the umbilical cord blood is used, and not the tissues of the child conceived); and, in special cases, bone marrow transplant.

Concerning the medical context involved, we have to mention that naturally conceived siblings have only 25 percent chances of sharing the genetic information with the ill sibling, and (considering the timeframe needed to conceive and bring to term a successful pregnancy, a time in which the sick child status could only worsen) therefore couples prefer to rely on more precise medical techniques⁴. Actually, these chances may be increased by choosing ART: in the first phase, through in vitro fertilization (IVF) a number of embryos are created. A cell of each embryo is going to be screened by using a combination of preimplantation genetic diagnose (PGD) with tissue typing to detect human leucocyte antigen (HLA) compatibility. Thus, out of the several created embryos, the most compatible one (HLA-match) is selected⁵ (which can subsequently become the perfect donor).

Concerning the legislative context, cases of „savior sibling” have been accepted in several legislations (UK, Australia, U.S. etc.), although the consequences for legislators could be enlarging the spectrum of possibilities for tort law cases (Chico 2006: 180-218). However, out of the existing cases, a number of them created public rumor (the case of Michelle and Jayson Whitaker, who were turned down in UK and travelled to Chicago in order to have a match for their son) some of them ending up in court (Raj and Shahana Hashmi, who were granted access to the technique but who got sued by a pro-life group).

Another issue that is worth mentioning at this point is the – so far – reduced accessibility of the procedure to couples that are particularly knowledgeable and that manage to navigate through the obstacles of an imperfectly provided information. Thus, studies have shown that the existing on-line information on these issues is difficult to be assessed by lay people not familiarized with the particularities of the medical jargon (Axler 2009: 173-183).

³ For a discussion of extending the possibility for couples unable to carry a successful pregnancy at term, see a proposal to apply the techniques for creating “savior embryos” of Sparrow, Cram (2010).

⁴ However, there were some documented cases of couples attempting to obtain a healthy offspring who could be a perfect match at the same time – such as the Ayala case and the Curry case (Devolder 2005: 582).

⁵ For general and ethical discussions on various acceptable forms of embryo selection, see Slowther 2008: 60-62.

Furthermore, these techniques have not been accepted without voicing difficult ethical dilemmas⁶. One of them is whether children may be conceived in order to save the life of other ones. To what extent are IVF and PGD opening the way towards the so-called *designer babies* (children conceived with the help of genetic technologies, having certain modified features desired by their parents)?

What is at stake here departs from the existence of opposing ethical perspectives. As Sally Sheldon describes it, the unveiling of the savior sibling cases: “provoked a storm of media interest and widespread debate regarding the ethics of the deliberate creation of so-called ‘saviour siblings’. Do these procedures create a child *merely as a means to an end*? Does allowing them lace us on a slippery slope towards permitting creation of fully-fledged ‘designer babies’? Do they take adequate account of the welfare of the child to be born?” (Sheldon 2005: 405⁷). Thus, from a Kantian point of view, a child conceived with the purpose of saving the life of another represents rather a mere means to an exterior end. The dignity of the future child is going to be damaged. Therefore, this type of medical interventions should not be allowed. Conversely, a Utilitarian would claim that a child saving the life of another will produce an increased quantity of good/happiness in his family. From yet another perspective, the intention of bringing a savior child in the world could be said to be one of the few rational acts of reproductive behavior⁸, which to a great extent remains unpredictable:

“The aim of producing a “saviour child”, using preimplantation diagnosis and in vitro fertilisation techniques, as a compatible donor for an existing ill child, would seem to be one of very few cases where the choice to create a new child could be viewed as a rational choice. However, most of us create children either for no reason at all or to attempt to produce outcomes that can in no way be predicted or guaranteed” (Bennett 2004: 379).

In the remaining part of the paper, we will attempt to present the main ethical challenges inherent in the concept of savior sibling: the instrumentalization of embryos; the perspective of *designer babies*; the instrumentalization of the body; the instrumentalization of human life and the perspective of children’s interests vs. parents’ interests.

Instrumentalization/commodification of embryos

Instrumentalization has been described as an on-going process through which different values are losing their potential as a result of their being indexed as merely useful ones (price, efficiency). The most dramatic case is when individual

⁶ It is worth noting that these ethical dilemmas are pervasive not only among existing ethicists, but also among lay persons. Thus, studies have shown the presence of opposing viewpoints both at the general level of opinion polls, and at the particular level of specific groups. Iredale et al. 2006.

⁷ Similar Kantian-sounding objections are formulated, in order to be refuted, in Devolder 2005: 583-584, Sheldon, Wilkinson 2004: 533-534)

⁸ Although for some this option sounds rational, for others it does not. See for instance the reply of M. Hayry, who qualifies the desire to have children immoral, and the action of ending with two children instead of one (as in the case of savior siblings) the same (Hayry 2005: 606)

beings are deprived of their human values and depicted as commodified things. The view of major philosophers usually claims that human beings are endowed with dignity, which cannot be reduced to the commercial value of a thing. However, in postindustrialized societies more and more of human life is reduced to instrumental values – children and embryos included⁹. Along with these considerations, arguments deploying the instrumentalization of embryos in the case of savior siblings claim that excess embryos produced as a result of IVF are devalued and discarded due to an extrinsic feature – their (in)compatibility with another person whose life is intended to be saved. It is also contended that a proof for this disrespectful use of embryos is the fact that they are analyzed using PGD techniques, the risks of those procedures not being properly assessed¹⁰. However, one can counter-argue that the same procedure (IVF and PGD) is used for couples having risks for transmitting a serious hereditary illness, in an attempt to facilitate the choice of a healthy heir. What differs is the intention of the selection purpose, which could be reformulated as: in the case of hereditary illness, one attempts at preventing a sick individual to be conceived, while in that of savior sibling, one is driven by the desire to make sure that only a compatible individual is to be conceived¹¹. We might say that this makes all the difference, because being non-compatible with one's sibling is not a disease that should be prevented; however, the compatibility with the sick sibling is the driving force motivating the parents to resort in the first place to the technology. The issue of parents' motivation is going to be addressed separately, in a different section. Concerning the second argument, it is true that the risk of harvesting a cell for analysis remains unknown; however it is unconfirmed by the existing children conceived through the same procedure, who seem unaffected. Nevertheless, some authors claim that, even if the risk itself is low, it is still disproportionate, by not being compensated with a comparable benefit for the future baby; the only beneficiary remaining the sick relative:

“when PGD is used to test for genetic diseases that testing is done in the best interests of the embryo or the person it will become, whereas when PGD is used solely for tissue typing, the only benefit is for the existing sick child” (Devolder 583).

Another more controversial but equally appealing to the general public is the issue whether discarding and destroying healthy embryos is an acceptable course of action - actually, the Quintavalle (on behalf of Comment on Reproductive Ethics)

⁹ There are discussions about the business connected with different reproductive options for the couples who cannot become parents in natural ways. See for instance Spar, Debora L. (2006) *The Baby Business. How Money, Science, and Politics Drive the Commerce of Conception*. Harvard: Harvard Business School Press

¹⁰ See for instance Editorial: ‘Preimplantation Donor Selection’ 358 (2001) *Lancet* 1195.

¹¹ Actually, the initial statement of HFEA limited the usage of IVF, PGD and HLA-matching to couples at risk of transmitting a serious hereditary disease to their children (including the would-be savior sibling). This is the reason why they turned down couples whose children suffered from sporadic (instead of hereditary) conditions (such as the case of the Whitakers). In this way, HFEA could argue that IVF and PGD were useful for the would-be sibling himself. However, in this way HFEA introduced an element of discrimination between couples. See Sheldon and Wilkinson 2004

v. Human Fertilisation and Embryology Authority case represented the locus for such allegations (Sheldon 2005). This problem is not applicable only for cases of creating savior siblings (because creating more embryos for selection purposes means also creating healthy embryos that are going to be destroyed), but for IVF technique in general.

The threat of designer babies

A second line of arguments against the idea of savior siblings is the one claiming that from the „savior sibling” to *designer babies* is yet a single step that will be soon taken. The threat of designer babies (that is, of children conceived with special features previously chosen by their parents) is powerful enough to close entire IVF programs, and therefore is especially relevant in the debate. However, in comparison with the previous arguments, the perspective of “designer babies” is not really an issue in the actual cases of savior siblings. This is true because the procedure itself (FIV + PGD) does not *change* the embryo, but only selects a previously formed embryo. *Designer babies* involve conscious embryo modification in the direction of a desired trait, by introducing or removing something from it. There are still voices claiming, in the logic of slippery slope arguments, that designer babies are merely the next logical step if only the prospect of savior children is allowed to exist. However, slippery slope arguments are notoriously hard, if ever possible, to be proved¹², as their entire rhetorical force is based on a conditional and potential sequence of events. One can nevertheless affirm that, departing from the cases of actually conceived savior siblings, this slope seems not to have been taken.

However, there are other possible understandings of the “slippery” concept of *designer babies*, whose vague characteristics have already been the subject of legitimate critiques (Axler et al. 2009). One connotation is of parents picking up their future child on the basis of a trait – such as eye color, or height, or sex of the future child. These traits are also already part of the genetic package of the embryo, such as the HLA compatibility in the case of savior sibling. Why would it be immoral to choose a blue-eyed child instead of a savior child? Here some authors insisted upon tracing differences between ‘screening out abnormalities’ (the case of savior siblings) and ‘screening in preferences’ (the case of designer babies) (Sheldon and Wilkinson 2004: 149).

Instrumentalization of the body

In a more general argument relying on the issue of instrumentalization, „savior sibling” are said to represent only a reservoir for organs/tissues for transplantation, therefore annihilating their dignity as human subjects. In fact, other dismal phrases

¹² See for instance the excellent article of J. Harris on the issue of sex selection, that accuses HFEA to reason on the basis of solely slippery slope argument (Harris 2005).

to label them are “slave siblings”, “spare part sisters” or “bred to order brothers”. However, the counter-argument states that this Sci-Fi scenario of persons as organ sacks is no more than a fantasy. That happens because harvesting of cells/tissues from any living person (including „savior sibling”) is subject to current transplantation laws, that actively protect subjects (with a focus on minor children). Thus, solid organ transplantation is generally forbidden in cases of small children¹³, and only stem cells from the umbilical cord and bone marrow transplant are permitted on behalf of the „savior sibling” (in those countries which support such legislation – Great Britain, Australia, New Zealand).

There are some authors who consider that there are serious differences between the donation of umbilical cord blood (a procedure entailing no risks for the donor) and the donation of bone marrow or peripheral blood stem cells by minor children (that entails some risks, especially in multiple donation cases). The prospect of subjecting minors to take part in bone marrow transplant is described as „forced altruism” on the verge of child exploitation (Then 26). The subsequent ethical questions concern the minor’ capacity to consent (especially in the case of babies), the sufficiency of parental consent (especially when there is a conflict of interests for parents, due to their incapacity to choose between the interests of two children), the way to properly asses risks (Then 26-32). By analyzing relevant law texts, the author arrives at the conclusion that subjecting incompetent people (such as minor children) to the risks of bone marrow transplantation is acceptable only when those people are in a stable relationship with persons to be saved and they would suffer the psycho-social consequences of losing the bonds with a significant other (Then 39). However, this is highly debatable in the case of minor children (especially babies), who cannot appreciate the benefits of a relationship, and for whom those benefits may only be anticipated. Therefore, the existing legal framework can be considered incomplete for providing protections for minors designed as savior siblings.

Instrumentalization of human life

A more philosophical version of the above argument questions the reasons for allowing the entire process of conceiving a child for saving another one. Thus, the argument goes that a child conceived for an exterior purpose (even a noble one such as the prospect of saving a fellow child) is a child who is not wanted for him/herself¹⁴. His/her dignity as human being is diminished by this process. Nevertheless, the counter-argument questions the extent to which parental motivations of people using ART (including those for conceiving a savior sibling) need to be subjected to analysis, while motivations of “natural” parents are not scrutinized. Here the whole

¹³ All European Directives on transplantation especially emphasize the protection of children, who cannot serve as living donors, except for regenerative tissues such as bone marrow transplantation.

¹⁴ These arguments do not take into consideration the fact that the parents might indeed wish to conceive another child both for saving the elder ill child, *and for the sake of the new child him/herself*.

issue becomes complicated, because there is no straightforward answer to the following question: What *model* needs to be followed in the case of ART-conceived children: that of natural children (where no rules are present, except in extreme cases of documented abuses), or that of adopted children (where there are rules)? Another – and more pervasive – question is: who could judge parental motivation in creating or adopting a child? And who could pronounce that having a child for ensuring the lineage for heritage of a factory is more moral than having a child for saving another one? As Sheldon and Wilkinsos rightly put it, the blame of instrumentalisation:

“does not adequately distinguish between creating a child as a saviour sibling and creating a child for some other “instrumental” purpose—for example, “completing a family”, being a playmate for an existing child, saving a marriage, delighting prospective grandparents, or providing an heir. Perhaps these things are different from creating a saviour sibling but, if they are, the difference isn’t that they are any less “instrumental” for in all these cases, the child is used as a means” (Sheldon and Wilkinson 2004b: 534).

Because there is no easy answer to these questions, some authors propose to overlook entirely the issue of parental motivation: “We judge people on their attitudes toward children, rather than on their motives for having them” (Devolder 584). Judging upon attitudes, the mere fact that the parents of the sick child want to save him/her so much that they are ready to pass through the process of IVF and PGD, combined with the existing evidence from the couples of savior siblings already born suggest that these parents are supportive and committed ones (Sheldon and Wilkinson 2004: 148), which increases future children’s prospects of having a good life afterwards.

Whose interests are protected?

The issue of parental motivation is further developed through the issue of children’s interests vs. parents’ interests. Thus, the argument claims that the parents’ interests involve saving the life of another, while, conversely, the interests of a „savior sibling” are (only) the interests of a child in pursuing a normal life. However, the opponents rightly note that, generally, if it cannot be said that transplantation is in the interest of the donor child, it is also worth noting that cell and bone marrow transplantation is not *against* the interests of the new child, otherwise these forms of transplantation between relatives would be illegal. For some authors, this remains highly controversial:

“As with the participation of young children in non-therapeutic research, the question is whether something which is not positively in a child’s interest can be tolerated or permitted if it is not positively against the child’s interests” (Ashcroft 2003: 217).

For other authors, the issue is better phrased in terms of *whose* interests are being pursued – those of the child him/herself or those of somebody else:

“Procreative reasons are deemed morally unacceptable for being largely or exclusively ‘other-referring’ – for being based upon, derived from, or characterized exclusively by reference to the good, interests or needs of someone other than the being brought into existence” (Lodz 2009: 292).

Concerning the role asymmetry, some authors discuss the complexities of the psychological relations between the future siblings, generally taking them as a supplementary indication for *not* recommending the procedure:

“In the real world of sibling rivalry and jealousy, it is discomfiting to contemplate a scene in which one child could say to another, ‘But for the grace of me you would be dead’. Speculations about psychological damage cannot be excluded from the debate” (Brooke 2004: 599).¹⁵

Here Brooke focuses on the psychological damages for the sick child. Nevertheless, other types of damages are accused for the savior one:

“first, that a future child may suffer psychological harm if she finds out that she was wanted not for herself, but as a means to save the life of a sibling; and second, that she may enjoy a less close and loving relationship with her parents who are less likely to value and nurture her given that they want her in order to save the life of her sibling” (Sheldon and Wilkinson 2004: 151).

These psychological arguments could be overturned by the equal possibility that a child could feel special because, on top of being loved for oneself by one’s parents, he/she is additionally valued for contributing to the family wellbeing by saving the life of his/her sibling. Alternatively, a putative child who was not a savior sibling would have to face his/her entire life the sad consequences of being born in a family devastated by the loss of his/her sibling that he/she could not save.

This asymmetry of roles, put it in psychological or other terms, between the savior sibling and the sibling that is planned to be saved is thus translated into the debate upon exterior or instrumental reasons for wanting a child vs. “the child himself”-centered reasons. Several authors consider this a false philosophical problem, based on the fallacies of the famous “non-identity problem”, as coined by Derek Parfitt and David Heyd. Thus, to hypothesize about the benefits of a future child is fallacious because there is no future child for whom those benefits make sense before the actual savior child is born. In Sheldon and Wilkinson words:

“This does not necessarily mean that child welfare considerations should be completely disregarded. But it does make it almost impossible to construct a child welfare argument against creating the child whose welfare is under consideration.” (Sheldon and Wilkinson 2004: 153)

¹⁵ Another type of psychological damages not discussed in detail here is the psychological consequences on the families themselves: “which will depend on the success or failure of any transplant” (Then 42) which may additionally affect a savior’s psychological wellbeing.

Heyd’s suggestion, states Lodz, is that all discourse on future benefits should be centered on parents, because they are already existing persons (Lodz 2009: 293). Extending the discussion of benefits, it is easy to note that parents are going to find it beneficial to have another child and save the life of the existing one, as opposed to merely losing a child.

Instead of conclusions

So far, the number of cases of savior siblings, although growing, remains low, and the success of the endeavor is hard to evaluate objectively, as other things might go wrong after the successful birth of a savior child. In another kind of slippery slope warning, authors contend that what works well in theory (transplant from umbilical cord blood) could fail in practice: “If the cord blood transplant fails, the next step is bone marrow harvest and transplant. This too might not succeed or the original illness might recur, requiring another bone marrow transplant. Additionally, once an HLA-matched donor is created, there is potential to require further tissues other than bone marrow.” (Thomas 2004: 121). Although existing legislation prevents and protects minor children from becoming solid organ donors, this protection is considered ethically challenging in itself. There are optimistic authors claiming that the standard will remain cord blood transplants, and other pessimistic ones worrying that repeated bone marrow transplant will become the new accepted rule. In the meantime, philosophers can continue to ask how much of a life can become instrumentalized or commodified. If those concerns are not going to be included as necessary ingredients of the public health policies and projects, they are not going to produce effects – other than rumors in philosophical journals.

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TOWARDS A NEW APPROACH TO HIV TESTING IN ROMANIA

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ABSTRACT. Without effective prevention of HIV spreading, the number of people at risk of infection and who will need antiretroviral treatment will be increasing constantly. This situation could result in additional pressure on health and social budgets at a time when the scarcity of financial resources is becoming more and more obvious. HIV testing plays a crucial role in the treatment and prevention of this infection. Stigma and discrimination associated with HIV infection are still obstacles that prevent people from addressing health services which offer care and prevention. The institutional framework in which counseling and testing are offered must be directly linked to the fundamental human rights principles.

Whereas HIV testing with informed consent is traditional and has been used from the beginning of the epidemic (*opt-in testing*), routine or universal screening is a relatively new approach in HIV prevention services (*opt-out testing*). Although Romania has a low prevalence of HIV transmission as compared to other European countries, data show that the number of newly diagnosed patients increases each year. As a response to this situation more and more medical professionals consider that a shift in HIV testing policy is needed by replacing the opt-in testing with universal screening.

This article aims to analyze the ethics of HIV universal screening using as a reference system four bioethical principles – beneficence, respect for human dignity, autonomy and justice.

Keywords: *informed consent, personal autonomy, HIV exceptionalism, universal screening*

Two different approaches to HIV testing

Statistics for the end of 2009 indicate that around 33.3 million people are living with HIV, the virus that causes AIDS. Each year around 2.6 million more people become infected with HIV and 1.8 million die of AIDS. AIDS is caused by HIV, a virus that can be transmitted from person to person through sexual fluids, blood and breast milk. Worldwide the majority of HIV infections are transmitted

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through sex between men and women, and nearly half of all adults living with HIV are women. But certain groups of people have been particularly affected and these include injecting-drug users, sex workers, and men who have sex with men. In many people's minds, HIV and AIDS are closely linked with these groups, which can lead to even greater stigma and prejudice against people already treated as outsiders. In the US, where more than a million people are living with HIV, heterosexual sex accounts for one third of new diagnoses. As a sexually transmitted disease, AIDS particularly affects adolescents and young adults. Deaths of young adults have an especially damaging impact on their families and communities: skills are lost, workforces shrink and children are orphaned¹.

According to the joint strategy of the World Health Organization (WHO) and the United Nations Fund for HIV/AIDS (UNAIDS), testing for HIV must respect three fundamental ethical principles: confidentiality, regardless of test results, counseling before and after testing, and consent².

The types of testing recommended by UNAIDS and WHO are: *voluntary testing* – the patient decides to be tested for HIV in order to know his or her HIV serological status; *diagnostic testing* – recommended whenever a person shows signs or symptoms which are typically associated with HIV infection; *testing for groups at risk of infection* – sex workers, pregnant women, patients diagnosed with tuberculosis; and *mandatory testing* – for blood donors. In Romania, HIV testing is done according to WHO and UNAIDS recommendations, which require counseling before and after testing.

According to data provided by the National Commission of Fight against AIDS, at the end of 2010, 10,405 people infected with HIV were recorded. In 2010 in Romania there were performed 291,915 tests for HIV risk groups (pregnant women, people suffering from tuberculosis, sex workers, drug users, etc.), registering a total of 2,337 positive tests. In the same year there were performed 398,758 mandatory tests for blood donors, out of which 50 were positive for HIV³.

Counseling for HIV testing appeared during the early epidemic of the 1980s, especially in the United States, as a means of preventing people diagnosed as HIV positive from committing suicide. HIV testing with counseling corresponds to the *exceptionalism approach* that emphasizes the rights of persons diagnosed with HIV to privacy and confidentiality⁴.

¹ UNAIDS (2010) UNAIDS Report on the global AIDS epidemic, 2010,

http://www.unaids.org/documents/20101123_GlobalReport_Chap2_em.pdf

² WHO and UNAIDS. *Guidance on provider-initiated HIV testing and counseling in health facilities*. Geneva, World Health Organization, 2007

http://whqlibdoc.who.int/publications/2007/9789241595568_eng.pdf accessed at 23.07.2011

³ Comisia de Lupta Anti-SIDA, *Romania la 31 decembrie 2010*,

http://www.cnlas.ro/images/doc/romania_31dec_2010.pdf, accessed at 15.09.2011

⁴ Smith J. H., Whiteside, A., *The history of AIDS exceptionalism*, Journal of the International AIDS Society, 2010, 13:47

As a response to high rates of HIV transmission in spite of prevention efforts, the Center for Disease Control and Prevention (CDC) has revised its recommendations for HIV testing of adults, teenagers and pregnant women. The rationale of these new guidelines was based on studies which estimated that from an overall of 1,106,400 people living with HIV in the United States, about 25% of them were not aware of their positive status. The same study revealed that 32% of newly-diagnosed patients were in the final stage of infection, which might represent a major failure in delivering care and prevention to people affected by this condition. This high percentage of people tested in the late stage of infection indicates that testing was proposed long after the infection⁵.

The CDC recommendations state that HIV testing should be performed without the patient's explicit consent; thus, universal HIV testing has become a routine in clinical services. The new guidelines no longer require the counseling and informed consent of the patients and the obligation of the care provider to register the patients' written consent. This radical change in the regulations introduced by the CDC for HIV testing has led to rethinking the conditions for obtaining consent for testing from patients. According to these guidelines, patients are informed that they will be tested for HIV and are given the opportunity to refuse it.

Written consent is not necessary because general agreement given for all other tests and medical procedures encompasses the consent for HIV testing. CDC also recommends that testing should be **offered** and **not imposed** to patients. Before testing, patients should receive verbal or written information on HIV testing, including explanations of the significance of the results⁶.

The ethical background for universal HIV testing

The utilitarian doctrine has at its heart the principle of maximum utility, considering that an action is good or moral as long as its beneficial consequences outweigh the negative ones. In other words, it is not the reason behind a certain action that determines its ethical character, but rather the consequences of that action. This philosophical view corresponds to the public health approach, which stresses on the positive effects of universal screening for HIV. These effects can be quantified in lower rates of HIV transmission among the general population, in the increase in the number of newly-diagnosed patients, and in the optimization in the quality of life for the people who live with HIV⁷. Currently, in contemporary

⁵ Center for Disease Control and Prevention, *HIV in the United States: An Overview* http://www.cdc.gov/hiv/topics/surveillance/resources/factsheets/pdf/us_overview.pdf accessed 16.07.2011

⁶ Branson BM, Handsfield H.H., Lampe M.A. et al., *Revised recommendations for HIV testing of adults, adolescents, and pregnant women in healthcare settings*. MMWR Recomm Rep. 2006;55(RR-14):1-17 <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5514a1.htm>, accessed 10.08.20011

⁷ Wolf, L., *Ethical Dimmension of HIV and AIDS*, <http://hivinsite.ucsf.edu/InSite?page=kb-08-01-05>, accessed 22.07.2011

bioethics, there are a number of moral principles which guide medical practice – beneficence (*aegroti supreme lex salus*), respect for individual autonomy (*voluntas suprema lex aegroti*), respect for human dignity, and justice⁸.

The beneficence principle implies a moral obligation for the physicians to act solely in the interest of their patients. This principle obliges the physicians involved in the therapeutic relationship to **maximize** treatment **benefits** and to **minimize** its **potential risks**. Emphasizing the positive effect of the medical intervention, this principle possesses a very strong utilitarian connotation. The beneficence principle has a central place in the medical practice, promoting the welfare of the patients as the ultimate goal of health care. The clinical and ethical justification for HIV universal screening is based on bringing benefits to the people tested, mainly by referring newly-diagnosed patients to care and prevention services. Thus, the purpose of HIV universal screening is both to identify undiagnosed patients and to reduce HIV transmission to their partners.

As a direct benefit of the introduction of combined antiretroviral therapy, since the mid-1990s, there has been a decrease in AIDS-related mortality in Western and Central Europe. Most people living with HIV in these regions have access to combined therapy, which reduces their chances of acquiring AIDS-related illnesses and considerably prolongs the life expectancy of these patients. The average life expectancy after HIV diagnosis increased from 10.5 to 22.5 years between 1996 and 2005⁹. A 25-year-old HIV-infected person currently has an 80% chance of reaching the age of 50, before 1996 this was no more than 5%¹⁰. Early detection is critical for several reasons. Early treatment, such as antiretroviral therapy, can also delay HIV from developing into AIDS. In contrast, HIV will progress to AIDS in about 10 years in untreated individuals¹¹. The evidence available so far points to high rates of late diagnosis across Europe – between 15% and 38% of all HIV cases¹².

⁸ Astarastoe, V., Ioan, B.G., *Etica si legislatie in infectia cu HIV*, 2007, Fundatia Romanian Angel Appeal, Bucuresti. The four principles of bioethics (autonomy, beneficence, non-maleficence, and justice) were originally formulated in the influential work of Beauchamp, Tom L., Childress, James, *Principles of Biomedical Ethics* 4th ed. Oxford University Press; New York, 1994. In Europe, a set of similar bioethical principles were included in Barcelona declaration (autonomy, human dignity, integrity and vulnerability). Kemp, Peter; Jacob Dahl Rendtorff. The Barcelona Declaration. Towards an Integrated Approach to Basic Ethical Principles. *Synthesis Philosophica* 46 (2/2008) pp. (239–251).

⁹ Harrison, Kathleen McDavid PhD, MPH; Song, Ruiguang PhD; Zhang, Xinjian PhD, *Life Expectancy After HIV Diagnosis Based on National HIV Surveillance Data From 25 States, United States*, *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 53 - Issue 1/ 2010, 124-130

¹⁰ Annemarie de Knecht-van Eekelen in collaboration with Cees Smit and Peter Reiss. *Aging with HIV/AIDS in the Netherlands*. EACS. 2010 http://www.aidsactioneurope.org/uploads/tx_windpublications/1820-0.pdf accessed 10.09.2011

¹¹ Center for Disease Control and Prevention, *Morb Mortal Wkly Rep*. December 3, 2010/59(47); 1550-1555 http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5947a3.htm?s_cid=mm5947a3_w accessed 12.09.2011

¹² Adler A., Mounier-Jack S., Cocker R.J., *Late diagnosis of HIV in Europe: definitional and public health challenges*, *AIDS Care*.21(3)/2009 (abstract)

Apart from providing access to health care services and improving the quality of life for people living with HIV, infectious disease clinicians bear the responsibility of preventing transmission of this infection among population. Together with their patients, the infectious disease physicians should examine the importance of notifying former or current sexual partners, and also assess the measures that can be taken to minimize the potential harm likely to be associated with the disclosure of their positive HIV status. Given that this kind of testing can offer timely linkage of patients to treatment, we can state that HIV universal screening has a favorable risk-benefit ratio for both patients and public health¹³.

Another principle that is specific for medical bioethics and which can be applied to HIV universal testing is the respect for human dignity. This concept can be viewed from two perspectives: firstly it refers to a right which is given to all human beings through birth. Secondly, human dignity is seen as an acquisition, an intrinsic value attached to each person considered to be able to determine their life according to their free will. In this sense, human dignity is formed by and depends entirely on the social and cultural exchanges in which the person is involved¹⁴. This principle states that all ethical decisions, including those related to health care, must meet both the innate needs of the persons and their cultural needs (psychological, social and spiritual).

The human dignity principle is basically linked to the concept of bodily integrity and according to this principle, individuals are capable of making autonomous decisions regarding their own body. Therefore, any medical procedures, including HIV testing, will be performed only with the patient's knowledge. The CDC guidelines assert that the medical provider has a sum of obligations in order to preserve the ethical character of routine HIV testing. First and foremost, the process of testing has to ensure the voluntary nature of testing, the patient having the right to decline to be tested for HIV. In this respect, the refusal of a patient to be tested for HIV should be documented and enclosed in the medical records. Furthermore, the medical provider must ascertain whether the patient has fully understood that a blood sample will be tested for HIV alongside other analysis. The CDC also advises that materials such as posters or leaflets containing accessible information about HIV should be available in clinical setting.

The principle of autonomy is extremely relevant in analyzing the practice of HIV testing. This principle can be found in medical practice in the doctrine of informed consent. The notion of informed consent refers to the authorization granted by the patient to their doctor in carrying out certain investigations and medical treatment. In order to be considered valid, informed consent must meet three basic requirements: the patient must be informed by the doctor about the procedures to

¹³ Branson, B. M., *HIV Screening in Health Care Settings in the United States*, American Medical Association Journal of Ethics, December 2009, Number 12: 974-979

¹⁴ Beauchamp, Tom L., Childress, James, *Principles of Biomedical Ethics* 4th ed., Oxford University Press; New York, 1994

be implemented, the patient's consent must be voluntary and without coercion, manipulation or influence. Finally, the patient must be mentally competent and legally capable of giving his or her consent regarding the medical procedures¹⁵. In the process of obtaining informed consent, physicians should be able to communicate effectively with their patients, providing them with adequate and comprehensible information about HIV testing and options for treatment, in a manner which shows respect for their private lives.

Traditionally, HIV testing has been associated with risk behaviors that are stigmatized in our society - sexual relations with same-sex partners, engaging in sex with multiple partners, and drug use. Some patients may think that if they accept HIV testing, they can erroneously be perceived as having been involved in risk behaviors related with HIV transmission. Therefore, HIV universal screening could minimize such bias perceived by the patient, through offering the patients who do not consider themselves at risk for HIV transmission or who do not want to disclose risk behaviors, a more acceptable testing procedure¹⁶. We can state that the new CDC guidelines preserve the basic requirements in obtaining consent for HIV testing and show consideration for the patients' rights to privacy.

There are several studies which have suggested that the accepting rate for HIV testing increases considerably when it is proposed as a routine test rather than on the more complex model with explicit informed consent. For example, in gynecological services in a province of Canada, the rate of accepting global HIV testing in the antenatal period increased from 84% to 92.5% in comparison with the provinces which traditionally offered testing with informed consent¹⁷. A prospective study conducted in Scotland on homosexual men showed increased rates of accepting HIV testing from 49.7% to 57.8% between 1996 and 2005. These data were associated with the introduction of opt-out universal screening in genitourinary clinics¹⁸. According to the moral principle of justice, physicians must offer equal treatment to all patients regardless of their social status, economic background, ethnicity, disability, gender or sexual orientation.

Justice is a moral virtue and a constant affirmation of the desire to give the others what they are entitled to¹⁹. The universal screening advocates consider that this type of testing will increase the number of people diagnosed in the early stages of infection and will contribute to lowering the transmission rate of this infection.

¹⁵ *Ibid*

¹⁶ Stein, N., *There are advantages and disadvantages associated with requiring explicit testing for HIV*, American Medical Association Journal of Ethics, December 2009, No. 12, 959-961

¹⁷ Yudin, M., Moravac, C., Shah, R., *Influence of an "Opt-Out" Test Strategy and Patient Factors on Human Immunodeficiency Virus Screening in Pregnancy*, Obstetrics & Gynecology: July 2007 - Volume 110 - Issue 1, 81-86

¹⁸ Williamson, L. M., *HIV testing trends among gay men in Scotland, UK(1996-2005): Implications for HIV testing policies and prevention* <http://sti.bmj.com/content/early/2009/03/09/sti.2008.033886.full.pdf>

¹⁹ Harvey, John C., *Considerations in providing lifesaving and life-extending drugs to the medically indigent in the United States*, Journal of the International Association of Physicians in AIDS Care, No. 11/ 1997

Thus, the main purpose of universal screening is to identify undiagnosed patients and to allow them to access care and prevention services. To achieve this goal, it is essential to ensure the availability of treatment and to facilitate access to health care settings for all people who live with HIV.

Limits of the universal screening

HIV universal testing without informed consent according to the CDC recommendations may hinder the ability of the individual to act independently and can also undermine the individual's efforts to engage in protective behaviors that would minimize the risk of HIV transmission. On the other hand, if this kind of testing becomes a routine, it might result in a rigid and habitual approach to HIV screening, which would affect the ability of the patients to realize that they have the right to refuse to be tested. Without written proof of consent to testing, health providers may face very serious legal problems (i.e. testing people who are not legally capable of giving their consent, teenagers, patients in emergency rooms, and immigrants).

Secondly, it is possible that patients may overlook the fact that, in comparison with other tests, an HIV test involves a series of psychosocial risks²⁰. The abridged HIV counseling proposed by the CDC guidelines, in which patients are not told about the probability of false positive results, might also expose the medical provider to charges of malpractice. Moreover, any protocol that allows the patient's silence to be understood by the medical provider as informed consent diminishes the patient's ability to receive and process sensitive information and raises serious ethical concerns. This approach is in conflict with the "European Convention on Human Rights and Biomedicine", which states that the patients have the right to be accurately informed about the nature, purpose, consequences and risks of any medical intervention, because it is the patients that bear all the consequences of diagnosis and treatment²¹.

The main objective of universal screening is to reduce mortality among the people who are evaluated. The new CDC guidelines emphasize that the patients who are being tested as positive for HIV should be referred to specialized services. As a matter of public health ethics, the primary beneficiaries of the screening must be the people who are screened. The CDC recommendations underline that linking newly-diagnosed patients to prevention and care services is essential, HIV screening without such linkage confers no benefit to the patient. On the other hand, an individual's knowledge of their HIV serologic status, may reduce his or her tendency to get involved in risk behaviors leading to HIV transmission, but a testing program that identifies this outcome as its end cannot be considered as ethical²².

²⁰ Bartlett. J. G., Mayer, K. H., *Routine Opt-Out HIV Testing: Rationale for the Consensus*, Clin Infect Dis., 2007, Suppl 4: 203-205

²¹ *The European Convention on Human Rights and Biomedicine*

http://europatientrights.eu/biomedicine_convention/biomedicine_convention_text.html

²² Hannsens C., *Legal and ethical implications of opt out HIV testing*, Clin Infect Dis., 2007, Suppl 4:232-239

HIV testing remains a sensitive area, and, therefore, we consider that health care providers should ensure a set of minimum criteria in order to maintain the ethical nature of universal screening – balancing the risks and benefits of HIV testing for certain groups of people, constantly adjusting the content of counseling to the needs of the patients, and providing permanent connection between prevention and treatment services for people living with HIV. In addition, we consider it crucial that the providers protect the confidentiality of the patients, acknowledge the stigma associated with positive results, and safeguard the patients' rights against discrimination, which may occur even in medical services.

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IMAGE REASONING – AN ARCHITECTURAL CASE STUDY

LÁSZLÓ GÁL*, GABRIELLA GÁL**

ABSTRACT. Our paper starts from a conclusion issued in a former paper regarding the issue of examination of imagery not necessarily consisting in how one looks at the way pictures become statements with truth values but rather at how images are transferred to statements and receive truth functional connections within the framework of logic, thereby losing their pictorial specificity. We have thus found a way of achieving this by specifically following the pictorial reasoning through the more accurate non-linguistic way of interpretation. To this end we have used C.S. Peirce's existential graphs Alfa theory, and correlated the graph reasoning constants to logical statements without having to resort to the concept of truth. Our thread of inquiry followed the architecture design phases of the project for The Promenade Cultural Centre of Cluj, from inception from beginning of March to end of April 2010. This process has been used to identify the steps of the existential graphs inference within Peirce's theory, only to realize that this theory alone is inaccurate for a complex architectural design despite our exhaustive and comprehensive investigation. Eventually, our results tried to connect the architectural design with language negation and conjunction.

Keywords: *reasoning; picture reasoning; linguistic and non-linguistic; architectural and non-architectural and (&), or (v), non (~); existential graphs; reasoning mental faculties.*

Introduction

In October 2009, the first International Opening Conference of the Academic Year was held on the theme of "Concept and/or Representation". The conference volume containing the papers delivered¹ was issued on October 1, 2010.

My paper in this volume (*The representations of propositional and pictorial content*) discusses the problem of the constant logical relations between images. The position of paper may be summarized as follows: "The image itself is not sentences p1 and p2. Judging whether images P1 and P2 are authentic or not means sentences. Consequently, the issue of the logical relationships between images has remained

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¹ Gál László, Egyed Péter (szerk.) *Fogalom és kép*, Editura Presa Universitară Clujeană / Kolozsvári Egyetemi Kiadó, 2010

unsolved, for true and false rather than authentic or not authentic words can not be called various terms but simply represent different terminology. Therefore the questions of the previous paragraph remain unanswered.”(95)

In other words, since the images are neither true nor false, but only have accurate and non accurate values, and since these values are essentially similar to truth values, my method of treatment of the above proved to be not only unfruitful, but downright wrong. The interpretation of logical constants (negation, implication, conjunction, etc.) as truth functions in the case of pictures is not at all successful, whereas in the case of statements it is.

Consequently, we decided that we must start from different assumptions and the following year we devoted our efforts to a new line of research as reformulated in the paper mentioned above: “In future, we are thinking of making further clarifications of the topic of pictorial reasoning and of how to use a conceptual (sentential) way of solving it.” (96) In the present paper we are trying to do just that even though we are fully aware that “pictorial reasoning” is not a self-evident concept, and may be quite a surprise to some, to whom it may seem a misnomer.

From the very first quote it is noticeable, however, that the concept is taken to include implicitly atomic, unique, self-reference images, such as paintings, melodies, the smell of chicken soup, etc., which all refer to mental representations.

The consequences of interpreting picture content as propositional

The analytic philosophical interpretations of reasoning with individual pictures content can convert the latter into sentences:

“P. For any picture *P*, there is a sentence, which gives the content of *P*.”
(Tim Crane, 2009, 460)

According to this principle, the pictorial content “exceeds” linguistics, in which case we can apply the classical propositions logic theory model. Consequently, by judging the content of a picture we obtain sentences which are, in truth, functional logical relations. In other words, the logical constants (conjunction, negation, alternation, implication, etc.) obtain sense. The terms of interpretation are the truth values. Thus, the linguistic description of the image moves within the propositional content, but does not solve the issue of pictorial reasoning.

Another comment in this regard is that in classical propositional logic, constants (in a sense, except for negation) exist between two variables, and thus fulfils the requirements of the principle of compositionality. But the “P” principle involves only singular pictures. Therefore, there is no permanent logical connection between two images to tell us whether there is a connection between the images themselves (not the statements about them), and if so, what is the result thereof. In compound statements, according to the principle of compositionality, there emerges a truth value. However, in the case of composite images, the result is completely undetermined.

Picture reasoning

The questions thus arising are: Is picture reasoning a meaningful concept or not?, and In the case of an affirmative answer, does it yield results?

Let us start from the logical concept of reasoning. Reasoning in logic means that from existing and known truths we obtain new truths. If the new truths are revealed from the existing ones, then we deduce them explicitly. If the new truth appears from an empirical source, then it was obtained by abduction or inductively.

Of course, all series of truth sources have not yet been exhausted. We refer here only to the truths of experience and experimentation. I should emphasize that the clarification of sources of truth can not be fully responsible for logic.

In the case of pictures, if they are singular we can obtain a new complex image. But the typical value becomes the accurate one. From the new picture we can obtain another one. The question is, however, in what way? Neither the deductive nor inductive path is feasible, since the forms of inference for obtaining a sample follow that of truth.

But at this point we formed a new and fundamental hypothesis inspired by cognitive neuroscience (Pléh Cs., Kovács Gy., Gulyás B., Eds., 2003), purporting that human mental faculties are all very similar, the only difference lying in their respective performative nature. Hence the **hypothesis**: *the image reasoning mental faculties do not differ from the characteristics of statement reasoning, but can not be modeled by the same instruments.*

The logical instruments of gaining new truths have been described quite early on. In fact, they have a history of some 2500 years, even while, at some point, pictorial thought was abandoned in Europe. Nyíri Kristóf writes about “... Plato’s obviously not quite being able to quell the face of the insight that people primordially think by pictures, and secondary in abstract words. This insight, like an underground-stream (brook), sometimes comes up, but was forced to monitor throughout the history of Western philosophy”, and moreover “Today ... philosophy seems to have definitely gotten rid of the idea of thinking without pictures.” (Pléh Cs., Kovács Gy., Gulyás B., Eds., 2003, 772)

Apparently, the “underground-stream” metaphor is not related only to the pictorial in the European history of ideas. Péter Egyed, the philosophy historian, says: “in European philosophy, however, a trend was set according to which determination is more important than indetermination, and that is the truth, which at the time was not a logical relation but a kind of philosophical statement in this regard. However, this long period devalued indetermination and probabilistic relations against the strong metaphysical (essentialist) determinations, favoring apodictic relations.” (Egyed P., 2010, 16-17) If you want to elude the contemporary thought of “the idea of thinking without pictures”, then acknowledging the relation of indetermination is a similar thing. Suffice it to mention the newest ideas, e.g. the use of fractal analysis of the probabilistic phenomena in multiple areas.

Images

To sum up the above said, the individual picture content becomes propositional content and thus reasoning is possible, ensuring the truth of a conclusion in a valid reasoning starting from true premises. But this too is a return to the century old logic tradition. This is justified and understandable, for its infallibility has been amply validated over time.

By contrast, in pictorial reasoning is it absolutely necessary that images become statements? If this should be the case, what are we to look at? In other words, let us start from the fact that images can not be transferred to language and will not be applied truth functional managing devices. Consequently, in the case of assets and processes validations are to be made, the latter having a specific explanatory force.

A further attempt at clarification has been that of finding answers to the questions below.

Why architecture?

When designing buildings there is practically always a place (site) where there is already some man-made thing. A completely new building in a completely new place (for example, a new city) is an extremely rare occurrence. Therefore, the design of new buildings should always take into account the already existing elements (buildings, natural environment, human environment, local culture, etc.), for any new building has to fit in the “context”. This fact forces the designer to adapt the new building to the existing ones and to the place; consequently she has to find historical and architectural solutions.

In other words, architecture definitely has to conclude from the images of the existing buildings that of the future buildings. Thus, the architect is not in the position of the painter, who does still life or landscape painting, nor is s/he in the position of a photographer taking pictures of, say, a church. For him/her several pictures represent the departure, and even more pictures are often the result.

Finally, the other reason why we chose architecture is because the design process is fairly easy to follow.

The case

Gabriella Gál is a fifth year architecture student at the Technical University of Cluj-Napoca and her design was prepared between the beginning of March and the end of April 2010 as her second semester exam project.

The design process itself was computerized in the Arhcad program. The designed building was eventually called **The Promenade** and its destination is that of a cultural center for the city of Cluj. Fully consistent with the “iconic revolution,” which Nyíri Kristóf defines as “... where people are starting to feel themselves at home among images, with image manipulation they gain experience which is unprecedented in

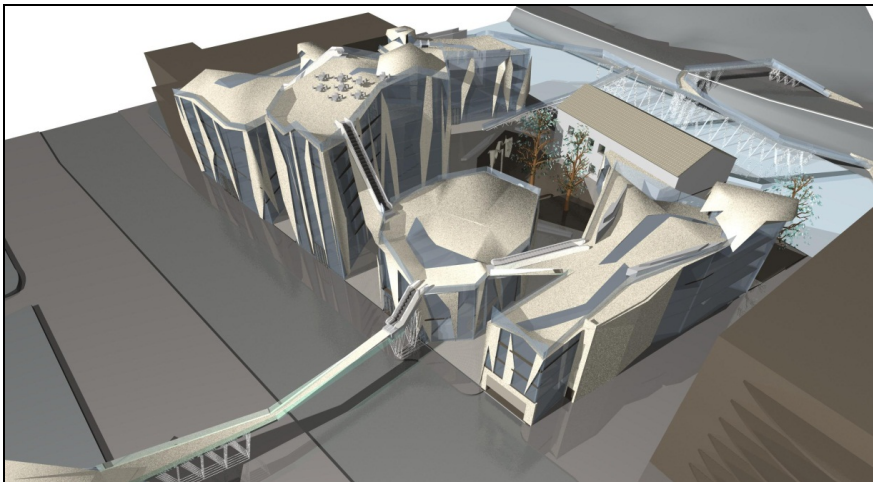
recorded history. And thirdly, I repeat, today’s computer applications can also generate a change: with the possibility of easy image creation, visual communication is becoming increasingly quotidian.” (Pléh Cs., Kovács Gy., Gulyás, B., Eds., 2003, 779)

We followed the planning stages step by step and we tried to reach a conclusion in line with our hypothesis.

The Promenade. The design of the cultural center of Cluj

Let’s start with the city center landscape.

The design is essentially a building complex, with a building and the river Someș already in the background. In the front there lies Malom Street, also the site of a former ditch and stream now both covered. Consequently, the street is wide and the traffic dense. Both from the Someș River and the four lane street flying bridges are leading to several buildings.



Picture 1. The Promenade. Cluj Cultural Center

The design of the building complex was completed over several periodical meetings subsequent to which we analyzed every new development trying to formulate them clearly.

The successive steps of the building design

The concept

Since the building is located between two rivers and the busy four-lane downtown Malom Road, insulated from the rest of the city, channels of communication with the rest of the city had to be designed. These channels are meant to allow approach from all sides, part by car, part on foot, hence the original concept of **The Promenade**.

The term both in English and French is very suggestive, while in Hungarian it means both ‘walking forward’ and simply ‘walk’. This sense of the word refers to free movement around a comfortable space, but the complex also allows for *stops* among the cultural forms and in this sense it occasions intercultural encounters. This multilingual existence of the term could easily inspire future creations for the brand, as the name of the design aptly suggests.

Survey for the location of the future building

The location (site) in Picture 2 shows the front of Malom Street. The space for the future building in this picture is not visible because of the other buildings lined up in the front. Behind them, however, there is a vacant lot that is part of an existing building (the Transit House). Entrance from the street to the left of the first gap is clearly visible as it displays no locked gates.



Picture 2. The site for the location of the future Promenade cultural center

A panoramic image has detected a fracture in the height of the row of buildings. This weakness of harmony has been caused by a lack of conception for the street.

The history of the place: Old Cluj

The second step in planning the outline was the history of the area. A great help for Gabriella Gál was provided by the old photos of the city. We have inserted here one of them.

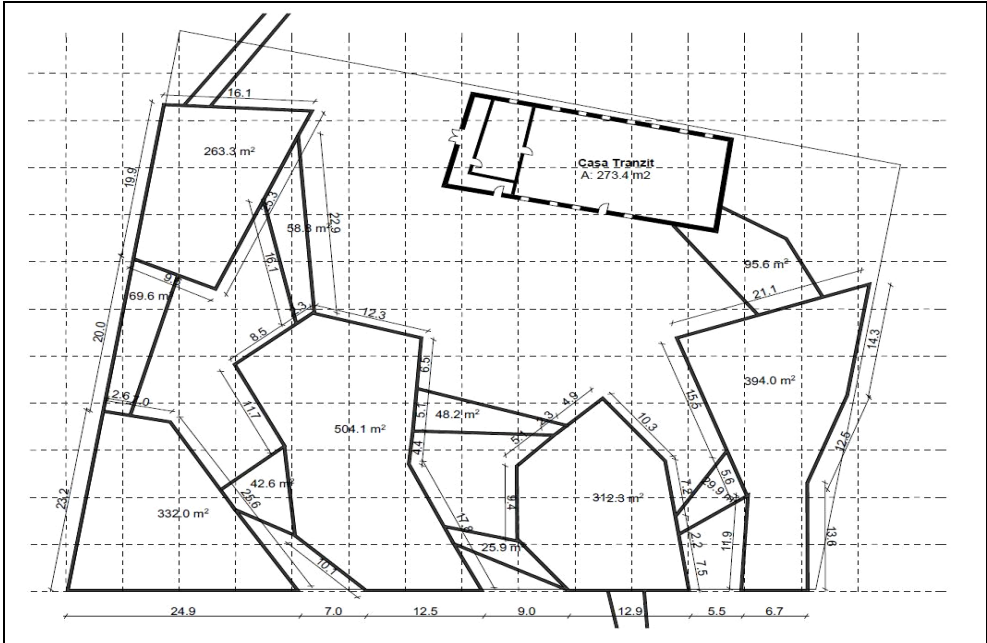


Picture 3. Old Cluj, the *Germans Plank* (1902)

The photograph was taken from across the front. The *Germans Plank* provided a genuine pedestrian crossing for the medieval city. The image shows it lying within the defense castle walls of medieval Cluj. Thus, the place (site) for the construction of the 2010 **Promenade** is located outside the former medieval city walls. By 1902 the urban area already displayed a massive building: the Franciscan church, at the top right hand corner of the image, now a standing symbol of the city and called St. Michael’s Church, next to the statue of King Matthias.

The survey area

The next step in the construction area was the assessment of reports. The image of the already existing building is marked by thick lines, and constituted in the interwar period a synagogue now called the Transit House. It is a 273.4 m², 2 storey building housing cultural activities.



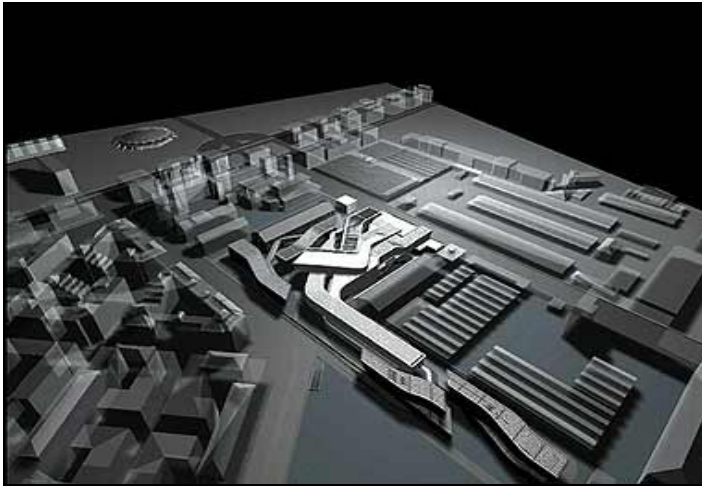
Picture 4. The survey area

The total built area covers 8000 m². The survey gave Gabriella Gál the opportunity to design future buildings for the undeveloped area. The 5 buildings are integrated as A, B, C, D and E, and are marked by letters. With the Transit House the building complex includes a total of six buildings.

The location of each building is also an opportunity for determining the shape and floor size of each space. This is an important step for the future building possibilities. If the buildings and the passages connecting them have unusual shapes, let us stress that all this is only a preliminary computer plan.

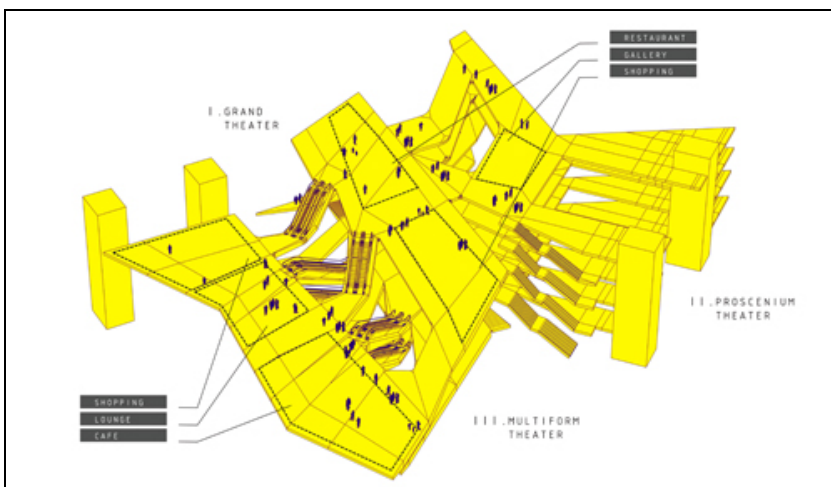
Visual ideas

The planning process contains a section documenting Gál Gabriella's search for visual solutions to problems which may be of further help in the planning process. While she found unlimited opportunities on the Internet, she only stopped at two for inspiration.



Picture 5. Integration in cityscape (example)

In Picture 5 you can see examples of urban integration but its origin can not be identified as Gabriella did not record it. This example can be found in the final plan, not specifically, but rather as some kind of message of the wide spaces.



Picture 6. The Promenade Theatre

Image 6 depicts three theatres and a complex of shopping centers, restaurants, an exhibition area and a café. The picture is meant as a functional scheme by displaying the multi-level communication channels between the parts. In this scheme the traditional functions performed by the theater are expanded, which is why it can be considered a complex. In **The Promenade** one can find the full plan.

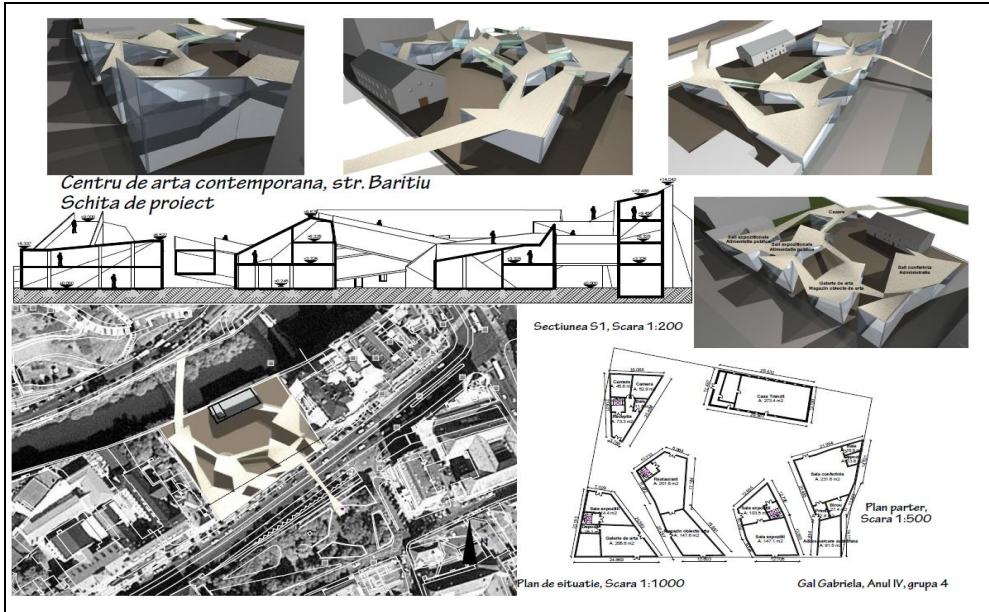


Picture 7. Boat Bridge (Barcelona)

While images 5 and 6 image depict virtual objects, by contrast Picture 7 is of the actual Boat Bridge in Barcelona (Photo by Gabriella Gal.) If few details can be observed at first glance, the final plan displays a lot more. The inspiration was provided by the area above the bridge surrounded by water and the two undulating roof stretches. The Wave located in the background is somewhat mitigated by a straight roof line and is consistent with the idea and image of the rippling water. The bridge relays the idea of accessibility.

The first outline of the plan

The first sketch of the plan was born on 3 March, 2010. Starting from the initial survey area near Transit House, Gabriella Gál integrated the other five buildings, each with a designated function.

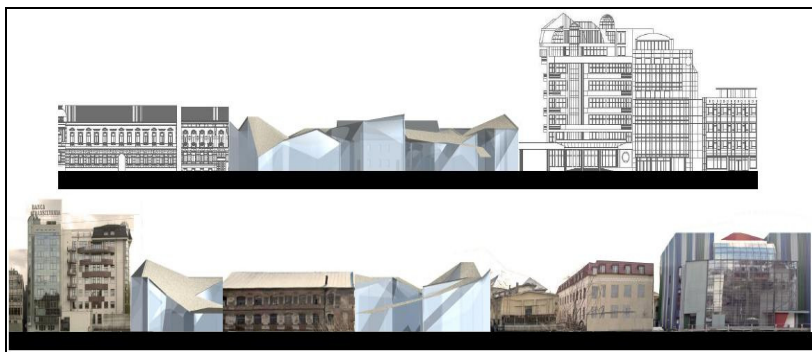


Picture 8. The first outline of the plan. 10 March, 2010

Thus, building A will accommodate rooms for exhibitions, Building B – a food court for the public, Building C rooms for art galleries with sale items, and Building D a concert hall and the administration offices.

A cross-section of the buildings shows them to be three levels above the ground. A bird's eye view from the bottom left of the image features a still indefinite walkway connecting the six buildings. In addition, an adjoining Someș bridge leads to the other side of the building and to the Malom Street front, spanning the four-lane road to the park at the opposite end.

The rough building volumes were made to fit and be consistent with the adjoining buildings on Malom Street and behind the Someș River.

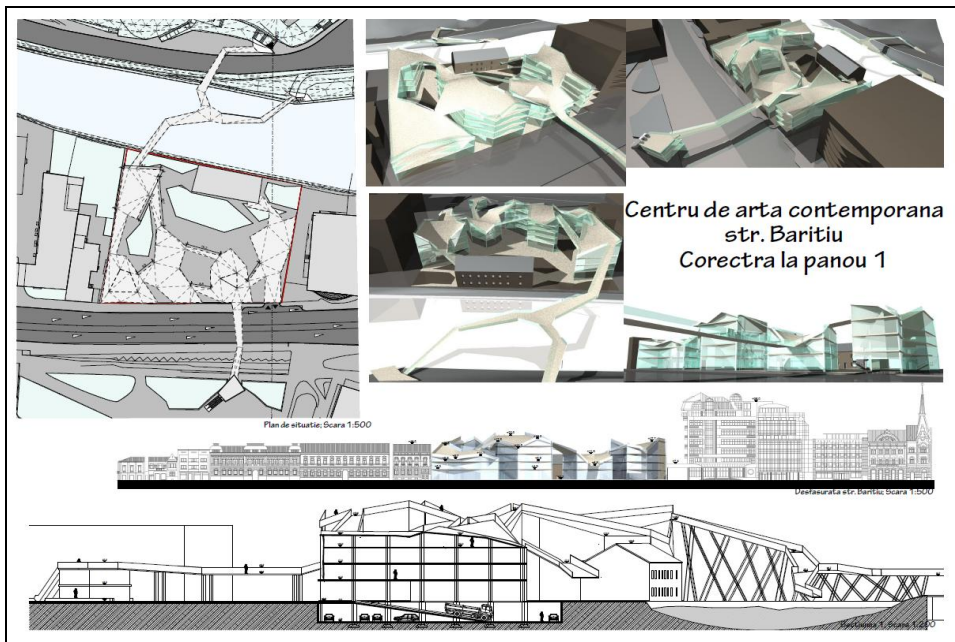


Picture 9. The Promenade cultural center in the joints of the first site

The first plan tried to handle the problem of the 2 projected images so that the level fracture would somewhat be eased or ceased altogether. On the other hand, there remained a major fracture between the left and right, where the Bank compares against the Technical University building. In the background we see the picture of the height limits in the new building. This is none other than the Transit House, which is already of some height dominating the surrounding levels, as if predestined for its future use. The built-in spaces allocating further volume are not yet finished, but the next stage of the planning will remedy that too.

Fixing and improving

Picture 9 shows that the new buildings should be heightened, which meant there was a need to develop the structure and volume by adding floors. The limit of volume structure is determined by the height and number of floors. This essentially determines the function performed. The result is the additional creation of new floors. Without illustrating the intermediate steps, here is the second plan, dated March 17.



Picture 10. The Promenade Cultural Centre. Plan II. March 17, 2010

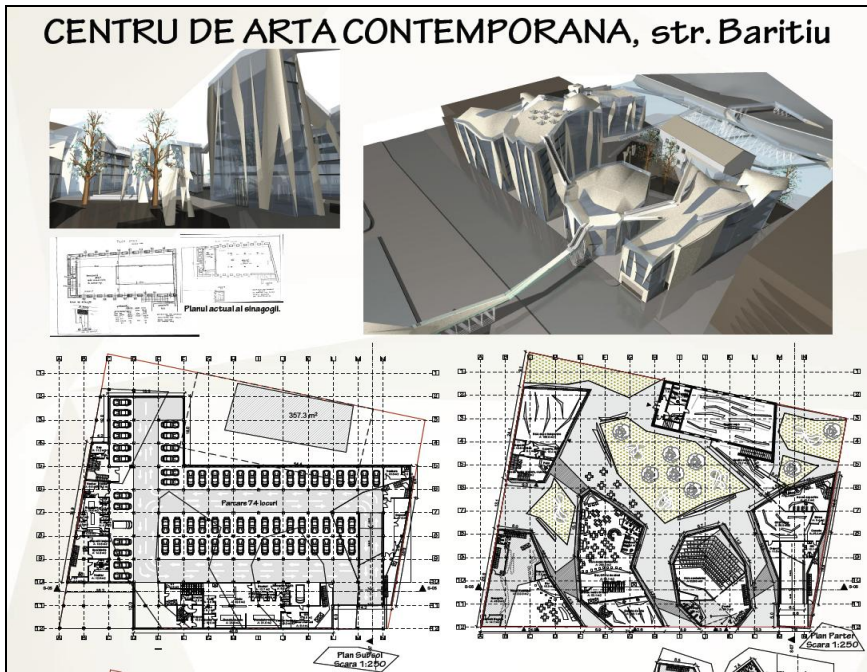
One of the problems of the previous plan had been the inner courtyard which was not adequately designed. Gabriella Gál found a remedy. In addition, new levels appeared instead of the previous three levels, namely two levels above ground and one underground. This latter feature was intended as a car park, as well as for logistics, and was an entirely new feature.

This plan does not display the final definition of the levels' functions, but in this paper we don't have enough space to reproduce them. However, the vertical fracture of the left and right neighboring buildings continued to improve. The bottom picture highlights the flying metal structures transferring to the Someș River.

The final building plan (end of April, 2010)

This plan finally defined the function of the basement (underground level), a car park which can accommodate 74 cars. In addition, the Transit House was expanded from 273 m² to 357 m², which also contributes to a better use of the courtyard, thus further fixing the project's deficiencies. To the right of the Transit House there is now less courtyard space. The final picture of all the six buildings displays the ground floors.

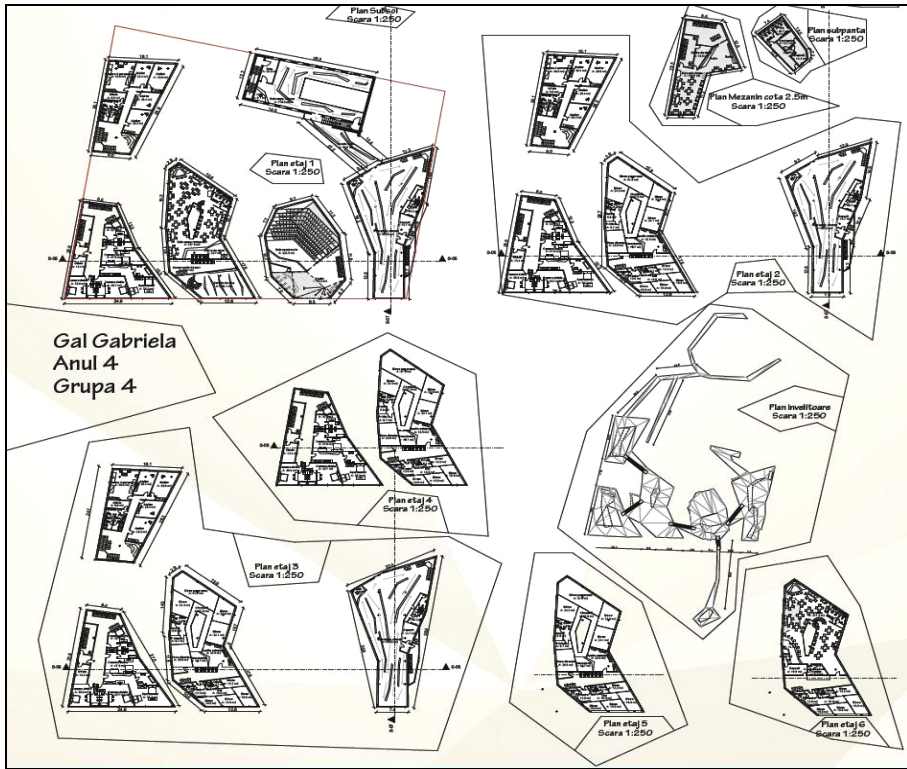
The Promenade Cultural Center



Picture 11. The final plan, basement and ground floor

The final stage of this design worked out in detail the levels and their associated functions.

The levels of the buildings are now all in place. Picture 11 shows the underground level and one of the ground levels. In Picture 12 there are 6 levels and the mezzanine. This represents a total of 8 levels and a mezzanine (mezzanine level).

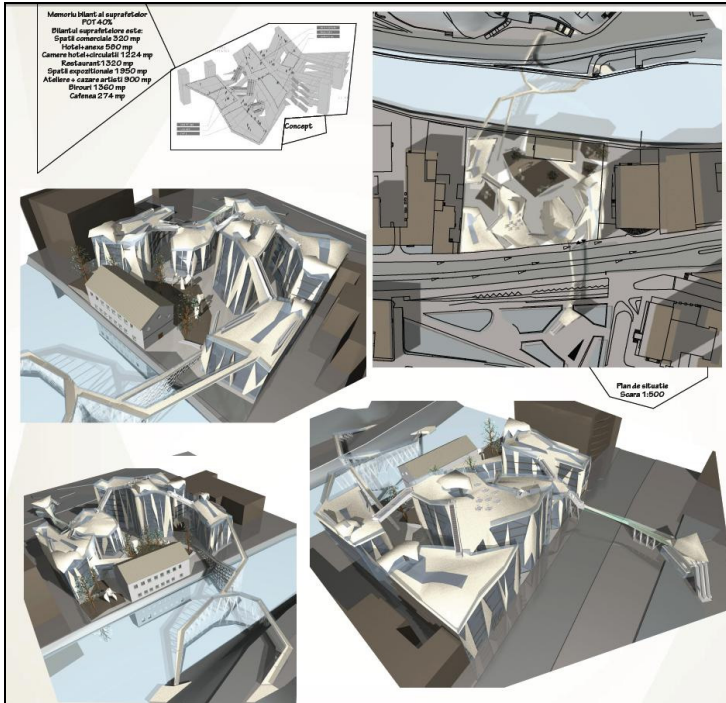


Picture 12. The Plan. Floors 1, 2, 3, 4, 5, 6 and the mezzanine. The roof.

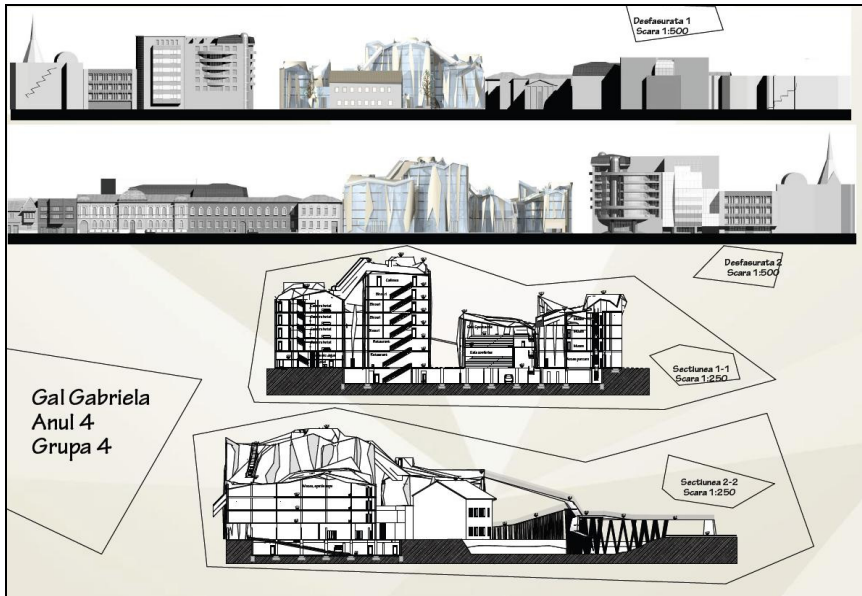
We also summarized the total space and its functions. Thus, there is a 320 m² space for commercial purposes, hotel and annexes: 560 m², 1,224 m² of hotel rooms and transit, 1,320 m² restaurant spaces, 1,950 m² of exhibition space, 900 m² for workshops and guest rooms, 1,360 m² of offices, 274 m² for the café, totaling **7,858 m²** of built space.

The plan of the roof shows a number of passages connecting the buildings across the roofs, together with the flying bridge across the Someș and the access from Malom street.

This picture has been inspired by the Internet picture of the theater walkway. Since the flying bridge plan is worked out in detail, it is clear how it is possible for both ramps to run to and past the complex, the one straight to the top of building D and the other to the complex ground level. Several floors of the final plan were a consequence of building an interface that is consistent with the surrounding buildings. The view of the upper part features the side towards the Someș and the lower front of the panorama, the upper section of the Malom Street front and the bottom of the Someș section. When elaborated it displays to the right the flying bridge which provides access to the top of the building and the courtyard.



Picture 13. The big picture



Picture 14. Front, rear-view and cross sections

The height ratio with the neighboring buildings was changed. To the left the height of the Technical University is two levels taller, totaling five floors. The highest building is the central C, two storey higher than building B. In addition, the adjoining part of the four-level D building is lower than the Bank building by seven floors. Thus, while **The Promenade** building complex elevation dominates the surrounding area, the Bank still reigns supreme. The roof architecture on the other hand is designated to enhance the position of the Bank portion, which looms over the entire area.

Interpretations

This study formulated at the beginning a fundamental assumption: *in pictorial reasoning the characteristics of the mental faculties do not differ from those for reasoning with statements, but we can't model them with the same instruments.*

When broken down this assertion reads that if the statements of truth-functional logical reasoning are formed by means of the fundamental constants of the conjunction (&), alternation (\vee) and negation (\sim), in short, the Boolean constants, and reasoning by images can be achieved, can they not too be interpreted as non truth-functional conjunction, alternation and negation? In other words, what does the mental logic conjunction, alternation and negation in non linguistic interpretation look like? We can thus elude the beginning of our study indicating that reasoning is always linguistic and it assumes the transformation of the visual into language. Simply put, is there visual conjunction, alternation and negation?

The first attempt in this direction was made by C.S. Peirce, the American philosopher and logician. A relevant presentation thereof is based on J. Following Norman (1999) and Don Roberts (1973). Roberts book is a serious reconstruction of Peirce's logic of existential graphs history and the step by step self-development of his author. This reconstruction is difficult because it happens in years in Peirce's special manner of work and write. Roberts's observations after a long analysis are:

“I make two further observations.

(1) When Peirce in 1893 turned his attention to the psychological theory of association, he came up with something remarkably similar to the analysis of inference just presented. He accepted the usual two principles of association, contiguity and resemblance, but he split “the suggestion of B by A into two operations, one leading from A to AB and the other from AB to B” (7.393). To illustrate this, he performed a mental experiment; namely, he looked out the window, saw the cow whose milk he and his wife generally drank, and observed the following sequence of ideas: I imagine I see a boy sitting by the cow milking her. The boy, and the stool, and the pail are added to my idea. Thence, I imagine that boy carrying the pail to the house. The cow and stool have dropped out. The straining of the milk presents itself to my imagination. A bowl is there and the pail. The boy is standing by; but I lose sight of him [7.428]. Studying that series of mental events, Peirce observed that as each new idea was added, there was always “something identical carried along” from before (7.429). The boy approaching the

house with the pail was thought of as the same boy, the pail as the same pail, that he had just been thinking of. “To one skeleton-set another is added to form a compound set. Then, the first, perhaps, is dropped and the ideas which remain are viewed in a new light” (7.430). Insertions, omissions, and viewing things in a new light.” (Roberts, Don, 1973, 112)

Roberts first observation refers to the insertions and omissions in the reasoning process what will be some the fundamental rules of existential graphs alfa theory, and very useful in architectural reasoning analysis.

“(2) Peirce claimed that EG enables one to reproduce the very “motions of reasoning” (Ms 693, p. 278), “the operation of thinking *in actu*” (4.6). In addition to insertions and omissions, he probably had in mind certain iconic features of the graphs which are discussed in section V.24 below. But reasoning for Peirce is necessarily a conscious act, since it is something which requires deliberate approval (2.182). Hence, by ‘motions of reasoning’ Peirce did *not* mean the thought-process “as it takes place in the mind” (2.27), for the thinker is not aware of it:

A man goes through a process of thought. Who shall say what the nature of that process was? He cannot; for during the process he was occupied with the object about which he was thinking, not with himself nor with his motions [2.27].

Indeed, neither physiology (2.27) nor psychology (2.184) have gained much knowledge about this process, and even if it were otherwise-if, for instance, it could be established that thinking is a continuous process, as Peirce believed it to be (2.27)-such knowledge would be “entirely irrelevant to that sort of knowledge of the nature of our reasoning” which is needed for logic (2.184). What *is* relevant to logic is the argument formulated after the fact as a summing up of the thinking-process. Here is how it works. Having completed a process of thought, a man tries to express his conclusion in an assertion which will capture “the attitude of his thought at the cessation” of the process. He then seeks to justify his confidence in this conclusion by casting about for an assertion “which shall strike him as resembling some previous attitude of his thought” (2.27). The propositions and arguments extracted in this way constitute a kind of ‘self-defence’ of the original process, and Peirce maintained that it is “only the self-defence of the process that is clearly broken up into arguments” (*Ibid.*). By ‘motions of reasoning’ and ‘operation of thinking’, then, Peirce meant the elements of this self-defence. Now all thought is dialogical and takes place in signs (4.6); hence the mind itself is a kind of sign “developing according to the laws of inference” (5.313). The Phemic sheet of ‘EG, in relation to scribed graphs which are determinations of that sheet, represents the mind in relation to its thoughts, which are determinations of that mind. The mind as a comprehensive thought is represented by all the permissible transformations of the total graph. And any particular process of thought is represented by the graphical expression of the appropriate self-defence. Hence, “the system of existential graphs is a rough and generalized diagram of the Mind” (4.582)” (Idem, 112-113).

The basic idea of quotation below is the iconic or visual character of reasoning and the dialogical role of him.

Peirce's three theories of the existential graphs were developed into: the Alfa-graphs – a re-interpretation of the logic of the statements (propositions), the Beta-graphs – the predicates in the logic, and the Gamma-diagrams which are second-order modal logic. The last remained incomplete, yet for our current goals it is the Alpha-graphs that are important. By proposing graphs Peirce intended to eliminate the sentence as inappropriate.

Existential graphs can be clarified and provide the most elementary logical connections. They are particularly intuitive as the iconic instruments of logical analysis. The diagrams and pictorial representations are similar to some of the more common Euler diagrams, but in this case they do not serve to illustrate the concepts' extension, but are an intuitive logic of constants unmarked by proposition symbols.

Since it is almost impossible to express them in words, let's see how Peirce expressed negation and conjunction through the existential graphs. There are just two of them, but they can be used to express the other logical constants.

The conjunction

P Q

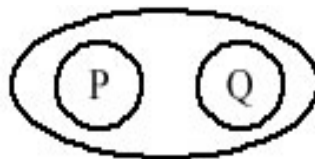
Variables can be written on both sides of a blank sheet of paper. Based on Frege and Russell the propositional spelling is: P & Q. According to Peirce's* graphs you can type diagrams on either side of the blank page, and the letters can be considered diagrams.

The negation of P is expressed by a circle around it.



The logical meaning is $\sim P$ in propositional logic. The logical representation also allows for a diagrammatic representation.

The following illustration is of the disjunction:



whose logical meaning is $P \vee Q$ in linear propositional logic but whose spelling can be rewritten using conjunction and negation as: $\sim(\sim P \& \sim Q)$ (according to the De Morgan laws).

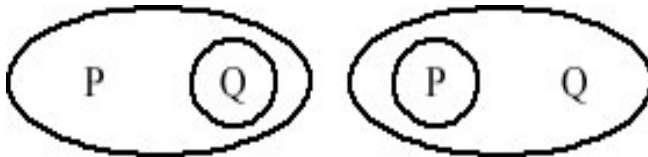
* Special thanks to Corina Fellner, informatician at the Faculty of History and Philosophy, for drawing the graphs.

The diagram representation of the implication is the following:



and as a logical meaning it is $P \rightarrow Q$. But if re-expressed using negation it can be written as follows: $\sim (P \ \& \ \sim Q)$.

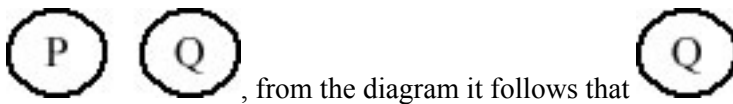
Finally, the biconditional is:



whose logical meaning is $P \leftrightarrow Q$, and whose linear rewriting by conjunction and negation runs as follows $\sim (\sim P \ \& \ Q) \ \& \ \sim (\sim P \ \& \ Q)$.

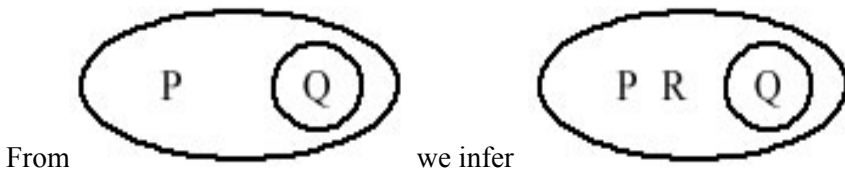
The most elementary steps in diagrammatic reasoning are insertions and elimination of elimination (omissions). Hence the further rules of reasoning. We have identified a total of five such rules, which are not always explicit in Peirce's logic. They are as follows:

R1 *Erasure (ER)*



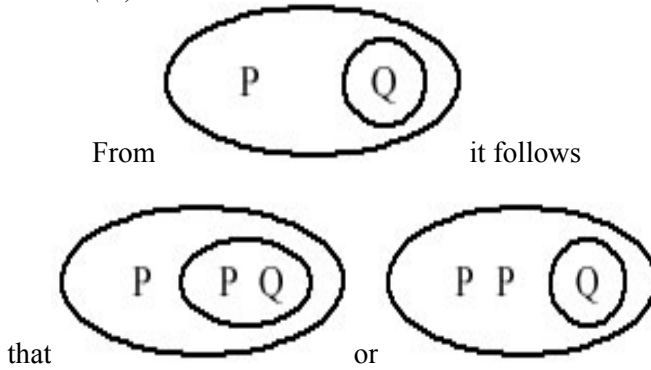
In propositional logic: $\Phi = \varphi \ \& \ \psi$, where Φ, ψ designate diagrams.

R2 *Insertion (IN)*



Rewritten in the language of logical proposition they are: $(\varphi \rightarrow \psi) \Rightarrow (\varphi \ \& \ \lambda) \rightarrow \psi$, where the Greek letters designate diagrams and \Rightarrow is a sign of consequence.

R3 *Iteration (IT)*



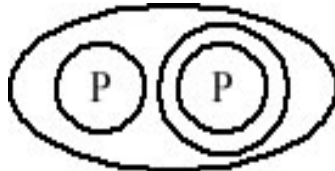
The two reasonings in linear propositional logic are: $(\varphi \rightarrow \psi) \Rightarrow \varphi \rightarrow (\varphi \ \& \ \psi)$ and $(\varphi \rightarrow \psi) \Rightarrow (\varphi \ \& \ \varphi) \rightarrow \psi$.

R4 *Deiteration (DIT)*. Diagrams obtained by repetition can be deleted.

R5 *Double Cut (DC)* corresponds to double negation in propositional logic.

These rules are useful in the diagrammatic proofs. Without going into details, we shall present in what follows how to proceed and the subsequent implications.

We can demonstrate the following existential graph:

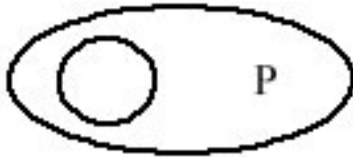


In other words, we must find the basis of this diagram. At first glance, its logical sense does not come straight out, however the linear propositional logic expression, $\Rightarrow P \vee \sim P$, is quite explicit. We can identify here the Basic Law of the excluded third in propositional logic. Here is the proof.

1. First step: starting with an empty sheet of paper, the surface and rule R2 insert (IN) the corresponding chart.

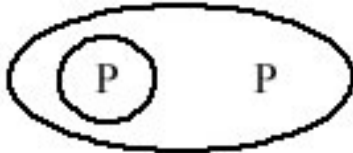


2. Transform



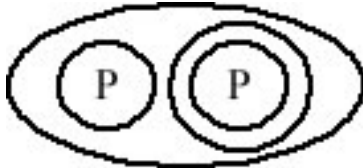
from Step 1 by inserting P (IN).

3.



from Step 2 by repeating P (IT).

4.



from Step 3 by inserting (IN).

To sum up, the evidence from the three insertions (IN) and one iteration (IT) demonstrates the validity by comparison.

In contrast, in language propositional logic The Third Law can be demonstrated as follows, by using the propositional variable:

$\Rightarrow p \vee \sim p$, which is the demonstrandum. But this time p is for propositions rather than for diagrams. Therefore, no circles or ovals, but the interpretation of truth values. I.e. p can have true and false interpretations, whichever the case. So if you presuppose that p is true then $\sim p \vee p$ is true, as defined by the disjunction, and if we presuppose that p is false, then $p \vee \sim p$ again is true. So for any interpretation of the p variable, in binary logic the excluded third is always proved true.

In contrast, the non-linear, two-dimensional existential diagrams of Peirce's theory of reasoning is a fully coherent theory. Consequently, it permits a series of proofs and it works like the writing in linear propositional logical reasoning. Thus we found the relationship between the linguistic and the diagrammatic i.e. visual **and**, and linguistic and visual **not**, and certainly to more logical constants too.

The architectural and (&), not (~), or (v)

The subject of our case study is a plan by Gabriella Gál, created on a specific computer program named Arhcad. The surface is a blank page on a computer screen. On this surface, she formed the plan of the cultural center of Cluj. Procedures were carried out observing the existential graphs rule-driven transformations.

That was the basic achievement of Peirce's existential graphs, and now we can try it.

“The major reason for this assessment was made clear from start to finish since Peirce repeatedly stated that his purpose in constructing EG was to build an engine of analysis. As he developed the graphs and applied them to various problems, it was always their experimental possibilities and analytic power that chiefly pleased him.” (Idem, 127-128)

In Pictures 8 and 9 commentaries were made as to the height fractures observed in the ambient and in relation to the built-in fields which did not yet have a distribution of volumes. The final treatment of Picture 14 developed a total maximum of eight levels. The diagrammatic understanding is that insertions (IN) and iterations (IT) were made, since five new building were introduced. On the other hand, the new building complex conforms to its environment, not physically but in terms of shape and form, which can not be understood if we take into account only the existential graphs’ explanatory force, since there are additional analogies, comparisons, and visual creativity.

Picture 10 clearly displayed a hitherto non-existent function, i.e. the function of the car park. Inclusion in the plan is also by insertion (IN), in today’s most frequent way: on the underground surface. This image also shows more harmony to the left and right with the neighboring buildings.

Pictures 11-14 represent the final plan. Subdivision of the levels is detailed, which has also been made possible by insertion (IN) and repetitions (IT). The expansion of the Transit House to a total built surface of 7,858 m² is an insertion. The flying bridges switched functions to some extent, since the roofs of the building can be connected by them. Again not considered a diagrammatic solution with the environment, this time, nevertheless, we have the final harmony, proportionality. The roof rises to the Bank building and also highlights the future potential advantages of **The Promenade** even while it preserves the *status quo*. The plan was carried out during a series of transformational insights into how practical rationality “works”. The reference here is to D. A. Schön’s reasonable, conscious, practical man concept (reflective practitioner). The complex, pragmatic, and mathematical design does not cover the complexity of this work, and it requires further research. Indeed, the logical reasoning abductive form has not been addressed in this paper.

Consequences and outlook

We have verified that the image (diagrammatic) reasoning evidences the use of mental tools that are basically but not exclusively similar in the mechanisms of language reasoning. The diagrammatic (Peircean) interpretation of the conjunction and the negation shows that image information can be processed by similar logical constants. However, this does not exhaust all the mental mechanisms required by the object’s characteristics. The specific complexity of architecture involves research in other directions too, for example abduction.

Showing how conjunction and negation are present in natural language and language processing has already been the subject of a study (László Gál, 2000). Thus, in free and complex sentence formation conjunction and negation occur on an average

of 79.755% with philology students (László Gál, 2000, 165) and 59.592% with physics students (Idem, 166). This is the prevailing proportion. In the *culturally stable complex sentence formation (proverbs)* the proportion of 69.36% shows they have a leading role. All this linguistic prevailing proportions can be explain with we named “...**social offer of logicity**. This makes us have a mental logic. In this thesis we are not making an inventory of complete social offer of logicity.” (Idem, 171)

Hence the conclusion that the proportion of conjunction and negation in both language and visual processing plays a leading role. This finding seems to justify the fundamental assumption from the beginning of our study. In other words, people have mental capabilities of a particular structure which they use both in linguistic and pictorial (diagrammatic) reasoning.

Acknowledgment

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