Traversal Hermeneutics: The Emergence of Narrative in Ergodic Media

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Abstract: Digital technologies are capable of simulating traditional media and to give rise to new media forms that often closely resemble the experience of somatic technologies. Their interactive capabilities are partially responsible for this, but procedural authorship and poïesis are supported by process intensity and generative potential.

Designers, the systems and their human operators have very different and maybe irreconcilable points of view, which profoundly affect their experiences during the dialogical construction of the works and of their effusions. From its particular point of view during the traversal, the operator develops a hermeneutic experience during which models and simulations of the system are built. The operator's actions within the system greatly contribute to this development, but it is their capacity to create theories of the system that is paramount to the success of this effort.

The analysis and critique of these digital artifacts, indeed the procedural pleasures attainable through these systems, are indissociable from their procedural understanding. Although traditional aesthetic studies of surface structures or outputs are still possible, once we regard behaviors and computational processes as an integral part of the system's content, it becomes essential to understand how the operator relates to these beyond a strictly mechanical relation.

This paper discusses how models and simulations allow the operator to anticipate the behaviors, reactions and configurations of the systems. How they are continuously revised, confirmed or falsified throughout the traversal, and how this process results in a dialectical tension that is the basis for the development of narratives and of dramatic experiences with these, otherwise highly abstract, systems.

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1. Artificial Aesthetic Artifacts

In his book *Collective Intelligence*, Pierre Lévy proposes a classification of the "technologies used to control message flow" (1997, 45) in three groups that he terms somatic, molar and digital. Somatic technologies are defined as those implying "the effective presence, commitment, energy, and sensibility of the body for the production of signs", and that are also characterized by the multimodal nature of the messages produced and by the uniqueness of each message, that is always produced in and dependent on a dynamic and complex context that inevitably affects it.

Molar technologies, that we usually simply call *media*, much as Lévy also does, "focus and reproduce messages to ensure they will travel farther, and improve distribution through space and time." (1997, 46) They are described as technologies that inevitably affect the production of messages but that "are not, as a first approximation, technologies for sign creation", rather for the "fixation, reproduction, and transportation of somatically produced messages." (1997, 46) Their capacity to create new signs is very limited, but it may be felt in media such as film, where the processes of montage introduce some potential for the generation of new messages for, "although the raw image or sound may be stored on the recording, the global message — the film — results from (...) montage." (1997, 46)

Digital technologies stem from digitalization, the "absolute of montage" that affects "the tiniest fragments of a message, an indefinite and constantly renewed receptivity to the combination, fusion, and replenishment of signs" (1997, 48) that preserves the power to record and distribute information while bringing the technologies closer to some of the characteristics of somatic technologies. This, however, only happens when digital technologies are able to retain a certain degree of what Chris Crawford called *process intensity*, "the degree to which a program emphasizes processes instead of data" (1987), and consequently retains some generative potential (Boden and Edmonds 2009). Perhaps naturally, given the way how we tend to relate to any new medium in the light of the previously existing media (Bolter and Grusin 1999, McLuhan 1964), digital technologies tend to follow on the steps of their molar predecessors, thus optimizing for constancy and effectivity, or for *data intensity*, instead of investing the technological resources in developing procedural and participatory traits (Murray 1997, 71). Many digital media are built with the explicit intent of simulating the traits of molar media rather than trying to escape from the conventions and limitations of previous technologies. We therefore find that in such cases, the potential of the technologies is not "effectively exploited" (Lévy 1997, 49), even if they are digital and computational.

> Processing data is the very essence of what a computer does. There are many technologies that can store data: magnetic tape, punched cards, punched tape, paper and ink, microfilm, microfiche, and optical disk, to name just a few. But there is only one technology that can process data: the computer. This is its single source of superiority over the other technologies. Using the computer in a data-intensive mode wastes its greatest strength. (Crawford 1987)

The code of these technologies is where the potential for procedural authorship resides (Murray 1997) but, while opening spaces of possibilities, code may also enforce strict

limitations within those spaces. The code is the *law* that governs these technologies and their products (Lessig 2001, 35), a law that one has no option besides abiding to, save for actually interfering with the code, something which may in some cases actually remain a possibility but that is far from being the norm when it comes to the experience of digital media.[1] Therefore, once one develops a digital medium as an analogue of molar media, one is building an experience that may have some benefits over the molar equivalent — such as speed, economy, etc. — but that may actually limit the freedom to explore and to reconfigure the messages being communicated. Aarseth (1997, 46) offers the example of William Gibson's 1992 poem *Agrippa (a book of the dead)* as a digital message that was built to force and preserve its linear integrity in ways that wouldn't in principle be achievable with molar media and that are strictly enforced by the nature of code.

We may therefore posit that if digital technologies allow us to develop radically new media and messages, they may also allow us to develop artifacts that outperform conventional molar media in regard to their specific traits. We are consequently faced with an ambiguous descriptor that may be equally applied to media with very diverse traits. For this reason we proposed the alternative designation of some digital media as *artificial aesthetic artifacts* (Carvalhais 2010, 2011b), a term that simultaneously points to their sensorial nature and to their essence as computational systems, as systems where computation is not only found at the *logical* or *code* layer (as defined by Lessig) but is also an integral part of the *content* layer.

Artificial aesthetic artifacts have the potential to develop what Christopher Alexander calls a "living structure" (2002): they are process intensive (regardless of whether they use data structures and of their complexity and extension), they are autopoietic and they are rich in procedural authorship.[2]

To consider a subclass of digital media as artificial aesthetic artifacts allows us to better understand the importance of the added dynamics and of the more complex user functions that are involved in their creation and experience. It allows us to better parse between digital systems that are closer in their nature and modes of operation to molar media and those that in some ways become more similar to somatic technologies. Artificial aesthetic artifacts become utterly dependent of their contexts of operation to develop messages that, regardless of the initial structures or of the intended final configurations are unique, messages that, in Lévy's words, become "inseparable from a changing context" (1997, 46). This was, of course, how Lévy described somatic messages, that are "never exactly reproduced by somatic technology" (1997, 45), and it is fitting to think of artificial aesthetic artifacts along the same lines. The contexts are necessarily different, perhaps at times less linked to physical settings[3] and more dependent on interaction, interpretation and on the procedural contexts at the core of the systems, a layer that, as we will see is difficult to perceive directly.

If digital technologies that simulate traits of molar media can, in some ways, be seen as stepping even further from the traits of somatic messages, we find that artificial aesthetic artifacts bring us closer to that original essence of the technologies for message production that are centered in the human body and that are dependent from it. If the focus of molar technologies can be described as *fidelity in reproduction*, that of artificial aesthetic artifacts may very well be *variety in every instantiation*. To keep recognizable structures or patterns between instantiations but to creatively infuse them with disorder, as suggested by Italo Calvino (qtd. in Aarseth 1997, 129).

1. Not quite with the experience of digital technologies. If in many occasions there is at least the theoretical possibility of accessing and editing the code of a digital medium, more often than not, that experience is not simple or straightforward, or it may not fit within the expectations of the users or readers.

2. We may identify this procedural authorship both in the author as well as in the readers, users or interactants, and even within the system itself, which may be the bearer of a considerable degree of autonomy.

3. Although this is naturally possible, as any message that originates in a digital medium must eventually be translated to sensorial stimuli before being perceived by humans.

Coprocessing (Aarseth 1997, 135), the human-machine regime of collaboration that is found at the heart of many of these systems, allows the conversational construction of the works and of their effusions. But as we will see, even non-interactive systems, or those where reader's inputs may be minimal, can be construed through iterative exchanges of information between the systems and their users.

According to Aarseth, cybernetic systems — as we may classify many of these artificial aesthetic artifacts — can develop three regimes of collaboration with the human, "(1) preprocessing, in which the machine is programmed, configured, and loaded by the human; (2) coprocessing, in which the machine and the human produce (...) in tandem; and (3) postprocessing, in which the human selects some of the machine's effusions and excludes others." (1997, 135) Alexander Galloway concurrently proposes the identification of *machine actions* and of *operator actions*, the first of these "performed by the software and hardware" (2006, 5) and the later by the human, clearly distinguishing them in scope but warning us of the artificiality of the division, as "both the machine and the operator work together in a cybernetic relationship", which makes both types of action "ontologically the same", existing as "as a unified, single phenomenon, even if they are distinguishable for the purposes of analysis." (2006, 5)

Notwithstanding this, if we want to understand the relevance of artificial aesthetic artifacts as communicational and artistic systems, we should be careful to maintain the distinction in the analysis because not only in the pre- and post- positions but also in coprocessing, the roles of the human operators are indeed different from those of the machines; perhaps more importantly, the points of view of the machines or systems (Bogost 2012) and of the humans at the different positions of collaboration may be quite different.

To better understand this, it may be useful to resort to Hunicke, LeBlanc and Zubek's *MDA framework* (2004), originally developed as a formal approach to game design and game research. The domain of computer games is of course one where we can find several artificial aesthetic artifacts, and one from where we can extrapolate a large quantity of knowledge for their study.

MDA, for *Mechanics*, *Dynamics*, *and Aesthetics*, is a framework for understanding games that aims "to bridge the gap between game design and development, game criticism, and technical game research" (Hunicke, et al. 2004) by proposing an approach by both the perspective of the designer and that of the player, two views through which we discover a wide range of possibilities and interdependencies in a system. MDA is developed from the assumption that games are characterized by a "relatively unpredictable" consumption, meaning that the "string of events that occur during gameplay and the outcome of those events are unknown at the time the product is finished", and that the main content of a game is its behavior, not the media that eventually "streams out of it towards the player." This is a sense in which we again discover code as the content of games, described as being "*more like artifacts than media*". MDA therefore formalizes the consumption of games by analyzing them in three distinct components: *Rules*, *System and "Fun"*; and establishing their design counterparts, described as: *Mechanics*, *Dynamics and Aesthetics*.

> **Mechanics** describes the particular components of the game, at the level of data representation and algorithms.
> **Dynamics** describes the run-time behavior of the mechanics acting on player inputs and each others' outputs over time.
> **Aesthetics** describes the desirable emotional responses evoked in the player, when she interacts with the game system. (Hunicke, et al. 2004)

Each of these three components can be considered as a "lens" to the game that is separate from, but causally linked to, all the others and that shapes the perspectives one may develop:

> From the designer's perspective, the mechanics give rise to dynamic system behavior, which in turn leads to particular aesthetic experiences. From the player's perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics. (Hunicke, et al. 2004)

We can therefore identify the layers of emergence in the system's becoming after the preprocessing stage, and consecutively understand the converse layers through which the player, reader or interactant may peer through in the dialogue with the system. The more a system is characterized by process intensity, the more complex will the emergences from one layer to the next be, the more control and agency (Murray 1997) the author may need to offer to the user, to the system or both.[4] Therefore, by focusing and filtering the perspectives, each of these layers inevitably affects the degrees of control that each coprocessor can have within the system.

4. We often refer to user as a singular human counterpart in the system's operation. We should however note that very often this user can of course be plural, and distributed, both in space and time, or the user's role can be occupied by another artificial aesthetic artifact, or by parts of the same artificial aesthetic artifact, itself a very singular form of plurality.

3. Reader's Roles

Although Aarseth doesn't use the term *consumption*, he addresses the unpredictability of the experience of ergodic texts[5] — and by extension of other ergodic media — through the analysis of their traversal function, the mechanisms by which units of the system are revealed as surface structures that are presented to the human operator. The analytical model — Aarseth's "textonomy" — developed in *Cybertext* is built as a descriptor of the artifacts according to their modes of traversal, each variable focusing on different aspects of the traversal function that uniquely characterize each of the systems: *Dynamics*, *Determinability*, *Transiency*, *Perspective*, *Access*, *Linking and User Functions* (Aarseth 1997, 62-64). In spite of the "relative neglect of the political, social, and cultural contexts in which texts are used" and of the "interactions of different modalities within electronic texts" (Hayles 2005, 36), the model is nevertheless possible to apply to similar traits in systems whose primary function is not "to relay verbal information" (Aarseth 1997, 62) or with outputs that are not exclusively verbal, although there is room for improvement and completion by expansion with further variables (Carvalhais 2010, 2012).

Trough the traversal, human operators always develop an interpretative function, similar to that we can find in more conventional media, where all decisions made by the reader only concern meaning. In the case of ergodic media and of artificial aesthetic artifacts, this interpretative function may be accompanied by three additional functions

5. "During the cybertextual process, the user will have effectuated a semiotic sequence, and this selective movement is a work of physical construction that the various concepts of 'reading' do not account for. This phenomenon I call ergodic, using a term appropriated from physics that derives from the Greek words ergon and hodos, meaning 'work' and 'path'. In ergodic literature, nontrivial effort is required to allow the reader to traverse the text." (Aarseth 1997, 1)

postulated by Aarseth (1997, 64): the *explorative function*, in which decisions can be made regarding which paths to take along the traversal; the *configurative function*, in which the order of the parts can be rearranged and the navigable structure can be created, shaped or influenced, more than just explored; and finally, in Aarseth's model, the *textonic function*, in which these parts can be permanently added to the (textual) system. We can generalize Aarseth's textonic function by shifting its focus from textual structural components towards any component of the system's outputs (regardless of their nature or modalities) or even of the system's code, thus calling it *structural* (Carvalhais 2011b, 375).

Aarseth's user functions are very good descriptors of the nature of the human operator's cybernetic interactions with the system. The omnipresence of the interpretative function can perhaps be seen as an extraneous emphasis, especially on media from which verbal structures are so often absent and where high levels of abstraction further remove one from any apparent meaning in the systems' emanations. Markku Eskelinen, for example, warns us of how in computer games, "we interpret in order to be able to configure and move from the beginning to the winning or some other situation, whereas in ergodic literature we may have to configure in order to be able to interpret" (2001), thus displacing the primacy to the configurative function (Bogost 2006, 108). In spite of this view, and regardless of its dominance over any of the other functions, interpretation is nevertheless prevalent.

And interpretation becomes especially important in the experience of artificial aesthetic artifacts because, besides semantic interpretative acts — that may or may not occur depending on the nature of the system's sensorial outputs, of which particular symbols are produced, etc. — there are several aesthetic interpretative acts that need to be performed in order to achieve a *poetic* understanding of the system. Much as machine and operator actions fuse, so we may propose that semantic messages "expressible in symbols, [and] determining translatable, logical decisions" and aesthetic messages, "determining interior states, [that are ultimately] untranslatable" (Moles 1966, 167) may also become somewhat indistinguishable in the exchanges with the aesthetic artificial artifacts.

At the layers of mechanics and dynamics, systems most often operate in a space of possibilities that anticipates the differentiation of modalities (Hansen 2004) that happens at the layer of aesthetics. When confronted with the modal outputs of the transcoded processes, the human operator tries to deduce meaning from them, not only a message that may be communicated but also clues to the procedural nature of the outputs, to their origin and significance. As so often happens in other contexts, humans try to identify a *design stance* that explains the purpose of inanimate objects, and *intentional stances* that point to the why of the behaviors of animate objects, to their motivations and emotions (De Landa 1991). Although crossed and combined, and eventually arbitrary (i.e., not trivial) in their relation to the previous two layers, these outputs — symbols and behaviors — are the only hints, the only points of access the operator has to the "internal, coded level", that "can only be fully experienced by way of the external, expressive level." (Aarseth 1997, 40)

> When inactive, the program and data of the internal level can of course be studied and described as objects in their own right but not as ontological equivalents of their representations at the external level. (Aarseth 1997, 40)

An alternative way of understanding this relation is put forward by Douglas Hofstadter, that explains that "although what happens on the lower level is responsible for what happens on the higher level, it is nonetheless irrelevant to the higher level", which "can blithely ignore the processes on the lower level." (2007, 43)

So, although artificial aesthetic artifacts can still be subjected to traditional aesthetic analysis at the level of their outputs, the operator needs to develop a more comprehensive procedural interpretation of the system, in order to understand, decode, and ultimately, to relate to their mechanics and dynamics layers.

Through procedural intuition (Strickland 2007) and the interaction with the system, the human operator starts to build hypothesis about the mechanics and dynamics layers of the system. These hypothesis are developed as simulations of the system or of its constituent parts, simulations that are not consciously created but that nevertheless provide the operator with possible scenarios about the system's outputs or behaviors, about the causal procedurality of the phenomena she interacts with (Dehaene 2009). This task is aided by cognitive processes of *patternicity* (Shermer 2011, 5) that seek patterns amidst the manifest sensorial clues in an effort to reduce complexity and to make "many symbols that have been freshly activated in concert to trigger just one familiar pre-existing symbol (or a very small set of them)." (Hofstadter 2007, 277)

Upon *establishing patterns*, the operator adds meaning to them, through processes of *agenticity* (Shermer 2011), through which she endeavors to operate along the same lines as the system (Metzinger 2009, 176), by emulating its operations and quite literally, by simulating it. These mental simulations can be developed concurrently, posing parallel hypothesis that are evaluated against each other — in their capacity to generate valid predictions or approximations to the actual behaviors of the system — and against the system itself — in the frequency with which the hypothesis are validated. The various simulations can consequently be adjusted and the models evolved in a process where the system (i.e., the external phenomenon) is used as the fitness function for the selection of the best models or simulations that are produced by the operator. During the course of several iterations (and interactions), the operator may therefore be able to develop a working model of the system, a theory of the processes within it, a theory of the artificial aesthetic artifact.

This set of simulations allows the operator to try to peer at the system from the point of view of its designer, from which the system is encoded with prescriptive rules, and even from the point of view of the system itself, a position better rendered by descriptive rules (Carvalhais 2012).

> [Theory of mind] refers to your ability to attribute intelligent mental beingness to other people: to understand that your fellow humans behave the way they do because (you assume) they have thoughts, emotions, ideas, and motivations of more or less the same kind as you yourself possess. In other words, even though you cannot actually feel what it is like to be another individual, you use your theory of mind to automatically project intentions, perceptions, and beliefs into the minds of others. In so doing you are able to infer their feelings and intentions and to predict and influence their behavior. (Ramachandran 2011, loc. 2632)

As with the development of theories of mind towards humans, animals or other entities, either real or fictional, the development of a theory of an artificial aesthetic artifact may very well stem from "an innate, intuitive mental faculty" (Ramachandran 2011, loc. 2632), a capacity that is so far unique to humans (Dehaene 2009, loc. 194).

Although, as postulated by the MDA model, while interfacing with the aesthetics layer of the system, the operator may be unable to have a clear view of the dynamics and mechanics layers, through these processes of simulation she effectively tries to reverse her view of the system, even if ultimately following models that are incomplete or altogether erroneous.[6] It is regarding the validation of these models that the next step in the exchange is taken.

6. Incomplete or erroneous models can nevertheless produce accurate enough predictions of the outputs or behaviors of a system. So a good simulation is not necessarily just an accurate simulation, rather it is an effective model for the anticipation of the system. (Carvalhais 2011a).

4. Dramatic Arcs

Traditional narratives are a fertile ground for the development of theories of mind — for characters and events, for narrators or even maybe the imagined authors — and for hypothesis of procedural causality — for mechanical events and natural phenomena. Provided the narrative is internally consistent, the reader or spectator is able to infer from the known events and information and to speculate about the narrative developments, anticipating its evolution and resolution. The reader can conjecture about narrative arcs, stable situations and unbalancing accidents, about events, goals, obstacles, commitments, protagonists and antagonists, eventually reconciling estimations as the narrative unfolds. Once the narrative is over, any further reading will most likely be aided by recollection and memorization than by further speculation and simulation, due to the stability of the narratives in these technologies.

A similar process is developed during the experience of artificial aesthetic artifacts and, while memory may also serve a role, due to the unpredictable nature of these systems — the indeterminate and unstable nature of the traversal function, according to Aarseth (1994, 61–62) — the processes of simulation must be developed even in rereadings, where the same systems may, for a variety of reasons (including, but not limited to, the operator's interactions) produce very dissimilar outputs.

The operator is constantly led to the production of models and to the resulting building of expectations to be confronted with the systems. This effort results in a dialectical pull between confirmation and violation of expectations that leads to a dramatic tension that characterizes artificial aesthetic artifacts and is a setting for the development of narratives. This is not only the aporia-epiphany pair that was identified by Aarseth in hypertext literature, at least not in the terms he proposed it, but he was certainly right in that this pair, although not being a narrative structure on itself, "constitutes a more fundamental layer of human experience, from which narratives are spun." (1997, 92)

Traditional narratives, due in part to their lower (or even absent) process intensity, relinquish procedural authorship and set the narrative in data to be replayed and perform it, presenting the reader with a single unified path to traverse. Artificial aesthetic artifacts make use of procedurality to build unique dramatic arcs from the variations and the space of possibilities that is opened by their computational nature, from the interactions and the simulations developed by the operator. These narratives tell the operator's personal story, a story that could not be without her (Aarseth 1997, 4), a story that absolutely depends on her to be shaped and formed.

This leads us to regard Aarseth's *perspective* variable, that may be so difficult to understand in the context of abstract and non-verbal artifacts, as something that far from just describing the operator's playing of "a strategic role as a character in the world [of the system]" (1997, 62), actually inscribes her as inseparable from the work, or from the particular instance of the work as it is experienced, imagined, theorized and experienced by her.

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