DOI: 10.69138/arete-2531-6249-20220729

On Michael Tomasello's "Ratchet Effect" and Bernard Stiegler's "Epiphylogenesis": How Do Humans Finally Come to Operate as One?

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Abstract: In this paper, I outline major claims concerning what Michael Tomasello originally named "ratchet effect" theory and Bernard Stiegler's "tertiary memory" or "epiphylogenesis" exposition contained in his three-volumes work *Technics and Time*. Following these authors, I show how human culture may be addressed as a cumulative evolutionary pattern which i) constantly increases over time and ii) never steps back across multiple generations of individuals. I then highlight how this 'chain' data transmission works, by what means, once human groups learn i) how to properly cooperate; ii) learn from each other; and iii) preserve a stable social order of cultural inheritance through time. I also argue most relevant humans' achievements, like the formation and consolidation of sciences, are a 'sociogenetic' outcome that would not have been achievable if humans did not act jointly as a genuine community of scientists. Finally, in the wake of Stiegler, I hold that writing, as an orthotetic technic of human prosthetization, offers a reliable model for data transmission throughout the history of human societies.

Keywords: *Ratchet, epiphylogenesis, collective intentionality, posterior passing model, epimetheia.*

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1. Cumulative culture as a second evolutionary process

Giant Antaeus used to take and maintain his phenomenal strength from the soil on which he was standing. His mother Gaia provided him invincibility by barely offering the earth on which his son could fiercely walk. Heracles, whose goal was to beat this portentous monster, as a crucial part of his well-known Labors, managed to find out the giant's terrible secret and eventually kill him. To defeat Antaeus, the Greek hero had to lift him for preventing the giant to touch the ground and so to stop him by continuously gaining his colossal vigour from the immediate contact of his feet to the earth below. Desperately kicking the air, i. e., taken away from the protection of his beloved mother, the extraordinary power of the giant slowly decreased, and Heracles accomplished his mission strangulating him. Humans, just like giant Antaeus, can take advantage of the earth on which they are standing, living their lives, acting on things. Without this vital support, namely, without the perpetual sustain of their attentive mother, humans would be rapidly and inevitably lost.

As opposed to most of the animal species populating this planet, human beings' ontogenetic fate is not exclusively determined by the interminable codes contained in genes, i. e., by the course of a purely 'natural' evolutionary pattern. Remarkably, humans are not 'naturally' formed once for all. Rome was not built in a day, and neither did humans as a unique, culturally-based species. Indeed, humans also evolved following a complementary way of never-stopping, contingent, cultural modification. According to most developmental psychologists, admittedly, humans can benefit from a trustworthy system of constant, 'nongenetic', informative transmission, i. e., of a diffusive culture that is at least as important as the genetic legacy in defining the route tracing their ontogenetic pathway to come.[2] This form of nongenetic communication and knowledge preservation, i.e., the

2 Similar definitions of "culture" may be found in literature concerning this topic. For instance, according to Boesch and Tomasello, culture represents the set of "information that is transmitted *non genetically* among members of a group of interest" (1998, 591, my emphasis). Tomasello distinguishes the "cultural" trait from the "genetic" one in human populations, for the cultural transmission of information must be intended "in terms of *social coordination*" (2016a, 649, my emphasis). Mclereath et al. (2018) define culture as a "*socially* transmitted behavior" (192, my emphasis). Given these descriptions, it can be argued that culture seems to be a strictly collective and collaborative process that by no means, I try to demonstrate, could be instituted by a single man acting alone.

self-evident persistent and disseminated phenomenon of human enlightenment, this latter considered as the brilliant yet still unfinished outcome of a "second evolutionary process" (Gabora 2018, 35) takes place "across generations" (Buskes 2019, 7)[3] and over a considerable amount of "historical time" (Tennie et al. 2014, 153)[4], thus granting the consolidation of a consistent "cumulative cultural evolution" (Beppu, Griffiths 2009, 2090).[5]

The cumulative cultural evolution theory consists of a model of data storage and transmission which is, following the lead of many scholars, a solely human feature. The collection of human cultural information steadily increases through space and time distribution and indubitably never retreats (as it never did in humankind history so far). Arguably, this incredible faculty of memory retention constitutes the core of the human 'gigantic' strength quoted above, given that this is the unique capacity that 'culturally' separates humans from the remaining animals, and makes human performances undisputedly superior.[6] The culture human beings

3 Confront this with Caldwell, Millen 2008, 165; Caldwell, Atkinson, Blakey, Dunstone, Kean, Mackintosh, Renner, Wilks 2020, 2-7; Tennie Walter, Gampe, Carpenter, Tomasello 2014, 153; Tomasello, Melis, Tennie, Wyman, Hermann 2012, 674.

4 See also Tomasello 2001, 138; Tomasello et al. 2010, 331-332.

5 See on the same topic, Buskes 2019, 1-3; Boesch, Tomasello 1998, 603; Caldwell et al. 2008, 165; Caldwell, et al. 2020, 2; De Oliveira, Osiurak, Reynaud 2017, 365; Haidle, Schlaudt 2020, 162; Mcelreath, Boesch, Kühl, & Mcelreath 2018, 192-193; Tennie, Call, Tomasello 2009, 2406-2408; Tennie, et al. 2014, 158; Tomasello 2001, 137; Tomasello 2016a, 646; Tomasello 2016b, 4; Tomasello, Kruger, Ratner 1993a, 495; Tomasello, Moll 2010, 342.

6 As Tomasello and Moll point out, "human beings are especially sophisticated cognitively not because of their greater individual brainpower, but rather because of their unique ability to put their individual brainpowers together to create cultural practices, artifacts, and institutions (...) which are then passed along to youngsters as a second line of inheritance in the species, resulting in a ratcheting up of cultural and cognitive complexity over historical time" (2010, 331-332). This point will be further developed in the following paragraphs. We take here for granted that animals do not show acceptable evidence of culturally-based behaviour. This said, a few episodes of broadly speaking 'emulative' gestures may be observed in the animal realm, as the "potato washing", or the "termite fishing" samples highlighted by Tomasello (1999, 519; 2001, 135; see also Tomasello, Savage-Rumbaugh, Kruger 1993b, 1689) seem to suggest. Yet it is unlikely that functional procedures of this kind could survive over multiple generations, and thus could be constantly repeated, as an acquired habit by a fictional animal community would certainly do: the imitation, then, does not become in this case a cultural fact. The "potato washing" action observed, unfortunately, never reached a spread rate to count as a true cultural factor of socially reliable influence. Moreover, Tomasello argues that chimpanzees, in contrast to humans, apparently cannot reproduce the very "strategy" (2001, 138), i. e., the abstract means through which their conspecifics

consolidate and rely on, throughout past, immemorable experiences, represents, in this context, the very 'earth' on which they are walking, and which provides them strength and safety.

Against the snares of nature, at their origins, humans found out how to successfully cope with the given, revealed condition of natural disadvantage – confronting human physical weakness when compared to the prowess of much stronger animals - and thus to learn how to recover from this sort of natural dependence. How is that possible? Where does human strength come from? How do humans grow up until they become real giants?

2. The ratchet effect: copying and innovation

Accordingly, the cumulative culture model justifies the formation of a solid, long-lasting structure of reliable and always – at least partially - retrievable knowledge that just cannot be effaced. Furthermore, the cultural background from time to time combined, like a building which is under – indeed unceasing - construction, continuously accommodates the basis on which new pieces of information could be efficiently stocked. As an illustration of this process, once a smart individual figures out something relevant, like the outstanding result of a scientific experiment he is working at, this new piece of information instantly becomes a part of this archetypal, higher and higher building of knowledge, just like an additional 'floor' which is edified and posited just above the one below would do. This brilliant discovery could never fall into oblivion since this building could not be somehow deconstructed or completely demolished someday. The building needs all its floors to call itself a building: arguably, one cannot postulate the existence of a building whatsoever with no foundations at all. This is why, for instance, we still know for a fact that the force of gravity exists, that it is a 'thing', despite the fact Sir Isaac Newton died almost three hundred years ago and though we do not retain a direct experience of his fascinating calculations (for instance, we were not by his side while that famous apple fell from the tree and hit his head). Nonetheless, all extra,

attain a definite goal: rather, they concentrate directly on desired objects, thus neglecting what is not immediately visible and so preventing themselves for gaining a completely new set of cognitively superior actions.

consequent information concerning classical mechanics could not easily neglect this sensational finding, once this latter is 'faithfully' archived in physics' books and savants' minds: as men of science, we can thus call Newton a 'contemporary'.[7]

Many developmental psychologists employ the suggestive figure of the "ratchet" to depict this peculiar dynamic of human cultural growth and constructive epistemic data maintenance over multiple generations of individuals. They use this term "by analogy with the device that keeps things in place while the user prepares to advance them further" (Boesch, Tomasello 1998, 602) and thus imaging a specific mechanical tool which allows "accumulating complexity over time" (Tomasello, Moll 2010, 342). The ratchet these authors are thinking of is the gear wheel which affords discrete but uniform advancements in motor chain transmission, just as the one combustion engine cars normally support in their gearbox. Once the clutch is disengaged and, consequently, the gear enters, the car cannot recoil, but either remain still or move forward.[8] Originally stressed by Tomasello and colleagues to describe the crucial "fidelity" which is necessary to prevent the eventuality of "information loss" (1993a, 495) in complex human processes of learning, the ratchet effect "explains why human culture accumulates modifications over time in a way that chimpanzee and other animal cultures do not" (Tennie, Call, Tomasello 2009, 2406).[9]

The "ratchet effect" metaphor boasts an incredible number of occurrences in recent scientific papers. One of the most striking pieces of evidence is the one offered by Tennie and colleagues. According to them, the ratchet effect "involves

7 This point will be further examined in the fourth paragraph. Faithfully data transmission across generations is one of the most relevant features of cumulative culture ratchet effect.

8 Indeed, according to the ratchet effect theory, Tomasello and colleagues affirm that "each modification stays firmly in place in the group until further modifications are made" (Tomasello, Kruger, Ratner 1993a, 495).

9 On this description see also De Oliveira, Osiurak, Reynaud 2017, 364. Following Boesch and Tomasello the way human beings "have sheltered themselves (...) over human history" (1998, 602) and did it better and better till the construction of full-fledged houses, is a clear example of the good application of the ratchet effect across human cultural history. A supplementary confirmation for this claim may be found in Tomasello 1993a, where the American psychologist holds "the history of hammerlike tools shows a gradual increase in complexity over time in human prehistory" (508): hammers have evolved too, just like humans did, to "meet novel agencies" (Tomasello 2001, 138). Following this statement, Chris Buskes states that "without cumulative culture we would not have had technology and science and all the conveniences, tools and gadgets are owe to these achievements" (2019, 1; see also Haidle, Schlaudt 2020, 169-171).

both copying and innovation – *copying* to provide a foundation on which to build and *innovation* for further improvements. Human cumulative culture is a product of both" (2014, 158, my emphasis). Therefore, to perform accordingly, human cultural productions mix up these two main characteristics: the modification added and applied to a certain "system" of data must be somehow coherent with the "tradition", with the previous pieces of evidence it inherits, to be effectively received, i. e., to the contents of the information contained within (Tennie, Call, Tomasello 2009, 2407).

3. Critical sociogenetic incomes: what happens if humans put "their heads together"?

One of the most significant theoretical features related to the ratchet effect formulation is the fact that this latter is explicitly defined as an 'effect'. The point is not trivial, since it has been recorded this cultural phenomenon only occurs in human communities, i. e., in human social groups which are composed of full-grown individuals.[10] This means, as mainly emphasized by Tomasello, human beings are not 'socially' born. This is to say social reference, communication and network transmission are not primitive facts in the human species. Conversely, it has been observed that humans acquire to socially 'think' and thus socially behave throughout several phases of rigidly scheduled ontogenetic development. Around nine months of age, for instance, children exhibit first pertinent episodes of "joint attention", i. e., the most basic form of social intentionality, and then of "triadic social skills and interactions" involving both adults and peers (Tomasello 1999, 514).[11] According to this shocking ontogenetic tread, children of this age begin "'triangulating' with others on the entities and situations around them – and, most importantly, – to understand others as *intentional agents* who have goals and perceptions toward the world". (Tomasello 2019, 56, my emphasis). This mutual

10 As exposed in a pilot study that will be quoted again in the next section, "cumulative culture is usually assumed to be created by *adult* members of a group who have acquired reasonably large and deep cultural intelligence. In contrast, children are thought to primarily learn about and absorb their cultures rather than to add to them" (Reindl, Tennie 2018, 3, my emphasis).

11 See also Tomasello 2000, 62, 66-67; Tomasello 2003, 11-12, 21-33; Tomasello 2009, 167-169; Tomasello 2010, 140-141; Tomasello 2014, 69-70.

understanding of others as others-I characters represents a big step forward in the *emulative* learning process since this latter "is not just on the environment but rather on the *intentional* actions of others" (Tennie et al. 2009, 2407, my emphasis).

Backing away from the simplest, dyadic forms of communication in obligate collaborative foraging actions, nine months old children start developing fundamental "abilities of secondary intersubjectivity" (Tomasello, Savage-Raumbagh, Kruger 1993b, 1688). These infants constitute, for the very first time in their still short lifetime, an elementary trait of "shared intentionality" and, subsequently, of "collective intentionality" as well (Tomasello 2019, 46), i. e., the third and most enhanced attribute of social intentionality theorized in Tomasello's works.[12] The attainment of this social stage of collective intentionality involves the formation of an "'objective' perspective (...) a perspectiveless perspective (...) positing a kind of invariant objectivity that *grounds*" all the perspectives taken then and there into account (77, my emphasis).[13] In this renewed context of human social action, the ratchet effect may then be finally described as the 'effect', i. e., "the *product* of sophisticated learning, emphasizing the advantages of joint attention" (Beppu, Griffiths 2009, 2089, my emphasis). The accomplishment of this ontogenetic procedure irrevocably leads, as briefly seen in this exposition, through time and constantly acquired ever-new social awareness, to the heuristic consolidation of a "shared agent 'we'", this letter intended to be the collective deputy which represents many singular intentionalities happily combined in global action towards the achievement of a one, joint goal whatsoever (56).

With this conclusion we reach arguably the most important yet problematic feature concerning the collective intentionality outcomes, faithfully carried on by ratchet effect multiple means of temporal distribution. Does a purely 'sociogenetic'

12 Tomasello and colleagues generally employ the term 'shared intentionality' "to refer to collaborative phenomena in general". In addition to this, they use the expression 'joint intentionality' "for the ad hoc, temporary collaborations characteristics of, e. g., foraging parties (...) and the term 'collective intentionality' for the more impersonal yet permanent group minded practices and modes of collaboration that characterize cultural groups as a whole" (Tomasello et al. 2012, 64).

13 Following Tomasello's claim, this form of perspective neutralization, i. e., the final reach of this hybrid form of objective constructivism, marks the very beginning of the human cultural worldly dimension. As the ratchet effect's agency testifies, a modern day's society worthy of this name can successfully unify two complementary aspects, i. e., the "*synchronic* social organization", namely the "coordinated social interactions that make it a society in the first place" along with "its *diachronic* transmission of skills and knowledge across generations" (Tomasello 2014, 80, my emphasis).

epistemic content of information exist? Is it possible to imagine a cultural fact which would not, under any circumstances, be accorded to a single person, no matter how gifted this one may be? The answer to these questions cannot but be ambiguous, as the dichotomy imposed by the ratchet's "copying" and "innovation" patterns can tell, and since no true revolution is one hundred per cent conscious of its scope, i. e., of its genuine legacy over the years. Nonetheless, Tomasello and colleagues firmly argue that if and only if individuals "*put their heads together*" in act of shared intentionality - at least, as the second type of social aim Tomasello detected, - they can "*create and maintain* the complex technologies, symbol systems, and cultural *institutions* of modern societies" (Tomasello et al. 2012, 674, my emphasis). The same argument may be found in Tomasello and Moll (2010), where the two authors claim that better cognitive skills "result from an ability enabling humans to *put their heads together* (...) in cooperating and communicating with one another in ways that led to the *creation* of complex cultural products, including both material and symbolic artifacts, such as linguistic symbols". Given that nowadays children "grow up in the midst of these material and symbolic artifacts – Tomasello and Moll pursue in the same work - and by learning to use them in interaction with the others (...), they actually *create, during ontogeny, evolutionary new ways of thinking*" (333, my emphasis).[14]

4. How to develop better hunting techniques: the chain sequence analysis

In a study published in 2008, Caldwell and Mirren advance similar hypotheses while analyzing data conveyance in a 'chain' transmission structured laboratory test. Following the cumulative constructive signs of cultural progress most children taking part in this experiment attested, if allowed to take as model peers working on the very same project (i. e., the construction of paper aeroplanes or always taller towers of spaghetti), Caldwell and Mirren stated children who observed did better than peers who could not profit from the same exemplar advantage, for these latter were located on previous, and thus unfavourable gears of the practice chain (166-167). This test led these scholars to the conclusion that "each generation", namely, each gear of the transmission chain "makes use of behaviours and artefacts invented by

14 See also Tomasello 1999, 512.

previous generations, which they would be unlikely to have been able to invent by themselves", thus commanding the further development of more "powerful technologies" (165). Despite this statement, we can argue the improvements shown in this experiment were, all things considered, of small-scale. The tower heights Caldwell and Mirren observed grew constantly until the reach of the final position of the chain. Nonetheless, these ameliorations were not, so to speak, truly game-changing ones. None of these children, indeed, could perform the construction of a "tripod", for instance, since this creation was, according to Reindl and Tennie, commenting on Caldwell and Mirren's conclusions, "beyond inventive power" of participants this young (2018, 11). The tripod was intended by Reindl and Tennie to be the most effective design project affording the construction of considerably taller and more stationary towers, a feature which these baby architects just could not conceive over the course of the quoted experiment.

This evidence supports cumulative social knowledge is not a primitive fact, but an acquired one. This stated, Reindle and Tennie also recognize that "when individuals are given the opportunity to share information in pairs or small groups", as it is the case in chain sequence simulations like that, where children are allowed and encouraged by adults to work in teams of peers, "they *outperform* individual performances and also create products (...) that participants working alone could not have achieved" (7, my emphasis). If we count 'discrete but uniform advancements' (see again paragraph 2) as genuine "inventions" - as we do in this study – it can be concluded, following once again Tomasello, that these inventions are "mastered relatively *faithfully* by conspecifics, (...) which enables these inventions (...) to remain in their new and improved form within the group until something better comes along" (1999, 512, my emphasis). Having said that, can we assume a possible situation in which age is not a relevant factor, i. e., in which only 'full-grown' individuals engage in a shared, cooperative activity? Although it does not provide a clear example of data laboratory analysis, human hunting may do the trick. Described as a complex "collective entreprise", Tennie and colleagues hold that hunting techniques for large preys, as long as behavioural novelties related to that very demanding practice, "are not created by individuals but rather by groups of individuals working together (...) *in the process of their collaboration*" (2009, 2411, my emphasis).

Furthermore, as also pointed out by Tomasello and colleagues, these abstract group-level phenomena of social organization, like a programmed hunting trip

arranged by a gathering of both hunters and non-hunters is, require a stable role reversal mechanism to properly work. One of the most crucial features of collaborative intentionality is, admittedly, the "recursive mindreading or common ground as the basis of the agreement" coordinating the group functioning at any instant (Tomasello et al. 2012: 682). Every member of the hunting group – and of the larger human community of meat-eaters since the meat obtained through hunting is also "shared with nonparticipants" (675)[15] – is thus conscious of her "impersonal" role in this peculiar dynamic. She knows what to do and how to do it: her actions are completely foreseeable, just the way her thoughts are for other members of the same community of hunters. Hunters need to act 'like one' if they want to prevail over considerably larger and vicious beasts.

5. Acting "like a single agent"

Nonetheless, group synchrony as such is not sufficient. Amateur, flat-footed hunters would make easy pickings for most wild animals they face. The experience serious hunters need or, better, the effects they can ratchet up and retain come along within a 'diachronic' process of model transmission, a transmission which could be both 'direct' and "indirect".[16] This point is made clear by Boesch and Tomasello who state that, according to social learning premises, we can call a transmission direct when "there is a perceptual contact between the model and the chooser – and so - transmission takes place between generations *living at the same time*. When indirect – on the other hand, and most significantly, - transmission can be effected between individuals *who are not in perceptual contact*. (...) This mode allows cultural change on a larger scale by facilitating transmission over much greater time and space ranges. It is typical of modern human societies and seems to be exclusive to them, indicating that *language* may make for a qualitative difference" (1998, 598, my emphasis). This means humans can reliably learn from others' experiences, even via indirect means of recording and data diffusion, as the case of language seems to suggest in this quotation. This point is also retrieved in

15 See also Tomasello, Moll 2010, 335-338 and Tomasello 2014, 40.

16 Data transmission becomes a necessary fact for, as Edward Casey affirms, human beings never experience past or future in their entirety, but only "in fragmentary form, through partial perspectives" (1977, 204).

Tennie et al. (2009), this time specifically concerning the hunting practice. "When individuals use the cultural artefacts and practices *invented by others before them* – these scholars affirm - they are collaborating *indirectly* with those others – so many improvements they make are owing to a kind to indirect collaboration, *as they build on the products of previous inventors*" (2411, my emphasis). Or, again, following Tomasello, "using these artifacts to mediate its interaction with the world, each human child thus grows up in something like the accumulated wisdom of its entire social group, *past and present*" (2001, 137, my emphasis).

But it is on a more schematic depiction we need finally to focus on, to detect the real, 'synthetic' functioning of data chain transmission in human cultures. The three-fold model proposed by Beppu and Giffiths is precious for this specific issue (2009). According to these scholars, learning iteration occurs following three possible 'passing' patterns. The first one, the so-called "pure iterated learning" modality, provides the agent to "receive *only* data which are (...) based on the *hypothesis* maintained by the previous agent" (2090, my emphasis). The game 'telephone' best describes this data distribution, i. e., a content transmission where no external information is allowed to pervert the purity of the message we believe we just heard. The second modality, the "*mixed data*", is the one conceding "each person – involved in the transmission – both receives data from previous person, *and observes data from external world*" (2090, my emphasis). Here the receiver is not only inspired by the tips a loyal collaborator gives her, but also makes herself sure about the very reliability of the information she gets concerning her surrounding world of action. This paradigm may be applied to our abovementioned hunters' case. Whereas a still novice hunter "observes locations where antelope can be found grazing–, indeed, - more experienced hunters also recommend specific locations where they would expect to find antelope. *By combining these specific locations with prior beliefs about where antelope are found, the hunter reaches a new sort of beliefs about where antelope are likely to be,* and can tell other hunters about specific locations where he expects to find antelope" (2090, my emphasis).

Given the stubbornness we all sometimes fall prey to, just like our novice hunter may do, it can happen this latter is not satisfied with the predictions more expert hunters could give her. That is why *mixed data* cultural transmission pattern is not one hundred per cent effective in data diffusion across multiple generations. But when the novice receives an "actual statement of belief" from a role model, which is more than mere unselfish observation, according to the "*posterior passing*" chart,

i. e., the third one proposed by Beppu and Griffiths, "[e]ach agent has *access* to the beliefs of the *preceding* person as expressed in a *posterior distribution over hypotheses* rather than data reflecting those beliefs, and takes that *posterior distribution as their prior distribution*" (2091, my emphasis).[17] This time, mixing up tradition and evolution, copying and innovation, "experienced hunters help train novice hunters by laying out a set of hypotheses about the habits of antelope, and indicating to which they *think* each of these hypotheses is likely" (2091, my emphasis). While the *mixed data* case does not allow to preserve inferences of previous learners, the teacher posterior distribution as the learner's prior do, following *posterior passing* transmission pattern. The *mixed data* model runs indeed the risk of falling in a certain form of unfortunate ratchet 'slippage', which could indeed cause the loss of "inferential contributions of all individuals" indeed participating in the antelope individuation process over time (2091). All the efforts may be in fact "undone by next participant" and so part of the transmission may be badly spoiled. According to Beppu and Griffiths, instead, only the *posterior passing* model can store and maintain this considerable amount of information, besides assuring its reliability and faithful transmission through time. Following this standard, in fact, "*the whole chain acts like a single agent who has seen all of the data*" (2009, 2091, my emphasis).

6. Stiegler's *epimetheia* as cultural heritage

Italian actor Alberto Sordi once declared he never got married, despite the numerous proposals he received throughout his life-long career, for he did not want, he said, to host a "foreigner" in his adored house. In fact, he claimed, one cannot get to know someone unless they come to share a familiar, intimate space together. This could turn out to be a bold move: one could also find out she does not like the person she married that much, for her habits could considerably bother

17 This is similar to what Edward Casey thinks the activity of the historian is made of. Trying to reconstruct past events he did not witness, the historian relies on both the testimony of "those who once witnessed it", for "he seeks their remembering in lieu of his own", and on "his own imaginings in the present". Indeed, as the American scholar points out, the historian's "imaginings are needed even when his sources *are* to be trusted. For no amount of historical evidence, however copious or firsthand it may be, can restore the past event itself as seen from every significant perspective" (1977, 195).

her routines, etc. etc... The crucial point of this illustration, as Sordi made it clear in that famous interview, is that one can only figure this out 'later', i. e., once she got effectively married: since then, it is like a leap in the dark she decides either to take or not. It could be argued the same thing happened to Epimetheus, the mythical titan, when Zeus plan to wed Pandora to him, in order to take revenge on his brother, Epimetheus. Although this latter advised him against this fatal decision and warned him about the wickedness of the Gods, Epimetheus welcomed Pandora home anyway, along with her infamous jar. As his name tells best, Epimetheus the 'afterthinker' did not realize soon enough his wife's intentions and so could not prevent her from opening the jar due to her curiosity, thus condemning humankind to a fate of labour and sufferance.

French philosopher Bernard Stiegler retrieves this formulation of the notorious Greek myth to explain the rise of human "technological" nature. According to him, Epimetheus's fault consists of the "de-fault of origin" to which he condemned "mortals" by means of his tragic "forgetting". Because of his unawareness humans, since then, do not remember where they come from and do not know where they are heading to, what their purpose in life is, given their essence is not, as Tomasello testified on a complementary ontogenetic plan, one hundred per cent natural. Once affected by mortality, namely the worst income the jar opening caused to human race, *elpis*, which is composed of "both hope and fear", was the only faculty humans could employ to react against this tragic doom (Stiegler 1998, 16). *Epimetheia* then, as the *aprè-coup* of *prometheia*, i. e., the foresight Prometheus demonstrated in stealing fire from Gods, represents for Stiegler the manner according to which humans think, act and, most importantly, organize themselves as a society. Hope, considered by Stiegler as the fundamental ignorance concerning events to be, enacts a power of technical "anticipation" and of possibility of realization, which is not, indeed, "determined by a biological program" (151). The "birth of the death" (175), as an acquired awareness of inevitable, physical decay which does not concern animals, leads humans to cope with their natural limits, i. e., with their matured weakness, through the construction of better and better technical 'prostheses', namely bodily and cultural 'anticipations' and 'projections', and thus to constitute a second, technological nature for human breed. To become giants, to truly profit from earth, according to

Stiegler, humans need to come together as one, to jointly cooperate for survival.[18]

In addition to this and most importantly, as Stiegler points out, *epimetheia* essentially means "heritage" in his philosophy (207). *Epimetheia* is a heuristic legacy that can last beyond "individual finite consciousness" (42), i. e., "beyond lived experience" (Stiegler 2009, 236) and, consequently, "*beyond mortality*" (Stiegler 2011, 99). *Epimetheia* is a feature that affects all individual finite consciousness after the unfortunate jar affair. This legacy is passed on via human generations under the technical relation humans entertain with the world and with the objects surrounding them. In fact, as quoted above, because of Epimethean de-fault, humans do not hold a proper essence: they cannot constitute, define themselves "internally" except through a continuous process of technological "exteriorization". Humans thus form themselves "by inventing the tool – Stiegler holds, i. e., – by becoming exteriorized techno-logically" (Stiegler 1998, 141; see also Hawort 2015, 6). As an act of technical emancipation that establishes the infinite horizon of anticipation and technical time postponement, according to the *prometheia* and *epimetheia* dynamic afflicting the human thought, technological exteriorization is "also *Erinnerung,* the very moment of reflexivity, of the affection of the self as a return to the self" (153; see Johnsons 2013, 38). But how does this exteriorization process survive across multiple generations? Where does technicity begin, if it does, if we maintain human original, Epimethean de-fault? How does it not recoil? Again, what is it so relevant, according to human technical "incompleteness"? (Stieger 1998, 260)[19]

7. Tertiary memory's infinite *enchaînements*

Summoning up the main outcomes exposed in the first volume of *Technics and Time*, Stiegler defines this exteriorization process as the "rupture in the history of life resulting in the appearance of a third – tertiary memory" or *epiphylogenesis*, as he names it several times in his previous work. Stiegler argues that "[e]piphylogenetic

18 According to Casey, human beings can indeed profit from an "*aura* of immediate futurity", which is given to their present life by the combined action of retention, as remembering, and protention, as the extension of their spontaneity of action through preformed, "projected possibilities", thus engendering a "protentional consciousness of this sort" (1977, 201, my emphasis).

19 See also on this topic Stiegler 2009, 198; James 2013, 70; James 2019, 39-41.

memory, essential to the living human being, is *technics* (...) inscribed in the non-living body. It is a break with the "law of life" in that, considering the hermetic separation between somatic and germinal, *the epigenetic experience of an animal is lost to the species when the animal dies, while in a life proceeding by means other than life, the being's experience, registered in the tool* (in the object), becomes *transmissible* and *cumulative*: thus arises the possibility of *heritage*" (2009, 4, my emphasis). Comparable to the ratchet effect outcomes, we assume - i. e. the additive data factor across different generations of individuals -, this typical form of human epiphylogenetic, technical memory, which overcomes the limits of the genetic and the epigenetic one, corresponds to the proper constitution and maintenance of human culture over an incalculable time of learning. This third form of memory or retention is recovered by Stiegler and reformulated from the Husserlian "image's consciousness" (Husserl 1991, 61-2; Stiegler 1998, 17), originally highlighted by the German phenomenologist in the *Phenomenology of the Consciousness of Internal Time.*[20]

With a special reference to paragraphs §11-14 (Husserl E. 1991, 30-38), Stiegler identifies a third form of memory which is radically different from the first and the second one – i.e., the immediate sense-perception just happened and the consequent remembering of the impression of the former – for the third corresponds to the "material inscription of the memory retentions in mnemotechnical systems" (Stiegler 2011, 4). This engraving material memory matches the fundamental "already there" of what the humans inherit from related forebears, as the result of the plural constitution of a "collective – and thus 'sociogenetic' - memory qua patrimony" (2008, 98). The development of this capacity is thus the result of a technological, posterior improvement that meets the human need for the collection of cumulative *epiphylogenetic* knowledge that can be neither ignored nor erased (2011, 221). This social heritage holds a strong relationship with the cumulative culture it receives, namely a specific form of shared past, a "*nongenetic* memory which is exterior to the living organism *qua* individual, supported by *nonzoological* collective organization of objects" (1998, 57, my emphasis). According to Stiegler, this culture has no specific or exclusive owners. It has not got 'real', identifiable

20 Crogan defines epiphylogenesis as a sort of "material substrate of the collective knowledge about the experience that has conditioned the formation of each individual consciousness always already situated in its historical and ethnocultural milieu" (2013, 109).

progenitors either: the already-there humans face, as the result of the technological, epiphylogenetic earning of past generations is indeed "not lived", i. e., not fully experienced or possessed by any of the present-day inheritors. Then again, this past represents the sole access to the traces of human sedimented tradition, a feature which could not last with "no relation to time, - namely - without artificial supports" (Stiegler 1998, 159).[21]

Given human's constitutive lack of origin, due to Epimetheus's fault, we can conclude there is no absolute beginning in human culture. This is also made unequivocally clear by Stiegler himself, when he states that epiphylogenetic adoption "process rests on the possibility (...) of gaining access to a past that *was never lived*, neither by someone whose past it was nor by any biological ancestor" (2011, 90, my emphasis).[22] Rather than on the very first impression, i. e., on the immediate presence of intuition of a datum perceived in flesh and bones, which would prove the erroneously belief in the existence of a "*commencement absolu*", Stiegler focuses on the question of technical, postponed "*enchaînements, c'est-à-dire l'histoire qui est le retard* – namely, the posterior course of *epimetheia – où se constitue le temps de la géométrie, c'est-à-dire son unité,* [*qui*] *est un maintenant, un unique grand maintenant se déroulant depuis la Grèce*" (Stiegler 2007, 15).[23] Just like the après-coup's structure of *epimetheia* seems to highlight, commenting on the Derridean reception of Husserlean *Origin of Geometry,* Stiegler emphasizes the role of the retentional continuity guiding through the "*évanouissement constitutif*" which unifies living along with dead memory in the image's consciousness realm (2007, 17).[24] The prolongation of perception to the darkness of non-perception,

21 Check also out Stiegler 2008, 7, 236; Stiegler 2011, 60. This point will be further developed in the following paragraph.

22 This point somehow echoes the Merleau-Ponty's quotation of *Phenomenology of perception* where the French phenomenologist holds that "reflection does not grasp its full significance unless it refers to the unreflective fund of experience which it presupposes, upon which draws, and which constitutes for it a kind of original past, *a past which has never been present*" (2002, 281-282). See also on this Al-Saji 2007 and 2008.

23 See also Stiegler 1998, 235.

24 As Stiegler argues, commenting on the Husserlean text, "we must revisit the entire question of the temporal object from a dynamic point of view, in which emergent tone, (...) would already be the rereading of all (just-having-been) tones in primary memory, and thus a modification of all past tones – but in such a way that this modification in return retro-acts on the passage of tones actually heard as originary impressions. The originary impression would only have been composed as "originary", then, *as a loop, as the après-coup of an already-composed, impressional, primarily-*

and thus the formation of the "*élargissement du present*" beyond the limited, individual intuition of the "*finitude retentionnelle*" is granted by the constant, original modification of the Husserlean "*souvenirs secondaires*", i. e., recollected representations, which have now become "*documentarisé[e]s*" (16). These memories are "*toujours déjà*" present and concur to the consolidation, as said, of the perpetual "*élargissement*" of "Living Present" (Stiegler 2008, 229-230) just as, in the same way, "*la presence perceptuelle est déjà habitée d'une absence rétentionnelle*" (2007, 16).[25]

This opens the great question concerning the infinite horizon of *epimetheia*, i. e., of heritage, for, at a closer look, it is all – and it has all been, ever since – a matter of heritage, given no absolute beginning is implied in Stiegler's 'geometrical' structure of cumulative, technical human remembering, this latter mixing up living (as innovation) along with dead (as tradition, like argued by Tennie and colleagues) memory of this 'mythical' past. Following Derrida's claim, the present Stiegler has in mind is somehow always contaminated by the absence, by the non-presence, the shadow, of an ever-lasting trace of the past humans have to constantly deal with. This retentional absence is not retrievable, since the original immediacy, the purity of that lost, intuitive present cannot be reconstituted for it never existed as such. As Stiegler quotes in the third volume of *Technics and Time,* through tertiary retentions, indeed, "heirs attempt to be open to a future framed by the unfulfillment of everything ceaselessly attempting to be complete, through the perfect *prostheses intensifying the default that inheritors try to fill in*, yet that always constitute only more manifestly the *fullness of the default*" (2011, 59, my emphasis).[26] How do

retained already-there, itself in perpetual modification" (2008, 203, my emphasis). Or again, as he suggests, we must consider, "to start from the heard melody in the same way as from all reactivation processes. As, for exemple, in geometry, *whose data are modified in being retained, in returning, in effect (in return) constitutes this question in an après-coup. And yet that imply the permeability, after the fact, of the primary to the secondary and tertiary*" (216, my emphasis, see also Stiegler 2011, 19 on this).

25 Casey defines "living present" in terms of "a temporal expanse sedimented with the immediate past in retentions and live with the immediate future through protentions" (1977, 203). See also on this Stiegler 2011, 7 and, most significantly, 14, where Stiegler affirms that "temporal object's presence is *its passing maintenance*" (my emphasis).

26 Casey reaches comparable conclusions commenting on Husserl's *Phenomenology of the Consciousness of Internal Time.* The American scholar argues in fact that memory and imagination, i. e., the Husserlian characters of retention and protention in their secondary forms, i. e., as recollection and creativity in their collaboration, "*take the place* of perception (...) which we

these heirs try to achieve this gesture? Is there a technical, preferential medium through which this procedure may effectively be un-completed?

8. Writing and communitization

One of the most relevant artificial support humans can rely on, in order to vehiculate epiphylogenetic supplements for the re-constitution of an always larger Living Present, is writing (Stiegler 1998, 205). As Stiegler clarifies, in fact, writing, as a visual, graphic and prosthetical technic, allows programming "a *new endurance of the past, of anticipation of the present*", thus transforming the 'now' into a "historical", successive feature of human cultural evolution (235). But there is more. The operation of writing transformation of the present into a definite 'epoch' of the history of mankind, in fact, settles the "technical conditions of actual access to the already-there that constitute it – i. e. that present – as an epoch, as both *suspension* and *continuation*" (236, my emphasis). Just like the clutch disengagement and the gear entering illustration shows, in defining how the ratchet effect properly works, in this quotation, Stiegler seems to highlight how writing can provide 'discrete but uniform advancements' in the perpetual formation of technical, human culture. In this process of continuous data augmentation across generations of writers (and of course of readers as well), written 'documents' play a pivotal role: as the union between "*empirique*" and "*transcendental*", and as the most important sample of tertiary memory human have stored in their many centuries-lasting cultural legacy, documents provide the "sedimentation" of a certain content of information, as long as its eventual "reactivation", namely, the possible transmission – i. e., the lecture, the 'readability' in general - of this latter across time and space (Stiegler 2007, 3, 18).

Documents humans receive from a distant, anticipated epoch, are thus consigned to the *epimetheia,* i. e., to the historical retard which properly constitutes their Epimethean 'historicity'. But this is not all. To be 'documented', to survive multiple generations, some content of knowledge must indeed become 'communitarian'. This is something Stiegler retrieves in his lecture of Husserlean *Origin of Geometry* for, in this intriguing yet enigmatic text, the ideality of geometrical object appears

no longer have" (1977, 205).

to be to him only accessible "at the surface or interface of a certain *instrumentality*" (2008, 37, my emphasis). The main theme of the *Origin*, according to him, is indeed the "*first time*, [the] history's debut specifically as the history of geometry, which is also that of an instrumentality: geometry is not conceivable outside of a process of *communitization* made possible by a *technic of presentation* of the 'already-there': no geometry without *instrumental* retentionality: without constitutive tertiary memory", i. e., without a written trace left behind (37, my emphasis). An ideal, geometrical content, like the Pythagorean theorem, for instance, manifests itself for the very first time within a determinate historical context, i. e., the Ancient Greece: this timeless truth, somehow, does not deliver itself except through history, i. e., via means of epiphylogenetic, retarded memory. This geometric ideal evidence needs proper, physical support to be distributed to different generations of young, trainee geometricians: in order to be effective, to "exist", this theorem must be written or promised, 'betrothed' to writing (40-41).[27]

"Communitization – as Stiegler points out several pages later, in a truly inspiring quotation I decide to report in its entirety - is essential to knowledge of ideal objects, which means first of all geometric knowledge: the passage from *land surveying to geometry* is possible only through production of irreducible idealities to the experiencing of them, as "detachable", decontextualizable, and *communicable beyond any here-and-now of any geometry: science is developed in time, beyond its present, cumulatively, and it is historical in the sense that it can be reactivated*: a geometry for today would not know how to produce new geometry that did not proceed from all the totality of the ancient ones, from its origins to the present moment – without "reactivating", in other words, the originary institutions that are the very movement of geometric idealization. Any assembling of geometric knowledge thus must be able to work between and among geometries *across space and time without their being present to one another*; *this is why it can and must be written*. In order for there to be apo-dicticity, a re-presenting of preceding geometricians' thought must be manifested constantly for any geometrician, *with*

27 This point is somehow retrieved from Merleau-Ponty's phenomenology of expression, according to which meaning is inseparable from its very verbal or textual utterance (see Merleau-Ponty 2002, 407). As Thomas Bush states, in Merleau-Ponty, meaning "never escapes space and time. Ideality has its unique form of time, as can be seen in the history of ideas, where a book's influence is traceable, in terms of the commentaries upon it, in the ideas that it inspires. But the book's life 'life' is inseparable from its inscriptions" (2014, 37).

no loss of the substance of this anterior thought – only possible thanks to techniques of orthographic writing. Writing is not here and simply a means of transmission of geometric knowledge that would be indispensable to its constitution; more profoundly, it is the *very possibility of understanding*, that is, of *receiving a geometric message*" (131, my emphasis).

9. Assembling the community of geometricians: as a conclusion

This said, the writing orthothetic prosthetization provides the survival of the *grand maintenant* possible mortification, and permits overcoming the too narrow boundaries of living, individual retention's limitations. The foundation of what Husserl defines, according to Stiegler, "intersubjective transcendence" is thus possible via the overwhelming of this retentional finitude, of the temporality of the inner self, of individual consciousness, towards the proper formation of the "community of geometricians". We are now able to appreciate what Stiegler calls an "archi-large-now (...) outside of the living present, affecting the originary moment of geometric invention itself" (2011, 230, 216). This is possible through the action of the "*literary* retentional *synthesis* – which – supplies – the retentional consciousness to proto-geometry" (142, my emphasis). This happens, once again, via the formation of a "*transcendental We*" which is forged by "written expressions", these latter aiming at an ideal sense which is collectively shared by multiple subjects – we can call geometricians – exactly in the same way (but not at the same time, though). To become "We", geometricians this made, "must have departed from (...) their egological monadicity and finally found, in tertiary memory, a certain (re)constutivity, as orthotetic *what* in which present-time-consciousness and past-time-consciousness can coincide" (2008, 229). Epiphylogenetic memory allows the "*accumulation* of a knowledge of ideality that encompasses a more fundamental transcendental 'we'" (230).

This leads to the formation of a larger cross-generational community of knowledge which overcomes the loss of information due to the ineluctable mortality of singular individuals yet composing the rigid chain of data transmission, this latter preserved in documents or in more complex rituals of remembering. We finally hold the two 'cumulative' cultural evolutionary models exposed in this work show several similarities. As emerged in paragraph 5, indeed, 'indirect'

transmission of pieces of information may occur employing language, which could be plausibly mean through 'writing' technics of data sedimentation and thus related, posterior, Epimethean reactivation. Human beings are the only species that use to give teachings to younglings in order to faithfully, 'actively', transmit the most important features of their related culture. This happens because humans learning process inevitably goes through a process of normalization most animals do not need for. To do good or to do bad often depends on how well distributed a certain behavioural strategy is, as the spread of more reliable hunting techniques across multiple generations of hunters has illustrated in the very same paragraph. What we do retain is what better works in a specific situation, and we do not decide what to inherit from a given culture. This is why most of the times we 'passively' receive what suits best for each pregiven situation we must face from time to time. Finally, this is what most of our habits are 'cumulatively' made of.

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