"ON NATURE" AND THE UN-NATURAL
Re-visiting the *Wunderkammer* with media-archaeological eyes & ears

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On nature and the un-natural: Re-visiting the Wunderkammer

In the aesthetics of so-called "social media", the almost anarchival disorder of the Baroque curiosity cabinet (Wunderkammer) with its unique combination of work of art, works of technology and natural artifacts seems to return. Is this simply a nostalgia for non-classificatory "order of things" (Foucault), or does this recursion indicate a structural affinity between the Wunderkammer and the algorithmic dynamics of the Internet? This lecture will first critically discuss this apparent return and then positively interpret this remembrance as a symptom of a new techno-museological regime: the digital Wunderkammer which extends to sonic items as well.

"Wunderkammer"

Let us re-visit the *Wunderkammer* with media-archaeological eyes & ears. In the visual aesthetics of user-generated Internet communication (the so-called social media), the almost anarchival disorder of the Baroque curiosity cabinet (*Wunderkammer*) with its unique combination of work of art, works of technology and natural artifacts seems to return. Is this simply a superficial nostalgia for a non-classificatory, rather similarity-based "order of things" as practiced in Renaissance and Barocke times (Foucault), or does this recursion indicate a deep-structural affinity between the Wunderkammer and the dynamics of the Internet? This might be positively interpreted as a symptom of a new techno-museological aesthetics: the "algo-rhythmicized" Wunderkammer. But first of all it takes a critical approach to the apparent "return" of the

Wunderkammer in Internet times. How can we possibly explain that something completely forgotten can turn up again massively? Traditional evolutionary models of cultural history fail here and ask for new figures of *iterative time*.

While the idea of the Wunderkammer had been forgotten in enlightened musological modernity, to the generation of social media users it becomes interesting again because the miscellania the curiosity cabinets used to display in the Renaissance and Baroque period, as well as the way these heterogeneous items were displayed seems not unlike the manner in which our digital archives and the Web are being organized "or dis-organized" today (Heloisa Amaral).

A critical approach to the "return" of the Wunderkammer

So what is the present nostalgia for the Wunderkammer a symptom for? It is the fascination of the Wunderkammer with "artificial nature" such as automata? In the curiosity cabinet, there was no ontological dichotomy between technique and "nature". While this was based on a theological conviction (all is God's almighty creation), without any religious belief the same is true again for digital culture when nature itself becomes virtual physics like in computer games: a simulacrum or even emulation.

The apparent disorder of the Wunderkammer in Baroque times was perceived as a hidden order of creation whose secret ratio was known to God the creator exclusively. The "digital Wunderkammer", on the contrary, exists without such theological background; image clusters are organized by algorithms which are known to the human programmer and have been "embodied" (computatinally implemented) in machine operations. Thereby, the creative potential of the new Wunderkammer in the Internet era carries within also a risk: "the danger of 'endless freedom', of never having to formalize knowledge"[1].

The museological fascination regarding the Baroque Wunderkammer today is two-fold: there is the anti-taxonomy of similarity-based order; and then there is its remarkable respect for the un-natural in nature and the artificial in terms of technology.

In the Wunderkammer, *naturalia*, *artefacta* as products of human culture, and *scientifica* (devices of human mastering of nature, such as astrolabes, clocks, automata, and scientific instruments"[2]) met in incompatible ways: "Resemblance was central to the baroque delight in paradox."[3] But such union of "incompatible distancess" (as once expressed by Thomas Browne) nowadays is calculated

[1] E-mail Heloisa Amaral, April 24, 2015

[2] Koeppe, as quoted in: Breen 2012

[3] Barbara Stafford, Visual Analogy. Consciousness as the art of connecting, xxx, 121

mathematically. "To think in the presence of a cryptic *Wunderkammer* <...> required a calculus of combinations for inferring the connections among thousands of unknown aspects"[4], like the algebraic generation of new concepts in Leibniz's epitemology. It is this mathematically sublime aesthetics which Gilles Deleuze re-discovered in Leibniz in his book *The Fold*.

How to cope with strange natural forms like the Nautilus shape? The relation between the ancient Wunderkammer and infinitesimal mathematics and logarithmic analysis is deeper than it is apparent at first glance - just like contemporary compositions like Johann Sebastian Bach's fugures with the "general bass" base represent a musical equivalent to the infinitesimal calculus.[5] Leibniz is not just a contemporary of the European *Wunderkammer* but its radical fulfilment and transformator. His differential calculus mathematized the wonders of God's creation, replacing the juxtaposition of forms by algebraic formulas: "Mit dem Kalkül war ein Weg gebahnt, dem 'unendlichen Autor' Gott in seine Physik hinein zu folgen."[6]

Let us therefore articulate a "veto" against a superficial nostalgia of the curiosity cabinet. René Descartes and Gottfried Wilhelm Leibniz once radically broke with the *Wunderkammer* epistmology of similarities in natural and cultural objects; they replaced both the *ars memoriae* and the collection of curiosities by culculating with numbers. Descartes criticized the traditional category of resemblance as fundamental experience and primary form of knowledge,

„denouncing it as a confused mixture that must be analyse in terms of identity, difference, measurement, and order. <...> Indeed, it is by means of comparison that we discover `form, extent, movement and other such things´ <...>. The comparison of the sizes of two multiplicities requires <...> that they both be analysed according to a common unit <...>. Measurement enables us to analyse like things according to the calculable form of identity and difference.“[7]

But even Leibniz' *Dyadik* (celebrated today for its reduction of mathematical calculation to binary numbers) was still presented within the frame of a religious view of God's creations, as expressed by Leibniz as "wondrous creation from Zero and One". The

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[4] Stafford: 122

[5] For the Oslo Ultima Academy Festival installation of a contemporary Wunderkammer, Ask Brean has created a "DNA" visualization of Bach's composition *Das musikalische Opfer* indeed.

[6] Friedrich Kittler, Ein Tigertier, das Zeichen setzte. Gottfried Wilhelm Leibniz zum 350. Geburtstag, in: *mtg* (Medien/Theorie/Geschichte), bulletin of the DFG Research Network *Theorie und Geschichte der Medien* (1996); http://www.uni-kassel.de/wz2/mtg/archiv/kittler.html

[7] Foucault, xxx, 52f

epistemic rupture is dramatic and should not be confused with present nostalgia. The present Internet is a result of algorithms. What looks like a curiosity cabinet on the "content" level is in fact an audio-visual or narrative dissimulation of data strings.

The ratio behind the Baroque Wunderkammer was that the strange configuration of objects in the Curiosity Cabinets which looks contingent to humans (like the "Chinese encyclopedy" described by Jorge Luis Borges and quoted in the introduction of Michel Foucault's *Order of Things*) made sense only from God's panoramic point of view.

The ongoing (rather than: "historical") epistemological irritation posed by the Wunderkammer aesthetics is this: Does such a collection result from an arbitrary construction, or should it be understood as "a ruined coherence, the `remains of a greater whole ´ which the collectors might transform into a sober assembly?[8] Are therefore the similarities between the objects and their affinities indices of an occult unity (which corresponds with the religious or paranoid perception), or are such affinities strictly formalisable similarities revealed by *pattern recognition*?

Today, we have a strange *déjà vu* experience when studying the Renaissance and Baroque curiosity cabinets. They immediately appear to have pre-formed present multi-media collecting, which leads Claire Preston to draw "an analogy between electronic search operations and the methods of the *curiosi* of early modern science and antiquarianism"[9] - with *analogy* itself being a figure of resemblance, as opposed to the Cartesian notion of difference which can be (mathematically) calcultated. Collectors in the seventeenth century "imposed structure on the apparent disarray of the phenomenal world by searching for `matches´ ... amongst the otherwise jumbled elements of their study." Systems of resemblance - visual patterns which may appear to us entirely accidental - were expressed by "horizontal or vertical contiguity" (Preston) in the cabinets. These efforts were driven by the belief that creation itself was coherent, and that the task of the scholar was to uncover and display this lost coherence - a kind of theological archaeology of knowledge, based on the assumption that what looks contingent to men, is a hidden coherence in God´s eyes.

But what looks like the digital "recursion" of the curiosity cabinet in the Internet is based on a fundamental dis-continuity by mathematical classification - a dialectical antithesis longing for final synthesis. Nowadays it is the computer which "deciphers"

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[8] Claire Preston, In the Wilderness of Forms: Ideas and Things in Thomas Browne´s Cabinets of Curiosity, in: Neil Rhodes / Jonathan Sawday (Hg.), The Renaissance computer: knowledge technology in the first age of print, London / New York (Routledge) 2000, 170-183 (174), referring here to: R. Hooke, Micrographia: or some physiological descriptions of minute bodies made by magnificent glasses, London 1665

[9] Preston 2000: 170 (abstract)

images of the *Wunderkammer* as data-sets. Once it has been digitized, visual content of museums becomes alpha-numerically addressable, and wondrous new options of mobilizing the inherent information by intelligent algorithms arise.

The hanging of pictures: Order *versus* entropy

In fact the storage management of visual content in computer memory rather adopts the old "St. Petersburg hanging" of pictures at the wall according to spatial economy of formats rather than according to subjects or as historical sequence in period rooms.

In the old Wunderkammer era, Montaigne observed that some similitude binds everything together ("toutes choses se tiennent par quelque similitude").[10] But different to the Renaissance and Baroque museology, computers juxtapose image according to exact numerical neighbourhood.

Do similarity-based algorithms of image organization in the present[11] correspond with Montaigne's poetic epistemology?

Did the Renaissance and Baroque curiosity cabinets perform an aesthetics of multi-media-like collecting *avant la lettre*?

Before the image worlds of today became a mathematical function of pixels, it was the museum context which has been its matrix. The sixteenth-century French philologist Dominique du Cange suggested that the words `musaeum´ and `mosaic´ were cognate. Even if this etymology was incorrect, what all such cabinets share is a syntax of resemblance in its insistence on idiosyncratically selected likeness; their patterns are to be read as comparative juxtapositions, "as a system of potential matches"[12].

Apparently likewise, the photo-aesthetics of a blogging-platform like Tumblr is literally based on the *tumbling* of images.[13] What

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[10] As quoted in Rhodes / Sawday 2000: 13, referring to: Michel de Montaigne, Oeuvres complètes, ed. Albert Thibudet / Maurice Rat, Paris (Gallimard) 1962, 1047, and to N. Katherine Hayles, The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century, Ithaca, NY (Cornell UP) 1984

[11] Michel de Montaigne, Oeuvres complètes, ed. Albert Thibudet / Maurice Rat, Paris (Gallimard) 1962, 1047; see N. Katherine Hayles, The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century, Ithaca, NY (Cornell UP) 1984

[12] Claire Preston, In the Wilderness of Forms: Ideas and Things in Thomas Browne´s Cabinets of Curiosity, in: Neil Rhodes / Jonathan Sawday (eds.), The Renaissance computer: knowledge technology in the first age of print, London / New York (Routledge) 2000, 170-183 (174f)

[13] Siehe den taz.de-Artikel vom 9. April 2010, Microblogging mit

articulates itself here, is the appeal of the "anarchive" which is closer to the *matching* of items in the *Wunderkammer* than to the modernist archival tectonics.

Economical display of paintings according to their formats has not only be a practical concern in Baroque collections but became the subject of paintings itself, in the genre of so-called gallery images as literal *imaginary museums* as painted by Panini, Téniers, or Frans Francken II:

[Fig.] Frans-Francken-II-Bildersaal.jpeg

When a photographic reproduction of such a painting is miniaturised on a classical xerox copying machine and then in return xerographically magnified again, it becomes subject to gradual entropisation. Entropy thereby becomes the "aesthetic measure" (Max Bense) of a Wunderkammer display of such items. The *informational* value is what media archaeology detects in Wunderkammer and image gallery representations, decisively different from cultural or art historical analysis.

The return of the *Wunderkammer*?

What nowadays replaces God's knowledge which in the Baroque theological world-view made sense to the apparent disorder in *Wunderkammers*, is the code which governs computer graphics, highly structures algorithms which define unexpected constellations.

In that sense, late media scholar Friedrich Kittler once predicted the return of the *Wunderkammer*.[14] The ultimate digital Wunderkammer of today does not simply archive snapshots from the Internet but hardware architectures and software solutions as well - to preserve the validity of mathematical algorithms.

The apparent return of the Wunderkammer in Web 2 - like the archival metaphor for the Internet - is only superficial; on the infrastructural level, a complete transformation has taken place: from contingent objects to rule-governed calculation.

There is a risk that with a superficial museological "renaissance" of the Wunderkammer and the "imaginary museum", the museum becomes a mere metaphor which looses its ground in real space.

The Wunderkammer constallation of direct confrontation of a material artifact with the bodily presence of the beholder can not be emulated by reproduction of virtual space - unless the object is scanned in 3-D and can be calculated in its visual vectors in *n*-

Tumblr. Das Durcheinandertagebuch, http://www.taz.de/!50880

[14] TS Kittler: 8, referring to: Horst Bredekamp, Antikensehnsucht und Maschinenglaube. Die Geschichte der Kunstkammer und die Zukunft der Kunstgeschichte, Berlin (Wagenbach) 1993

dimensional space, suddenly becoming even more accessible than any object during a concentional museum visit.

The "imaginary museum" (as defined by André Malraux) once started with photography[15] and became even more dynamic with Aby Warburg's *Mnemosyne Atlas* which is based on the idea of permanent experimental reordering of photographic reproductions of art works by iconological or orther affinity. Only the lightness of the technical reproduction allows for such operations - to be continued in algorithmic space.[16]

Searching pixels: Similarity-based dis/order (Legrady's SOM)

In a Flash animation on the still existing website of the *Searching Image* project from 2001 an array of moving pixels progressively associates with each other by colour similarity.[17] But today the computer is capable of more sophisticated forms of visual rhetoric. Techno-mathematical operations can identify the whole of an object from the sight of a part of it. Still, "[t]he computer is no good at spotting associations between seemingly unrelated pieces of information and deriving generalizations" of images.[18] Neurons in the human brain do not primarily process, recall and transfer iconological content but rather *patterns* of visual memory; the image here exists rather in a structural, that is: *archival* latency. "Fuzzy" computer-sorting has begun to make useful comparisons of similar but not identical images on the basis of new protocols, but the strength of computing does not develop by just emulating human image perception.

The human brain itself operates by association which is explicitely emulated by similarity-based retrieval algorithms like the Kohonen Self-Organizing Map.

The computer scientist Teuvo Kohonen divides the memory models into two main categories: *physical-system* models and *information-processing models*[19] - which separates the Baroque *Wunderkammer* from its algorithmic version in the Social Web of today. For Internet culture today, WEBSOM has been developed by the Neural networks Research Centre at Helsinki University of Technology, as a method for automatically organizing collections of documents and preparing visual maps of them to facilitate the retrieval of

[15] André Malraux, Psychologie de l'art - Le musée imaginaire, Geneva 1947. See the notorious Photography of Malraux in his office as minister of cultural affairs, undated, for *Paris Match* (Photo: Maurice Jarnoux; Getty Images)

[16] See Stefan Grohé, Die Verfügbarkeit der Bilder. Museen und Medien, in: Darsow (ed.), Metamorphosen, 151- (esp. 166)

[17] URL: www.suchbilder.de

[18] Davies et al. 1990: 61

[19] Teuvo Kohonen, Self-Organization and Associative Memory, Berlin / Heidelberg / New York / Tokyo (Springer) 1984, 4

information.

The self-organizing and associative memory model has has been applied in George Legrady's media art installation *Pockets Full of Memories* in the Paris Centre Pompidou in 2001 where visitors were invited to first scan personal items and then ascribing values to then by means of a computer touchscreen with a pre-set questionnaire. The resulting values as database then led to the algorithmic placing of scanned objects on the large two-dimensional map.[20] On this visible surface, the "imaginary museum" did not place incoming objects in a pre-existing spatial order but was in constant motion, driven by the visitor's tags to their individual object contribution which were organized through the self-organizing map algorithm. But this combination of user-generated emotional, semantic content and computational method still confirms the human agency instead of being more radically driven by the distribution of shapes, textures, colours etc. from the scanned objects themselves.

The real *archive* in the strict Foucauldean (and Kantean *a priori*) sense as condition of possibility for enunciative statements like this, though, hides within the order of the Kohonen self-organizing map and stays strictly immobile (not changing a single source code line during the installation). Against the metaphorical visual interface, a different map (as archival diagram) is at work here. What might look like randomness in the dynamic re-placement of visible objects therefore is heavily structured[21] on the archaeological level of media operativity.

A more radical version might order the digitally scanned objects according to formal criteria by truly image-based sorting such as order by shape or by colour distribution. When applied to collections of art historical motives, the evolutionary order is thereby replaced by the differential drive to find similar patterns.

Even if still "tagged" by human semantics, once being sorted by algorithms in a data bank, such image clusters invite to be analyzed in non-human machine aesthetics as such - statistically resulting in color histograms, or in hybrids of color distribution and human labelling. With effective algorithms, for the first time, the image archive can organise itself not just according to external verbal description, but according to criteria proper to its own data structure: an endogenic visual memory in its own medium. By translating analogous photographic images (including film) into digital codes, not only do images become addressable in mathematical operations, their ordering as well can be literally calculated. While the traditional photographic archive still

[20] See Sven Spieker, On the Question of Archives and Entropy in Contemporary Art (Legrady, Muntadas), in: Krzysztof Pijarski (Hg.), The Archive as Project. The Poetics and Politics of the (photo) Archive, Warschau 2011, 114-126 (116 f.)

[21] Spieker 2011: 117

represents a spatial order ("l'espace de l'archive"[22]), today the online image archives themselves take place in time. Dynamic access to image archives is a flexible tool which allows for the coexistence of different orders without destroying the existing database structure.

The radicalized Wunderkammer: Constant's *Active Archives*

The *Wunderkammer* is being "radicalized" by media-archaeological analysis, when the term "radical" is understood in its mathematical sense: the square root symbol "Ö".

Automatic feature extraction of objects in large digital image banks at first results in a Wunderkammer-like effect:

Very often, what the cluster of features reveals is rather puzzling at first glance. Such probes have been assembled by the Bruxelles-based research art collective Constant (Active Archives). By such a techno-mathematical operation, the ratio is revealed which replaces "God's gaze" as supposed in the baroque Wunderkammer museology.

While the juxtaposition of the matching features can sometimes be understood by humans intuitively to look alike, in other image clusters, the ratio that connects them seems to evade human visuality and stays hidden in their algorithmic morphology. Nowadays, there are non-human visitors to the new *Wunderkammer* which apply distant reading - the media-archaeological gaze.

Image-based image retrieval and sorting algorithms should not try to emulate high-level human perception or even to hermeneutically "understand" an iconological scene, but rather discover zones that have specific unforseen characteristics. The future might be the happy alliance or even "convergence between the algorithmic output and what would correspond to human judgement" <ibid.>.

The sonified *Wunderkammer*

Let us finally return to the core of this year's Ultimate Academy and risk an outlook "On Nature" by turning its subject upside down, shifting attention to the "Un-Natural" with a focus on sound.

"Several of the musical productions presented at this Festival relate to natural phenomena, from which composers derive particular sounds, algorithms or compositional systems.

[22] Michel de Certeau, L´espace de l´archive ou la perversion du temps, in: Traverses. Revue du Centre de Création Industrielle No. 36, January 1986, 4-6

Let me fold this focus on "natural" music upon the Wunderkammer itself - especially since the notion of the Wunderkammer so far has been almost exklusively related to visual objects and images.

The current electro-sphere, appropriately defined as synchronous "acoustic space" by Marshall McLuhan, separates the new Wunderkammer from its visually oriented historic version - since all is different when the Wunderkammer objects are sonic.

The Baroque *Wunderkammer* lacked a sense for the dynamics of things. But once nature is extended to the temporal regime, a different kind of Wunderkammer arises.

The transition to the "sonic Wunderkammer" happens when methods of "digital archaeology" as operative image analysis are being used to sonify the image-as-memory itself,

resulting in a continuously evolving composition. This is no deliberate, but a algorithm-based, rule-based, in strictly Foucauldean terms *archival* transformation[23], giving a voice to the Wunderkammer, sonifying the artefactual collection.

Beyond the notorious Vocoder (the electronic device for speech synthesis resulting from spectrographic speech analysis for efficient voice transmission), the natural itself can be given a "voice" by un-natural means. For the following experiment of a sonified *Wunderkammer*, I have been inspired by Ryan McGee's, Joshua Dickinson's and George Legrady's multimedia installation *Voice of Sisyphus*. In *Voice of Sisyphus*, a black & white photographic image from the 1970s displaying a hotel scene "At the Bar" is filtered by a computer program which then reads the segments and produces sounds out of them.[24]

From a digitally scanned image of a Baroque Wunderkammer as well, several regions and items can be automatically identified and then repositioned over time, therefore allowing for the subsequent sonification of the items. "Unlike the spectrograph approach used by most graphical synthesis programs, such an image-to-sound technique is derived from raster scanning of pixel data. By adding frequency domain filters, polyphony within a single image can be archieved.[25] Sound spatialization filters and segmentation algorithms thereby try to "make sense" of a *Wunderkammer* from a signal processing point of view. What human visual perception

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[23] Ryan McGee (image analysis, audio and spatialization software), Joshua Dickinson (assisted with the audio composition software), George Legrady, VOICE OF SISYPHUS: AN IMAGE SONIFICATION MULTIMEDIA INSTALLATION, presented at: The 18th International Conference on Auditory Display (ICAD-2012), June 18–22, 2012, Atlanta, USA

[24] See http://vimeo.com/30238729 <alternatively: https://vimeo.com/34859885

[25] See McGee / Dickinson / Legrady 2012, "abstract"

recognized as shapes and *Gestalt* does not sound melodic when audified: "Non-acoustical data is inherently noisy when audified since it is not a time series of pressure data obeying the wave equation" <McGee et al.>.

Together with Johannes Maibaum, the Signal Laboratory at Humboldt University Media Studies converted digital scans of Wunderkammer paintings (jpgs) into its sonic equivalents as MP3 files, based on defaults of the sonification software Photosounder - which, as a re-entry of the *Wunderkammer* as its diagrammatic image, can be in return visualized in its wave forms and frequency domain.[26]

On the y-axis of such a digitized image, each one line of pixels, by means of parameter mapping, is related to a defined frequency generated by an oscillator (sine tone generator). Line by line a spectrogram is being produced in which periodicities or non-periodicities can be detected and thereby can be sonified. Thereby we can listen to what Frans Francken II once painted as a Wunderkammer. By sonifying the otherwise spatial configuration of the *Wunderkammer*, its temporalization unfolds: And it is no more museum, but music. From that results a really (electro-)acoustic Wunderkammer, or a huge archive of sound items from both art (technology) and nature. While the traditional Wunderkammer addresses vision (literally "visitors"), the Ultima Academy addresses "listeners" as well which discover real and imaginary connections between the music presented at the festival and techno-mathematical culture.

[26] See http://photosounder.com, Demo version