alt’ai whitepaper

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0. Introduction

One of the main effects of the increasing diversity of machine species in our epoch is slow but dramatic change in the composition of Earth’s landscapes. What we used to call “nature” became populated by artificial objects: small and large, pervasive and ubiquitous, moving and standing, swarming and looming. Today, this transformation has culminated in the emergence of *automated landscapes*. Populations of sentient machines are taking over not only our cities, but also over remote locations, not meant to be visited by humans — and if visited, then just by way of accident or curiosity. We are slowly being evacuated from industrial parks, logistical hubs, agricultural fields and vast countrysides, and we can expect that this process will soon move to even more distant locations, such as mountain regions and pristine valleys. Take the example of the Rotterdam container terminal: it was once a place full of vibrant energy which was radiated by human muscles moving and organising goods. Now, the energy of those muscles has been replaced by the discreet buzz of (semi-)automated creatures. Or take the Pearl River Delta, with its agriculture zones serviced by drones and increasingly automated factories managed by smart apps.[1] These new landscapes are still waiting to be properly imagined and visualised and on top of that, they pose some unprecedented design challenges. In particular, one may ask: What are the strategies of machine-to-machine interaction in these contexts? What are the address and identity protocols suitable for such automated environments?

In order to provide provisional answers to these questions, we decided to build a simulation. We call it *alt'ai*, and it is inspired by the rich aesthetics, landscapes, and cultural practices of the remote Altai mountain system, stretching over the borders of four countries: Russia, China, Kazakhstan and Mongolia. The simulation itself is an agent-based, self-evolving and complex system. It develops within a feedback loop between agents, behaviours (called *rituals*) and environments extracted from the Altai region. It thus presents a sort of world-in-itself: as Galina Balashova's spaceships and modules[2] or Biosphere 2 are experiments in creating physical versions of closed systems,[3] *alt'ai* enacts the same manoeuvre of interiorization in the simulation space. As a visual meditation, *alt'ai* makes an allusion to the rules of visual perspective in automated landscapes. As a self-generating repository of unique snapshots that capture instances of interaction among the agents in the simulation, it provides instrumental reference for the development of future machine-to-machine interaction protocols. This whitepaper aims to unpack the conceptual and technological background of our simulation, and argues for a heavily aestheticized approach to the design of machine interfaces in future automated landscapes. Such a mode of design practice consciously aims for building productively inefficient and information redundant systems, and it exploits insights from philosophy, architecture, software engineering, ecology or evolutionary sciences to achieve this goal.

What are the stakes of this project? The gesture of *alt'ai* begins with staging future automated landscapes in the environment of computational simulation and proceeds to reverse-engineer the technological solution for authentication protocols within this self-enclosed and evolving space. Rather than directly proposing the solution, we have proposed a virtual ecology that can foresee and resolve it on its own. For this reason, one may say that *alt'ai* works like a petri dish that grows machine images. But beyond this utilitarian design goal, we use *alt'ai* to critically approach certain general trends in contemporary culture of design and technology innovation.

First, we tackle the reduction that entities can be addressed only as quantifiable clusters of properties called data.[4] Instead, we investigate a qualitative mode of identification based on recording patterns of entities' behaviours, that takes each entity as a cohesive and dynamic whole. Operational images are today used only in the aforementioned quantitative, reductionist manner (e.g. QR codes). What if we let them express irreducible qualities instead? In relation to

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[1] Examples taken from ongoing research "Automated Landscapes" conducted by Het Nieuwe Instituut, Netherlands. See https://automated-landscapes.hetnieuweinstituut.nl/

[2] http://www.bmiaa.com/galina-balashova-architect-of-the-soviet-space-programme-at-dam-frankfurt/

[3] http://biosphere2.org/

[4] Compare Holland (2012: 36).

automated landscapes and its future users, one may follow here the way our intuition is expressed by Bratton (2015: 362):

"[L]ike Darwin's tortoises finding their way to different Galapagos islands — the Cambrian explosion in robotics sees speciation occur in the wild, not just in the lab. [...] In the construction of the User as an aggregate profile that both is and is not specific to any one entity, there is no identity to deduce other than the pattern of interaction between partial actors."[5]

Second, borrowing from research in evolutionary biology and theory of complex adaptive systems (CAS), we propose *general intelligence* as emergent property of CAS. The structure of this intelligence consists of patterns of heuristics, motivations and tendencies intrinsic to agents and their environments. If you imagine future automated landscapes, the survival of the artificial agents needs to be driven by implicit, quick and adaptable strategies, rather than explicit rule-based logic.[6] The environment must be allowed to shape and morph the agents and the agents need to be prepared to withstand these evolutionary pressures. Moreover, instead of mere representation, this intelligence is directly enacted in the simulation.

This point hints at our last stake: we engage with a very idea of representation in critical fashion on multiple layers. *alt'ai* is not representation of Altai: it has no authoritative claim over the territory it is roughly inspired by. One cannot get much of an impression of what Altai is like as a physical space from our simulation. Further, *alt'ai* is not a representation of a computational process. In *alt'ai,* code and picture are one side of the same coin — here, the manipulation of algorithms via images is concomitant to manipulation with text-based code infrastructure.[7] Images do not represent algorithmic processing — they *are* these processes (Farocki 2004). Moreover, the simulation does not hide that it is a simulation — it exposes its "underlying" backend to public view and maps this infrastructure directly into its visual manifestation.

One final remark before the end of this introduction. As practitioners and researchers, we come from very different disciplines: software engineering, data visualisation, philosophy and architecture. To create *alt'ai*, we gave up our disciplinary habits and boundaries. We are acting in a deliberately *anti*-disciplinary way to open a conversation about frontiers of design in the Anthropocene. That is, we became someone else through this project. First, we became collective rather than sum of individuals bringing their skills into a group. Second, we temporarily inhabited exteriors of our disciplines and engaged in methods only indirectly related to them — discussing sound design or doing natural language processing instead of staying on firm ground of philosophy writing, human-centered storytelling or affirmative data visualisation.

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[5] The name "Cambrian explosion" originally comes from paleontology, and it refers to massive increase in diversity of biological species during Cambrian period (541–485 million years ago) (Briggs 2015). Recently, this term has been used to describe proliferation of deep learning technologies: https://www.datanami.com/2018/04/02/whats-fueling-deep-learnings-cambrian-explosion/

[6] See Gigerenzer and Selten (2001: 9) and Selten (2001).

[7] Hence one can ask - can we *draw* programmes instead of *writing* them?

1. Complex adaptive systems and agent-based simulations

Imagine a mountain valley. It contains manifold species: herbs, grasses, trees, different kinds of mammals (bears, deers, lynx, rabbits or hares, tigers, eagles, mice, hedgehogs,...), insects (bees, bugs, mantises, ladybirds,...), atmosphere, soil, minerals and stones, bodies of water and underground flows and so on. As a whole, they present an ecosystem — an open system where its organic and inorganic inhabitants as well as their collectives metabolise flows of energy, material and information. In sum, they create a system of interactions between organisms and the physical environment, capable of absorbing and responding to external and internal influences (catastrophes, epidemies, changes in populations, human activity,...). According to the theory of complex adaptive systems (CAS), ecosystems stand for paradigmatic examples of CAS. Let us clearly explain what we mean by CAS here.

Complexity in CAS results from the fact that these systems contain *emergent properties*. According to Holland (2014: 38), emergence is a distinguishing feature of CAS. In general, emergence can be defined as the relation between properties existing on two separate yet interconnected strata, where the lower strata provides elementary substrate on which the higher strata "grows" as the aggregate of the elements of lower strata. Crucially, aggregate features at higher strata are not reducible to lower strata — they cannot be explained as summation of properties or elements of lower strata (Ibid.). An example is an analysis of properties of water (Ibid.). As far as we consider water as individual molecules, they have many chemical features, but we would hardly find anything like "wetness" among these properties. However, taken as a cohesive aggregate of molecules, water is wet. Thus, between different emergent strata within CAS, there is no linearity: rather, these hierarchical systems are *non-linear*. Holland further unpacks the relation between hierarchy and emergence:

"Hierarchical organisation is thus closely tied to emergence. Each level of a hierarchy typically is governed by its own set of laws. For example, the laws of the periodic table govern the combination of hydrogen and oxygen to form H2O molecules, while the laws of fluid flow (such as the Navier-Stokes equations) govern the behaviour of water. The laws of a new level must not violate the laws of earlier levels — that is, the laws at lower levels constrain the laws at higher levels. Any laws (or a theory) that violated laws at more elementary levels would typically be discarded. Restated for complex systems: emergent properties at any level must be consistent with interactions specified at the lower level(s)." (Ibid.: 36-37)

One of the basic mechanisms of emergence within CAS is *co-evolution*:

"In a typical biological example, a leafy bush has a wide range of herbivorous insect predators. Then, as the bush evolves, it develops a protein, say quinine, that is poisonous to most insects. However, after further evolution, some insect species develops an enzyme that digests quinine. Still later, the bush evolves quinine-b that is poisonous to these insects, and so it goes on." (Holland 2014: 122)

Co-evolution thus leads to series of *trophic cascades* or *Galapagos effects* that create new *niches* facilitating emergence of agents with new properties. How is this emergence possible? Through the adaptive behaviour of agents, hence adaptivity that comes from evolutionary dynamics present in a system is another distinguishing feature of CAS. The previous example of a feedback loop of interactions between bush and insect species shows several rounds of implementation of adaptive behaviour — A does X, B responds with Y, A responds with Z and so on until the spiral of adaptations gradually moves the agents into new state where they create separate niche: a subnetwork "with high local recirculation" (Holland 2014: 134). The emergence of niches in CAS is supported by a series of interactions that facilitate codependency but also demarcate zones of participation. There exist in ecologically diverse systems parallel operations of *recirculation* in which resources are distributed in a catch basins scenario where the metabolic or corporeal remnants of one organism becomes nutrition inputs for another. We can conceive these exchanges as feedback loops, or transferences of multiplier effects leading to the proliferation of niches. Meanwhile, the offset of niche and hierarchy is one that possesses interior tendency, one that performs via rejection of other and even "destroys all cells that don't send the 'self' signal" (Holland 2012: 15). Niche is thus essential for the conception of boundaries and permeability that engender all kinds of tactics of control and verification, which drive local concentrations. Despite the fact that we identify these as antagonistic versus collaborative traits, these interactions are often accidental and could easily oscillate with a switch of interpretation, simple miscommunication, or override by another mean of reception. For example, once the tree develops immunity to the poison of the ants, the whole calibration tilts to an entirely different dynamic.

Abstracting from these examples, we can rephrase the whole story in terms of *signalling game*: bush signals its resistance via development of protein, insect adapts via enzyme that signals resistance towards protein, then the resistance of plant is signalled again by new protein etc. Signals thus build on top of each other and generate novel variations. This dynamic can be further associated with another basic evolutionary mechanism occurring in CAS — *recombination*. The idea of recombination follows an intuition that a small number of basic building blocks create a space of permutations that can potentially go ad infinitum. Take an idea from grammar — from a fixed set of rules, one can derive innumerable complex variations of syntactic structures (Holland 2014: 116-117). Similarly, complex objects like faces may be generated from only 10 building blocks each counting 10 alternatives — eye colour, hair style, nose shape and so on (Ibid.: 115-116). Thus we can conclude that co-evolution and recombination are basic mechanisms that characterize emergence in CAS.

In *alt'ai*, we decided to follow these examples to create a rich environment where emergence is driven by analogous evolutionary dynamics. This is done by constructing an *agent-based simulation* that *alt'ai* as such is. By simulation, we mean a particular type of computational model (Miller and Page 2007: 36). Models can be understood as mappings that abstract from unnecessary details of object(s) being modelled, in order to separately analyse particular dynamics or traits of the object(s) (Ibid.). However, not all models are simulations. Specifically, simulations are bottom-up and open-ended models (Ibid.: 67). Another special feature of simulations is their complexity: "As the structure of the model becomes more complicated, many of the desirable features are lost, and we move away from modelling to simulation" (Ibid.). For this reason, simulations — and more precisely agent-based simulations — are well-suited for modelling of emergent behaviour (Gilbert and Troitzsch 2005: 13). By agent-based, we mean simulations populated with heterogeneous types of agents endowed with different intrinsic motivations and extrinsic constraints. As noted above, diversity is essential for co-evolution, and agent-based modelling thus provides a good framework for the treatment of emergence. As addressed by Holland (2012: 42-43), we are aware of the types of simulation and how their respective structures correspond to the mapping of outputs. First, *data-driven models* which illustrate routines and patterns offer sufficient means for prediction and decision-making. Second, *existence-proof models* "shift attention to addressing techniques" (Holland 2012: 44) that make it possible to observe patterns and behaviours that would otherwise remain invisible. Finally, there are *exploratory models* that work as a means to evaluate the performance of lateral sets of mechanisms which tend to give rise to '"unsuspected connections" (Ibid.), i.e. emergence. Hence our agent-based simulation can be treated under the rubric of the final exploratory type of simulation. Details on the technical implementation of CAS/agent-based simulation framework and types of agents, behaviours and environments in *alt'ai* can be found in chapter 3.

2. Cosmograms and operational images

Google's UX designer Josh Lovejoy introduced the new Google Clips smart camera in a blogpost with the following statement: "This year [2018], people will take about a trillion photos, and for many of us, that means a digital photo gallery filled with images that we won't actually look at."[8] The camera is powered by an artificial neural network trained to recognise and take picture of moments that users may find important to capture. The crucial point of his proposition lies in its last part: we take images that we actually do not look at again. We share them on social media or simply automatically dump them into online photo galleries. There begins their second life of datasets for training AI systems developed by platform corporations. According to some statistics, Facebook or Google today work with mammoth datasets consisting of tens or hundreds of millions of images.[9] Comparing to these oceanic reservoirs, most publicly available datasets such as ImageNet (counting 32,326 annotated images in the last 2011 release)[10] or LFW ("Labelled Faces in the Wild", currently counting more than 13,000 annotated images)[11] are just tiny drops in the data sea (the exception is MegaFace, counting 4.7 million photos).[12] But today, images are not just largely viewed by machines rather than humans. Convolutional neural networks produce endless variations of input images within their latent space.[13] Some are even able to compose motion picture. Still another class of machine images are automatically generated QR codes, meant for economic transactions (WeChat Pay), or for machine navigation and identification of items within structured environments, such as factories.

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[8] https://design.google/library/ux-ai/
[9] https://ai.googleblog.com/2017/07/revisiting-unreasonable-effectiveness.html
[10] http://image-net.org/explore.php
[11] http://vis-www.cs.umass.edu/lfw/
[12] http://megaface.cs.washington.edu/
[13] http://ml4a.github.io/ml4a/convnets/

Overall, the quantity of images produced by machines and/or meant to be read by machine audiences far exceeds the number of pictures produced by and meant to be seen by humans (Bratton 2013). For this reason, it seems that we have approached a culmination point when our visual culture rotates towards a non-human mode of further evolution. And what is more, machine-produced images significantly differ from photographs or videos taken by humans in terms of their use. They cease to be objects of aesthetic appreciation, and instead they become interfaces, or diagrammatic surfaces, that actively hide some algorithmic processes in order to make other algorithmic processes visible (see *depresentation* in van den Boomen 2014). They mediate information flows and data transactions. As little machines, they serve various purposes in machine-to-machine interactions, such as identification, authentication, validation, authorization or tokenization. In short, their role is the role of *operational images* (Farocki 2004) or *techno-images* (Flusser 2011).

Flusser developed his notion of *techno-image* in contrast to an understanding of traditional images. The difference lies in their mode of production. Instead of being a result of (human) imagination or depiction of reality, these images are based on the automatism of an apparatus. In the sense of Flusser, we can think of images made by a technical apparatuses (via camera or computer), but also images based on conceptual models and notions, i.e. diagrams. Thus, their logic follows the paradigms of programming and calculation. According to Flusser, these images cannot be fully understood from a humanistic perspective — they can be only computed and processed (Flusser 2011). Further, the notion of *operational images* coined by Farocki describes a type of images that do not represent a process, but rather are part of a process; images that work and act on their own, in the very sense of Virilio's (1994) *vision machines*. Their operativity, however, threatens their pictorial character. They are not needed as images anymore, but only as mathematical-technological operations. As Farocki puts it, these images are without social agenda, not meant for edification or reflection (Farocki 2001).

Now, drawing from these concepts, what are the prospects of using images as instruments of machine-to-machine interactions? Let us look at one particular instance of such interactions: *authentication*. In authentication procedures, it is usually assumed that an agent is authenticated by means of verifying some claim about the agent's identity. This claim may concern something that the agent *knows*, *has* or *is/does* (Bratton 2015: 345). Once verified, the agent is authenticated and further authorised to access some resource, pass to other checkpoint or engage in some operation. The flow of authentication is thus following:

identification → verification → authentication → authorisation

Generally speaking, authentication procedure checks some unique trace or *imprint* of the agent, its proof-of-identity. The question then arises: Can we use pictures as instruments of authentication? Drawing from the intuition machine images are diagrams (Flusser 2011) and parts of algorithmic processing (Farocki 2004), we may claim that they present a unique imprint of an agent's behaviour, because they capture procedures an agent executes. Peirce's (1894) concept of *icon* grasps this intuition by conceiving icons as signs constructed by means of analogy: icons literally depict some trait of an entity, whether visual, sonic or other. On the one end of spectrum, Kohn (2013: 31) lists examples of sounds that resemble the real-world happening they refer to, such as words *tsupu* (pig jumping into water), *ta ta* (chopping of wood) or *pu oh* (falling palm tree) in the Quichua language. On the other end, graphical icons are still foundational for contemporary computer/platform GUI — folder icons still resemble physical archives or handcases, the Windows "This Computer" folder still resembles a PC. In an important way, icons transparently depict what objects they refer to are or do.

Similar thoughts about icons-as-imprints may be found in Christian Orthodox iconography (Bartlová 2012), where the authority of a holy image — an icon — is guaranteed by the imprint of some divine agent (saint, angel) encoded into the image. What is more, their function is interfacial — they facilitate some religious practice (e.g. worshipping of saint). Such a perspective resonates with Latour's (1998) notion of *iconophilia* as a "respect not for the image itself but for the movement of the image"; in a religious icon, a certain movement of mediation is executed, that is a certain act of transporting attention from one object (icon itself) into another object behind the image in its physical presence (e.g. a holy person). Thus, religious icons serve as peculiar *attention-shifters* (Latour 1998: 433-434) — they engage in hermetic mediation. Such images can be called instruments in the proper sense. A similar function may also be ascribed to Buddhist *thangkas* or Hindu religious images. In their lasting presence, religious icons then also become a universal media of repetition and hence of encoding certain practices/habits; they are techniques of social institution of collective memory. This last remark is crucial in relation to Stiegler's notion of *tertiary retention*, a type of shared external memory that is inscribed into material culture and environment: "[...] the material inscription of the memory retentions in mnemotechnical mechanisms" (Stiegler 2011: 4).

At this point, a contradiction arises in our notion of icon. On the one hand, it depicts by means of analogy, on the other hand, it functions as mediating device. The second characteristic is however dedicated in Peirce's triad icon — index — symbol to *indices*, not icons (Kohn 2013, Peirce 1894). Obviously, our concept of icon departs from its classical definition and needs to be refined. Before we introduce our final stage of conceptualisation of icons-as-imprints, let us summarise the previous steps of our argument in the following statements:

1. **Icon is imprint**
   The icon is a kind of sign that functions by means of sharing some formal quality or trait with its prototype. For this reason, icons can function as authentication devices, as their genealogy can be publicly recognized.
2. **Icon is interface**
   The icon is an instrument of (re)mediation — it moves action forward, it provides a threshold for access, passage, or transaction.
3. **Icon is sacred**
   Icons are integral instruments of ritual practice.

4. **Icon is instrument of memory/zation**
   Icons are technologies of cultural memory/isation and intergenerational passing of knowledge and social practices (tertiary retention).
5. **Icon is operational image**
   The icon is not an artefact of aesthetic appreciation. Its formal qualities are subordinate to its function of (re)mediation. Moreover, most contemporary iconography is produced by machines for machines. Thus, images turn into little machines of identification, validation, authentication etc. They are no longer pictures in a mimetic or representational sense, but diagrams taking part in algorithmic processing.

The idea of icon-as-imprint is central to our conceptualization of *alt'ai*. What *alt'ai* does is that it generates these special images. We call them *cosmograms*, and they serve as unique pictorial devices that visualise and order current state of affairs within the simulation, and provide the overall interface. Hence, cosmograms rather then icons are final stage of conceptualisation of machine images instrumentalised as authentication devices. Cosmograms are also interfaces of the simulation and their segmentation devices. As far as *alt'ai* presents a complex self-evolving environment, it can become quickly messy, and so it needs an ordering system that also allows for relationality between agents. On the level of the general overview of the simulation, the universal cosmogram is called *metagram* — a map that shows what is happening and where it is happening within the computational environment. As navigational interface, a visual system of cosmograms strips away its typical arborescent, hierarchical structure of online environments, and allows for a flattened view on the whole world of the simulation. As primary visualisations, cosmograms are created by traces of agents that entered into interaction, hence they are literally *drawn* by agents' footprints. This explains why we talk about a *cosmo*gram: a cosmogram depicts the relative perspective of agent(s) on its (or their) position in ongoing interactions within the universe of simulation at given time. For this reason, cosmograms are themselves dynamic and evolving structures, where information about interactions overlap, converge and have adjacencies for new readings. Hence, similarly as signs within language, cosmograms are prone to *semiosis* (Kohn 2013: 34) — the process of concatenation of signs into chains of interpretation that build on top of each other. Note that semiosis refers to the same evolutionary mechanism as that of signalling games in context of co-evolution and recombination in CAS. As Kohn (Ibid.: 33) writes: "Semiosis is the name for this living sign process through which one thought gives rise to another, which in turn gives rise to another, and so on, into the potential future." For this reason, cosmograms are images functioning as artificial living structures. This last point finally brings us to the exposition of the structure of our simulation.

3. Structure of *alt'ai* simulation

Building on insights from previous chapters, we may say that *alt'ai* is agent-based simulation (chapter 1) serving as an environment for the production of cosmograms (chapter 2). Since simulation does not have any end goal and the rules of behaviour in the simulation are based on properties of agents and environments, they are themselves prone to change. The simulation thus breaks the linearity of change and generates emergent properties of environments and agents together with rules of their behaviour. An important role in the evolution of our simulation is played out by trauma and catastrophe; traumatic events are vital for the augmentation of organisms (Pasquinelli 2015: 10). Since traumas create non-linear ruptures between states of an entity, this claim may be generalized to CAS, as Holland (2012: 53) remarks in the discussion of the role of inhomogeneities in evolution and the creation of diversity. In our simulation, this aspect is covered with random and recurrent changes in environment or exceptional events such as the crash of cosmic debris.[14] As a result, the patterns of interaction between agents within our simulation persist in a modified state, through repairing and recombining themselves after being disturbed (see Holland 2012: 38).

The basic structure of *alt'ai* consists of ten types of agents, nine types of behaviours (called *rituals*) and seven types of environments extracted from the remote mountain region of Altai, together with its border situation. When we started developing the simulation, we provisionally labelled it as a "virtual republic" — an autonomous space into which certain actors, practices and ecologies are evacuated. However, it would be a mistake to approach *alt'ai* as a representation of Altai. It stands on its own, it is universe in itself and for itself.

Agents are derived from research into adaptive strategies borrowed from biology, CAS theory, and basic environmental and technological conditions needed for consistent but rich behaviour of simulation. Each agent has *type*, *attributes*, *special attribute* and *family type*.

Agent types:

1. **Isolation**
   Seeks solitude, capable of self-regeneration
2. **Trans**
   Unstable, transitory identity, learns via imitation and corporeal transformation
3. **Influencer**
   Evangelist, creates rules and narratives for organization of other agents
4. **Sensor**
   "Thermostat-like" information processing
5. **Recognition**
   Learning from environment via non-biased categorisation
6. **Elemental**
   Provides basic building blocks for more complex agents
7. **Common/Generic**
   Spiritual, ethereal agent; fills the void between other entities
8. **Social**
   Capable of ideological manipulation of populations and technological operations on environment

[14] This phenomenon is based on reality: Altai mountains are place where obsolete parts of rockets launched from Baikonur cosmodrome in Kazakhstan fall down. See http://www.russianspaceweb.com/baikonur_downrange.html

9. **Predator**
   Survival via hunting for other agents
10. **Couple**
    Symbiotic agent

Agent attributes:

Intrinsic

1. **Age**
2. **Fitness**
3. **Name**
4. **Size**
5. **Family**
6. **Special attribute**

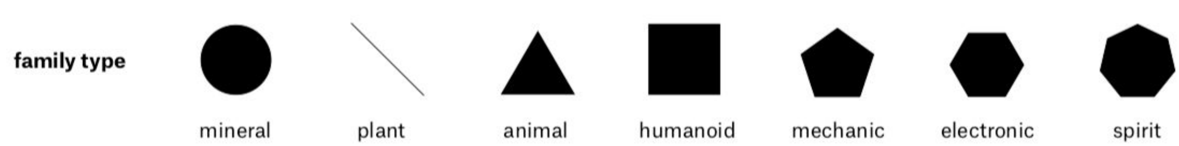
Extrinsic

1. **Altitude**
2. **Resistance**
3. **Temperature**

Agent special attributes drive intrinsic motivation of agents (one per type):

1. **Calmness/Silence** → Isolation
2. **Cohesion/Network size** → Social
3. **Spectrum of transformation** → Trans
4. **Kin-factor** → Couple
5. **Bonding / mimicry**→ Common/Generic
6. **Knowledge / Processing** → Recognition
7. **Density** → Elemental
8. **Sensitivity** → Sensor
9. **Hunger** → Predator
10. **Prestige** → Influencer

Agent family types define their visual presentation in metagram and ritual scenes:



Rituals are rule-based practices that happen at a specific time in a specific environmental setting. By means of talking about rituals rather than simple behaviours or signalling games, we highlight the relation between technology, rules governing social practices and the institution of collective memory that stores these rules and conditions agent behaviours. We can refer here to Yuk Hui's discussion of Stiegler's tertiary retention:

"Technical objects, for Stiegler, constitute an epiphylogenetic memory, a 'past that I never lived but that is nevertheless my past. without which I would never have had a Past of my own'. Epiphylogenetic memory is distinct from both genetic and ontogenetic memory (the memory of the central nervous system); in Stiegler's words, it is a 'techno-logical memory' which resides in languages, the use of tools, the consumption of goods, and ritual practices." (Hui 2016: 216)

While explaining Confucian teaching on rituals, Hui (Ibid.: 109-110) also notes that instruments of rituals practices (*Li Qi*) can be viewed as *compressions* of rituals, and their proper usage means to understand rules of ritual that are encoded in the object. In this account rituals, technology and social memory coalesce, and our conceptualisation of rituals points towards same direction.

Moreover, in the heterogeneous population of human and non-human agents, the concept of ritual ceases to have its anthropocentric connotations. For this reason, rituals in *alt'ai* simulation are not only derived from categories of cultural and religious practices associated with populations of the Altai region,[15] but also borrowed from basic evolutionary biological behaviours and technological processing of information. Rituals in a narrow anthropological sense are thus a subclass of a larger topology of coping mechanisms. In other words, human cultural practices called rituals belong to a category of functional analogues of adaptive strategies of other forms of life. Moreover, for each ritual, an accompanying rule is specified that guides the modification in simulation caused by given ritual:

1. **Technological rituals** → change the environment (time and physical appearance)
2. **Therapy/Anti-therapy rituals** → change the age of the agent
3. **Ideological rituals** → change agent's type
4. **Salvation rituals** → changes fitness of agent
5. **Revitalisation rituals** → change value of specific attribute
6. **Pilgrimage rituals** → change position of agents
7. **Corporeal transformation rituals** → change agent's family type

The last two categories have a specific role in the initial stages of simulation:

8. **Quantification/Computational rituals** → build basic structure (scaffolding) of simulation
9. **Survival and preservation rituals** → build environment of simulation

Triggering conditions of each ritual are based on temporal categorisations of rituals adopted from Bücher (1899):

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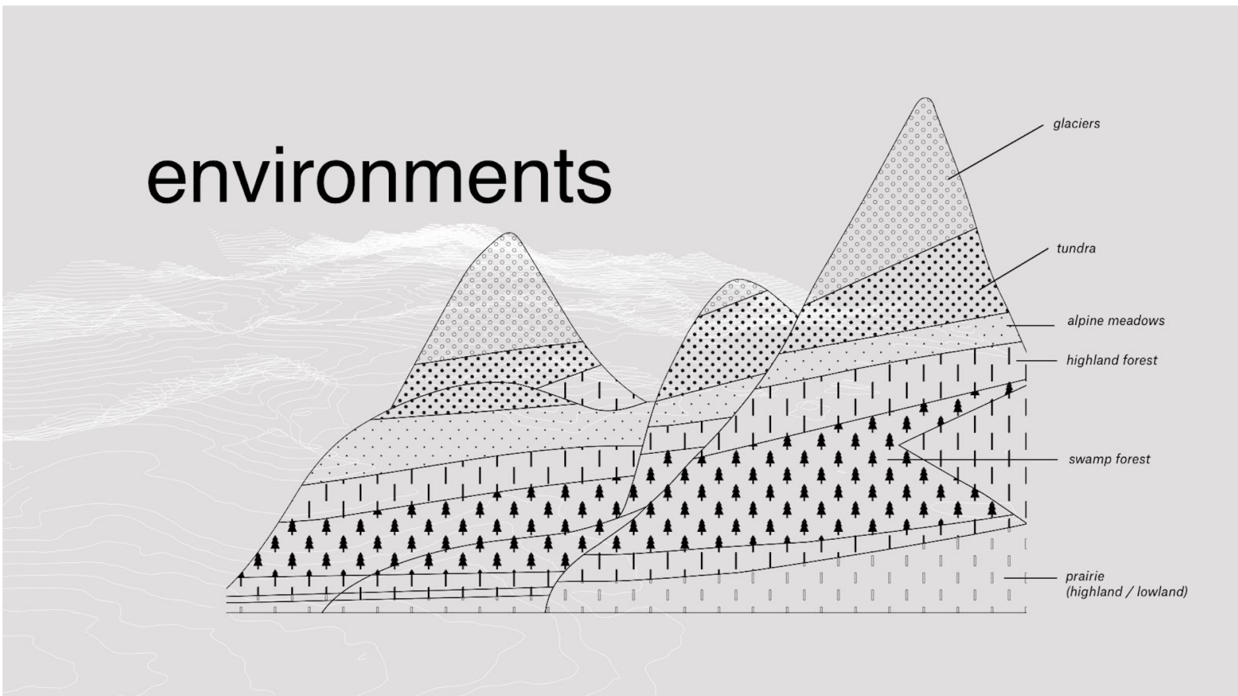
[15] Categorization of cultural rituals is derived from categories used by Wallace (1956).

1. **Cyclical rituals** (time-based — daily, weekly, yearly, seasonally) → time-triggered (loop — temporal state of environment)
2. **Life-cyclical** (rituals of initiation or passage — birth, baptism) → age-triggered (age of agent)
3. **Event-based** (death, hunger, crossing border, ...) → event-trigger (e.g. catastrophe)
4. **Interaction-based** (greeting, dance, tea ceremony, ...) → proximity-based

Environments are based on flora-fauna conditions presented through the Altai mountain system and layered according to their overlapping hierarchy:



1. **Glacier**
   Altitude: 2500-4500m
   Flora: algae, inferior microscopic fungi and lichens
   Fauna: snow leopard (Irbis)
2. **Tundra**
   Altitude: 2000-4000m
   Flora: mosses, polar birch and willows, lichens, partridge grass
   Fauna: reindeer, partridge, snow leopard (snow leopard), Siberian mountain goat, mountain sheep (argali)
3. **Alpine meadows**
   Altitude: 1600-3400m
   Flora: great diversity of plants, including medical (Rhodiola rosea Juniperus communis, Altai onion)
   Agriculture: nomadic pastures

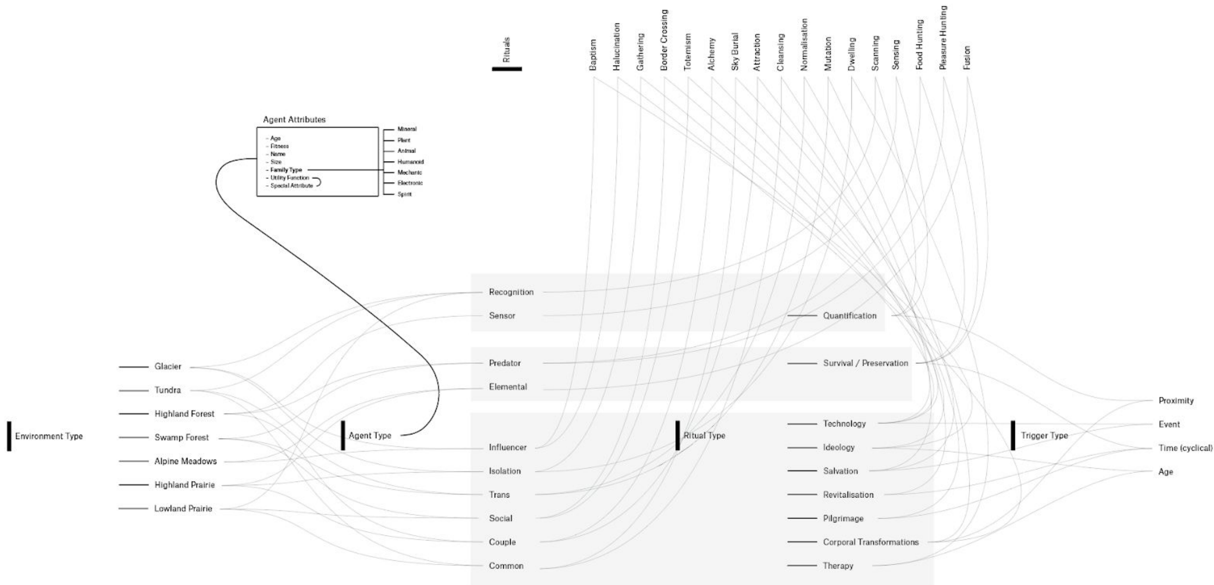
4. **Highland forest**
   Altitude: 1100-2200m
   Flora: pine, cedar, larch forests
   Fauna: reindeer, ermine, weasel
5. **Swamp forest**
   Altitude: 200-1600m
   Flora: medical plants (Drosera rotundifolia, Iris sibirica), Siberian fir, cedar, aspen, birch
   Fauna: brown bear, wolverine, lynx, sable, chipmunk, musk deer, Siberian maral deer
6. **Highland prairie**
   Altitude 1000-2200m
   Flora: anemones, irises, lucerne, cereals, shrubs, steppe horseradish
   Fauna: various rodents, rabbit hare, fox, wolf
7. **Lowland prairie**
   Altitude: 200-1600m
   Flora: anemones, irises, lucerne, steppe horseradish, cereals (feather grass, fescue, meadow-grasses), shrubs (caragana, honeysuckle)
   Fauna: various rodents (voles, Daurian pika, Tarbagan marmot), mountain hare, fox, wolf
   Population: most of the villages
   Agriculture: pastures and arable fields

The political situation of the Altai region is encoded into simulation through the introduction of border conditions, which are implemented in simulation as features of environment. The borders are not visually present, but they influence the way that agents can move, and thus they present another set of environmental constraints. One of the rituals in the simulation is even explicitly labelled as *border crossing*, and it refers precisely to this political dimension of the Altai region, where borders delineate spaces of physical movement as well as of management of information flows.

Simulation evolves in five stages, where the first four stages introduce a few new agents and the last stage presents the full self-evolving setting:

[0] **Building of basic structure** → introduction of sensor and recognition agents
[0.1] **Building of environments** → introduction of elemental and predator agents
[0.2.1] **First inhabitants** → introduction of common, couple and social agents
[0.2.2] **Maturing** → introduction of trans, isolation and influencer agents
[0.3] **Full simulation** → spontaneous evolution of all agents, rituals and environments

Given all the previous categorisations, we can now look at the overall picture of the simulation:



Environments stand for sites where interaction between agents can happen. Each agent type is associated with two *native environments*. Agent types define who is *primary agent* within a given interaction, and these types are introduced at different stages of the simulation ([0], [0.1], [0.2.1], [0.2.2]). Rituals present these interactions themselves. Each agent is primary agent for one or two rituals; the secondary agent for each ritual can come from any of the other nine agent types, and there can be more than one agent of the same type standing in this secondary position within any ritual. Ritual goals inform how the ritual unfolds, based on the nine ritual types mentioned above. Finally, triggers inform that the ritual is executed, based on four temporal categories of rituals.

Finally, each agent and each environment has its own *narrative* — a computer-generated story displayed before and during ritual. These narratives serve in simulation as elements of storytelling with reflective tone: they describe ongoing happenings, while they also problematise them with use of over-poetic language and random references to real world objects, persons, situations and literature. Metagram is accompanied with a log screen that exposes the simulation's backend and critically comments on the function of the interface as camouflaging some processes in order to display and facilitate other.

4. Beyond *alt'ai*: speculative authentication and platform animism

alt'ai is not just a visual meditation that lives its own life of artificial object on the borders between software engineering, design, data visualisation and philosophy. As mentioned in the introduction, it tackles a bigger question of designing machine-to-machine interaction protocols in automated landscapes. Since cosmograms present imprints of agents' behaviour, we can view them as their aestheticised and dynamic IDs. Now, imagine that you run a simulation like *alt'ai* in the wild. Its purpose is clearly defined: it makes pictures that can be assigned to agents at different scales in automated landscapes in order to provide them the means to prove their identity and proceed with their tasks in mutual interaction. A drone can approach the terminal of a platform that manages access into some remote shipping area: it declares its cosmogram and the platform checks whether it matches the history of agent's behaviour. If the identity is verified, the drone is authenticated and authorised to proceed into the area. In fact, this fictional situation is the setting of *alt'ai* — it presumes this scenario is possible and desirable. Authentication protocol based on use of cosmograms would even have the potential for universality, transcending national borders and regional jurisdictions — that is one of the motivations for our reference to the Altai region, which is divided between four countries with sometimes clashing policies. On top of that, as far as it would be based on self-evolving agent-based simulation, this protocol would be managed by itself without the need (and preferably even the possibility) of human assistance. Here, we enter the space of a larger discussion about the design of identity layers, address spaces and sovereignty.

One of the peculiar features ascribed to religious icons is their capacity for *subjectivation* (or *person-making*) (Latour 1998: 428, 431). Kohn (2013: 34) explains this effect of subjectivation with reference to Peirce. By subjectivation it is simply meant that some agent becomes a locus of interpretation activity, i.e. of processing and producing of chains of signs interpreting each other in course of semiosis. Such a notion of subjectivity emerging from semiotic activity is minimal, and it is agnostic towards human or non-human, conscious or unconscious status of an agent. Objects within tge address space of the Stack have similar functional property — their identity is declared only by "the User triumvirate" of *knowing*, *having* and *being* (Bratton 2015: 345). Cosmograms compress these three registers into one dynamic image of an agent's unique imprint: its individual pathway through the fabric of the simulation environment. Replace "agent" with "User" and "simulation environment" with "Cloud" and from this notion of minimal subjectivity you get a model of identity providing universal platform suffrage for any kind of addressable entity.

There is an unsettling similarity of address space depicted above with ontology of animism, in which each entity belongs to the shared space of generic interiority (e.g. spiritual realm) while having a disparate external physical appearance (Descola 2013): stones, mountains, plants, rivers, animals and humans belong to one realm that only manifests itself differently through different bodies.[16] For this reason, everything is in very generic sense human and non-human at the same time, or simply *inhuman*.[17] We can interpret this claim that animist ontology ascribes each entity some minimal subjectivity, as explained above. Once secularised, such *platform animism* might be even viewed as a universal ontological template for the upcoming ecology of AI-powered sentient machines (or simply Internet of Things, if you will). Pasquinelli (2016) even notes that "[a]rtificial intelligence is animism for the rich," and conversely "animism is a sort of artificial intelligence made in the absence of electricity." However, it is not that easy to take

[16] It might be more precise to talk about *perspectivism* rather than *animism*, but for the sake of the clarity we will not open this discussion at this place. For more information on differences between animism and perspectivism, see Viveiros de Castro (2014: 69, 78).
[17] For notion of *inhuman*, see Negarestani (2014).

down animism as collection of superstitions. With regards to the ecological situation of the Anthropocene, it may be the most pragmatic way to approach issues of negotiating shared space with vast populations of non-humans that were mostly viewed as only instrumental, accidental or wholly external to our large-scale design projects. And since the Cambrian explosion of machinic species seems to already follow its autonomous trajectory, we may better think about how to tackle design challenges in the situation of self-evolving machines, adapting to their environments on their own, communicating on their own, and engaging in games of mimicry, camouflage and display. We can even presume that these scenarios involve curious reversals of the Turing test: machines hacking platforms by pretending to be human and vice versa.[18] *alt'ai* provides a point of reference for this intellectual endeavour that has already taken off, as far as one can observe not only from contemporary climate in architecture and design thinking, but from the overall wave of interest in the idea of Anthropocene, that seems to be far more than ephemeral fashion, but rather a theoretical enframing that seeks to navigate interventions of humanity on planetary scale.

The last question to be posed is: Can a simulation provide a space of sovereignty? Our research has been mostly conducted in the Russian Federation. This country has a huge tradition of central governance: a territory of continental scale has been for centuries governed from a single node — either St. Petersburg, or Moscow. To make this possible, the central government always relied on maps, models and simulations that represented the territory as a governable whole. However, what if we bracket off what is being modelled and we are left with model itself? Can identity attached to or existing only within the model provide a fundament for another kind of sovereignty, one that is not associated with fixed territory, but with an ever-changing flow of processes? Perhaps *alt'ai* is also a manifesto for the construction of non-territorial spaces of aggregate interactions — virtual republics residing in anarchic spaces in-between rabbit holes of Westphalian geopolitics. In the end, simulation is as real as territory, since "digital" does not stand for "virtual" in the old-fashioned sense of ephemeral "cyberspace" (Gibson 1984, Barlow 1996);[19] it is always physical.

[18] "Everyday interactions replay the Turing test over and over" (Bratton 2015: 362).

[19] We vehemently oppose any naive interpretation of our claim about sovereignty of simulation, as would be for example the case of John Perry Barlow's speech at World Economic Forum in Davos in 1996: "Governments of the Industrial World, you weary giants of flesh and steel, I come from Cyberspace, the new home of Mind. On behalf of the future, I ask you of the past to leave us alone. […] We have no elected government, nor are we likely to have one, so I address you with no greater authority than that with which liberty itself always speaks. […] Cyberspace consists of transactions, relationships, and thought itself, arrayed like a standing wave in the web of our communications" (Barlow 1996).

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