© Lo Sguardo - rivista di filosofia
N. 34, 2022 (I) - Algoritmo

DOI: 10.5281/zenodo.7768562

Contributi/2

Intentionalities of the Algorithm: Historical Practices and Socio-Computing Infrastructures

A Philosophical Account

Javier Toscano 0000-0001-8317-8311

Articolo sottoposto a doppia blind peer review. Inviato il 29/11/2021. Accettato il 08/06/2022.

Computing does not only imply a logical interaction with and through machines, but also – maybe more poignantly – a way of thinking. As historians of technology acknowledge, computing meant in the past so much as counting, or even reasoning. But in this sense, the history of computing has a much earlier beginning than what is popularly thought. The first machines that we can recognize as abstract computers were imagined by Charles Babbage in the 19th Century, but the first algorithms were assembled centuries before, to be performed by social machineries. Drawing on an expanded understanding of Tomasello's hypothesis on the nature of collective thinking, this article argues that collective intentionalities – which can be thought of as pre-conceptual or non-conscious states of collective organization – are inherent settings embedded in social algorithms, and that they play an important role in the socio-computing infrastructure in which these algorithms perform. The article then investigates this path by exploring historical samples of social algorithms and collective intentionalities, from Antiquity and the Middle Ages to contemporary socio-algorithmic practices. It then attempts to reconstruct the functional patterns and the complex relations they afford, while it looks at some of the cognitive articulations they conform. In the end, the article explains an algorithm as a collective social technology that emerges as a cultural script, where we find recurring process of signifying, inscribing and interpreting, and in which a given form of social thinking, involving a characteristic worldview, is always mobilized.

***

Introduction

An algorithm entails a piece of coding within a given language where a specific solution for an observed problem is proposed. Articulating a notion of code in the early days of computing history, pioneer logicians Newell, Simon and Shaw wrote that «the appropriate way to describe a piece of problem solving behavior is in terms of a program […]. Computers come into the picture only

because they can, by appropriate programming, be induced to execute the same sequences of information processes that humans execute when they are solving problems».[1] In this sense, even if we have become used to the idea of algorithms and codes for computers, the machine is contingent, and only the processes of defining, framing and solving a problem become relevant. This allows to shift our attention from a computer-based mechanism to the interrelated, cognitive and normative cultural practices sustained through socio-computing infrastructures, which have a history of their own.

Furthermore, if an algorithm (a code, a program) implies an instruction to achieve a particular end (a solution), this can only be implemented if the encoding of that instruction is readable, i.e. if it can be interpreted. As such, the interpretative demand inscribes the algorithm under a hermeneutic domain where two further premises follow: on the one hand, an interpretation implies that the implementation of an algorithm cannot be thought of as the repetition of an exact procedure, but rather entails an adaptation, an adjustment, transformation – even if of a very slightly different kind each time.[2] This is what, in a lateral but rather fruitful development of their own agenda, pioneer mathematicians Goldstine and von Neumann hinted at when they wrote in a groundbreaking paper that «coding is not a static process of translation, but rather the technique of providing a dynamic background to control the automatic evolution of a meaning».[3] In this sense, an algorithm opens itself beyond the idea of an inert repetition, towards creative developments where a social machinery flows in rhythms and resourceful iterations.

On the other hand, the necessary encoding/decoding process supposes already a common ground or shared context between the individual or group that proposes the procedure and those that receive and apply it. If we look deeply into this feature, we can see that the encoding/decoding transaction not only requires a linguistic understanding of the procedure itself, but a whole immersive comprehension of the particular task, i.e. a pragmatic know-how associated with a worldview, which stems out of and at the same time allows for social coordination. This is what the linguist and cognitive scientist Michael Tomasello

[1] A. Newell, J.-C. Shaw and H. Simon, *Elements of a Theory of Human Problem Solving*, «Psychological Review» LXV, 3, 1958, pp. 151-166.

[2] As we will see, this amounts to a re-centering of the critical tradition of hermeneutics (Heidegger, Gadamer) that wanted to distance itself from a positivist approach to computing. In the argument presented here, computing is instead thought of as a complex cognitive interaction with the social and material environment. And in this view, as the social cognitivist Shaun Gallagher writes, «cognition is an enactive and emotionally embedded engagement with the world by which we are able to solve problems, control behavior, understand, judge, explain, and generally do certain kinds of things – much of that constitutionally shaped by tools, environmental factors, social practices, etc.» S. Gallagher, *The socially extended mind*. «Cognitive Systems Research» 25-26, 2013, pp. 4-12, here p. 8. http://dx.doi.org/10.1016/j.cogsys.2013.03.008

[3] H. Goldstine, and J. von Neumann, *Planning and Coding of Problems for an Electronic Computing Instrument*, *Report on the Mathematical and Logical aspects of an Electronic Computing Instrument Part II*, Princeton 1947, vol I-3, p. 2.

has termed *collective intentionalities*. For Tomasello, collective intentionalities are necessary pre-conditions through which shared goals and social cognitive processes are inherently organized and anonymously systematized. He links them directly to the development of human thinking when he states: «important aspects of human thinking emanate not from culture and language per se but, rather, from some deeper and more primitive forms of uniquely human social engagement».[4] Tomasello argues that human thinking has evolved not only through the organization of cultural conventions, norms and institutions, but also, on an equal weight but seldom acknowledged, through joint goals and joint forms of attention – a common ground – which have created the possibility of individual roles and perspectives within «an ad hoc shared world or 'forms of life»[5].

Tomasello cunningly leans his hypothesis on the phenomenological notion of intentionality, which should be distinguished from that of intention. An intention implies a purpose, a causal antecedent of an action; an intentionality, by contrast, is the property of a mental state.[6] In a way, intentional states may be pre-conceptual and sometimes non-conscious, but do not need to be visceral or irreflexive. Intentionality is a way of being-in-the-world, a form of orienting oneself in one's environment, and not a mere psychological state. According to the philosopher Alfred Schutz, intentional descriptions classify over situations and actions, as typifications clear enough to imply pattern recognition, but with a certain inherent indeterminacy, since they invariably include an «open horizon of unexplored content».[7] Therefore, they become the framework for both conscious and unconscious intentions and actions. Intentionality occurs as a background mental activity, implying a collective pragmatic know-how, intuition, belief, affect and habituation, rather than a conscious state of the mind.

But how exactly can a collective intentionality ensue? The link is set through a socially-derived knowledge transmitted through customs, social habits, routines and particularly the syntax of everyday language. As Schutz put it: «This includes ways of life, methods of coming to terms with the environment, efficient recipes for the use of typical means for bringing about typical ends in typical situations».[8] Now, rather than presenting here the different epistemological models that discuss

[4] M. Tomasello, *A Natural History of Human Thinking*. Cambridge and London 2014, p. 2.
[5] *Ibid.,* p. 5.
[6] We could also remind of the discussion in Thomas Aquinas, who established that the object which is thought is intentionally in the thinking subject, the object which is loved is intentionally in the person who loves, the object which is desired in the person desiring, and so forth. In that sense, intentionality is clearly something that can be predicated of inexistent phenomena, but which has an effect on our own conceptions, desires and beliefs. The difference between intentionality and intention is further discussed in J. R. Searle, *The intentionality of intention in action*, «Cognitive Science» IV, 1980, pp. 47–70; or in M. Chapman, *Intention, intentionality, and the constructive character of scientific knowledge,* «Psychological Inquiry» I, 1990, pp. 251–253.
[7] A. Schutz, *Collected papers I: The problem of social reality*, The Hague 1962, p. 14.
[8] *Ídem.*

the issue[9], we can think of a working example. If a community engages in a given public ritual, individuals might participate with the intention of strengthening their bond with the collective, but for the community at large the ritual might be the occasion, encompassing a very clear intentionality, of performing a political act where roles and hierarchies are set or distributed. A collective intentionality is expected for social coordination or cooperation to occur, but this does not mean that every individual pertaining to that collective might share, or even be conscious of, the intentions behind the actions that this entail.[10] In any case, going back to Tomasello's hypothesis, collective intentionalities are pre-conditions of social thinking; in that sense, they can arguably be used to explain and articulate forms of social programming where a social algorithm performs a specific task. Therefore, an expansion of Tomasello's hypothesis is put here to the test. In the first section of this article, some historical practices will be presented as prospects of such collective intentionalities guiding characteristic social algorithms. The descriptions seek to explain likely assemblages, but also to shed light on typical traits of what can be understood as a social algorithm from different perspectives. In a second step, some of these practices will be further analyzed, outlining specific cases, in order to yield analytical insights, with the aim of understanding how intentionalities may function as part of a socio-computing infrastructure in which a social algorithm performs.

1. Historical sampling

Collective intentionalities are not always easy to locate for an external observer, as one usually lacks the necessary contextual insights that could make them entirely readable, which would in turn make a social procedure transparent and a cultural device wholly interpretable. Nonetheless, under Tomasello's expanded hypothesis, intentionalities are assumed to form an ensemble with social algorithms. So if we look for the type-form of an algorithm – an instruction or a sequenced procedure – we may come up with a set of joint articulations that may be further scrutinized.

[9] Different models on this issue are contrasted in S. R. Chant, F. Hindriks, and G. Preyer (eds.), *From Individual to Collective Intentionality*, Oxford 2014.

[10] As Julian Nida-Rûmelin writes: «The kind of collective intentionality that is constitutive of cooperation does not necessarily require a community or a group that is bound together by a specific ethos. Think of a society in which a strong individualism prevents the development of any sense of cultural, social, or ethnic community. If the members of this society are asked which community they belong to, they would answer 'none'. If communities are understood as being held together by a common ethos, that is, a common system of rules and norms and a specific feeling of belonging, we still can imagine a society in which there are no communities of this kind but in which cooperation among individuals nevertheless exists. The basis of this cooperation may be trust, interest, and some common normative beliefs regarding autonomy and fairness.» J. Nida-Rûmelin, *Structural Rationality and Collective Intentions*, S. R. Chant et al. (eds.) *From Individual…* cit., pp. 207-222.

Furthermore, intentionalities do not behave as stable categories nor conceptual tags, and the precise pre-figural mental state that they could eventually denote would most certainly be historically determined too. Given such difficulties, this section tries to group together typical cultural practices and devices as they are enacted in their algorithmic form, in order to organize them and pierce through their performativity. The resulting sets refer then to collective intentionalities as semantic clusters that involve more or less evident historical procedures, where a social algorithm or an algorithmic device is seen to function in a specific social dynamic. The samples were selected out of archeological or ethnographic accounts; these usually provide more detail and depth, but they are here synthetized so they can fit an argumentative discussion.

Moreover, due to space limits, the groups referred here are briefly sketched and reduced to five sets, even if their number could be easily enlarged on an expanded quest. Section two will then provide a closer analysis of some examples stemming from these divisions, to show how these can contribute to a deeper understanding of their intrinsic articulation.

1.1 To command / to control / to order

From ancient times, the most evident drive embedded in an algorithm is to achieve control over the world and over matter. Many of the subsequent intentionalities will be later subsumed to this original dynamic, which denotes the algorithm as an instrument of power. For instance, in a broad sense, the act of praying in any religion is a way of invoking a non-human force to affect the world. A prayer is a call for the order of the world to be regulated, used in favor of the speaker uttering the plea[11]. In the most fundamental prayer of Christianity, the *Lord's Prayer*, that is the function of the words *fiat voluntas tua*: through a speech act – reinforced through the embodied gesture of joining the palms together – the orders of heaven and earth are expected to coincide. This is the same principle ascribed in magic to an enchantment, a spell, or a ritual. The examples in which an invocation operates in this sense are multiple, but we cannot follow here further categorizations. In any case, we can explore another dimension, since it is possible to distinguish this aspect of command over a situation or a state of things in one type of algorithm that operates in a similar way, as a set of instructions that aims at ordering a course of action: the operation of the law.

[11] As Frazer writes, «From the earliest times man has been engaged in a search for general rules whereby to turn the order of natural phenomena to his own advantage.» Religion is one of those techniques in which man, driven by faith, seeks «a propitiation or conciliation of powers superior to man which are believed to direct and control the course of nature and of human life.» J. G. Frazer. *The Golden Bough. A Study in Magic and Religion*. London 1983, p. 65.

The rule of law enacts an order over a given territory (a *Raumordnung*, according to Carl Schmitt[12]), a jurisdiction. One of the earliest known sets of laws is the Code of Hammurabi, sixth king of Babylon. That code itself, composed between 1792 and 1750 BCE, was a compilation of different commandments, a unification of regulations from different cities of the Babylonian empire, but it was also a guiding device that generated at least three things: firstly, a sense of order over the territory it aspired to control; secondly, an instrument that symbolically established and reinforced sovereign power – in this case through evoking a direct connection between the monarchs and their god Marduk – and finally, it also sanctioned the vassalage of the subject, since subjects were all those individuals for whom the code applied, and for whom the stone with the inscribed code was placed in the center of public squares. Furthermore, this code was one of the first devices of civilization written entirely in conditional instructions *If… then…*[13], where punishments and fines were administered according to precise parameters.

1.2 To calculate / to compute / to reason

It is difficult to separate the boundaries in which an algorithm stops being an executable instruction that involves a command and becomes a way of calculating and generating knowledge. We doubtlessly enter here the terrain of a will to know that articulates knowledge and power in a straightforward way. In any case, it is worth exploring the operation and scope of some devices that can be collected under this modality.

In ancient Greece, Pythagorean thought was founded on the idea that the world is organized in numerical proportions; encoded, for instance, in music and mathematics. The golden section and the Pythagorean theorem – one of the foundations of Euclidean geometry and classical trigonometry – were elements of an aesthetic that tried to prop itself around an idea of beauty of mathematical proportions. The Pythagorean project consisted then of «the extraction and application of a numerical code that organizes both art and nature.»[14] This code allowed for the formation of correspondences between the micro and the macrocosm and aimed at describing the harmonic principle of the world. In this sense, Pythagorean thought found in the notion of harmony the possibility of defining and anticipating – that is, of computing – the exchanges between nature and humankind.

Another tradition where we find a source of authority based in calculation is the Kabbalah. Kabbalah is a mystical system that was developed during the

[12] C. Schmitt, *Der Nomos der Erde im Völkerrecht des Jus Publicum Europaeum*, Berlin 1950.
[13] The code was made up of 282 laws written under this format (although a number of them, those between 66-99 and 110-111, have been lost). An early commentary on the code can be read in R. F. Harper, *The Code of Hammurabi, King of Babylon about 2250 B.C.*, Chicago and London 1904.
[14] F. Cramer, *Words made Flesh. Code, Culture, Imagination*, Rotterdam 2005, p. 25.

European High Middle Ages and the Renaissance. One of the oldest books, the *Sepher Yetzirah* or *Book of Creation*, was published towards the end of the 9th century CE. Here, the letters of the Hebrew alphabet appear, just as Arabic numbers in other systems, as building blocks of the cosmos.[15] The language of God is said to have created the universe, and the language of mankind would be the only way to arrive at a reconstruction of its original intention. That is why human language itself is thought to be of divine inspiration. In an interesting analysis, Florian Cramer makes a translation of the idea of divine creation expressed in words to a logical system that shows its consistency and reaffirms the notion of the Kabbalistic code as an algorithm. Cramer quotes the fourth chapter of the *Sepher Yetzirah*:

> 1. There were formed seven double letters, Beth, Gimel, Daleth, Kaph, Pe, Resh, Tau, each has two voices, either aspirated or softened. […]
> 3. These seven double letters He formed, designed, created, and combined into the Stars of the Universe, the days of the week, the orifices of perception in man; and from them he made seven heavens, and seven planets, all from nothingness […].
> 4. From two letters or forms He composed two dwellings; from three, six; from four, twenty-four; from five, one hundred and twenty; from six, seven hundred and twenty; from seven, five thousand and forty; and from thence their numbers increase in a manner beyond counting; and are incomprehensible.[16]

Then Cramer draws attention to the mathematics involved in this permutation, such that 2! = 2 * 1 = 2; 3! = 3 * 2 * 1 = 6, and 7! = 7 * 6 * 5 * 4 * 3 * 2 * 1 = 5040. In the *Sepher Yetzirah*, the combination of letters grants divine creation a strictly formal and verifiable character; the alphabet transcends its metaphoric value to be inscribed as a mechanical and metonymic computing device. Consequently, the formalization of this and other passages scattered throughout the text favored, through different analogies, readings of the Torah that took it as an acrostic (*notaricon*), a permutation of letters (*temurah*) or a numerical code (*gematria*) of the name YHWE. In this way, the primitive Kabbalah can be counted as one of the first comprehensive speculative sciences that took linguistic computation tools as its fulcrum, with the aim of unveiling the enigma of divine creation.

A final example worth mentioning in this path is the mathematical system constructed by Leibniz, comparatively closer to our day. For his is one of the most complex notational developments on record. Leibniz builds his system on a combinatorial of signs and characters with which he hoped to order mankind's thinking and the possibilities of knowing the world. This system was already shown in its time as a historical descendant, although structured

[15] The Kabbalists shared this belief with the Pythagoreans, for which the letters – *stojeion* – were elements of discourse (*logos*) and at the same time foundations that were used in the construction of the universe.
[16] *Sepher Yetzirah or The Book of Creation*, trans. by W. W. Wescott 1887, available at: http://www.sacred-texts.com/jud/yetzirah.htm

with a visible logic, of those Renaissance efforts put forward by Ramon Lull and other philosophers. What Leibniz was looking for with his set of characters – as all mathematicians had done before him – was certainty for a system, a parameter of objectivity. Leibniz thus elaborates a vision in which the secrets of the world could be opened to whoever could read the projection of geometric lines and the laws of calculation that govern them. Leibniz called this language a *characteristica universalis*, and it was supposed to accurately translate human thoughts, making them objective and free from error. «This very writing – the philosopher argues – would be a kind of general algebra and would provide a means of reasoning through calculus, so that instead of arguing, one could say: let's count».[17] However, due to its scope and sheer ambition, the Leibnizian project was left as an unfinished attempt.[18]

1.3 To contemplate / to meditate / to worship

The intentionalities inscribed on technical devices have not always been oriented to control or to count, nor to produce efficiently under an economic logic. Many times the encoded objects have emerged as mere pastimes, like ancient board games and automata referred to in Greek and Medieval texts. Along this line of inquiry, there have been technological developments that have simply sought to serve as reflections of the ephemeral elements of the natural world, as aids in contemplation, so to speak. Heron of Alexandria, for example,

[17] G. W. Leibniz, *Scientia Generalis. Characteristica*, Gerhardt, K. I. (ed.) *Die Philosophische Schriften*, Berlin 1890, p. 26.

[18] Even if Leibniz did not achieve what he expected to be a universal language, his work in mathematics, set towards that aim, led to the invention of modern calculus (an accomplishment he shares with Newton, who derived a similar mathematical system out of different metaphysical assumptions). Leibniz is of course a very well known and estimated figure among contemporary historians of mathematics and science. Norbert Wiener even named him the saint patron of cybernetics. According to Wiener, «The philosophy of Leibniz centers about two closely related concepts – that of a universal symbolism and that of a calculus of reasoning. From these are descended the mathematical notation and the symbolic logic of the present day. Now, just as the calculus of arithmetic lends itself to a mechanization progressing through the abacus and the desk computing machine to the ultra-rapid computing machines of the present day, so the calculus ratiocinator of Leibniz contains the germs of the machina ratiocinatrix, the reasoning machine» (N Wiener, *Cybernetics. Or Control and Communication in the Animal and the Machine*, Cambridge 1985, p. 12). This quote is full of allusions that need clarification and context. It is evident, for example, that the 'current' desktop computer Wiener mentions does not refer to those existing in our time, although it prefigures them. For this reason, the concretion of a *machina ratiocinatrix*, which Wiener takes as fact, must remain as an assumption. Wiener also assumes that cybernetics fulfills Leibniz's desire to grant order and a deep knowledge of the world, but if that were the case, it would mean that cybernetics fulfills a Kabbalistic and a Pythagorean desire as well. On the other end of this speculation, it could also be stated that today's desktop computer reproduces the world to its own image, a claim that most probably would have horrified Leibniz. In other words, these can only count as anachronisms. This article proposes precisely that similar intentionalities might be at work, but given that they all function within their own historical context, further provisions need to be taken before they can be contrasted and analyzed, as we will see.

was the inventor of the first steam engine, the aeolipile, which was an apparatus made up of a chamber of air or water (generally a half sphere or a cylinder that could be heated) with tubes protruding out of it, by which the steam was expelled, moving thus the whole metallic body. However, with this mechanism Heron merely designed fountains and other mobiles (*Pneumatics* II, XI), that is, his invention was not intended to engage in mobility or productive projects, but was proposed instead for the embellishment of public places.

Along the same lines, Lynn White Jr. suggests that the technology behind the windmills used in medieval Europe for grinding grains was actually used as early as the 8th century BCE in China and Tibet for religious purposes. Thus, the Buddhist cylinders activated by the wind, which revolved around their vertical axis like anemometers, were part of a complex technology of prayer in which all the technical knowledge of an era came together in an organized way.[19] White also reminds us that the most complex machinery of the European Middle Ages was the wind organ, a monumental instrument built for Christian churches of different confessions and located in the most diverse latitudes.[20] In the 10th century, a 400-flute specimen was built inside the Winchester Cathedral in England; it required two people to play it and 70 men to pump air into its air retainer.

These devices remind us that the spiritual aspect linked to technology cannot be underestimated. After all, the so-called information age was born when the printing press set up by Gutenberg, turning an old wine press into a rotary press, managed to print a Bible around 1455. In that sense, the socio-computing infrastructure implied in these early devices worked under a completely different intentionality than the one that emerged later with the aim of maximizing productivity and profit, even if the visible mechanisms may perform similar functions.

1.4 To structure / to coordinate / to enable

By structuring an order (access, sequence, coordination, alternation, etc.), an algorithm not only regulates, but also enables a process. When this is the case, the algorithm behaves as a protocol that assigns and distributes tasks, while it effectively manages the sequences that comprises a generative chain. Thus, an algorithm *qua* protocol is an ordering method. It is productive since the steps it includes were articulated at a given moment with a certain logic, to be used at different points in an automatic, decentralized way, and without the need to reflect thoroughly upon the consequences of each of the steps during its application. There are different types of protocols. As Alexander Galloway writes:

[19] L. White, *Medieval Technology and Social Change*, London and Oxford 1974, pp. 85-6.
[20] *Ibid.*, p. 117.

Prior to its usage in computing, protocol referred to any type of correct or proper behavior within a specific system of conventions. It is an important concept in the area of social etiquette as well as in the fields of diplomacy and international relations. Etymologically it refers to a fly-leaf glued to the beginning of a document, but in familiar usage the word came to mean any introductory paper summarizing the key points of a diplomatic agreement or treaty.[21]

In a world obsessed with efficiency and the higher aim of productivity, protocols are multiplying. These include procedures, formalities, or specificities that must be fulfilled in a course of events. A protocol is a waiting line at the super market or in a government office, or its substitution for another sequencing mechanism that implies giving a number to each person when they arrive. This does not mean that protocols are always effective, as anyone who has become entangled in bureaucratic procedures can testify. Getting on the public transport by paying the ticket to the driver or to a collector involves a suboptimal process compared to getting on board with a pre-paid card, but the protocol also obeys specific social conditionings and tenacious habits that sometimes defy common sense.

In any case, protocols can be understood as standards that govern the implementation of characteristic sequential processes. Technical protocols establish then the essential and agreed points for a standard of action with which the exchanges and relations of a large number of users can then be managed. By these means, technical protocols disseminate peculiar ideologies and forms of control; in a first layer, these can be decentralized and pre-agreed between institutions and directing agencies, then they get to be coordinated as a framework that regulates flows, systematizes exchanges, encodes relationships, and connects agents.

In that sense, a protocol cannot be seen as an imposition. Nobody would claim that a traffic light placed in a street junction to regulate vehicular traffic tries to impose its power; what it achieves instead is the regulation of sequences that operate in intersections or opposing trajectories. In other words, a protocol coordinates flows and needs, with a distributive logic that makes it easier for everyone to achieve their particular goal. Hence, the protocol is not simply a normative framework or a set of rules to be submitted to, but an order that enables a circuitry. And as Galloway argues here again: «protocol is like the trace of footprints left in snow, or a mountain trail whose route becomes fixed only after years of constant wear. One is always free to pick a different route. But protocol makes one instantly aware of the best route – and why wouldn't one want to follow it?».[22] A protocol is a form of organization that raises pre-formed solutions to recurring problems; it is a successful formula because the benefits of submitting to that order clearly outweigh the inconveniences it can

[21] A. Galloway, *Protocol. How Control Exists After Decentralization*, Cambridge 2004, p. 7.
[22] *Ibid.*, p. 244.

generate. In that sense, the protocol is a rational operative device, which outlines an agreement to whose jurisdiction it is assumed advantageous to adhere to.

1.5. To disorder / to deconstruct / to regenerate

We have already seen how a social algorithm is an important device to try to order and structure matter and the world under particular conceptions. But there are algorithms that seek exactly the opposite: to reverse or deconstruct a given state of affairs or a social structure, or at least to call it into question. Clearly, this intention was not a recurrent search during Antiquity, in civilizations that endured stable cultural forms as natural facts of the world. In any case, towards the Middle Ages in Europe, there were already social devices that allowed for the generation of temporary spaces of symbolic rearrangement, such as a 'carnival'. Now, the concrete structure, the sources and the imminent effects of that phenomenon constitute a particular case in the history of culture. For as long as it was linked to popular customs, the carnavalesque occurred in informal layers of the cultural production of the time, away from intellectual interpretations and analyses, so its emergence and cultural networks are difficult to reassemble and follow. In this regard, the critic Mikhail Bakhtin found in the work of the French writer François Rabelais (1494-1553) a communicating vessel that informed of a 'secret' world, insofar as it was nurtured through and thrived precisely on it. Bakhtin located thus the key to a social algorithm in a specific literary work. As the critic writes:

> Rabelais is difficult. But his work, correctly understood, casts a retrospective light on this thousand-year-old development of the folk culture of humor, which has found in his works its greatest literary expression. Rabelais' illuminative role in this respect is of the greatest importance. His novel must serve as a key to the immense treasury of folk humor which as yet has been scarcely understood or analyzed. But first of all it is necessary to take possession of this key.[23]

The Rabelaisian corpus and all the very interesting relationships that it illuminates are certainly not part of the scope of this article. However, it is worth taking into account the way in which the social algorithm that Bakhtin uncovers, rearticulates and uses in Rabelais, manages to reconstruct a particular, invisible structure for an entire era, in the complex operation of restoring, in a sort of archaeological approach, the social algorithm with its specific means of transmission – i.e. the cultural ecosystem as a socio-computing infrastructure – that gives it its characteristic fertility. In a way, Bakhtin manages to locate the central ritual act of the carnival in the false coronation and deposition of the carnival king. This is the opening act and the culminating point of that event: an inverted world is here denoted. The coronation and deposition thus constitute a dual and ambivalent ritual that expresses change, the relativity of structure

[23] M. Bakhtin, *Rabelais and his World*, trans. H. Iswolsky, Bloomington 1984, pp. 3-4.

and order, and the contingency of authority and hierarchic orderings. In that sense, an inversion is not merely a disorder, but a restructuring that dismantles social structures and habits, and thus shows the ultimate meaning of this social ceremony: the pathos of change and renewal, the cycles of death and rebirth. The carnival is for Bakhtin then a festival that brackets time (a *chronotopos*, in his own terminology) in order to end and renew everything. The source code in Rabelais allows Bakhtin to read not only aspects of an archetypal subjectivity, but also a whole cluster of life forms, of ways of being and of a set of values and inquiries for a determined historical moment.

What Bakhtin found in Rabelais was experienced by other cultural agents in the wake of the 20th century. Through different means, literary or artistic, encoding operations became flexible and variable. During the early decades of the century, these agents were already trying to leave behind an aesthetic and epistemological model to try to inaugurate an alternative cultural order. For the Dadaist poet Tristan Tzara, for example, who challenged an artistic tradition that valued abstractions such as the work of 'genius', 'talent', the 'uniqueness' of the artwork or the importance of passive contemplation, a poem should not only affect the life of an individual, but it must also pierce through the very heart of tradition itself. The generation of an algorithm allowed him to establish computational processes from arbitrary inputs that not only made every reader a creator in him or herself, but also aimed at deconstructing the tradition of the individual 'genius' in literature. His text *To Make a Dadaist Poem* from 1923 states:

> Take a newspaper.
> Take a pair of scissors.
> Choose an article as long as you are planning to make your poem.
> Cut out the article.
> Then cut out each of the words that make up this article and put them in a bag.
> Shake it gently.
> Then take out the scraps one after the other in the order in which they left the bag.
> Copy conscientiously.
> The poem will be like you.
> And here are you a writer, infinitely original and endowed with a sensibility that is charming,
> though beyond the understanding of the vulgar.[24]

This algorithmic process for the production of a literary piece turns repeatability into a subversive trait. That is, while for Christian mystics or Jewish kabbalists repeatability promised the attainment of an order and the formation of a totality, Tzara mechanizes a process that is assumed to be of personal inspiration, and with that move he reinserts chaos and dispersion into the production of meaning. Tzara's algorithm prefigures the post-structuralist conception of the world in which there are no essences or deep truths, where

[24] T. Tzara, *Pour faire une poéme dadaïste*, *Œuvres completes*, Paris 1975.

an author is a function and an effect of a work and not the expression of a predefined subjectivity.

Other artists throughout the 20th century also generated pieces as instructions that could be repeated by anyone. That was the case, for example, of the artists associated with the *Fluxus* movement. John Cage premiered in 1952 his well-known piece *4'33"*, a work in which the notation asks an interpreter to generate – or rather: to open – a frame to listen to the accidental sounds at a concert hall while the interpreter remains still. Cage's piece is a search to underline what exists as a product of a previous program (that of classical music) and to depict reality as generated and generative, rather than an attempt to introduce a new aesthetic for an unintentional and random sound, as it has sometimes been interpreted[25].

These algorithms contain expressive intentionalities, points of view, subjective inflections and subcultural interrelationships. But they are only effective when understood under the parameter of a specific social frame – the world of art experimentation – where they are seen as contained nodes of relations and exchanges. In any case, all these examples denote how a work of literature or an artwork may condense in itself, abbreviated, the character of its time. This gives us an invaluable opportunity to understand an algorithm as a cultural symptom of a specific era.

2. Filtering, Contrasting, Reassembling

The previous section aimed at showing feasible assemblages of social algorithms working on historical socio-computing practices according to common inherent structures and intentionalities. On the one hand, that procedure helps to observe certain affinities and possible genealogies. On the other, it also allows grasping fundamental differences, so that one can understand, for example, why the steam engine from the 19th century stands basically on a completely different path of development than the early aeolipiles invented by the Greeks[26]. In that sense, the focus of these emerging sets has been to shift away from the machine-based functioning of an algorithm, and to concentrate instead on the socio-computing infrastructures on which social algorithms rely, and over which collective intentionalities play a major role. Clearly there is, for every historical

[25] Cage uses the rhetoric that surrounds the meaning of 'a concert' to highlight the same concert-form, thereby underlining the fact that a sound piece can be a simple 'frame' in which 'anyone' can participate, which brings him closer to the Dadaist spirit of Tzara. On the other hand, the randomness involved in the piece is not a totally open accident, as might be believed at first, so we are not in front of a silent piece, linked to Japanese Zen, or to the mystical contemplation of the concrete. *4'33"* is a code that commands the opening of a sound receptacle in which a controlled, stochastic chance comes into play, by means of an algorithm that is also random in itself.

[26] This claim could be further investigated, to allow for example a discussion with the thesis of Gilbert Simondon and what he observed as an autarkic evolution of technical realities. Cf. G. Simondon, *Du mode d'existence des objets techniques*, Paris 1958, esp. pp. 50-70.

practice, a wider socioeconomic and cultural context that needs to come to the fore for a deeper archeo-historical analysis, but that would require a thorough study, which is not here intended. What is here pursued instead is to understand what working with the notion of intentionalities might yield, and the reach these may have when reflecting on the overall structure of a socio-computing complex.

To continue our quest, this section will now inquire deeper into specific practices. The aim is to observe what social algorithms might entail, and to remark how comparing practices ascribed to given intentionality sets can actually illuminate one another, for the intrinsic similarities and differences can be telling of the respective socio-computing infrastructure that is at work in each of them. For this end, the groups presented in the previous section need not be taken as definitive and closed sets, but only as guidelines or proxies; high porosity between categories and the slipping of meaning are assets in a cultural dynamic, although they might make difficult an analytical task that pretends to make observations across extended time periods. For this same reason, the practices here analyzed are taken from recent decades, to avoid unnecessary assumptions or just slip unwise anachronisms. That this is needed will be clear when we see that, even if the time period is restricted, shifts in technological habits and collective behaviors can be already distinctly perceived.

2.1 Completing a task: social algorithms as scripts

For this first case, we will start by laying forth another artwork that could have been easily added to the last set from the previous section. George Brecht, an artists associated with the *Fluxus* movement, took the process of algorithmic art to the extreme, showing everyday activities as programmed procedures. Stated as operational processes, that is, habits as computational loops, the aesthetic components of the everyday resurface in his works as an unintentional coded style in which individuals interact with each other. A classic Brechtian piece from 1961 formally reinterprets the simplest act of answering the phone:

> Three telephone events
>
> *When the telephone rings, it is allowed to continue ringing, until it stops.
> *When the telephone rings, the receiver is lifted, then replaced.
> *When the telephone rings, it is answered.[27]

More than commanding an action, Brecht's piece suggests that in our daily life every subject participates in some work of art (maybe his own?) without fully being aware of it. Of course, that would only be clear to a person that knows how

[27] G. Brecht, *Three telephone events,* 1961. Retrieved from: *Galeria d'arte moderna gammm* https://gammm.org/2021/03/21/three-telephone-events-george-brecht-1961/

conceptual art insinuates its meaning, not to the lay individual. For in the end, Brecht is of course not the author of this particular daily performance. But by issuing a script over the array of possibilities around a given event for a given era (nowadays most telephones don't have a receiver to be lifted, and contemporary cell phones may be answered by way of a text or through an already old-fashioned answering machine), the artist underlines this action as something than can be fully anticipated and programmed, much like in a theater play. The script is what he claims as an art piece; the audience is then left to relate to it freely. But even ignorance of the piece does not leave an individual unaffected: the act of answering a phone is made transparent as a coded moment in daily life. In the end, the piece is ingenious because, when anyone reads and understands its meaning, a daily action appears as 'fully' conditioned, for even the minute exceptions on particular 'telephone-ringing events' can be individually filled ad hoc and fitted in the Brechtian coding. And as Lucy Suchman writes, describing how we go through the mutual intelligibility of action:

> We walk into a situation, identify its features, and match our actions to it. This implies that, on any given occasion, the concrete situation must be recognizable as an instance of a class of typical situations, and the behavior of the actor must be recognizable as an instance of a class of appropriate actions.[28]

Accordingly, the Brechtian piece relies on a shared understanding of the actions and elements involved on a particular event, so that his script can be simultaneously seen as 'evident' and therefore 'effective'.

We can compare this work with the description of a very simple task in artificial intelligence research, which shows entanglements in the uncertainties of an action and its many deviations from intended effects. Describing the task of 'turning on a light', the computational scientist James Allen wrote two decades after Brecht:

> There are few physical activities that are a necessary part of performing the action of turning on a light. Depending on the context, vastly different patterns of behavior can be classified as the same action. For example, turning on a light usually involves flipping a light switch, but in some circumstances it may involve tightening the light bulb (in the basement) or hitting the wall (in an old house). Although we have knowledge about how the action can be performed, this does not define what the action is. The key defining characteristic of turning on the light seems to be that the agent is performing some activity which will cause the light, which was off when the action started, to become on when the action ends. An important side effect of this definition is that we could recognize an observed pattern of activity as 'turning on the light' even if we had never seen or thought about that pattern previously.[29]

[28] L. A. Suchman, *Human-Machine Reconfigurations. Plans and Situated Actions*, Cambridge 2007, p. 81.
[29] J. Allen, *Towards a general theory of action and time*. «Artificial Intelligence» XXIII, 1984, pp. 123–154.

Allen uses this example precisely as a way to problematize the indeterminate relationships of intended effects when articulated into a descriptive method, which would be used afterwards in a sequencing program. That Allen relies in the notion of intention here to anticipate an action is clear in that he tries to convey every possible course of action that derives to the desired effect, as if the accumulation of steps were the expression of an underlying plan. Of course, the contingencies leading to 'turning on a light' are also significantly broader than those of answering a telephone (in an extreme, one can also include 'opening the curtains to let the sunlight in'), but Allen's point is that the accumulation of tasks will not necessarily lead to a precise outcome, and that, even if it does, the outcome cannot be reconstructed precisely out of the contingent tasks leading to its accomplishment. In his own work, Allen proposes then a path for plan recognition by constructing a logical language for action descriptions that distinguishes causality and logistics. Nevertheless, Allen does not abandon the principle of planning or plan recognition systems, which relies on the anticipation of actor's intents and purposes, and ignores the adaptability to situated actions that scripts might offer. And as Suchman suggests: a

> planning model […] takes over our commonsense preoccupation with the anticipation of action and the review of its outcomes and attempts to systematize that reasoning as a model for action while ignoring the actual stuff, the situated action, which is the reasoning's object.[30]

The shortcomings of the planning model provide then an effective contrast between plans and scripts.

Plans associate intentions with action sequences, while scripts – as it is clear in the Brechtian piece – associate action sequences with typical situations, and are usually described as partial list of tasks, which actors may take further and adapt in their own unique way. A social algorithm seems to be better described through a script, where the contingency of individual intentions subsides, and where the problem to be solved appears to be more malleable, yet remains clear. Moreover, the description of plans implies mostly post hoc *representations* (reconstruction of intentions, imagined projections, recollected reconstructions), and the observer needs to imagine a course of action between two temporal points as if the agent had everything under control. On the other hand, to describe a social algorithm as a script entails certainly post hoc *interpretations* (semantic approaches, the heuristics of proof and error, playful conjectures etc.) but these are fundamentally based on ad hoc recurrences of the coding process itself, made over time and reiterated by several individuals.[31] This is what unveils

[30] Suchman, *Human-Machine Reconfigurations*, cit., pp. 60-61.

[31] Harold Garfinkel describes forms of analog coding within a medical clinic that shed light on the function of 'ad hoc' processes that end up structuring a task, an epistemological category, or an empirical finding as a piece of systematized information. He writes: «Ad hoc considerations are invariably relevant considerations in deciding the fit between what could be read from the clinic folders and what the coder inserted into the coding sheet. No matter how definitely and

the articulation of collective intentionalities within them. In the end, scripts are enriched by small deviances and quirks, but they maintain a specific type-form, since that they are engrained in aspects of a shared know-how, as part of the socio-computing infrastructure in which they perform.

2.2 Expanding a speech act: enacting ways of being and influencing states of affairs

For this second case, we will consider an intentionality set that was not laid out in section one, and which could be stated as the cluster *to judge / to sanction*. Some insights brought about in Garfinkel's article *Some rules of correct decision making that jurors respect,* from 1967, will serve here as a point of departure. In that piece, Garfinkel analyzes what it means for a person to be called on duty to perform the task of a jury under the US-American system of justice (which incidentally provides here a stark contrast to the function of the law in Antiquity). Garfinkel finds that, when appointed to that position, jurors feel responsible to modify the rules used in daily life, including their own. In other words, besides introducing a verdict into the world – a classical uptake that follows the structure of speech-act theory – jurors not only influence a state of affairs, but also affect their own attitudes and self-perception.[32]

In this sense, the speech act of pronouncing a verdict should be analyzed not only as a linguistic utterance with pragmatic consequences, but as part of a cognitive microsystem that exceeds the linguistic domain and enters into a complex social phenomenon of role-assigning, role-playing, and group thinking, where the valued task and prerogative of 'announcing a verdict' is able to transform behaviors, ways of being and the perception of situations. No wonder that the whole realm of *juror decision making* has become a field of cognitive inquiry in its own right. As Pennington and Hastie argue:

elaborately instructions had been written, and despite the fact that strict actuarial coding rules could be formulated for every item, and with which folder contents could be mapped into the coding sheet, insofar as the claim had to be advanced that Coding Sheet entries reported real events of the clinic's activities, then in every instance, and for every item, 'etcetera', 'unless', 'let it pass' and 'factum valet' accompanied the coder's grasp of the coding instructions as ways of analyzing actual folder contents» H. Garfinkel, *What is ethnomethodology?,* in *Studies in Ethnomethodology*, Englewood Cliffs, 1967, p. 21.

[32] When Garfinkel describes the changes on jurors' ethical and epistemological attitudes, he states: «in their idealized accounts, jurors talked as if they knew the rules of decision making before they went into the deliberations; jurors did not say, nor did they care to discuss the fact, that it was in the course of the deliberations that they learned how the decisions were made […]. Their accounts stressed instead that from the beginning they knew what was expected of them and used this knowledge.» H. Garfinkel, *Some rules of correct decision making that jurors respect*, in *Studies in Ethnomethodology,* cit., p. 113.

the juror is a sense-making information processor who strives to create a meaningful summary of the evidence available that explains what happened in the events depicted through witnesses, exhibits, and arguments at trial.[33]

In other words, a contemporary legal system does not rely in the mere application of general laws to individual cases, but performs through the interactions between individuals trained in or attuned to the system's traditions, the collective intentionalities behind those traditions, and the institutional precedents that these conform. And as Gallagher writes:

> [Verdicts] are not necessarily confined to individual brains, or even to the many brains that constitute a particular court. They emerge in the workings of a large and complex institution. Yet these verdicts and legal proceedings are cognitive processes that then contribute to the continued working of the system in the form of precedents. The practice of law, which is constituted by just such cognitive and communicative processes, is carried out via the cooperation of many people relying on external (and conventional) cognitive schemas and rules of evidence provided by the legal institution itself.[34]

The intricacies of the legal mechanism clearly suggest that, in the end, a verdict matters less for its truth-content (outright evidences may be discharged on formal grounds, a sentence might be appealed, etc.) than for the processes it triggers within the social system in which it works. In that sense, the legal socio-computing infrastructure is less attuned to reflect upon facts in themselves, as to engage in interactional procedures where legal inputs are transformed into convened statements that influence, as judged things, the attributes of social situations.

In a similar way, we can analyze some technical algorithms that introduce their own 'verdicts' into the world, such as the dating apps. For instance, in Tinder, one of the most popular apps nowadays, a 'match' is a verdict that drives possibilities: its likelihood pulls representational strategies, linguistic habits and collective behaviors from the users, while its actual occurrence enables new options for them (e.g. contacting another person) which will keep the 'game' going. In that sense, an algorithm introduces a judgment into the world – two persons might fit romantically together – which organizes and coordinates a community of users[35]. Now, of course the programmed algorithm has a function

[33] N. Pennington and R. Hastie, *A Cognitive Theory of Jury Decision Making: The Story Model.* «Cardozo Law Review» 13, 1992, pp. 519-557, here p. 519.
[34] S. Gallagher, *The socially extended mind*, cit., p. 7.
[35] The function of the 'judgment' has been clearly distinguished, but users see the program also as a game or as a beauty contest plus messaging. This implies some perceptions of the 'judging app' as a juror of 'beauty' and 'ugliness'. Cf. B. Bosker, *Why Tinder has us addicted: The dating app gives you mind reading powers,* «The Huffington Post», September 4, 2015. Retrieved from http://www.huffingtonpost.com/2013/04/09/tinder-dating-app_n_3044472.html); and D. Wygant, *The shocking truth about Tinder dating.* «The Huffington Post», October 2014. Retrieved from http://www.huffingtonpost.com/david-wygant/the-shocking-truth-about-_3_b_4967472.html

of its own in this structure and its operative sequencing, but its reach is pegged to a broader social dynamic, where the intended rules of the app mingle with expectations, anticipations and other developmental conducts, i.e. collective intentionalities, which will end up producing a wider assemblage that can be recognized as a social algorithm in its own right. The social algorithm revolves around the match-as-verdict event, but not because this is taken in its truth-content, as a new fact of the world[36], but because of the ways of being and the dynamics or 'life forms' this triggers within its entourage. As the anthropologist Nick Seaver comments on a presentation of his colleagues:

> In their study of an online dating site, [it was found that] various actors enacted the site's algorithm differently: engineers tweaked their code to mediate between the distinctive behaviors of male and female users; some users tried to game the algorithm as they understood it, to generate more desirable matches; other users took the algorithm's matches as oracular pronouncements, regardless of how they had been produced. No inner truth of the algorithm determined these interactions, and non-technical outsiders changed the algorithm's function: machine learning systems changed in response to user activity, and engineers accommodated user proclivities in their code.[37]

In the end, this means that the machine-based algorithm might have an influence over a given structure or state of affairs, but it is actually in the affordances that this code can achieve in its interactions within a social situation, and therefore in the assemblage of a more complex social algorithm, that the final set of arrangements or effects need to be inspected.

Conclusion

Drawing on an expanded understanding of Tomasello's hypothesis on the nature of collective thinking, this article has argued that collective intentionalities are inherent settings embedded in social algorithms, and that they play an important role in the socio-computing infrastructure in which these algorithms perform. Collective intentionalities are not easy to define and refer, but by way of a historical sampling, even if restricted, sets of practices and devices can be organized under particular intentional arrangements in order to inspect their joint articulation. The description of these likely articulations does not imply an analitical proof in itself, for intentionalities designate fluid, pre-conceptual qualities, but the process leads to an heuristics that allows for sharp focusings on characteristic practices through which a deeper understanding of social algorithms can ensue. In that sense, those assemblages can be further inquired

[36] Even if the advertisement of the app has sometimes pushed the idea that it generates life-changing events (for instance by playing with the motto «Any swipe can change your life»), users appropriate themselves the logic of the program and develop their own uses and routines. Cf. G. David and C. Cambre, *Screened Intimacies: Tinder and the Swipe Logic,* «Social Media + Society» April 2016.

[37] N. Seaver, *Algorithms as culture: Some tactics for the ethnography of algorithmic systems*, «Big Data and Society», 2017, pp. 1-12, here p. 6. DOI: 10.1177/2053951717738104

in different directions and depths. I have pursued two specific cases here to show how intentionalities allow for a better understanding of social algorithms, by presenting contrasts and structural differences between adjacent practices and domains.

In the end, this article aims at bringing a novel configuration to the fore, for which further analysis and descriptions are needed. But a substantive attainment of this text would be already to shift the focus of an algorithm from a machine-based perspective to the interrelated and normative cultural practices sustained through socio-computing infrastructures, where collective intentionalities are seen to play a defining role. In that sense, an algorithm should be seen as a collective social technology, emerging as a cultural script, where a recurring process of signifying, inscribing and interpreting takes place, and for which a given constellation of social thinking, involving a characteristic worldview, is always mobilized.

Javier Toscano
CAIS – Center for Advanced Internet Studies
✉ tosgue@yahoo.com

References

Primary Sources

Bakhtin, B. 1984. *Rabelais and his World*, trans. H. Iswolsky, Bloomington, Indiana University Press.

Frazer, J. G. 1983. *The Golden Bough. A Study in Magic and Religion*, London, McMillan.

Galloway, A. 2004. *Protocol. How Control Exists After Decentralization*, Cambridge, MIT Press.

Garfinkel, H. 1967. *Studies in Ethnomethodology*, Englewood Cliffs, Prentice Hall.

Leibniz, G. W. 1890. *Scientia Generalis. Characteristica*, Gerhardt, K. I. (ed. by) *Die Philosophische Schriften*, Berlin, Weidmann.

Schutz, A. 1962. *Collected papers I: The problem of social reality*, The Hague, M. Nijhoff.

Suchman, L. A. 2007. *Human-Machine Reconfigurations. Plans and Situated Actions*, Cambridge, Cambridge University Press.

Tomasello, M. 2014. *A Natural History of Human Thinking*, Cambridge and London, Harvard University Press.

White, L. 1974. *Medieval Technology and Social Change*, London and Oxford, Oxford University Press.

Wiener, N. 1985. *Cybernetics. Or Control and Communication in the Animal and the Machine*, Cambridge, MIT Press.

Secondary Literature

Allen, J. 1984. *Towards a general theory of action and time*, «Artificial Intelligence», XXIII, pp. 123–154.

Bosker, B. 2015. *Why Tinder has us addicted: The dating app gives you mind reading powers,* «The Huffington Post», September 4 2015, retrieved from http://www.huffingtonpost.com/2013/04/09/tinder-dating-app_n_3044472.html

Brecht, G. 1961. *Three telephone events,* retrieved from «Galeria d'arte moderna gammm» https://gammm.org/2021/03/21/three-telephone-events-george-brecht-1961/.

Chant, S. R., Hindriks, F., and Preyer, G. 2014. *From Individual to Collective Intentionality*, Oxford, Oxford University Press.

Chapman, M. 1990. *Intention, intentionality, and the constructive character of scientific knowledge,* «Psychological Inquiry», I, pp. 251–253.

Cramer, F. 2005. *Words made Flesh. Code, Culture, Imagination*, Rotterdam, Piet Zwart Institute.

David G. and Cambre, C. 2016. *Screened Intimacies: Tinder and the Swipe Logic,* «Social Media + Society», April.

Gallagher, S. 2013. *The socially extended mind*, «Cognitive Systems Research», 25-26, pp. 4-12. http://dx.doi.org/10.1016/j.cogsys.2013.03.008.

Goldstine, H. and von Neumann, J. 1947. *Planning and Coding of Problems for an Electronic Computing Instrument*, *Report on the Mathematical and Logical aspects of an Electronic Computing Instrument Part II*, vol I-3, Princeton, Institute for Advanced Study.

Harper, R. F. 1904. *The Code of Hammurabi, King of Babylon about 2250 B.C.*, Chicago and London, University of Chicago Press.

Newell, A., Shaw J. C. and Simon, H. 1958. *Elements of a Theory of Human Problem Solving*, «Psychological Review» LXV, 3, pp. 151-166.

Nida-Rûmelin, J. 2014. *Structural Rationality and Collective Intentions*, in Chant, S. R. et al. (ed. by) *From Individual to Collective Intentionality*, Oxford, Oxford University Press, pp. 207-222.

Pennington N. and Hastie, R. 1992. *A Cognitive Theory of Jury Decision Making: The Story Model.* «Cardozo Law Review», 13, pp. 519-557.

Schmitt, C. 1950. *Der Nomos der Erde im Völkerrecht des Jus Publicum Europaeum*, Berlin, Duncker & Humblot.

Searle, J. R. 1980. *The intentionality of intention in action*, «Cognitive Science», IV, pp. 47–70.

Seaver, N. 2017. *Algorithms as culture: Some tactics for the ethnography of algorithmic systems*, «Big Data and Society», pp. 1-12. DOI: 10.1177/2053951717738104.

Simondon, G. 1958. *Du mode d"existence des objets techniques*, Paris, Aubier-Montagne.

Wescott, W. W. (trans. by). 1887. *Sepher Yetzirah or The Book of Creation*, http://www.sacred-texts.com/jud/yetzirah.html.

Wygant, D. 2014. *The shocking truth about Tinder dating,* «The Huffington Post», October 2014. Retrieved from http://www.huffingtonpost.com/david-wygant/the-shocking-truth-about-_3_b_4967472.html.