Strumenti digitali e collaborativi per le Scienze dell'Antichità

a cura di Paolo Mastandrea

Perceptual, Grammatical and Hermeneutical Dimensions of Digitality

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Abstract Taking the work on the graphemic and morphemic analysis of the cuneiform texts of Ebla as a starting point, the paper reviews the 'grammatical' criteria that make digital coding not only more efficient and dynamic, but also intellectually more in tune with the goal of establishing an argument and unfolding a narrative. This throws light on aspects of software application on the one hand (such as the semantic web) and of the digital humanities on the other, ranging from textual to archaeological data.

Summary 1 Foundations. – 2 Perception. – 3 Grammar. – 4 Hermeneutics. – 5 Bibliographical note.

Keywords Digitality. Digital thought. Perception. Grammar. Hermeneutics. Prehistory. Semantic web. Narrative.

1   Foundations

If we consider seriously the prehistory of digitality, we are lead much farther back in time than one would expect. Such a perspective is helpful not because of an antiquarian interest, but because it helps us to become aware of unsuspected roots that deeply influence our stance today.

It is in fact far from irrelevant to go back to even the beginning of our species, over two and a half million years ago. A major feature that distinguished the first hominini from other members of the animal family was their ability to create contiguity where there was none. Shaping a stone into a tool entailed awareness of a structural template: on the one hand, the perception of the rough stone was accompanied by what, on the other, may be called a para-perception of the tool. The two perceptions, the stone and the tool, were present in the mind of the hominini before and during the execution. The inherent dynamics of this bracing of discontinuities had immeasurable consequences: it was the essential precondition of experimentation, which started our species on a road to progress that was unknown to other species.

The beginning of language signalled the next epochal step, some sixty thousand years ago. The bracing of discontinuities was extended to a

point where perception as such could be objectified in the form of words: one could conceive and name both the stone and the tool, irrespective of whether they were present to the speaker and/or the listener. Even more importantly, humans were now able to objectify, through syntax, the very bracing that linked elements that were otherwise distant from each other: they could linguistically describe the process itself of shaping the stone into a tool. Discontinuity extended, in other words, to a level where perceptions were no longer immediately tied to sensation. Perceptions and their dynamic correlation had acquired a conceptual and linguistic identity of their own: they were embodied in a reality, language, that was independent of the original reality to which it referred.

This new reality was, however, still tied to the physical confrontation between speaker and listener. Writing broke the barrier, some six thousand years ago, by providing what emerged as the extra-somatic embodiment of perception and of its linguistic conceptualization. The bracing of discontinuity was now placed outside the brain, in the physical medium that embodied the pertinent words. As a result, the potential for manipulation was incalculable. Thought had become fully reified and could be confronted as a thing in its own right, however closely linked to its original referent. A new contiguity of the discontinuous was now possible: a writer could place and a reader could see – physically side by side in their new graphic incarnation – things and processes that could not otherwise be seen.

In the written medium, such new contiguity was permanent, so much so that we can 'read' it millennia after it was written down. But it was static: it had to be activated by a reader. And here we can see how radical is the innovation brought about by digitality. While, at first, para-perception made the association of discontinuous perceptions possible; while, then, language and logic introduced the structuring of these associations on a somatic level; while, finally, writing provided a static extra-somatic extension of the same – digitality has now given us an *active* extra-somatic extension: structured perceptions can now interact with each other outside of the human brain. It is the only cultural innovation that can be placed on the same level as the other three epochal revolutions – para-perception, language, writing. The digital revolution is, indeed, an axial moment in cultural evolution.

There is a common thread that runs through the phases of development I have just outlined: it is the progressively greater distance among perceptions, on the one hand, and the equally progressive strengthening of the bracing power over them, on the other. At each step, both distance and bracing were magnified by being objectified through words and syntax first, then through the written signs, and now through digital programming. It is not as though perception could be bypassed at any one of these stages. Perception remained the controlling mechanism at all stages, starting the bracing and then judging the outcome. The finished stone tool, the

word and concept that expressed it, the written symbol that gave it a parallel tangible existence: they were all the result of a bracing of perceptions and they all, at the same time, offered sensations of a wholly new order for perception to internalise in turn. It is no different with digitality – as I will endeavour to show.

My personal research relating to the digital medium has been in the area of both textual and archaeological data from ancient Syro-Mesopotamia. With regard to the texts, I dealt with graphemic and morphemic analysis of the text from Ebla (dating to the 24th century BC), and a large corpus of Old Babylonian letters (18th and 17th century BC). I started at the dawn of the digital age, in 1968, and have continued throughout the remainder of what is by now almost half a century, establishing various grammars and writing pertinent programmes. With regard to archaeology, I brought the first personal computer to the field on an excavation in Syria in 1978, and I have continued to the present day through all the intervening stages of hard- and software development. I will not present here the technical aspects of these projects, which I did elsewhere. Instead, I wish to describe two factors that I found to be recurrent in my effort. I was drawn to reflect on these constants precisely because of the unrelenting process of change that was taking place in digital technology. In the fascinating whirlwind of innovation, which we eagerly adopted while just as eagerly waiting for what would next take its place, these two anchors remained firm, never overtaken. The first was the sense that human perception retained the commanding role at all times: the systems could not be auto-referential to the point of making human judgment irrelevant. The second was the realisation that the logic of structuring was upstream of all implementation, a logic that I describe under the heading of grammar. It is on the basis of these considerations that I will then draw some conclusions about the wider reach of digitality in terms of hermeneutics, especially in relationship to the humanities.

2 Perception

We will first address the question of perception. How does digitality impact the way in which we perceive the data? At its core, my answer relies on the historical (and *pre*-historical) argument developed above, concerning the bracing of discontinuities. Digital analysis confronts levels of discontinuity that are immeasurably greater and develops bracing mechanisms that are immeasurably more powerful than one could ever have expected before. And yet, the challenge in facing perception has remained the same. At the end of the line, processed data are offered to human perception and judgment, in ways that ultimately summon a confrontation similar to the one faced by humans and hominini in the other situations. The major

substantive difference is that the bracing itself is now inscribed in mechanisms that are outside of the human mind. Still, they call for a perceptual response that relies on an analogous human potential. We must assess more closely the nature of this confrontation.

Think of the size of the data we control, and of the degree to which we can articulate this control. In the case of Ebla, we have a total of some 173,000 words and almost 350,000 cuneiform signs; in the case of the Urkesh archaeological material, a total of almost 16 million records from only seven excavation units at the site. Each entry is tagged according to a rich categorization system, so that an equivalent count by attributes would reach a total many times over. Now, two observations help to put this in perspective, especially as we compare the perception resulting from digital processing with the one that immediately preceded it, based on physical card files.

1. In the digital world, we gain a perception of the whole because we can give precise totals that can be updated instantly; because we can just as instantly call for subdivisions and subgroups, adjustable with even the slightest change of parameters; and because we can see these groupings represented graphically in the form of pie charts or bar histograms. These results, and more, summon a specific perceptual response. The author caters to such perceptual dimension by seeking the best way to convey the nature of the corpus. The users expect this and adjust their response accordingly: they can criticise the formulation chosen by the author because such a reorganisation of the material is by now second nature to all. Our perception of the very role of quantification has changed. The perceptual response that writing had introduced into the world of orality helps us understand this: thousands of animals listed on a cuneiform ledger gave a perception of a 'herd' that was independent of any perception resulting from a physical confrontation. The king who had never even been to where the animals were would know the amounts from the graphic equivalents given on a cuneiform tablet, through the further filter of a scribe who would interpret the writing. The physical appearance of the signs incised on clay provided a guarantee of its correspondence to the animals as physical referents: the perception of these signs had replaced the perception of the original. Farther back in time, when first introduced, language had made it possible to have words for individual animals and the ability to combine them syntactically into new logical wholes. Naming animals and describing the process of herding created a new perception of the world: it was as if animals and their clustering had been invented for the first time. Sheep and herds had existed all along: but 'sheep' and 'herd', as words and concepts, placed a

completely new configuration on the way in which the same reality was perceived and reckoned with.

2. On the other hand, we lose, in the digital record, any perceptual connection with the single digital elements seen in their totality. It is wholly beyond perception to see the millions of records of the Urkesh database, or the tens of thousand of the Ebla digital archive, in their juxtaposition, because they are deeply hidden in the vast construct of a multi-tiered website. You can of course summon any single element at will, and you can see them clustered in new and unexpected ways. But the notion that they are there is taken on faith, in terms of perception. It is never like looking at a large book, or a multi-volume series, and see even just from the spines of these volumes how sizeable the whole really is. There is, truly, no overall perception of a digital whole. This may be contrasted with the pre-digital eras. A ledger, whether on a large clay tablet or in the form of a printed spreadsheet, provides such an overall view of the whole. The individual daily records may be detailed in separate documents, but the ledger as such, even one with many pages and subsections, has a perceptual consistency of its own. In the digital dimension, elements that are not contiguous are brought together in such a way that a new contiguity emerges, which transcends the physical dimension. It is a contiguity that is recreated conceptually and offered up to a higher level of perception, one on which a new judgment is exercised. What holds the pieces tightly together, in their enormous quantity and differentiation, is the grammatical scaffolding that supports them.

3 Grammar

The underlying factor that is instrumental in bringing about this new contiguity is the enhanced ability to brace the distance. This does not happen in a vacuum. The linking of discontinuity is far from haphazard: rather, what is being brought together is predisposed to such bracing by virtue of its very nature. We may think of such a predisposition as a tensional factor that is inherent in the structural make-up of each element: the template of a stone tool is inherent in the rough stone, since the toolmaker has to assess the size, shape, hardness, etc., of the material at hand in order to derive from it a given finished tool; as a digital equivalent, the clustering of a number of objects into a class of, say, clay conical cups depends on the formal attributes applied by the potter and exhibited by the individual items.

There are, we may say, two parallel notions of grammar. The first is constitutive: it is the actual coherence of the data. The second is reflective or descriptive: it identifies and conceptually defines such structural

coherence. A conical cup tends of its own accord, at the time of its making, to be clustered with other conical cups: this is the constitutive grammar. Conversely, we conceptualise the attributes that are inherent in the data and, thus, establish the corresponding descriptive grammar. The term 'ontology' is quite appropriate in this respect: it refers to the intrinsic nature of the data as well as to the formalization we give of it. My choice of the term 'grammar' over 'ontology' is due to the fact that it more adequately emphasises the tensional dimension of the elements with each other (in addition, I prefer to restrict the term to its function in classical philosophy). To use an example from the grammar of English: the moment I start a sentence (e.g. 'When I first arrived in…'), a whole series of constraints is set in motion, which limit the possible ways of continuing the sentence. This is the tensional factor: the preposition 'in' tends to, or expects, a reference to a location; the temporal clause tends to, or expects, a given resolution, invoking some and excluding others. It is in the nature of all structures to have components that are so tensionally linked with each other – hence, the constitutive dimension of grammar –, whereas the descriptive dimension reflects the conceptualization we give of it.

A digital grammar raises the ability to identify the most minute filaments in this tensional network of relationships, and to fully control their dynamics. An essential component of this is the phenomenon of capillary nesting. As far back as the pre-linguistic stage, we can infer a taxonomic awareness that even then could become progressively more complex, i.e. more intrinsically nested. The various tool kits reflect internal subdivisions where the types are clustered depending on degrees of differentiation and of similarity at the same time. Language and then writing make it possible to relate to these categories in an increasingly more pronounced definiteness, whereby the nesting itself receives its own expressive identity. A blade will be nested with others depending on whether they are made of stone or metal, on the size and shape, on the function and style, etc.

What is immensely more developed in the digital system than ever before is the almost unlimited extent to which such capillary nesting can be implemented. This is a central dimension of grammar. Capillarity means that the tensional bracing can be seen in the form of an inverted tree, where progressively lower nodes subsume clusters of attributes that come closest to the original organisation of the data. Nesting refers to the way in which some nodes are subsumed under higher ones. The power of the digital approach is that through such a capillary system one can instantly reach the lowermost nodes and the single elements that are included therein, regardless of how complex the system is.

Capillarity ensures continuity within discontinuity. While discontinuity refers to the de facto separation among items, continuity refers to the presupposition of hidden tensional linkages among them. If the uppermost node is, let us say, the archaeological site, there is, at first blush, no con-

tinuity between it (the site conceived as a whole) and the smallest sherd found in a deep trench. Or rather: the continuity is presumed given that the sherd is part of the site, but there is no immediate and apparent way to trace it. That is what digital capillarity makes possible. Inscribed in a grammatical system that defines the tensional qualities of each element, it describes conceptually the equivalent of the nervous system that links together all the intervening stages from the topmost to the lowermost node. This is due to the tagging that a proper grammatical categorization system recognises in the data. An ideal morphing is not an arbitrary overlay, but rather the conceptual result of making reality transparent. The enormous flexibility of digitality makes it possible to increase such transparency to the utmost. We can highlight here four aspects of the process.

First, atomism. The minimal constituents must be really minimal. At the very start of the confrontation with the data, digitality reduces the urge to interpret: the single record exists in its most elementary quality, and only its immediate formal traits are registered. In this perspective, one can understand the significance for atomism of two diverse areas of interest. (1) In archaeology, the record emerges at its most disconnected from the excavation, and it must be kept rigorously in this condition to provide the best possible measure of objectivity. (2) The whole emphasis of the semantic web on individual records instead of documents builds on the same premise: the records are tesserae of a mosaic that has to be constructed subsequently, and not concurrently, with the definition of the single record.

Second, predictability. A grammatical system is predictable in the way in which the individual elements relate to each other. It is for this reason that the elements, starting from the atomistic nature of their original disposition, fall into a unity. Thus, the application of a proper grammar to the archaeological record of an excavation makes it possible to predict, and therefore to project, a variety of ways in which the elements, as atoms within the system, can cohere into a tiered system of meaningful wholes.

Third, exclusivity. Exclusivity is an important result of predictability. The relationship among elements is univocal, i.e. 'exclusive', in terms of what it tends to and what it excludes. The phrase 'I run…' excludes a large number of possible ways to complete the sentence (e.g. it cannot be followed by 'yesterday'). A fundamental heuristic benefit of this is the opportunity of making statements of impossibility as to the occurrence of given relationships. The ultimate validity of such statements hinges on the size and quality of the sample and, thus, must be calibrated accordingly.

Fourth, automation. Given predictability and exclusivity, i.e. given a proper definition of the categorization system, one can automatically make explicit for each item a given attribute cluster that is otherwise implicit. Just as the phrase 'I run' is immediately understood as having the attributes of first person present of a given verb, so a programme can extract

from a textual string or from the digital representation of an artifact a wide set of attributes that establish correlations with all other strings and artifacts. This requires a special grammatical attention to the quality of the input: it has to be conceived as embedded in the same structural system that the grammar defines and can then operate on

These aspects of a digital grammar explain why the search function is such a prominent feature of digitality. One can reach for the most minute individual items, and for their clustering into complex groupings, in answer to the most specific question we may want to pose. That is the hallmark of the use of the digital medium in all its forms. But there is another aspect that is potentially just as far-reaching, but is not sufficiently implemented, especially in the humanities and social sciences. It is the opportunity of having an argument develop from the way the fragments are reconstituted. In section 1 above, I have stressed the active dimension of digital data in comparison to a written non-digital record, and that is because digital data are processed outside the mind. But the data so organised remain passive in one respect, namely because the building of an argument is generally left to the querying and the sorting that one applies to the data, since there is no unfolding narrative in a database. The underpinning of the grammar makes this possible, to the extent that the data can be organised automatically along progressive lines of significance. It is in this respect as well that the theory of a semantic web operates: reconstituting the individual records as fragments in an ordered sequence that follows the logical order of a sequential narrative, thus proposing more than a series of reconfigured clusters of data.

4   Hermeneutics

Grammar is essentially inner-referential: the coherence of a system is described in function of its own structure. Extra-referentiality, on the other hand, means that the value of a system is in function of a referent that is external to the system itself. Of this, there are two distinct types.

In the first type, the referent is chosen by the observer. It is fully defined from the start, which means that the nature of the referential range is under the control of the observer. To give a banal example: if we want to assign a chromatic value to a given set of items, and we choose a given scale external to the set of data, e.g. a Munsell colour chart, then a judgment about the interpretation of the colours stands and falls only with reference to that specific scale. It is the approach that is normally described as -etic or, better, (e)-tic, given the etymology of the suffix.

In the second type, the referent is assumed to be given within the cultural system from which it originates. Thus, the structural system of the three colours red-yellow-green at a street intersection depends not on the

precise chromatic value of the colours, but on a convention that builds on the contrast among the colours. The external referent is in this case the control of the flow of traffic – something that is second nature to us as being part of the culture that has designed the system. For an extraneous observer, the judgment as to the validity of the referent would not be immediately transparent. It would have to be inferred as to its effect from various observable correlations (the traffic stops at red, etc.), and as to its deeper nature in the measure in which it can be deduced from higher level correlations, which are not necessarily observable (in the case of the traffic light, the deeper nature is a convention accepted by vehicular traffic and not, for example, the result of a hidden power of the traffic light device). The progressively greater distance from observable facts makes interpretation less and less assured: herein the hermeneutic risk.

The first type of extra-referentiality is, as a matter of fact, an expanded grammar, i.e. a grammar where the external referent becomes an element of the grammatical system to which it refers. The correlation is grammatical in nature because, by positing the referent, the observer institutes a set of correlations that is univocal and explicit. Thus, adopting a colour scale to refine the taxonomic organisation of a given class of items means that the grammar is expanded to include a new roster of variables and lexicon of variants.

The second type of extra-referentiality, on the other hand, is specifically hermeneutical. Hermeneutics proposes factors that are presumed to be the hidden spring for a given constellation of factors. The case of the traffic light is simple and obvious to us, but for an observer wholly outside our culture the notion of a convention would have to be identified as being the factor that explains the various aspects of the flow of traffic. Here lies the hermeneutic risk, that is intrinsically a part of the extra-referential system for which the external referent is not posited by the observer.

These considerations have important consequences for the central themes of our *Convegno*. We may discuss them from the point of view of digital humanities. The concept is generally understood in the sense that data of a certain type (especially texts, and generally ancient texts) are processed through a variety of programmes. One aims for greater complexity of the data and for more sophistication in the way in which they are processed. The progress in the last few decades has been astounding. What has expanded immensely beyond limits that were long since established is the grammatical approach to the data: through programming, we propose ever new, and ever more challenging, parameters that function as external referents in re-organising the data. Being grammatical, it proposes a mechanical certainty that is in line with the model of the 'exact' sciences.

It goes without saying that this is of primary significance, and I have myself engaged fully in the venture. But it has often obscured what is even more important, namely the hermeneutical dimension of digitality, to which

we may refer as digital humanism. What makes the effort humanistic is not the nature of the data (such as texts), but rather the approach that accepts the risk of an external referent that is not posited by the observer. The role of digitality is then to present to the observer the broadest range of correlations on which the power of judgment can thus be applied. It offers, as it were, multiple re-configurations of the data to the observer's perception, which remains the judge. Herein lies, in my view, the unsurpassable limit to artificial intelligence, and the profound uniqueness of a humanistic mode of thought. I have given the definition on 'digital thought' to this new perception that digitality makes possible: it is the mode of thought that relates to the immensely powerful means we have to master discontinuities and rearrange them into a kaleidoscope of new contiguities.

We may thus better appreciate my initial comments about the foundations of digitality, which are in effect the foundations of digital thought. The progress of our species has rested on the ability to brace discontinuities in nature. What digitality has done has been to bring such bracing to the nth power. Conversely, this also shows the continuity across the vast gulf of time between us and the forebears of our species. Risk and experimentation have rested all along on the ability to brace discontinuities and to draw inferences from that. We are still progressing on the same road.

The title of our meeting, *Risorse digitali e strumenti collaborativi per le scienze dell'Antichità*, offers an apt formulation of the points I have been raising. A scientific approach to antiquity requires a grammatical structuring of the data, and 'resources' and 'instruments' are mechanisms that offer up to perception the results that have been thus made possible. The logo of the *Convegno* is evocative of the same: a library that seems to progressively vanish in the distance, as if escaping the control of the digital tablet in the foreground, is shown. The exact sciences would know only grammar, only the tablet in the foreground; they would know no hermeneutics. Digital humanism starts from the tablet, from these immensely powerful means of control over the data. But it then looks in the depth, accepting the risk ensuing from a reduced measure of control, but a richer appropriation of perceptions.

Bibliography

Rather than focusing on the specifics of individual systems, I have chosen to give in this article the conceptual and methodological foundations of a long research I have developed over the years, which included my direct involvement with the writing of various dedicated suites of programmes. These specifics I have dealt with in the publications listed in the relevant websites to which I give a reference below.

Of the pertinent literature, I will cite here only the most recent book by Federica Frabetti, *Software Theory. A Cultural and Philosophical Study*, London-New York 2015: it gives a thoughtful assessment of current trends and develops an original approach to the concerns I address here, starting from however different presuppositions and data.

For my work on digital projects in general I refer to the extensive entry on digital analysis in my personal website (`giorgiobuccellati.net`).

For the digital analysis of graphemics and morphemics in textual data, in particular with regard to the Ebla archives, see the website `cybernetica-mesopotamica.org`.

For the digital treatment of archaeological data from the excavations at Urkesh see the website `urkesh.org`.

The, see: Buccellati, Giorgio (2017). *A Critique of Archaeological Reason*. Cambridge: Cambridge University Press. URL `critique-of-AR.net` (2017-11-13).

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ABSTRACT

Il libro costituisce l'esito di un Convegno internazionale di studi tenutosi all'Università Ca' Foscari nel 2014, e si propone quale momento di riflessione sopra le opere di digitalizzazione e ricerca condotte a livello accademico su materiali e testi inerenti alle Scienze dell'Antichità. I contributi in esso raccolti rispondono all'esigenza di porre a confronto esperienze maturate in ambiti disciplinari apparentemente distanti fra loro (dall'archeologia all'epigrafia, dalle letterature antiche e premoderne al diritto romano) ma accomunate da punti di contatto significativi. Lo scopo è di individuare nella collaborazione interdisciplinare nuove linee di ricerca, capaci di estendere le potenzialità degli attuali sistemi automatici di indagine.

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