SYSTEMS REPRESENTING THEMSELVES 自我表达系统

By Juaniko Moreno, 2020

Our lives and actions are all framed within a multiplicity of overlayed systems. Whether them be material or ideological, we identify them, define o criticize them; our perception of the world increasingly acknowledges them[1], and our analysis of how things around us work depends on the notion of "system" to explain things whenever the immediate and contingent fail to explain them. The etymology of "system" comes from the greek σύστημα (*systēma*), meaning *composition*, or "a whole compounded of several parts" [2]. Nowadays system may be defined as a set of interconnected parts or principles, either biological, mechanic or informatic. In any case, the idea of system presupposes an objective relationship between a series of subcomponents, a border determined by an objectively identifiable "inside", and a surrounding environment with which exchanges of matter, energy or information occur.

Neuroscientist Karl Frinston proposes that a system identifiable as such, obeys the *free energy principle*. This means that, a system captures information about its environment through sensory epithelia, It generates models of said environment that minimize disorder and its internal entropy, predicts future events and assumes the causes of the sensory samples it captures based in a Bayesian model[3], it updates said models based on the aforementioned sensory information, and further reconfigures its sensory epithelia in order to sample inputs that can be predicted by the representations it generates[4]. This approach from mathematics, biology and neuroscience identifies a principle that does not only describes the behavior of the human brain, but also applies to any system that exists in an objective way (whether social media, central nervous system, capitalist system, or the internet). Under this principle, we may identify that part of the functions of a system that sustains itself in time is generating representations of itself and the environment it finds itself

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[1] Art critic Jack Burnham already suggested in the 60's decade a "transition from an object-oriented culture towards a system-oriented culture", where change does not emerge from things but rather from processes to make them (1968: 15-16)

[2] "σύστημα", Henry George Liddell, Robert Scott, *A Greek–English Lexicon*, on Perseus Digits Library.

[3] A bayesian model is a statistical model that uses probability to express the degree of belief that an event Will occur, given previous experience on its occurrence. Gelman, Andrew; Carlin, John B.; Stern, Hal S.; Dunson, David B.; Vehtari, Aki; Rubin, Donald B. (2013). *Bayesian Data Analysis, Third Edition*. Chapman and Hall/CRC.

[4] K. Frinston, *The free-energy principle: a rough guide to the brain?*. Trends in cognitive sciences, 2009, Volume 3, Issue 7, p.293-301.

into, finding proof of it and adapt the way in which it captures said proof to perpetuate its existence, or negate the entropy[5] it naturally tends to.

Systems are thus, by definition, complex yet identifiable. Despite the fact that their components may be dissimilar, there are ways to determine where to draw their *markov blanket*[6], or the boundary that delimits the elements and relationships that compose it. It is in this point that cosmological frameworks become relevant. It is from the worldview we have that we are able to identify what elements participate in a given system, their roles as agents, mediators or intermediaries[7] in the transactions they engage into. Depending on what we consider relevant inside our world, is that we are willing to consider as part of what acts back upon it.

Western thought has been generally characterized by cartesian rationalization of the world, and the reduction of sensible elements to universal principles. According to the anthropologist Phillipe Descola, one of the most notoriously unique ideas emerging from modern western thought is the idea of "nature"[8]. This notion, is not only fairly inexistent in a large ammount of cultures, but is also a relatively new concept. The idea of "nature" only makes sense when you have "culture" or "civilization" as its counterpart: "culture" are all the products of human labor, organization or semantics; and under the label of 'nature' we group everything else. In his work, Descola takes on the work of how behavior and linguistics of cultures around the world do not reflect such taxonomy. Both human beings, as well as their artificial labor and techniques are not ontologically subtracted from the rest of existence, and Descola finds certain general compatibility between the ways in which different ethnic groups experience the continuity of human and non-human entities. It is

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[5] Entropy is a scientific concept and a physical property associated with disorder, randomness and uncertainty. In physical terms, it describes the degradation of matter and energy in the universe up to a state of innert uniformity. A living being might be characterized by its tendency to produce negative entropy (negantropy), or in other words, its ability to postpone or ward off the natural decay of matter and energy. Entropy definition by Merriam Webster, negentropy idea by Erwin Schrodinger, *What is life? The physical aspect of a living cell*, Lectures at the Dublin Centre for Advanced Studies, 1943.

[6] *Markov blanket* is the term used by the *free energy principle*, and refers to the limit or subgroup of variables that are chosen in a statistical model or in machine learning, and that allows to infer a particular variable leaving outside those less relevant. Pearl, Judea (1988). *Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference*. Representation and Reasoning Series. San Mateo CA: Morgan Kaufmann

[7] In actor network theory, an intermediary is any entity that transports meaning or action without transforming it, while the mediator is an agent that transforms, translates, distorits or modifies the meaning or elements that is supposed to transport. An agent is that one whi has the ability to act upon or affect its environment with certain degree of intentionality. B. Latour, *Reassembling the Social - An Introduction to Actor-Network-Theory*. Oxford University Press 2005, P.75.

[8] P. Descola, *Beyond Nature and Culture*, The University of Chicago Press, 2013.

under this framework of cosmological compatibility and complementarity that doubts about the exceptionality of human technological developments can be casted.

For example, if there is information encoded in living and non-living beings (DNA and molecular structures), if there is informational exchange between them (soundwaves, the mycorrhizal network between roots and fungi, or the food chain), and that exchange includes and implies the representation that each of those subsystems create about their environment, could we say that there is computation beyond the personal computers we use daily? Is computation *discovered* instead of *invented*? Thinkers such as B. Bratton suggest this might be a possibility: we as humans are a result of a planet that computes itself, and the machines we use for our daily chores are good at computation, yet they are not computing themselves, in the same way as a lightbulb is good in carrying electric current, yet it is not "electricity" or "light" itself[9]. Friederich Kittler considers that silicon, the material that composes transistors and storage memory of modern computing, "is nature calculating itself. If one is to ignore the engineers writing on small silicon structures, one sees a part of matter computing the rest of matter"[10].

With this exploration of Chinese and Amerindian cosmologies, and their relationship to computation and interpretation on the information available in the world, we aim to understand "computation" beyond the machines we use, "technology" beyond what is designed in Silicon Valley, and "systems" beyond the mechanisms for control, marketing and surveillance that surround us.

Yin and Yang as code for the real, cosmos computation through Data and Dao

In this exploration of computation and Chinese traditional cosmology, is worth exploring two sets of ideas. In the first place, the contact point that the history of western computation had with the cosmological principles of Yin and Yang (阴阳), and second, the relationship between two concepts that articulate the way technology is conceived as part of cosmos, namely, Dao (道) or *the way,* and Qi (器) or tool.

[9] B. Bratton, The Stack, On software and Sovereignty, MIT Press, 2015.

[10] Nicholas Gane and Stephen Sale, "Interview with Friedrich Kittler and Mark Hansen," Theory, Culture, and Society 24 (2007): 323–329.

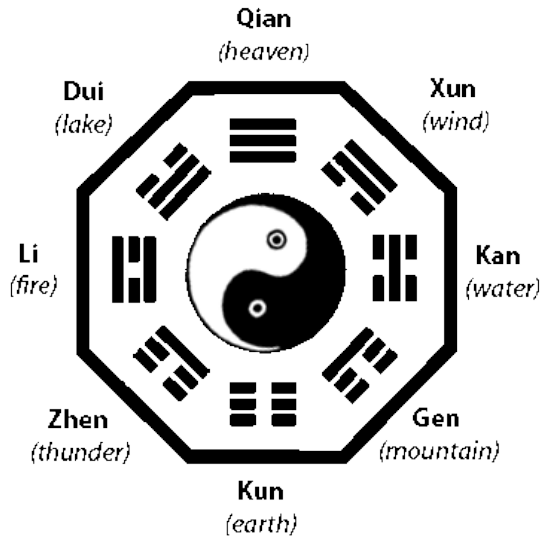

Diagram of Shao Yong's *Primary Heaven Trigrams* (先天八卦). The continuous lines are Yang (1) and the broken ones are Yin (0), and they combine to create the main elements: Heaven (乾 – 天), wind (巽 – 风), water (坎 – 水), mountain (艮 – 山), earth (坤 – 地), thunder (震 – 雷), fire (離 – 火) and lake (兑 – 澤).

In *online esoterism* we explore in more detail the *I Ching* and how everything that exists comes to be from the notion of Yin Yang (阴阳). In short, this is a binary, complementary and correlational principle of the cosmos: Yin 阴 (darkness, receptive principle, the feminine, etc.) and Yang 阳 (light, active principle, masculine, etc.). These two forces subsequently subdivide until everything is produced and composed by its permutations[11]. From its accumulation in organized and variable sets thus distills everything that exists (you 有 – or the manifest) and does not exist (wu 无 – the non-manifest)[12]. On his search to describe the primeval configuration of the world, Chinese philosopher Shao Yong (邵雍) (1011–1077) developed the *earlier heaven eight trigrams* (先天八卦) where he proposes the distribution and direction of permutation cycles of the principles first identified in the *I Ching*. This diagram found great receptivity on behalf of both nobleman and general populace at the time, given the elegance and cohesion with which it described reality and its phenomena[13]. This a-priori understanding of the world would set the scene for a discussion with another philosopher centuries later, the German Gottfried Wilhelm Leibniz (1646 – 1716). In his quest to propose a

[11] "Two forces" comes from the mandarin liangyi (兩儀), also interpretable as "two appearances". *Leibniz' Binary System and Shao Yong's "Yijing"*. J. Ryan, on *Philosophy of east and west* Journal, 1996, Vol. 46, No. 1, p.66

[12] Citation needed

[13] Is worth mentioning that said diagram drawed part of its legitimacy from the fact that Shao Yong named it as the *Eight Fu Xi trigrams* (伏羲八卦), implying that it was Fu Xi, a mythical emperor and world creator that supposedly lived around 2000 B.C.E, and to whom the trigrams were revealed by heaven. This claim would make Leibniz to consider Fu Xi close to a religious figure similar to Moses.

characteristica universalis[14]*,* he aimed to develop a universal and analytic language for thought[15] that expressed any concept as a combination of elements from a basic set. For that purpose, he refined binary arithmetic, with which besides of practical applications, he could express all ordered mathematical permutations with operations with base 2[16]. This arithmetic represented for him the perfection of *ex nihilo* creation by God, where every-thing that exists is composed between permutations between one (God) and zero (nothingness)[17]. Leibniz' binary arithmetic is the base for contemporary computational systems, the complexity of the world expressed as symbols of ones and zeros; the broken and continuous lines of Yin and Yang.

Is interesting to trace how Yin and Yang can be said to compose both the sensible world, as well as the digital 'second nature' that assembles upon it. Nevertheless, to put both worlds in equivalent terms would be contrary to the thought expressed by Shao Yong. While Leibniz was a strong advocate of rationality as means to understand and decipher divine creation, Shao Yong considered reason to be subject to human passion. "For Shao, a necessary condition for objective[18] observation was the overcoming of self's egocentric point of view, for the self tends to take things as real which are not real"[19]. In his view, Yin and Yang are *principles* that can be obtained and observed, yet cannot be explained through mere "forms", or sensible appearances[20]. The world is in constant

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[14] Universal characteristic, formal and universal language that can express mathematical, scientific and metaphysical concepts. Proposed in his book *De arte combinatoria* (1666)

[15] Leibniz, the Yijing, and the Religious Conversion of the Chinese Author(s): Frank J. Swetz Source: Mathematics Magazine, Oct., 2003, Vol. 76, No. 4 (Oct., 2003), pp. 276-291

[16] Leibniz' Binary System and Shao Yong's "Yijing". J. Ryan, on *Philosophy of east and west* Journal, 1996, Vol. 46, No. 1, pp. 59-90.

[17] This idea is base don the genesis passage where creation emerges from a primary void (0) and God (1), whom, by the second day of creation, had made heaven and earth (10 in binary). In the seventh day, creation was completed (7 is 111 in binary, further cementing the perfection of God's creation). Leibniz' Binary System and Shao Yong's "Yijing". J. Ryan, on *Philosophy of east and west* Journal, 1996, Vol. 46, No. 1, pp. 59-90.

[18] It could be said that the notion of "objectivity" in the western sense of the word does not exist in ancient China. This is a translation from the chinese fanguan (反观) composed by fan (oppose, upon itself, self-, infer, used in analogies) and guan (observe, watch, perception).

[19] Leibniz' Binary System and Shao Yong's "Yijing". J. Ryan, on *Philosophy of east and west* Journal, 1996, Vol. 46, No. 1, p.78

[20] "The images and numbers of heaven can be obtained and calculated, but the working of its spirit cannot be obtained and measured. Heaven can be exhaustively explained with principle, but it cannot be exhaustively explained with forms. How can the techniques of astronomy exhaustively explain heaven by means of forms?", Shao Yong, in 皇極經世書 Huangji jingshi shu, [Book of Sublime Principle Which Governs All Things Within the World], (1060) [(Sibu beiyao ed.), 7A.

change, in a waning and waxing cycle[21], and as such, any empirical science applied to the world is but an attempt to capture a momentary form[22], and thus Shao considers it a selfish and mistaken effort to control nature through “techniques”. These *techniques* or shu (術) refer to divinatory practices or numerological arts that pretend to gain personal control upon the world, measure it and quantify it in a convenient way. Because of this, Shao Yong considers science to be on the same level as esoteric arts[23]. According to Shao, the only way to attain an objective glance of things is from the point of view of things themselves, and this is only achieved through the ‘meditative’[24] practices of no-mind (wuxin 无心) and no-idea (wuyi 无意), given that it is through them that things do not become individualized or subjective, they do not become *selves*, thus allowing for them to emerge and manifest on/by themselves.

It is because of these reasons that we can see how modern computation, despite being composed by a binary architecture that might mirror a cosmos structured by Yin and Yang, is nevertheless an intellectual product of western enlightenment thought. From Shao Yong’s perspective, modern computation is but an extension of deterministic ego, a forceful projection of *self* and its way to delimit and understand the world. Allowing ourselves for certain interpretative freedom from our historic standpoint, we might say that the digital world is a distortion of nature on behalf of the ego. Despite the fact that the digital realm might replicate it in a somewhat effective manner, it is in the natural flow and constant transformation of things that we see reflected a world that computes itself without the need of *techniques* or contraptions. The world is already computing itself in the exchanges that set in motion the waning and waxing cycle, and the binary language that encodes reality does not need to be instrumentalized or entrapped by tools that ignore the true nature of things.

This does not imply that *tools* are opposed to traditional Chinese cosmology by definition. Conversely, it is through *tools* or Qi (器) that technology and cosmos can achieve compatibility. Dao

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[21] Xiaozhang (消长), or ‘grow’ and ‘decrease’, ‘expand’ and ‘disappear’.

[22] Xing (形), appearance or form. Opposed to the elements or the real composition of things, which are those composed by the trigrams.

[23] Leibniz' Binary System and Shao Yong's "Yijing". J. Ryan, on *Philosophy of east and west* Journal, 1996, Vol. 46, No. 1,P.80

[24] These ideas are present in Buddhism and Taoism. Nevertheless, this meditation is not necessarily one sitting one as it is used to be characterized. This meditation can be done while walking, in a mountain or garden, while painting or doing Taiji (太極拳) and one that fundamented in substracting oneself from worries and intent, striving for resonance (ganying 感应) with the surroundings.

(道) is *the* omnipresent principle that resists any description, as “the Dao that can be spoken of is not the constant Dao”[25]. Despite this condition, we may try to describe it as “the supreme order of beings”[26], “the original harmony of the productive force of the cosmos”[27], or the natural course[28] of things. More than being the substance of all material and sensible, Dao is instead its unquantifiable vector[29] of movement, a directionality principle and order that everything follows. Qi (器) is the “tool”, or technique that “must be compatible with Dao to attain its highest standard”[30]. This relationship is complementary and inseparable: “*Dao* needs *Qi* to carry it in order to be manifested in sensible forms; *Qi* needs *Dao* in order to become perfect (in Daoism) or sacred (in Confucianism), since *Dao* operates a privation of the determination of *Qi*”[31] .

From this perspective, the “natural” and “technological” are not antithetical, but instead, technology is a vehicle for the manifestation of the “natural”, at the same time that it can only be considered “complete” as long as it abides and behaves according to its principles. A perfect example of this relationship is the story of PaoDing (庖丁), a very talented butcher who, after being praised about his perfect and rhythmic technique to dissect bullocks, replies that it is his love for *Dao* far greater than his skill[32], and that it is this love that taught him every time the way to thrust his knife. As he would always follow this path of intuition, he would never encounter hard tendons or bones, and thus his knife preserved its original sharpness after 19 years of use, while most butchers would have to sharpen theirs every few months. The artisan relies more on *Dao* than in the tools at his disposal, and tools reach their optimal functionality when applied in sync with *Dao.* The human

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[25] Lao Tzu, Tao Te Ching, Chapter 1.

[26] (Hui, 2016: p.65),

[27] Idem, p.66.

[28] In this case, *natural* translates *zi ran* (自然), whose meaning is composed by *zi* (self-, own) y *ran* (right, occurrence). In this sense, natural does not imply the western connotation of ‘nature’, but instead it only means that that occurs by itself, the naturally occurring, free from affectation or intent.

[29] This dimension of direction and movement is characteristic of several description of Dao, including those of ZhuangZi when he mentions “Things flourish and decay, but the Way, which is the movement of this flourishing and decay, does not itself flourish and decay (22/51). Things complete and destruct, but the Way, which is the movement of this completion and destruction, does not itself complete and destruct (2/35–6). Like Heaven, the Way is the transcendental life that gives life to the living but does not itself live and die.” (Mollgaard, 2007 : p.22)

[30] Hui, 2016, p.65

[31] (Hui, 2016: p.101).

[32] Library of Chinese Classics: Zhuangzi, R.P., Wang, Hunan People's Publishing House Foreign Language Press, 1999. P.43-44

being is not unique in listening to *Dao* to achieve such ends, as *Dao* is "present in every being, yet escapes all objectification"[33].

This complementarity principle has had several interpretations across Chinese history, but in general terms, it characterized the technological development of classical china. However it may seem that the harmonic relationship between *Qi* and *Dao* only applies to pre-modern[34] technologies, we refuse to think this relationship can be established with contemporary ones, and in fact, a case for the complementarity between Qi and Dao can be made within contemporary cybernetics.

Data consigned in computers is an exosomatization[35] of memory, the exteriorization of abstract thought and sign remembrance from our bodies. Therefore, data is the organization of a series of signs that can be communicated, recorded or decoded; they constitute a common language between technical and global computational systems. Leaving aside format or language compatibility issues, it is through data that climate stations, migratory patterns, pollution indicators, traffic hubs or factories can all communicate with each other. It is a somewhat unified language that allows to take stimuli, concentrations and transformation of intrinsic characteristics of biosphere, atmosphere and lithosphere; and translate them all across space and cumulatively through time. Data is a representation of the world, gathered through a sensory layer of artificial nerve endings that translate pressure, light, temperature, or any other quantifiable phenomena into a series of binary symbols. Data is therefore, a surrogate of the world, it provides a digital representation that is nevertheless very distant from the real systems it is extracted from. Even while acknowledging this limiting condition, data still has a capacity that mere human action or reason has fallen short to achieve: to place a set of entities different from humans as the center of measurement or interpretation of the world. When river pollution levels drive decision-making replacing mere capital reproduction, or when deforestation leads to the creation of legal representation of forests[36], we can see a set of agents such as NGOs, non-human entities, technical

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[33] Idem, p. 68.

[34] We may consider using the term *a-modern* instead, as the prefix *pre-* sets all cultures in modernity's timeline, thus implying ideas of less and more development, as well as development as a univocal concept.

[35] Refers to the production of objects which are analogous to our internal organs, but built and used outside our organic bodies, as for example, video cameras and our eyes. These external organs are modeled and maintained by human activity (Montévil, Stiegler, Longo, Soto, & Sonnenschein, 2020 : p.6)

[36] Article 71 of 2008 Ecuadorian Constitution grants to *Pacha Mama* (Mother Nature) the rights of integral respect, sustenance and regeneration of its vital cycles, protection and respect to the elements that compose an ecosystem. (Translation is mine)

apparatuses and data processing software; all taking decisions that contravene the individuation of land as resource and biomass as capital. With these new ways to enframe reality we can find brief moments of non-human representation subverting a system based on an egocentric worldly representation. Within this framework the intervention of traditionally neglected perspectives become possible outside the representation generated by anthropocentric systems. Even though this new enframing might imply the scaling down the rate at which raw materials are extracted, reducing the territory available for material productive cycles, and the redesigning of several technical subsystems; it proposes an alternative route to promoting a primeval state of illusory "technological austerity" as the only means to achieve sustainability. E. Carutti says that "there has been such a firm entanglement between biosphere, humans and machines, that there cannot be an unweaving of their relationships without destroying ourselves"[37]. It is through the exploration of how the ideas of these cosmologies can reconfigure this weaving that we may find a path for viability.

In this proposed scenario, the assemblage between algorithms, sensory terminals and data can be interpreted as *Qi,* as the tool that reaches its highest standard, a technique that perfects itself as it materializes the path of least resistance and exhaustion, and through which the *Dao* of a largely ignored world can become manifest. In this case, *Qi* encompasses the "immateriality" of digital instructions and computational memory, as well as the backhoe excavators, dam floodgates and oil drilling machinery that is located at its terminals. While the computational systems and extractivist cycles of contemporary capitalism continue to ignore this model for the communion of technique and cosmos (*Qi* and *Dao*), we can ensure that any future technological "development" will continue to dull and erode prematurely, just like all the knives belonging to the butchers insensitive to *Dao.*

Raising both of these examples is due to the fact that, ultimately, we consider that there are multiple compatibilities between contemporary digital culture and the aforementioned traditional Chinese principles. Likewise, we believe that there is an intrinsic harmony between the technological fundaments of contemporary computation and the material composition of the world and the way it functions. This harmony can be discovered through the exploration of cosmotechnical frameworks that allow these relationships as plausible. After all, both in China as in pre-columbian America, several cultures have been able to discover that memory, communication and representation are

[37] E. Carutti, Inteligencia Planetaria, Kier, 2014. P.25

not characteristics unique to the human being, but rather common to the multiple beings that populate the cosmos.

Transistor-less informatics of Amerindian thought

At the same extent to which it can be controversial to generalize cosmological thought across China as "unified", this action multiplies several orders of magnitude when trying to find a common thought that can identify the hundreds of tribes, language groups and creation myths of Amerindian tribes across the Colombian and pan-Amazonian territory. This problematic can only be mitigated as long as any comparison is identified as an analogy, and any attempt to generalize as a mere analysis from an outside perspective, performed through conceptual tools that despite being insufficient, are only used as an attempt to close a gap, to bring several complex thoughts closer to ours, and adapt them so as to get to understand them analogically.

We can identify Indigenous thought as generally systemic for two main reasons. First, the shared notion of a continuity of human and non-human[38] living beings on a spiritual level: plants, animals and humans are spiritually the same, and the only thing that differs is our appearance. The ability to use language, reason and technology is understood not as an essential privilege that grants humans absolute dominion upon their environment, but only as mere means of representation[39] of the world that implies human intrinsic connection with the thousands of beings that inhabit the forest. These means of representation are not unique nor exceptional, and this is why they do not grant any special status. This is how people, animals and plants have a similar ontological categories, as they all share the same attributes of mortality, social and ceremonial life, intention and intelligence[40]. This is the principle that allows the Barasana tribe to interpret the melody of swallows and sparrows

[38] Manifested by Phillipe Descola in his study with the Achuar people in the Brazilian Amazon, Makuna and Desana people in the Colombian Amazon.

[39] This term comes from the work of anthropologist Eduardo Kohn with the Ávila and Runa communities, in the Ecuadorian Amazon. In his work he argues that world representation is given through signs in a process that identifies all living entities. This is under the assumption that we are willing to leave behind the idea that human beings are the only capable of semiotic meaning. "What we share with nonhuman living creatures, then, is not our embodiment, as certain strains of phenomenological approaches would hold, but the fact that we all live with and through signs". Kohn, E., How forests think, University of California Press, 2013.

[40] Makuna thought, as described by E. Kohn, *Beyond Nature and Culture*, The University of Chicago Press, 2013. P.17

as chants that indicate the proper time to work the chagra[41]; or the fall of certain fruits, the change of swimming patterns of some fish, and the flutter of some birds, as indices that allow several species to foresee the mating season of leaf-cutter ants[42]. Instead of assuming these examples as mere "pattern recognition" of human intelligence, they are evidence of a worldview that assumes all living entities as pairs, and this interprets this symphony of signals as *thought* that manifests through multiple species.

The second systemic characteristic of Amerindian thought is the recognition of fractal analogical structures that are to be found in processes at micro and macro cosmical levels[43]. The structure of the cosmos reflexes at the level of the territory, house and body. Tukano, Ttauyo and Itana tribes[44], understand the maloka[45] as a projection of all life on planet, a structure[46] that mirrors in a smaller scale the design and distribution of the cosmos in general. It is because of this reason that orientation and proportion when building a maloka is crucial, as it should symmetrically contain the world, and only then it can be used as a medium to think and connect with it. The fractal representation of the universe contained in buildings, and sacred or daily use objects is shared across various ethnicities, not necessarily amazonian. It can be found in the biconic Yucuna support

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[41] Chagra is the agricultural system of Amerindian cultures in the amazon forest, consisting of controlled clearances of patches of forests and the planting of several edible and non-edible species. "A small roadrunner lives in the chagra, a swallow and a sparrow guard the plantation and the forest. That sparrow guards the upper-worlds, and that is why he sings at 4:30 in the morning: ¡Oah, Oah, Oah!, "Good morning, how is your day my friend, today we are not working, is not going to rain, easy, in order, sharpen and take your machete, women let's clean the chagra, today is a good day!""

[42] https://multimedia20stg.blob.core.windows.net/publicaciones/Kohndissertation2002.pdf p.99-102

[43] Akin to our scientific thought, the thought of Eastern Tukano ethnicities is fundamented in a series of analogies, what we would call fractal analogies in mathematical terms. They use a series of structures and processes at different scales that contain identical organization. And these structures are the human body, the house, the territory, and the cosmos. B. Santos, *Curación como tecnología (Basado en entrevistas a sabedores de la Amazonía),* Instituto Distrital de las Artes, Bogotá, 2019, p.79.

[44] B. Santos, *Curación como tecnología (Basado en entrevistas a sabedores de la Amazonía),* Instituto Distrital de las Artes, Bogotá, 2019

[45] Maloka is a multi-family residential structure that houses several families, generations and animals. Its building process and use is not mundane, as through rituals they become mediums from where they access ancient knowledge, as well as the knowledge available in the forest.

[46] This denomination as "artificial" corresponds to our notion of everything produced by human as external to, and opposed to "natural". However, this idea does not have a place in Amerindian cosmologies, given that their labor such as agriculture or construction are also undertaken constantly by spirits (and therefore, natural actions). Also, tools as the axe are part of creational myths, such as those of the Yucuna people.

that represents a universe with identical structure[47], in the kogi temples and looms that are oriented according the trajectory of the sun[48], or the spiral weaving in misak traditional hats that replicate the flux and unfurling of time[49]. Harmony and proportion between artifact and cosmos is not only important as an 'aesthetic' principle: it is a fundamental factor that allows that particular device to fulfill its ritual role, the foundation for it to be able to access the knowledge and thinking of the world. The link between indigenous thought and informatics becomes evident in the interviews from the book *Curación como tecnología*[50] (healing as technology), in which metaphor is used as a mechanism that allows to compare digital technologies and healing practices at the same level. Tarsicio Vanegas from the Itana tribe mentions "A feather is a very special sacred material; for the outside world is a simple feather, but for us is like a folder inside a computer, the feather provides the light that enlightens my though, that guides me where I want to go"[51]. In another analogy, he compares the techniques and sciences related to the study and diets that a *kumu*[52] must perform to heal or prevent disease, to the process by which a programmer creates an antivirus[53]. Instead of thinking of these metaphors as a mere narrative resource that allows him to introduce his thought to a foreign public; we might also be invited to think that, only now that western technological

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[47] "The world is also represented symbolically, the biconical support known in Yucuna as *umichiripucueste*, is an artifact that corresponds to what they now call in physics as black holes. Is a balanced piece that is used to keep balance in the use of nature. The (thought) bench is used to manage the world in interaction with all the other benches; this means that we are *all* and also part of it, and by properly managing each part is how we properly manage *all*." (Translation is mine)(Conchacala et al., 2015: p,40-41)

[48] "The light ray goes from one stove to the other in between solstices, but every day advances very slowly from north to south, according to the inclination of the sun. This movement has lead to a concept of great importance for kogi thought, namelu, the idea that *the sun is a big weaver*. They iagine the earth as a giant loom around which the sun moves in a spiraled and swaying motion". In G. Reichel-Dolmatoff, Templos Kogi: Introducción al Simbolismo y a la Astronomía del Espacio Sagrado, Revista Colombiana de Antropología, 1975.

[49] "The *kuarimpoto* or *tampal kuari* is the traditional hat of the misak people. Is made from a band that is woven in spiral shape, synthesizing their notion of spiraled time and space. For the misak, history repeats itself at the same time it changes, turning itself around. Likewise, people is tied by an ancestry thread, one that develops and unfurls circularly, tracing the path of everyone's life.". Exhibition text for kuarimpoto, Instituto Colombiano de Antropología e Historia, Museo Nacional. Cod. ICANH 3440ª.

[50] B. Santos, *Curación como tecnología (Basado en entrevistas a sabedores de la Amazonía),* Instituto Distrital de las Artes, Bogotá, 2019

[51] B. Santos, 2019, p.56

[52] Sabedor, curador, líder espiritual.

[53] B. Santos, 2019, p. 57

development has configured as distributed systems that refine and specialize through phylogenetic processes, is that we are able to understand the similitude between technical objects and processes, and use them to try to understand some of the fundamental ideas of their cosmology. We may take this activity a step further and understand that the gold and quartz which is necessary to measure time and conduct electric pulses as data in computers, accomplish an identical function in the process of healing the world[54], albeit for the fact that in Amerindian technological thought it must remain buried in its place of origin[55] in order to keep working, without exploitation or refinement. Likewise, to understand the maloka as a server or database from which they can access and update knowledge in an instantaneous and simultaneous fashion. Understanding the *yagé* (ayahuasca) visions as a type of authentication protocol such as TCP/IP[56] that guides the procedure to perform healing, and through which they can make sure is the appropriate one[57]. Understanding the shaman as software/interface that accesses information present in the forest, and interprets it in a healing technique in particular[58]. Ultimately, to understand the forest as a network of networks, containing a myriad of terminals and users, that read and write information, that apprehends and represents itself with each interaction, that seeks its own continuity and homeostasis.

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[54] "Quartz and gold continue to be the basic mineral components of any recording device. The nanoparticles that record on analogical support the digital codes. Minerals are both in ancestral knowledge as well as in the western one used in similar ways as means of registry and memory." (Translation is mine) Barbara Santos in conversation with Juan Álvaro Echeverri. *Curación como tecnología (Basado en entrevistas a sabedores de la Amazonía),* Instituto Distrital de las Artes, Bogotá, 2019

[55] Davi Kopenawa from the Yanomami ethnicity says "The gold makes Xawara (epidemic and contagious diseases). Xawara is a disease. Gold creates a disease to harm people. Omama considered that gold should remain kept under the ground, beneath the earth"

[56] TCP/IP or "Transmision Control Protocol/Internet Protocol", is a model of compatibility and authentication that all internet information uses in order to make sure the user and server sending and receiving information are correct. If authentication fails at the application level (HTTP), transport (TCP o UDP), network (IP, routers), datalink (ethernet, switches) or physical level (Cables, NIC), the data packet is discarded.

[57] "I had a *yagé* visión (hallucination), and that vision is what later appears again when healing. It gives you an explanation, it tells you where disease originate, how should to be spoken and your soul or yourself as living person to make that flow in a spiritual world linking with the other person, so that you can prevent or heal the disease" – Jesús León Muipu, etnia Tatuyo.

[58] "With knowledge achieved through *yagé*, the sabedor (shaman) goes around the planet, he turns around to know what is happening and in a single vision everything is recorded, he never forgets it. With that vision, the kumu analyzes those symbols and data to determine what is that information useful for, if for healing, for protecting the children, for dancing. And you must close it in the end, to prevent viruses from coming in" p.59

From this perspective we might get to understand how traditional Amerindian thought is intrinsically cybernetic. It is telematic[59] without the need of transistors or binary code. It requires from energy in the shape of sacred materials[60], and equally requires links, servers, protocols, interfaces and terminals. Instead of trying to instrumentalize its materiality and way of functioning within our destructive media[61] technologies, we might understand amerindian knowledge and its different disciplines as an operative system that runs on the world, that comes from the world and is also part of it, that has to be preserved, and from which we can find valuable design lessons in order to steer informatic modern technologies.

Compatibility between operative systems

With this brief exploration of the relationship between cosmologies from Asia and America and information technologies, we can track compatibilities between them. In the first place, we find a shared idea of a continuous cosmos. Whether it be expressed through Dao (道), or ideas such as the makuna *masa* (person), we are presented with a universe in which, although not based on a flat ontology[62] (in which everything has exactly the same existence value), we do have certain taxonomies or hierarchies that yet do not allow for binary divisions between "them" and "us"; an "outside" and "inside" that ignores that common essence that links and homologates all things. Nevertheless, is worth mentioning that here "essence" is not meant in Aristotelian[63] terms, and thus is not the type that defines things as an immutable principle, but instead as some intrinsic characteristic that transforms, changes its position, concentration or identity.

Another shared principle between both cosmologies is the one of fractality, or symmetry between micro and macro levels. There is a shared importance in the orientation of construction, the cardinal

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[59] Term and idea taken from "Telepathy without the internet" by Juan Pablo Pacheco Bejarano, 2020. http://www.journalofvisualculture.org/dispatches/telepathy-without-the-internet#

[60] "Sacred materials such as the mambe, the tobacco, the karayuru, the stones and seeds contain the origin word. It is through those materials that visibility, memory, and knowledge are activated and de-activated."

[61] The "moist media" proposed by Roy Ascott envisioned the evolution of computation as diverting towards biological media, without proposing a fundamental reorientation of the design of informational western systems. http://www.journalofvisualculture.org/dispatches/telepathy-without-the-internet#

[62] Understood in *flat ontology* terms as proposed by Object Oriented Ontology.

[63] In Aristotelian metaphysics, *Hylomorphism* is the form-substance composite that predicates the essence of all things. Under this view, not only the dichotomy between matter and form is established, but things themselves are given and defined by this intrinsic characteristic. https://plato.stanford.edu/entries/aristotle-metaphysics/#SubsEsse

orientation that their actions have, both in fengshui (风水)[64] as in the maloka. The representation of the cosmic structure in tools such as the thought bench or the biconic support, aligns with the principles of complementarity between tools (Qi 器) and Dao (道) or the way. Here is worth paying attention to how the notion of "tool" can be understood in both thought traditions. If the idea of tool/technology (器) in Chinese thought refers to devices of human manufacture that imply the transformation of raw materials, their connotation as technology related with Dao (道) may not apply to the artifacts or materials used by Amerindian cultures. In their case, technology manifests as an action or procedure; the act of *healing* is the technology, rather than only the tobacco or the recipients where the sacred plants are treated.

A third compatibility between them, and one of the bases for this research, is the systemic, relational and analogical thought. This is materialized in the aforementioned micro and macro symmetry, and the structures that successively mirror each other. Not only everything is related in "essence" and causality, but things acquire their characteristics in the process of getting in contact with other things: the interaction with surrounding elements become part of what those things *are*. As an example of this we see the classifications of the Yagua tribe[65], whom assign taxonomies to things based on the proximity, symbiosis and competition that several species manifest in their mutual relationships[66]; or at a fundamental level in the way Chinese language is composed, where words can be either subject, verb or adjective, and only in the relationships tended with others is that their meaning crystallizes. This relational thought is one of the principles that refrain from "knowing"[67]

[64] The active principle that explains the way in which Feng Shui works is the Flow of Chi, the energy that is to be found in all things. This energy flows in the heavenly vault, the valleys and mountains, as well as in side our homes. In https://baike.baidu.com/item/%E9%A3%8E%E6%B0%B4/155451?fr=aladdin

[65] Ethnicity from the Peruvian Amazon.

[66] As for example, tall trees being hostile in comparison with other vegetable species in their struggle for sunlight; or the fight between sweet and bitter mandioca to contaminate each other. ". For the characteristics attributed to the entities that people the cosmos depend not so much on a prior definition of their essence but rather on the positions that they occupy in relation to one another by reason of the needs of their metabolism and, in particular, their diet." (Descola, 2013)

[67] Lao Zi advocates in favor of wisdom and against knowledge. Whilist the second is predicated on addition , control and calculation, the first one is predicated in substraction, stewardship and flow. Book three, Tao Te Ching.

things in an encyclopedic way[68]. Although careful specialization and detailed knowledge[69] is to be found and achieved in both traditions, knowing the world as a series of laws and descriptions able to be contained in a book is a deeply incompatible task.

Lastly, we hope that exposing the ways in which these traditional cosmologies conceive information, as well as the communication of the world, serves as reference framework to understand these characteristics as emerging from the world, and not as built upon it by us. De-humanizing thought is the first step to be able to understand how minerals, spaces, atmospheres, geological strata, plants and animals all make part of "thinking" and "communicating" outside our craniums. Both of the explored cosmological frameworks allow for this to not only be possible, but inevitable.

It is a wrong approach to mistake information technologies with the cycles of capitalist reproduction of wealth upon which the manufacturing of their hardware, and privatization of their software is based upon. Computation is a planetary process, as well as representation and information exchange. Unhinged exploitation, resource accumulation and the imbalance that profit maximization is based upon, are not. This makes us think that contemporary information systems can be steered so as to adopt the lessons on design and purpose that we can learn from here. Instead of implementing data harvesting systems motivated by tracking and control, they can be redesigned to make production and regeneration cycle of resources[70] more sustainable. Instead of having systems whose measurement unit is the human and the individual; we might take instead forests, animals, carbon flows, mineral concentration, thermic cycles and migratory patterns[71] as users, ones who contribute information at the same time they demand representation within a

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[68] There are, of course, exceptions. The *TianGong KaiWu* (天工开物) or *The Exploitation of the Works of Nature,* is an encyclopedia compilated by Song Yingxing (宋應星)in 1637. It is a technological encyclopedia, divided by subjects such as agriculture, textiles, gunpowder, metallurgy, papermaking, fermented drinks, among others. This encyclopedia precedes by almost 100 years the *encyclopédie* by Diderot y D'Alambert, and their perspectives are very different. While french encyclopedism presents a systematization and dissemination of knowledge that detaches itself from "nature", the *"Tian Gong Kai Wu* is an attempt to understand these principles, and to describe the way in which human intervention in everyday production is compatible with the principle of Heaven" (天). (Hui, 2016)

[69] "We the indigenous people from the Pirá-Paraná rivers have many sciences, because as sabedor (shaman) there is an exact oratory defined from the origin, but one can specialize as water spiller to heal a disease, or as a disease blower which is a different knowledge to heal people, one can specialize as disease sucker, or that can take diseases without touching people" B. Santos, 2019, p.35

[70] In this new thought model, minerals, plants, spaces, animals or people may not be still considered as "resources" by definition. As long as the idea of "resource" persists, this new model Will continue to elude us.

[71] All of those groups or individualities where we can identify a *chi*, a *masa*, a coherence principle in the cosmos.

system that accommodates to their needs and regeneration cycles. We may lead to believe this thought is speculative or utopian; yet we believe that, once our civilization finds itself extinct because of its unsustainable models for reproduction, preexisting systems will continue to represent themselves.