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## E-text.

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## Summary

Electronic text can be defined on two different, though interconnected levels. On the one hand Electronic text can be defined by taking the notion of 'text' or 'printed text' as the point of departure. On the other hand, Electronic text can be defined by taking the point of departure in the digital format in which everything is represented in the binary alphabet. While the notion of text in most cases lend itself to be independent of medium and embodiment, it is also often tacitly assumed that it is fact modeled around the print medium, rather than for instance hand-written text or speech. In late 20th century the notion of text was subject to increasing criticism as in the question raised within literary text theory whether there is a text in this class? At the same time the notion was expanded by including extra linguistic sign modalities (images, videos). Thus, a basic question is whether electronic text should be included in the expanded notion of text as a new digital sign modality added to the repertoire of modalities or whether it should be included as a sign modality which is both an independent modality and a container in which other modalities may be contained. In the first case the notion of electronic text would be paradigmatically formed around the ebook conceived as a digital copy a printed book, but now as a deliberately closed work. Even closed works in digital form will need some sort of interface and hypertextual navigation which together constitute a particular kind of paratext necessary for accessing any sort of digital material.

In the second case the electronic text is defined by the representation of content and (some parts of the) processing rules as binary sequences manifested in the binary alphabet. This wider notion would include for instance all sorts of scanning results whether of outer cosmos or the inner of our bodies and of digital traces of other processes in between these (machine readings included). Since others alphabets, like the genetic alphabet and all sorts of images may also be represented in the binary alphabet such materials will also belong to the textual universe within this definition. A more intriguing implication is that digital born materials may also include scripts and interactive features as intrinsic part of the text.

The two notions define the text on different levels centered on the Latin and binary alphabet respectively and both definitions will include hypertext, interactivity and multimodality as constituent parameters. In the first case hypertext is included as a navigational, paratextual device, while in the second case hypertext is also incorporated in the narrative within an otherwise closed work or as a constituent element on the textual universe of the web where it serves an ever-ongoing production of (possibly scripted)

connections and disconnections between blocks of textual content. Since we are only in the very early years of the globally distributed universe of web texts, this is also a history of the gradual unfolding of the dimensions of these three constituencies (hypertext, interactivity and multimodality). The result is a still expanding repertoire of genres including some emerging via path dependency, some via remediation and some emerging as new genres unique for networked digital media including for instance 'social media texts' and a growing variety of narrative and discursive multiple source systems.

**Keywords**
digital media; digital text; e-literature; hypertext; media text; materiality and media; Humanities Computing; Digital Humanities; writing space; language of new media

**E-Text and Hypertext**.

Among the results of the spread of digital media are also disturbances in the array of core notions: 'text', 'work', 'document', 'corpus', 'collection', 'archive', 'machine' and 'materiality'. Each was complex and unstable before they were mobilized to deal with digital materials, but digital media brings a set of still developing properties, which cannot but add to the complexity given the fluid and dynamic nature of these media. In spite of this, the notions have prevailed even if they are reinterpreted to deal with a fast-growing variety of digital materials. The notion of e-text is a very significant case in point. One reason is that the foregrounding of the 'electronic' aspect is an obstacle to many theories of text. It is often doubted that e-text can actually be made into a concept. The notion refers to physical characteristics, which did not enter into previous conceptualisations of text. A second reason is that the role of the medium for the messages, insofar as this issue is accepted, is subject to a variety of interpretations. A third reason is that both the conceptualisations of the electronic and the textual component are subject to changes in ways which bring the relation between the two components into play.

The disturbances have important empirical and historical dimensions. The physical production of printed texts and the features characterising digital media are constantly developing. Today printed texts are usually produced with help of an e-text. As a result, they can be printed in any number, at any place, in any design and format, and any time within the contemporary networked media landscape. How it will affect the concept of a document, work or an edition, not least a scholarly edition, remains to be seen. Digital media provide printed texts a range of characteristics not available with former print technologies. However, the disturbances go further.

Regarding the notion of text, there is no commonly agreed upon definition of the meaning of 'electronic' or of the constellation 'e-text' and it is not clear what sort of materials should be included. A fundamental question is whether e-texts forms a subcategory of linguistic texts as opposed to for instance, printed texts and electronic images or whether it

establishes a new distinct category with its own set of characteristics and within which digital linguistic text is included.

If e-text is considered a subcategory of text, it is primarily defined as a digital representation of linguistic text whether written or printed. Eventually, a broader range of media texts is included. This will be referred to as e-text type 1. A question then is what about the electronic part of the text, is it an intrinsic part of the text or is it extrinsic? A further question is whether the relation between the text and the electronic format differs from the relation between the text and the printed format? The answers to these questions depend both on the notion of text and the notion of the computer.

E-text can also be considered a new and distinct category of text including all sorts of digital materials. What these materials share is that they are coded, manifested in the binary alphabet, and processed bit for bit.[1] Many of these processes can be sequenced and automatized with the help of algorithms. The algorithms inherit the editable functional architecture of the device, but algorithms can also be a significant part of a message because they are represented and processed bit for bit on par with other data. They remain as editable software. Whether binary sequences serve as data or as algorithmic structures, they can be combined and composed into intentional and discursive wholes in which linguistic articulations are mixed with other audible, visual, kinetic and formal semiotic modalities. Digital materials manifested in the binary alphabet, be it as data or as code in any possible interrelation between these, will be referred to as e-text type 2. The two types overlap as type 1 is included in type 2, though the electronic dimension is conceived differently within the two perspectives.

While the frameworks today coexist and are sometimes mixed together, they can be related to three major paradigms in the history of digital media. The three paradigms form around the notions of the computer as a rule-based machine or automat, as a tool for human-computer interaction, and as networked digital media respectively. Each of these conceptualisations is connected with particular sets of e-texts representing different blendings of e-text type 1 and 2.

The relation between the three paradigms and the notion of text can be traced by following a variety of concepts such as author-reader configuration, types of interactivity, conceptualisations of the relation between text and image, development of mark-up languages and so forth. However, the relations between text and e-texts will be illuminated in the successive unfolding of three different types of relations between text and hypertext. Hypertext is always present in any kind of e-text and hypertext relations are intimately connected both to the concept of the computer and to the concepts of text, interactivity, author-reader configurations and so on. The notion of hypertext is contested though and will be included as part of the themes it is used to structure.

Hypertext can be defined as a coded relation between anchor, link and destination. A link in digital media will always include the explicit address of the destination and a specific and explicitly stated instruction of what to do at the destination. All elements, however, remain editable thus trespassing the physical closure of printed texts. Taken together, this makes hypertext distinct from printed node-link relations such as footnotes, annotations and other types of referential devices known from print. The definition makes explicit that a hypertext link in digital media need to include an editable instruction, even if this dimension is ignored in many accounts of hypertext. The definition allows for the inclusion of not simply surface-links, but also random access, search, interactivity, automated updating, and a variety of more complex configurations utilising the editable semiotic space between storage and interface.It is possible to characterise significant differences between various types of digital materials due to the particular configuration of hypertext relations.

Three major configurations structure the presentation:

1) Hypertext as a navigational (para-textual) device to manipulate and navigate e-books understood as digital 'copies' or 'translations' of non-digital, finite texts and corpora. Hypertext is used as a tool and eventually as a methodological device for manipulation and analysis. The field of e-texts is delimited by the conceptualisations of linguistic and literary text as independent of the electronic format, which is only seen as a physical instantiation and conceived of as external to the text. The use of hypertext practices may be unacknowledged or eventually denoted with terms like 'search', 'navigation' or 'annotation'.
2) Hypertext as a textual feature built into the narrative of a text created in electronic form or into the original structure of an electronic corpus. The coded link and the connected nodes are intrinsic to the text or corpus. Hypertext is considered both part of the content and a materialized dynamic feature. It is executed mechanically on the level of the binary alphabet. The execution is coded and some hypertext relations are significant parts of the text.
3) Hypertext as the basic globalised landscape and networked infrastructure connecting all sorts of digital materials. Links can be extrinsic as well as intrinsic parts of all sorts of digital materials. They can be established in the original production or in later use. At the same time, links serve as a means to deliberately create porous delimitations between texts and parts of texts and to establish ever ongoing new connections and disconnections between any deliberately chosen sequences of bits. This brings to the front issues concerning time and text, closure, self-identity, machine, and materiality.

**Hypertext as external to the notions of text and computer**

***Humanities Computing from The Computational Paradigm to theories of text***

The notion of 'e-text' was not widely used before the late 1970s following the development of electronic typewriters, desktop machines, text editors and word processors for the

production of linguistic texts in digital formats. In Humanities Computing, the term 'natural language texts' was often used until the early 1980s.[2]

The history of natural language processing however goes further back to the pioneering work of father Roberto Busa, a Catholic priest, who took up the task of creating an edition of the works of Thomas Aquinas in the late 1940s. The idea was to create a trustworthy, authoritative edition of the original intentions of the authors rooted in established bibliographical studies. To reach this goal, Busa looked for 'machines for the automation of the linguistic analysis of written texts'. He convinced IBM to sponsor his project. The computer was a tool, which should help to automatize scholarly routines as much as possible. He considered the digitised representation of text in punch cards and magnetic tapes processed in mainframes as a carefully edited copy of a printed or written original. The digital format was considered external to the text.[3]

There were other early efforts to introduce computers into the study of linguistic texts. During the 1950s, machine translation, pioneered by Andrew Booth and more implicitly also by Claude Shannon and Warren Weawer, attracted great academic and financial interest.[4] In machine translation, the focus is not on the text but on the underlying, predominantly statistical methods to automatize text translation. These early experiments with statistical methods did not meet expectations.[5] For Bar-Hillel, a main obstacle was linguistic polysemy and – in the meantime inspired by Noam Chomsky – the lack of insight into the transformations required for an adequate description of the syntax of any specific language. There were other more rudimentary experiments to build text generators, such as Christopher Strachey's 'love letter generator', which aimed to generate a literary text from scratch. Completed in 1952, it is assumed to be 'the first known experiment in Digital Literature'.[6] A related attempt was Joseph Weizenbaum's ELIZA programme from 1966. If Strachey's project was for fun, Weizenbaum intended to show the lack of deep knowledge of language and the superficiality of human-machine communication.[7] Taken together, these early approaches cover both digital representations of textual material, and issues on using formalisms in text production from scratch and in statistical machine-translation.

With the emergence of the Humanities Computing community during the 1960s and 1970s, Busa's idea of the computer as a tool was raised to a higher level. The computer was now assumed to provide a fundamental scholarly methodology due to its formal rigour and demand for disambiguation.

At the same time a broader range of issues was addressed. The journal *Computers and the Humanities*, launched in 1966, published articles on development of concordances and text retrieval programmes, literary analysis, stylometrics and attribution studies, dictionaries, lexical databases, applications for archaeology, visual arts and musical studies. Historians had a different focus, they tended to prefer a diplomatic edition faithfully transcribed from its appearance in a particular document or a facsimile of a particular document.[8]

The focus on computational methods aimed to bridge the gap between the sciences and the humanities by adhering to the rigor and systematic unambiguous procedural methodologies ascribed to the sciences while opposing the loose reasoning ascribed to the humanities.[9] Formal methodologies would be the defining characteristics of Humanities Computing. Later Stephen Ramsay described the analogy with science 'as a backward path' because the relation between the two cultures was seen as a one-way road.[10]

***Theories of text***

During the 1980s, the computational paradigm was questioned by Human Computer Interaction Paradigm (HCI) and by 'neural network theories' (or connectionism) and related ideas of parallel computing.[11] Neural network theory inspired exploratory efforts to analyze for instance metaphors.[12] It turned out that 'computation' itself might have different meanings both within the classic paradigm of the rule-based automats and within the HCI-paradigm.[13]

Both paradigms influenced the Humanities Computing community. The computational paradigm was transformed into a modelling paradigm and the aim was increasingly oriented towards the analyses of limitations of the models based on exploratory approaches. The use of the computer would more often be described as 'computer assisted' analysis,[14] 'computer assisted interpretation',[15] or the computer would rather be used for modelling and experimental exploration than for computation.[16] Modelling was not simply a method to detect the shortcomings of the computational paradigm, it was also a method to gain insights about the modelled texts.

The computer is now a toolbox used to assist research for instance with statistical methods, or to compare and to test hypotheses and so forth. In this respect, Humanities Computing is in accordance with the emerging HCI-paradigm and the ideas of interface, interactivity in the human-machine relation, hypertext and multimodality appear more frequently.[17] At the same time a range of new disciplines including cultural studies, media studies, media ethnography, information studies and computer semiotics enter into the scene outside Humanities Computing.[18]

Within Humanities Computing, the epistemological role of the computer was replaced by theories of text and principles of critical scholarly text edition. In critical bibliographic theory the ideal text was considered to be an expression of the intention of an author (the 'McKerrow-Greg paradigm'). Whether and how it was possible to achieve this goal became a still more contested issue.[19] The doubts were both a result of practical experiences within the scholarly editing community and of influences from modern and postmodern literary theories. Modern literary theory had a focus on the text as an abstract, neo-platonic, entity, as a free-standing, compositional whole defined by its own internal structures.[20] Postmodern literary theory moved the focus from author and work to the infinitely ongoing intertextual transactions.[21]

The efforts to produce digitized editions of non-digital originals also raised awareness of the intricacies inherited in the notions of works and texts and the need for standardized methods of encoding. At the same time, a trend developed within the commercial IT and publishing industry with the aim to establish a robust and content-based format for digital representation of text.[22]

Both traditions were concerned with establishing the authenticity of digital documents. The focus in the publishing industry could either be on the electronic document itself or the use as a source for a printed copy.[23] Among the elements was the development of descriptive mark-up protocols such as the Generalized Markup Language (GML) conceived by the IBM employee C.G. Goldfarb. Later it was developed into Standard Generalized Markup Language (SGML) advancing from older forms of procedural and punctuational mark-up.[24] The format-content distinction originating in batch processing of text on mainframes gradually led to more analytical questions on the structure of texts and efforts to identify the codes at an editorial rather than typographical level.[25]

In the 1980s and 1990s, a landmark was reached in the development of content based encoding with the development of SGML (released in 1987) and the Text Encoding Initiative (TEI) guidelines for scholarly editing (first draft released 1990).[26] SGML was based on the idea that texts are abstract compositions of content, which are organized in an 'Ordered Hierarchy of Content Objects' (OHCO) and aimed to provide a standardized platform for e-text production and processing of commercial and institutional documents.[27]

The original version was based on two strong claims: First, the essential parts of documents are content objects, which include a variety of types such as paragraphs, quotations, emphatic phrases and attribution. Graphical form, layout, technology or medium are not essential in this view. Second, content objects are always organized within an ordered hierarchy and without overlapping hierarchies. This principle was soon modified with the suggestion that hierarchies should not be considered part of the text but of an analytical perspective applied to the text and thus extrinsic. If two hierarchies overlapped, each of them could be considered an ordered hierarchy.[28] Both the OHCO-model and the pluralist, multi perspective model were based on a structuralist approach. The text is an abstract entity with one overarching hierarchy or with a series of hierarchies. The material instantiation was contingent. Allen Renear described the development from SQML/OHCO to the revised multiple perspective theory as a development from a platonic to a pragmatic-scientific version of content-based encoding.[29] The methodology was not as earlier guaranteed by the rigor of the computer, but on a theory of the abstract text. Even if the OHCO-model is independent of the machinery, it is fully in accordance with the concept of the computer as a rule-based machine processing content objects ordered in a database. The modified OHCO-model however brings the theory closer to the postmodern issues of the relation between analytical perspectives, which cannot but be between different interpretations.[30]

A strength of the model is that it allows for different types of digital resources. The three major examples, the use of the document as database, as hypertext, or as network, happen to reflect the three waves in the history of digitization. The use as database reflects the computer classic paradigm, but now on par with other conceptualizations of usage. Hypertext now appeared explicit. It refers primarily to user navigation considered extrinsic to the machine-readable text. The focus is the option of multiple representations of the same document. The network perspective primarily refers to the collaboration among scholars in large editorial projects. Finally, the binary representation appeared, though so far only as disturbing 'binary arcana', which are not represented.[31] The SGML platform did not quite meet the demands of the Humanities Computing community, but it served as a template for the development of the TEI guidelines which establishes a series of norms for how to ensure coded closures of text on many levels and later often used as a standard in E-book editions.[32]

During the discussion of the multiple perspective model, the 'binary arcana' are also addressed in a way which opens up new considerations of the relation between the text and the machine. According to Sperberg-McQueen, it is 'an incontrovertible fact' that 'texts cannot be put into computers. Neither can numbers'. Computers can only 'contain and operate on patterns of electronic charge'. As an implication, Sperberg-McQueen considered computer processes as representations of data reflecting conscious and unconscious human judgements and biases. Applied to the issues of mark-up, an implication is that any kind of mark-up represents a theory of the text. This again leads to the question of whether the mark-up tags inserted in the e-text are part of the text as they represent a theory of the text, which could not be processed without.[33] In this view the binary coded electronic charge, the physical instantiation, still remain external to the notion of text. The physical characteristics of texts were primarily identified as the visual characteristics related to electronic representation of images and facsimiles.[34] Even if the codes are physically enacted on the level of patterns of electronic charge, there are yet no further considerations of the characteristics of digital media. The focus is on the description of the physical characteristics of the non-digital originals and there is a strong demarcation between the codes in the machine and the text even if the material characteristics of printed text need to be interpreted and represented in a digital copy.

If the OHCO-model and TEI represent crucial achievements based on the theory of the abstract text, the paradigm was also met with criticisms both with respect to the theory of text and the conceptualization of the computer.

***Hypertext – from extrinsic to nearby intrinsic to the text***

A comprehensive critique of the OHCO-model and the underlying theoretical assumptions were articulated by Jerome McGann who put forward an alternative built on the notions of 'overlapping hierarchies', 'decentered text' and 'radiant text'. The aim was to develop

critical tools for studying the full range of interpretations as well as the material traces surrounding the linguistic text including textual materials with a significant 'visible' component.[35]

A core issue is the question of how the scholarly edition of literary works can account for the ambiguities of the text, which is not 'self-identical' as each reading represents a new interpretation. In this way the visual and textual ambiguities are expressed as a series of different readings eventually evolving over the years. Thus, the platonic model of the abstract text was replaced by a notion of text, which aimed to include the material (visual) characteristics as well as the social history of the text in the form of later interpretations as genuine part of the scholarly edition.

Early on the focus on visual manifestation was anchored in McGann's poetics related to the semiotic ambiguities in the literary text. Inspired by Gerard Genette and his notion of paratext and by Johanna Drucker's work on graphic forms, McGann would add a set of 'bibliographic codes' which comprised the material (visual) characteristics of semiotic relevance for any particular written or printed text.[36] At the same time he contributed to unfold the notion of hypertext and the materiality of e-texts by pointing to the 'virtual space time' of digital media as distinct from the reading space of print.[37] In this view, the virtual space time facilitates that 'the book's semantic and visual features can be made simultaneously present to each other'.[38]

If the printed text and the electronic version are identical from a linguistic perspective, they still differ with respect to their material characteristics. These are articulated in different types of 'mark-up', different mechanisms of closure, in different time-spaces provided for production, editing and reading, and in the difference between 'bibliographical' codes which are related to the physical appearance on the interface, and the coding of the e-text in editable binary sequences. The e-text thus is considered a translation of a written or printed text.

To combine the notion of the work with the ever-growing number of new interpretations McGann introduced the notion of an autopoietic system borrowed from the biologists Humberto Maturana and Francisco Varela.[39] As a notion for text, it includes both the production and the readings. This again points to the social nature of text processing. Thus the notion should keep together the wholeness of the object of attention in a now infinitely open time-dimension allowing for the gradual inclusion of multiple interpretations.[40]

In his discussion of The Rosetti Archive based on these ideas, McGann used both the notion of 'work', 'scholarly edition' and 'archive' for the same 'object of attention' within very few lines.[41] If the Rosetti archive as a whole is considered a work, the hyper structure would be an intrinsic part of the system. If it is considered an autopoietic system, it would include generative procedures allowing new links to be created in future operations. If considered an open-ended archive combining a growing range of interpretations, it remains a

navigational device extrinsic to the connected works. The three notions at the same time imply three different configurations of hypertext: as intrinsic and closed, as an open ended, intrinsic link generating system, and as extrinsic to the archived entities.

If not a paradox, the sliding between terms creates a tension, but a productive one. Hypertext features allow for the accumulation of interpretations, but they also open up experimental ways of exploring the sources, by implementing features for explorative methodologies, juxtaposing, 'backward reading', 'deperformative' readings and other sorts, often antithetical ways of readings.[42] Thus hypertext was directly connected to interpretative operations involving a high cognitive load well beyond the broadly acknowledged (goal directed) navigation and (associative) browsing approaches associated with hypertext that were widely accepted within the Humanities Computing community and often considered to be mere prolongations of already developed practices within critical bibliography.[43]

With the introduction of hypertext as a fundamental compositional principle in the production of critical scholarly editions of literary works, McGann added to the methodology of critical text editing. In the 'The Rosetti archive,' the focus was on the link relations between texts and text-image, and on providing the reader with the possibility of playful explorations of the work and all associated documents in question.[44] The new medium thus changes the analytical focus from 'finding' order in the text to 'make order and then to make it again and again, as established orderings expose their limits'.[45]

The theory also contributed to an enrichment of the notion of hypertext as he placed a high cognitive load of interpretation in the use of link relations. This was not least a result of his professional concerns with critical editions of texts approaching hypertext from the position as editor between the author and reader positions. The editor position differs in principle from the author position because the editor deals with existing text and it differs from the reader position because it allows for an interpretation to impact the 'object of attention'. In print media, the editor position ends with the publication of the printed version. In digital media it remains open subject only to coded closures, which remain editable. Thus hypertext incorporates an editable time dimension in all kinds of e-texts making these distinct from printed text even if the e-text is meant to be a copy of a printed original. This again can be utilised to allow the reader to switch between the author, editor and reader modes.

The rationale behind the idea of the 'autopoietic' work can perhaps be found if seen as a result of the tension between hypertext considered as extrinsic and intrinsic to the object of attention. For the editor it is both at the same time. McGann's ambition was to maintain some sort of interpretational wholeness associated with many interpretations of particular works of attention even if they are ambiguous in their meanings. While aware of the dissolution of the physical support of intentional closure, which was a characteristic of

printed books, he only vaguely foresaw the tensions related to the complex time dimensions of web-based hypertext.

In the history of Humanities Computing, his work marks a transition in the development from unrecognized use of hypertext, to acknowledgement of hypertext as a methodological device for navigation, browsing and interpretation, external to the materials and at the brink to full-fledged conceptual inclusion of hypertext as an integral part of the text as well as on the brink to the incorporation of culture and society into a networked hypertext-based media landscape. Thus, the conceptualization remains dependent on previous notions of digital media not yet recognizing that hypertext is the very feature allowing for digitization of text in the first place.

## Hypertext as intrinsic to the text

### *The computer reconsidered*

During the 1980s and 1990s, the production of e-text developed in many unprecedented directions due to the spread of 'personal computers', graphical user interfaces and a fast-expanding range of application programmes which always would include text editor software. The computational paradigm was supplemented with the HCI paradigm and the notion of the computer as a tool-box for a growing variety of particular purposes supported by specialised application programs. The process represents a breakthrough of what Alan Turing described as choice machines, 'whose motion is only partially determined by the configuration […]. When such a machine reaches one of these ambiguous configurations, it cannot go on until some arbitrary choice has been made by an external operator'.[46]

For Turing, this was a rather trivial precondition. With few exceptions, the idea of the choice machine remained trivial until the potentials were gradually unfolded in the wake of the spread of personal computers both among office workers and a broad range of experts in other fields beyond the engineering and computer science cultures in the late 1980s.[47]

In one of the most significant interpretations of this shift Jay Bolter described the computer as a fourth fundamental type of writing technology in the history of humankind, following modern print technology, the codex technology of the middle ages and the papyrus roll of antiquity.[48] On this basis, he also provided a full-scale reinterpretation of the computer by replacing rule based programming with hypertext as the central operating principle. The argument is based on the semiotic distinction between 'a sign and its reference', which is inherited in the relation 'between the address of a location in the storage and the value stored at that address'. This distinction between the sign and its reference has 'to be learned in any kind of writing and programming'. The editable co-relation between address and content constitutes the architecture of all digital media. At the same time, it is the 'essence of hypertext and of programs for artificial intelligence, in all of which text is simply a texture of signs pointing to

other signs'.[49] As a consequence, both the address and its content can be edited via the interface. This again provides the computer with an invisible space behind the visible representation of the text, which in former media 'has been all image, never anything more than the ink we see on the paper or the scratches in clay or stone'.[50]

Television and radio are also based on invisible sources appearing on a screen or through a receiver, but the relation between source and representation is limited to a few mechanical variables on the side of the receiver, which is also separate from the sender and the storage. There is no access to the storage and no editable hyperlinks between storage and interface. Thus Bolter's claim concerning former media remains true also for radio and television. In digital media, the interpretation of the text is generated by the interactions of the machine and the reader due to the 'kinetic' nature of the textual representation.[51] The visible text is only the 'superficial text' in between the poles of the machine and the reader, which all together established a new type of writing space.

Bolter's conceptualisation of the computer also included a second expansion of the notion of text by stressing the spatial dimension as a fundamental semiotic dimension manifested on the screen but codeable in the interaction between the operator and the codes stored in the machine.

This spatial perspective Bolter called 'topographic writing' derived from' topography' denoting a written description of a place, later understood as mapping or charting a space. Bolter's reinterpretation refers to relations between the verbal and the visual appearance as well as between the interface and the storage. The topographical nature of e-text thus means that it is possible to compose the screen interface or any visual interface by writing 'with places, spatially realized topics'.

The echo of poststructuralism resonates maybe a bit too much when he also added that his concept of topographic writing refers to a mode which is not limited to the computer medium since you can divide a printed text into unitary topics and organise this in a connected structure. This is true, but only for the fixed visual representation. The dynamic codes behind the screen are put aside in contrast to his definition of computer mediated signs as a link-based relation between editable (hidden) codes and the visual representations.[52]

At the same time, text is extended to include mathematical, verbal and pictorial signs. The inclusion of non-textual modes is often denoted 'hypermedia', a term originally suggested by Ted Nelson. In Bolter's theory, the inclusion of these different semiotic modalities is not simply a notion for a set of additional semiotic modes but derived from the semiotic relation between address and content which allow for the full array of semiotic modes to be deliberately incorporated and mixed in the same architecture of binary sequences.

The theory has been influential, but the fundamental analysis of the computer as a writing technology and the conceptualisation of hypertext have maybe not yet been fully appreciated.

In early Hypertext theory, hypertext was primarily understood on the level of the interface as a technique that allows authors and readers to compose and read text in new ways, as the readers were offered multiple pathways through the text and in between texts. The positions of author and reader remained conceptually separate. Ted Nelson, who coined the term, described hypertext as non-sequentially read text, as links were inserted in a primary text as references.[53] Later he gave a more dynamic version claiming that hypertext was best described as 'branching and responding text. Best read at a computer screen'.[54] A more far reaching idea of his was that all documents could be incorporated and supplied with semantically motivated links in a fully cross-referenced 'docuverse' connecting any text to any other relevant text or passage of text.[55]

In the 1980s, the perspective of the writer became more significant, since the computer could be used to link information together, create paths through a corpus of related material, also incorporating hypermedia perspectives to compose and combine heterogeneous sequences 'created with different applications such as a painting program, a chart package, or a music editor'.[56] In accordance with this, George P. Landow described hypertext as a simple node-link relation based on associations much similar to a footnote.[57] Later he interpreted the notion as an incarnation of postmodern theories of intertextuality, arguing that the hierarchies of the textual world would be replaced with non-hierarchical networks.[58]

The closeness of the writer and reader positions would soon form the basis for reconsiderations of the relations between author, work and reader most radically perhaps articulated in George P. Landow's idea of convergence into the 'wreader' aiming to characterize how a reader may utilise hypertext in an interpretative interaction with a text. The two extremes in the reader-writer relations are relatively easy to identify.[59] On the one end, hypertext is delimited to a navigation tool allowing a reader to add her own markers and comments in the margin, as a footnote external to the text. In most cases such remarks would remain unpublished. Insofar as they represent a scholarly interpretation as suggested by Jerome McGann, they might be included in a scholarly edition. This would be a dedicated archive eventually still edited and thus evolving over time. In this case the physical closure of a printed text is replaced by a coded closure in an e-text. Since such coded closures are inserted as text in the text they can be manipulated on par with any other element in such a text. Thus, the most extreme interference in any e-text is the complete rewriting or deletion. The question then is how is the semiotic space between these two poles exploited for meaningful articulation?

***Hypertext as a tool and as a signifying feature in the literary text***

Two major traditions emerge responding to this question. One is rooted within the HCI paradigm focused on the tool perspective describing 'hypertext-as-interaction with information

to build associations, and through associations to build knowledge'.[60] A second tradition with a main focus on hypertext as a node-link relation incorporated in literary works emerges primarily within hypertext fiction and literary studies. The two traditions have been described as incompatible due to their different epistemological roots in computer science and poststructuralism respectively.[61] In Bolter's perspective, they might as well be seen as different configurations of hypertext. While the HCI-tool perspective developed with a strong focus on creating editable tools for knowledge building and for modifying the functional architecture, literary hypertext theory and practice developed with a strong focus on utilising hypertext as fully integrated part of a literary work.

In an attempt to establish a canon of literary hypertext, Astrid Ensslin set up a three-polar typology taking as the point of departure the pioneering works by Michael Joyce, Steve Moulthrop and others forming what N. Katherine Hayles denoted as the early and classic hypertext literature.[62] This generation was dominated by an author-centred approach in which the author provides the reader with a set of narrative pieces. To continue reading, the reader has to choose among a subset provided at each location in the work as in the pioneering work 'The Afternoon' by Michael Joyce.[63] This is indeed some steps away from Ted Nelson's original concerns with hypertext as an instrument to organise notes and manuscripts for a writer due to ever changing associative and interpretational needs.[64] The focus is text centric and the links are predominantly simple connections between two pieces of text or between two pages each with a restricted number of texts and options. The author-text centric perspective implied that hypertext was mainly, though not solely, considered as a feature intrinsic to a closed work, the delimitation of which from other texts was not part of the experiments. The focus was primarily on the modal shift between ordinary reading mode and the navigation or browsing mode, leaving the reader with the question of how to make sense of and decide the next step. The editor mode is not yet facilitated as an option in the reader position. The narrow and screen focused interpretation of literary hypertext is also addressed by Hayles who considered the 'first generation hypertext' as building on a rather simple, print based convention 'moving through a text passage by passage'.[65] The notion of the work was opened mainly towards the readings even if many issues referred to the implications for the authoring of hypertexts as works.

Matthew Kirschenbaum traced a number of shared tropes in the early literary hypertext literature chained together by notions like the 'flexible', 'fluid', 'ephemeral', 'instantly transformational', 'flickering' and ending up in the 'ultimate apotheosis, "immaterial"'. He described the theoretical framework as the advent of 'a media ideology rather than it points to a transparent and self-sufficient account of the ontology of the medium itself'. Still there are interesting insights in the lingering moves between materiality and immateriality, the editable relation between address and content, and between hidden code and visible manifestation, and the variety of coded closures.[66]

Early hypertext literature was also criticized by Marie L. Ryan for lack of aesthetic quality, 'pleasurability' and 'of allegoric meaning to the actions of moving through a textual network'. The link system is treated as an invariant generic message related to the medium rather than giving unique meaning 'to each particular text, and ideally recreated with every use of the device'.[67] Janet Murray argued for lack of literary quality and Hayles came to the conclusion that (early) hypertext failed to deliver the immersion.[68] For Hayles, a further limitation of the first generation perspective is the lack of innovative use of e-text components belonging to the textual universe such as 'cut-outs, textures, colours, movable parts, and page order'.[69]

According to Ensslin the second generation took up the hypermedia perspective which was already addressed by Nelson, Alan Kay and Adele Goldberg, Yankelovich et al. and Bolter, but now also manifested in artistic works like Deena Larsen's *Marple Springs* and others.[70] For Hayles, the second generation was characterised by the inclusion of 'all the other signifying components of e-texts, including sound, animation, motion, video, kinaesthetic involvement, and software functionality, among others.' With the inclusion of software, the notions of e-text, hypertext and hypermedia are taken a step further as the editable programme function in this view is included as a signifying part of the text.[71]

For the third generation, Ensslin counted works somehow fitting into the theoretical concept of cybertext, put forward by Espen Aarseth and then widely recognised as a major step forwards in hypertext theory. In his own perspective, it is an alternative and he only accepted a limited set of literary hypertexts as cybertext.[72]

While the distinct material and technological features of e-text were often a main focus in the hypertext theories of the 1990s, they are deliberately absent in Aarseth's conceptualisation of cybertext. The purpose of introducing the notion of cybertext is to get rid of 'vague and unfocused terms as *digital text* or *electronic literature* […] and to develop a function-oriented perspective, in which the rhetoric of media chauvinism will have minimal effect on the analysis'.[73] Cybertext is 'a perspective on all forms of textuality'.[74] The concept thus includes only the characteristics shared with other media. Compared to McGann's theory of autopoietic systems based on reflexive second order cybernetics, Aarseth relied more on Norbert Wiener's first order cybernetics. The conceptualization of the computer is consistent with the computational paradigm.

In spite of the return to an abstract notion of 'ergodic', computational text, Aarseth contributed both to the understanding of hypertext and e-text. This includes his focus on the modal shift from reading mode to a participative mode in 'nontrivial' hypertext systems and the value of the explorative potentials. In this respect, he aligned with Michael Joyce who introduced the distinction between explorative and constructive hypertext and with McGann.[75] Aarseth added to the explorative perspective by focusing on the variety of combinatorial reading strategies and added to the understanding of the huge potential of hypertext based, interactive media, computer games included. Third, he recognized that hypertext relations are not always flat and open networks. They might as well serve as a

means to navigate and interpret hierarchies by allowing multiple pathways to any given destination and relative to a variety of possible anchors. This is in accordance again with McGann.[76] Finally, with Bolter, he stressed the double nature of hidden and visual representations, which Aarseth denoted as textons and scriptons.[77] The cybertext notion, however, limits some of the insights because it hides that in digital media there are never simply textons and scriptons. The relation between stored sequences and visual representations is itself organised as a coded, editable and externalised instruction, as hypertext.

Hypertext literature survived and developed not least within the 'electronic literature' community which organises itself around the Electronic Literature Organization (ELO) founded in 1999.[78] From the ELO perspective, electronic literature refers 'to works with important literary aspects that take advantage of the capabilities and contexts provided by the stand-alone or networked computer'.[79] 'Importance' of course is in the eyes of the reader. The ELO definition of electronic literature implies that 'electronic literature' is distinct from 'literature' due to the characteristics of the computer rather than due to two distinct sets of aesthetic values. The 'literary aspects' and the value system of print at the same time maintain a priority to other modalities even if 'important' literary aspects are found in works dominated by paint, video, music, games or codes.[80] In recent years, the delimitation of text to linguistic and literary text have been further challenged within the ELO community by the inclusion of Virtual Reality stories, visualisations of scholarly and scientific fields, bio-texts and other experimental practices related to issues of narration, interfaces and interaction.[81] The importance of the various modalities and their interrelations within a work is not as much used as a criterion for exclusion or inclusion in a canon as it is an issue for the interpretation of any individual work.

Digitisation brings the various symbolic modalities and their related artistic practices previously existing in separate materials and media into new kinds of interference and interrelations without necessarily breaking down their boundaries. The boundaries can both be maintained or opened for flux and blending's as a part of a particular creative work. This is possible due to the 'universality' of the binary alphabet, allowing all sorts of symbolic content to be coded, stored and modified in the same alphabet if not always without loss.

Materiality is ascribed a growing variety of meanings. First, it refers to the perceptual conditions: symbols need to be physically manifested to be perceived. Second, it refers to the particular perceptual conditions on a screen interface e.g. the flickering on the screen. Third, it refers to the time/space conditions of particular medium or eventually of particular time space conditions build into an application or a work. Fourth, it refers to the interpretation of cyberspace as an immaterial (virtual as potential or as fictive) space as opposed to 'real life'. Fifth, it may also refer to the sequences of bits and the mechanical devices needed to perform the invisible physical processing in digital media. As there is yet no dominant conceptualisation, the theme will be addressed below.

**The e-text immersed in the World Wide Web.**

***From 'tamed' to 'feral' hypertext***

In the first wave in the history of e-text, the variety of concepts was primarily related to the interpretations of the notion of text. The electronic dimension was considered extrinsic and of minor relevance. The notion of hypertext was articulated but resided in the shadow of the computational paradigm of the dominating mainframe culture.

In the second wave, the focus shifted. Hypertext, interactivity, code, node-link, storage and interface, screen oscillation, reading and writing relations, and a growing variety of semiotic modalities including codes entered into the interpretation of 'e-text' type 1. This is manifested both in the development of application programmes, in the tool perspective of the critical text edition and in the literary version of e-text theory.

The first two waves developed in close relation to stand-alone machines but differed in the conceptualisation of the computer as a computational automate in the first wave and as a toolbox for human operators and authors in the second. The users or readers were assumed to be served rather than to be servers.

On the crest of the second wave, a third wave took off with the release of the World Wide Web (WWW)-protocols which more or less overnight transformed the existing internet based on the TPC/IP protocols into a new globally distributed, electronically integrated communicative infrastructure formed around networked digital media.[82] The WWW protocols also provided a convenient interface, which made the internet accessible to a fast-growing part of the world's population. In the following years, a cascade of new types of software genres and communicative practices serving a fast-growing array of purposes emerged and the processes of digitisation spread into almost all spheres of society and culture.

Both the TCP/IP internet and the web-based parts of it build on hypertext connections allowing new addresses and connections between existing addresses to be added and content to be edited deliberately. Thus, the quantitative changes in scale, reach and access were obtained with the help of an infrastructure in which hypertext was not something additional whether extrinsic or intrinsic, but the very 'landscape in which the text is immersed'.[83]

In late 20$^{th}$ century, hypertext primarily developed within the horizon of the stand-alone computer in which the sequences of bits are controlled by a central processing unit. For networked digital media, there is no such central unit. Networked digital media can be programmed to interfere with each other on all levels, including the functional architecture of any machine. Even if networked digital media are still mechanical machines, they lose the autonomy when immersed in the network of fluctuating hypertext connections whether these connections are made visible or not.

The full range of – ever developing – implications inherited in the emergence of networked digital media is beyond comprehension both in an overall societal or cultural perspective and in the narrow perspective of digital media genres.

On a large scale perspective, it would be necessary to consider known drivers of the development be it the exponential growth in knowledge production, climate changes and threats to the biosphere, globalisation, migration, urbanisation and modernisation, new types of mediatisation and new types of social interaction and communication. Among the issues raised are also questions of the authority, of democratisation and deflation of cultural value systems, of copyright and privacy, of networked forms of social collaboration.

In the narrow perspective of conceptualisations of e-text, it is still possible to trace significant trends by looking at a variety of hypertext configurations from a growing range of multiple source knowledge systems. The first example deals with e-text type 1 when immersed in networked digital media. The second example deals with participatory and social media texts, which are born digital. The third example deals with the international currency trading system. These examples together do not form a representative sample and they are not based on comparable sources. They are selected to ensure diversity in types and themes. They will be filtered towards two approaches addressing the language of new media, which represent alternatives to the approach taken here.

In 2005, Jill Walker described the 'unleashing' of hypertext 'into the world wide web' as a transition in which the concept 'goes feral' and 'refuse[s] to stay put within boundaries we have defined'.[84] Feral hypertext denotes the emergence of hypertext structures that may or may not trespass any structural delimitations. They cannot be restricted as navigational features outside a work – as originally imagined by Ted Nelson – or kept within the closure as in the literary hypertext tradition. For networked digital media, hypertext is both inside and outside and the connection in between.

The dichotomy between 'tamed' and 'feral' echoes the wider philosophical controversies about whether digital media and particularly the 'setting free' of the hypertext repertoire on the internet represent a decay in literacy, logic and rationality and leave us with the kind 'freedom' where there is nothing left to lose. The dichotomy is also set between 'unplanned structures' and the 'massive possibility for collaboration and emergence in the network that creates truly feral, uncontrollable hypertext'.[85]

Among the network dependent genres are, however, also highly organised and controlled configurations of hypertext. These include a number of multiple source systems for real-time monitoring of climate, of weather, of pollution, of human behavior, of traffic, of market developments and so forth often also combining real time data, interactive transactions and other sources. Besides these primarily research-initiated sources there are also increasingly important commercial sources such as the data repositories of Google, Facebook, Twitter, Amazon and other service providers as well as numerous civic projects in a variety of

crowdsourcing formats, including Wikipedia. A range of such systems are also developed in relation to the 17 UN goals for Sustainable Development.[86] Some systems are oriented towards user interactions in a growing variety of formats such as online games, virtual reality systems like Second Life, social media sites, crowdsourcing sites, and online services like Google search,and variety of personalised newsservices. Others fill out many intermediary positions between centrally controlled and feral hypertext configurations.

Multiple source systems as such are not unique for digital media. Encyclopaedias, dictionaries, newspapers, journals, catalogues, phone books, collections of any sort, stored in libraries, museums and archives, many research corpora are all based on the aggregation of materials from a wide range of sources. They are gathered with respect to a variety of purposes and criteria for inclusion. Still networked digital media allow for fundamental changes in the character and functioning of such systems.

Corpus linguistics provides a very illuminating example. In a study of 'The web as Corpus' within a corpus linguistic framework, Gatto concluded that 'the idea of a "web of texts" has brought about notions of non-finiteness, flexibility, de-centring/re-centring, and provisionality' to be added to the established notion of a corpus as a 'Body of text of finite size, balance, part whole relationship, and permanence'. A summary of the methodological implications suggests that the study of a corpus of linguistic web materials questions issues such as data stability, the reproducibility of the research, and the reliability of the results, which formerly could be taken for granted. These seemingly negative characteristics are counterbalanced by an array of new methodological possibilities. Gatto did not refer to hypertext, but she described a great variety of instantiations with more specific terms.[87]

In current debates on the exponential growth of data, it is often taken for granted that the majority of these materials are 'unstructured', 'messy' or heterogeneous due to still more different purposes articulated in distinct software paradigms resulting in a growing diversity of knowledge formats.[88] Among the reasons are not least the hypertext infrastructure that allows the ever ongoing connection and disconnection of any deliberately chosen sequence of bits located anywhere on the Web.[89] Even within a strict linguistic text perspective, networked digital media bring with them fundamental changes in the conceptualisations and the analyses of linguistic materials. Early in the 21st century, David Chrystal reached a more moderate conclusion in an analysis based on e-mail, chat groups, and virtual worlds. While the internet provided a wide range of variations of reading modes, it remained as a whole a linguistic text, 'an analogue of the written language that is already "out there" in the paper based world'.[90] That notwithstanding, he described in detail a range of digital only features such as written synchronous communication across distance, the incorporation of links as signifying parts of the text often signified by use of colour-codes among others.

Later, Naomi S. Baron described how the move of computer mediated communication (CMC) 'beyond academics in the 1990's' was accompanied by the question of whether CMC in general or at least e-mail and instant messaging in particular 'more closely resembles speech or writing'

and set out to analyse 'the new forms of language: online and mobile language'.[91] In this move CMC is established as a distinct sub field within communication studies, organized around the Journal of Computer-mediated Communication.[92] A great part of CMC can be seen as the ongoing study of language and linguistic text as it develops in the new, networked landscape and often observing how gaps between previous separate semiotic fields such as speech and writing are filled with a variety of intermediary forms. In continuation of speech act theories, the CMC tradition also adds to the understanding of the dynamic character of e-text mainly focusing on the interactive relations between communicating people while the interactions with the functional architecture of the machinery seems to be a less prioritised focus.

In the literary hypertext tradition, a main change relates to the expansion of interactivity to include readers who can alter the text, soon to be further extended by the development of new forms of collaboration and interaction. The move of CMC from academia to society at large is also a move into popular culture. Thus, there is a growing tension between the literary value system of say ELO and the electronic forms. The explorative dimension seems to be beyond the literary value system insofar as it is oriented towards networked digital media.

***Multiple source cultures and the language of new media***

Writing about 'Internet literature in China', Michel Hockx addressed the elitism of literary studies that ignore popular genres such as fan fiction even if fan communities are involved in the exploration of the expressive potentials in networked digital media.[93] Popular culture is not that obsessed with the notion of authorship and is not privileging text for multimodal and participatory communication. Hockx made his case by analysing a variety of genres ranging from avant-garde experimentalism, blogging, fan-fiction, online poetry to mass produced semi-pornographic fiction. For Hockx, the notion of electronic literature needs to include multi modal, interactive and participatory expressions. To some extent, he maintained the expectations, rooted in the literary tradition, that the texts chosen for analysis should demonstrate a certain level of reflexivity about the aesthetic aims and prioritising work that explores boundaries.[94] If the ELO tradition sticks to closure in a mimetic relation to print, popular culture enters into situational closures, which to some extent are negotiated by the participants.

A similar and perhaps more radical step was already taken in media studies, such as Henry Jenkins' analyses of the complex interrelations between commercial content providers and their increasingly interactive and participatory consumers. A main theme is the claim that stories today are told across multiple media platforms and semiotic modalities.[95]

For Jenkins, 'Convergence' refers to the coordinated use of many channels on the side of the culture industries while 'grassroots' meet in participatory communities to widen the narratives with their own contributions. These are not always that interesting, but in some cases these communities develop new genres such as fan fiction created around for instance Harry Potter films and utilizing a range of semiotic regimes be it textual, pictorial, video and audio. Fan cultures have the potential for developing adequate social media skills of the 21st century,

which include the capacity to incorporate the array of multimodal regimes in the narrative. They do not restrict themselves to digital linguistic text, but are on the move into multimodal texts and the hypertext based coding repertoire of e-text.

Writing in 2006, Jenkins foresaw that the clash between corporate interests and fan-communities might lead to a closure of a still open window for user-generated content. The clash was followed by the breakthrough of Facebook which provided a commercial platform for social communication. Contrary to the fan culture sites, Facebook did not require fans to be part of some sort of community. Facebook allowed only a more limited semiotic repertoire centred as it is on linguistic text and fixed topographic space flows. Still Facebook provides real time, typed public or semi-public communication. The timescale is thereby the same as spoken communication but the messages are stored. To respond, subscribers need to be present within a time-limited 'window-of-interaction' partly controlled or 'edited' by the service provider who forms the streaming of messages on the news page. The subscriber can trace back the stream as it is stored, but time for response may have passed anyway.[96]

The demand for response presence – the window of interaction – demonstrates the significance of the time dimension in a number of hypertext systems. A perhaps more extreme example is described by Knorr Cetina analysing various cases of mediatisation of face-to-face encounters.[97] One of the cases analysed is the global currency trading system which provides a huge array of information distributed on 6-8 screens that are constantly updated with real time financial data and relevant news from around the world provided by professional journalists. The system includes facilities for private communication between currency dealers. It also includes their individual trade actions as well as deals performed by preprogramed algorithms. The dealers thus both read and write into the system and have to respond to the flow of constant updating within fractions of a second so as to not lose out on a fluctuating market. Knorr Cetina described the communication of the dealers 'as if a traders' brain was attached to the market . . . unthinkingly'.[98] The system defines the need for 'response presence' (as distinct from embodied presence) as a very narrow window of interaction, determined by the speed of market fluctuations as these are filtered in this particular hypertext configuration.

From a semiotic perspective, the system includes numbers (e.g., for exchange rates and time), icons, charts, graphs (representing numbers), alphanumeric text, colour codes and probably other formats. The materials are processed sequentially, but they are likely to be read according to visual recognition of changes on the screens due to updating frequencies, colour code changes and other indicators. The reading still takes place in linear time, but does not necessarily pass the screen space due to a standard routine order as is often assumed for printed texts. The use of graphical markers to call attention to some parts on a printed page breaking the standard order for reading is well known from printed newspapers and magazines and is often seen in light of the montage technique of early 20$^{th}$ century. In digital media, the array of such markers are expanded both in number and function not least because they can be dynamic and time coded. They can be used as markers also of hypertext anchors triggering

actions at a destination. This can be done for any fraction on the screen, for a pixel, a single letter, a word or any other arbitrary delimitation of screen space. Because these features are available to be utilised as 'signifying components of e-texts' it may well be argued, they should be included in a contemporary interpretation of the notion of e-text.[99]

The answer to the question of why introduce a wider notion of e-text than the language-centred one of e-text type 1 elaborated in the 20th century is that it is necessary to incorporate different modalities, codes and dynamic time dimensions in the analyses of digital media narratives insofar as they are used as signifiers in these narratives. These visual, aural and kinetic modalities both include the full array of semiotic modalities on the perceptual level and the array of binary sequences, be they codes or data or both, manifested in binary coded electromagnetic signals on the level of machine processing below our sensory capacities. Because hypertext is rooted in the basic address system, most link relations such as the use of the keys on the keyboard in a word processor are 'trivial' in most cases. A distinction between trivial and non-trivial hypertext can be made due to the criterion suggested by Hayles of whether a link is utilised as a signifying component in a message.[100]

The most widely used notion for digital materials is arguably the notion of data inherited from the computational paradigm. So why introduce the disturbing notion of e-text type 2 between the notion of data and the notion of e-text type1? In this case the answer is that data refers to passive objects. The notion 'data' does not include mechanical transactions performed by the bits or sequences organised as programs and scripts and it does not include the significant hypertext relations. Thus, the notion e-text type 2 qualify because it includes all sorts of digital materials, data as well as codes and links. At the same time, it comes with an increased focus on the signifying potentials one the one hand and the messiness and noisy character of data related to networked digital media on the other.

If there are good reasons to establish e-text as embracing the full array of 'signifying components', the question is what would be its main characteristics? Is it possible to identify a common denominator for CMC, a language of networked digital media? In his 'Language of new Media,' Lev Manovich provided a positive answer. Digital media have a set of shared characteristics. The theory takes its point of departure in the history of film. This resonates well with Manovich's primary interest in visual representation and it adds a variety of interesting aspects compared to Bolter's analyses of digital media as writing technologies.[101] Manovich introduced transcoding as the process in which the characteristics of digital media become cultural forms. Thus, the conceptualisation of the computer becomes central in this notion of culture. At the same time new media are influenced by conventions developed in former media but this influence has to be articulated in the cultural forms of digital media.[102]

The generalisation of the transcoding principle may be farfetched. It makes perfect sense, however, as a description of the relation between the stored sequences of bits and those, which are made visible on the screen or otherwise perceptible. Ignoring former interpretations of this distinction between storage and interface (e.g., Bolter and Aarseth), Manovich

conceptualised a relation between on the one hand 'the computer's own cosmogony' characterised by the database format and complete separation between data and programmes, and on the other hand the interface level which makes sense to human users.[103]

The separation of data and program, or data and software, reinvokes the computational paradigm. Still the distinction of hardware and software is also essential, but the reason given is unusual, as he traces this separation back to analogue electronic media in the 19th century. With the shift from tangible and sensible physical objects to invisible electronic signals, he argues, digital coding of electronic signals is only a minor change compared to 'analogue' coding of, for instance, amplitude and frequency, brightness, and contrast.[104] Yet the 'minor change' is of major impact as there was no editable software in the pre-digital media world. The theory hides the semiotic array of possible connections in the coding of links between storage and interface.

Manovich's theory adds to the interpretation of digital media as they become integrated in culture at large. This is not least due to his overall approach in which he characterises the language of digital media as based on numerical representation, modularity, automation, variability and transcoding.[105] Even if each of the five principles needs to be further elaborated, perhaps reinterpreted, they comprise a set of essential dimensions.

The theory is an alternative to Bolter's writing space concept because it includes HCI concepts such as modularity and variability in the computational paradigm, which remain the overarching principle in Manovich's interpretation of modularity, variability and transcoding. Thus for instance variability is linked 'closely' to automation because data 'can be assembled into numerous sequences under program control'.[106] This may be true, but it does not include all dimensions of the language of new media, since programmes are programmed and controlled by human operators using Turing's choice machine to create deliberately composed hypertext configurations, including a variety of automata and robots. Bits are not numerical representations, but when combined in ordered sequences, they may represent letters, numeric and operational characters, formal rules, instructions, images, signals, and addresses as well.

Recalling Bolter's theory, it may also be argued that it is not the numerical values of data, which allow for data processing, but the storage of binary coded data in addressable form. This allows for random access to any sequence of bits independent of their semantic values, meanings and function. What counts in the machine is their mechanical function on the physical level. Writing on the brink of the third wave of digitisation, Manovich contributes to the increased focus on the role of the computer as a medium in society at large. He also added significantly to the interpretation of the multi modal nature of digital media especially in his elaborate account of coded visual materials.

Bolter's writing space concept of the computer also competed with the writing machine perspective articulated by N. Katherine Hayles, elaborated and still evolving over three decades

dealing both with literary perspectives and the interpretation of the computer. A main distinction between the two perspectives is indicated by the difference between 'a space' and 'a machine'. Both theories however incorporate a communicative space as well as mechanical and dynamic properties. They differ in their conceptualisation of the connection and it is most clearly visible in their different notions of hypertext. For Hayles, hypertext exists both in print media and electronic media and 'minimally' includes only multiple reading paths, text that is chunked in some way; and some kind of linking mechanism that connects the chunks together so as to create the multiple reading paths.[107] In Hayles' account, the 'machine' is coded but the coded link relation between the storage and the interface remains black boxed. In Bolter's account, the machine is built with algorithms which remain editable as any single sequence is stored at one or another address from where it can be accessed, modified, or moved.

In Hayles' perspective, linking is a rather simple process equalising the reader's interpretation of a superscript numeral in a text as referring to a footnote with the coded anchor link destination relation. The digital equivalent, however, includes an instruction of what to do at the destination and all of it remains editable. Thus an editable time scale is built into any deliberately chosen part of the e-text. Since the timescales are editable, they can be used as significant semiotic elements in an e-text type 2. With the author and reader positions in focus, Hayles contributed to the elaboration of terminology for these modes and the related textual perspectives. The editing mode made available due to the hypertext relation between storage and interface is left out. In this respect, Hayles is also aligned with Aarseth and Manovich. Contrary to them Hayles includes the codes as integral part of her notion of text. None of these theories are yet fully capable to include the characteristics of E-text type 2.

***The text in the machine***

The original computational paradigm, modified into an explorative modelling paradigm, now competes with HCI interpretations of the computer as a toolbox, which can be adjusted by hypertext menus, and with networked digital media interpretations. Networked digital media is generally accepted as the new landscape. The interpretations span from seeing the internet as a communicative landscape external to the scholarly foci to a growing integration of the global network facilities in new interactive hypertext genres.

Stephen Ramsay describe 'coding and structure' and modularity as the basic characteristics of computers. Ramsay's position echoes Lev Manovich's inclusion of modularity in the computational paradigm. The program remains the central compositional feature. The machine is distinct from the text it processes. This is a modest theory, concealing the role of the programmer even though Ramsay actually exploits McGann's explorative and 'deperformative' ideas related to the interpretations of literary texts.

Quite different interpretations include Jay Bolter's notion of a writing space, constituted by hypertext connections between the storage and the screen and between connected machines.[108] This position is continued in the works of among others Henry Jenkins and Axel

Bruns *Blogs, Wikipedia, Second Life and Beyond: From Production to Produsage*, introducing the notion 'produsage' for the variety of ways citizens are involved in production and reproduction of content.[109] In this perspective hypertext, the kernel in Turing's choice machine, is the basic compositional mechanism used by professional or civic programmers to produce, connect and disconnect the modules. The text is part of the machine and can be used also to control the mechanical processes.

Steven Roger Fischer and Peter Sahle address the question how to delimit the electronic part of a text (type 1) from the software in which it is embedded. Or more precisely how the codes that represent 'the text' can be delimitated from the surrounding codes be it mark up codes, Ascii codes, or hyperlinks? Which parts of the electronic materials are intrinsic to the text and which are extrinsic? This relates to the question how to establish closures in a medium in which the materials, the coded algorithms included, remain editable? The question may apply both to digitized and born digital linguistic text.

In *A History of Writing*, Steven Roger Fischer argues that e-text differ from alphabetic text because it does not rely on spoken language but on electronic programming. Computers can 'write' both messages and entire programs between themselves. Both kinds are considered to be 'complete writing'.[110] If the computer 'writes' and program executing is a part of that, the machine is defined by the writing of the program. If so, there is only a short step to acknowledge Bolter's writing space perspective and include not only 'ASCI texts' but all sorts of digital materials including the writing instructions in the concept of e-text type 2.

A related argument is given in Peter Sahle's *Digitale Informationsformen* describing both program and hypertext as part of the invisible and linear text on one level, while hypertext on a different level is considered non-linear and thus oppositional to the linear text.[111] It may be argued that this is only possible because both e-text type 1 and the hypertext link are materialized in e-text type 2. Sahle want to delimit his theory to linguistic texts (e-text type 1), which are manifested within a delimited set of characters (such as ASCII or UNICODE). According to Sahle, an e-text can be distinguished from the e-image ('Bild') because each is based on different types of semiotic coding. The e-image on the screen is defined by coded pixels, while the text is composed of characters that are both visible and can be processed as semiotic units.[112] Facsimiles of printed text, however, can be converted with character recognition software. E-Text and e-image need not to share any algorithms or codes, but they do need to be manifested and processed in the very same binary alphabet, as does any particular algorithm. In this perspective the interpretation of e-text type 1 cannot but move fast towards the inclusion as a particular type within e-text type 2.

The implications of this are amplified in so far individual computers and other digital devices are interconnected, because the interconnection is based on hypertext links between destinations and addresses. The hypertext connection of machines implies that the individual machine loses functional autonomy. Networked digital media facilitate communicative exchanges of content by interfering in the functional architectures of each

other. The physical devices may be dedicated to particular kinds of usage, but their functional architectures are still defined on the level of the binary alphabet.

The computer was originally used to mechanize calculation, text processing and other processes. To do so, the text as well as the functional architecture, the algorithms and address systems, had to be represented as sequences of – editable – bits already recognized but not further explored by Turing. The mechanization of text processing in digital media is based on the textualisation of the functional architecture of the machine. Thus electronic text type 2 may also include the functional architectures of 'automates' and 'robots' performing via remote controlled programmes, as deliberately coded closed works. Robots may be monitored in real time like drones or unmonitored like 'self-driving' cars. In all cases, the algorithms are both part of the functional architecture and of the individual 'messages' processed.

Electronic text type 2 is both the basis for further developments of automates and robots governed by either externalised or real time monitored remote controls and for a fast growing array of less controlled and semantically richer narratives.

***Materialities***

As a consequence of the growing awareness about the intricate relations between text and machine, the question of the materiality of text and of digital materials becomes an increasingly dominant issue. This is partly due to the the emergence of a huge variety of new genres. Digital Media are used to produce texts as well as images, sounds, 3D virtual spaces, 3D printing and a huge array of other physical and social processes in a variety of physical materializations far beyond the oscillating screen images. The issue of materiality is also conceptual in nature, as it relates to the hardware, the software, and to the materials processed and is ascribed a growing variety of meanings. It refers both to a set of perceptual conditions, to the time/space conditions of a medium and eventually within a particular text, to the interpretation of virtuality and potentiality, to the processing of the sequences of bits and the dynamic impacts of these processes, and to physical and formal characteristics of the hardware and software. These refer both to tangible physical objects and energy and digital processes often described as purely immaterial or virtual processes.

What is seen as materiality of media and of messages is thus a matter of epistemology discussed from a range of different perspectives more or less closely related to digital media. The question of materiality is a recurrent theme in the works of N. Kathrine Hayles relating both to discourses of embodiment, analyses of *Writing Machines 2002,* and the dissolution of the modern I, for instance *How We Became Posthuman* (1999) and further elaborated in *How We Think: Digital Media and Contemporary Technogenesis* (2012). A central claim is that materiality cannot be specified in advance, as if it pre-existed the specificity of the work. For Drucker materiality 'inheres a process of interpretation rather than a positing of the characteristics of the object'.[113] Further reflections in this direction is

Diana Coole and Santha Frost, (eds.*) New Materialisms, Ontology, Agency and Politics* (2010), and Jay Bolter *Posthumanism* (2016).

From a literary media perspective, Matthew Kirschenbaum, *Mechanisms. New Media and the Forensic Imagination* (2008) analyzes the hardware devices in a kind of close reading perspective, arguing that the physical characteristics, say of a drive, is of particular relevance as they may provide clues or pose constraints for the usages. Kirschenbaum elaborates on Drucker's and Hayles' idea that the materiality is defined in the act of signification, which he denotes 'forensic materiality'. With this concept there is no room for a notion of media, which are used repeatedly for a huge variety of different messages or such a notion has to be added. In the case of digital media, Kirschenbaum suggests adding the concept of 'formal materiality' referring to 'the simulation or modelling of materiality via programmed software processes'.[114] A question then is how the repetitive, programmed processes and the individual messages are connected as they are materialized in two completely distinct forms. Media theories, not least medium theory and parts of mediatization theory would argue, that physical characteristics in these analyses do not refer to physics, but to the organization and eventually institutionalization of physical materials used for human communication both in theform of a medium and in the form of a repertoire of possible variations within a medium and in the combination between media which can be used to articulate individual messages or sequences of such.[115] An indication of a turn to media theories is also found in N. Katherine Hayles and Jessica Pressmann's recent *Comparative Textual Media*.[116] Further complications awaiting closer inspection relate to the distinctions between physics and biology, notions of embodiment and biological tissue, biological and mental processes, not to say life and death.

The overall, recurrent theme in this literature is the post-Cartesian relation between the brain and mind, physical process and mental content. Both dimensions exist within the same time and space in so far ideas and thoughts are conceived of as materialized in the brain or in external mediated forms ranging from fluid speech over fixed objects, to digital media which are physically fixed devices made fluid by codable software and messages manifested in the binary alphabet.

The generalizations in the meta-reflections and meta-perspectives somehow mirror the generalization of the representation of everything, be it things, physical processes and mental content in the very same binary alphabet.

An anthropological perspective is presented in David Miller (Ed.), *Materiality* (2005) arguing that there is a need to give room for the analysis of particular manifestations and conceptualizations of materiality throughout human history. This may fit well both to recent efforts to include human behavioral data in climate research indicating that human culture, as it is always materialized, plays a significant role in the history of nature, and to the conceptualization of the Anthropocene as a new geological epoch.[117]

**Review of the Literature**

***E-text type 1***

The literature on e-texts is extensive while the literature on the notion of e-text is spare. The term is most often used without further qualifications but primarily associated to e-text type 1. There is, however, no established canon across all relevant disciplines for the conceptualization e-text type 1. In the broader area of e-text type 2 including all kinds of digital materials it is even worse due to the exponential growth in amounts, types and genres of digital materials, as well as of areas and purposes of digitization.

Some disciplines, however, qualify in particular ways in particular epochs in the history of digitization. Regarding e-text type 1 this is the case for the Humanities Computing community in the second half of 20th century. Humanities Computing qualify due to a sophisticated understanding of texts and of the interpretative subtleties of e-text-processing. The tradition also renders open a range of new issues. Former assumptions and theories of text are revised in the attempts to take advantage of a technology which gradually turn into a medium which brings its own set of underlying characteristics in play. The interpretation of these characteristics becomes a still more significant part of the story.

In second half of the 20th century, the Humanities Computing community was surrounded by postmodernist theory, but remained rooted in modernist thinking and for a while subscribing also to computational epistemology. The history of and developments within Humanities Computing is documented in *Journal of Computers and the Humanities* (1966-2004) *Natural Language & Linguistic Theory* (1983ff) and *Literary and Linguistic Computing* (1986-2014) and in an array of anthologies throughout the period. These include among many others Raimondo Modiano, Leroy F. Searle, and Peter Schillingsburg (eds.) *Voice, Text, Hypertext Emerging Practices in Textual Studies,* 2004, and Marilyn Deegan and Kathryn Sutherland. (Eds.) *Text Editing, Print And The Digital World*, 2009. Modiano et al. cover both 'oral, material and e-text' from a wide range of periods studied in a wide range of countries and focusing on methodological issues related not least to the application of hypertext tools. Deegan and Sutherland cover the incorporation of digital media as workplace and methodological tool in critical text editing. Peter L. Shillingsburg *From Gutenberg to Google*, (2006) discuss electronic infrastructures needed for the transfer of written or printed text to e-text type 1 based on his theory of script acts comprising every sort of act related to written, printed and electronic representation of text. In this view such a theory is needed precisely because 'the electronic representations alter the conditions of textuality' due to the unique capabilities of digital media beyond simple hypertext search and navigation.[118] The wider implications for cultural criticism of the incorporation of a broad range of digital features in literary studies is discussed in Alan Liu 'Social Computing' among others in the MLA Encyclopedia *Literary Studies in a Digital Age. An evolving Anthology* (2013) edited by Kenneth Price and Ray Siemens.[119]

A second strand of linguistic and literary text theory in the 20th century develops as attempts to automatize language production and translation ranging from the early experiments inspired by Shannon and Weaver's statistical approach or by Chomsky's transformational grammar approach. Both cases are touched by artificial intelligence ambitions as in Herbert Simon's heuristics strategies or as in the connectionist paradigm in 1980s.[120] The EU funded EUROTRA project[121] was perhaps among the most ambitious of these and generated many insights in the subtleties of translation, but without reaching the ambition of full scale automatized translation. As for today Google Translate seems to be the better bid, though the quality is questionable. It builds on huge amounts of heterogeneous linguistic datasets and a big data approach, but without revealing why it translates as it does.[122] For Bar-Hillel a main obstacle was linguistic polysemy. [123] Fifty years later, these issues are still on the agenda for the Google Translate team: 'The same meaning can be expressed in many different ways, and the same expression can express many different meaning'.[124] Nevertheless, in a pragmatic perspective there has been some progress in the use of statistical analysis. Like Google Search which has become a serious rival to information retrieval theories in library and information science, Google Translate has become a serious rival to certain areas in linguistics.

A third strand is the corpus linguistic-tradition comprising a range of approaches based on analysis of a corpus of a 'real language'-materials usually collected due to research defined criteria. Regular conferences have been held biannually since 2001.[125] The *International Journal of Corpus Linguistics* is published since 1996, *Corpus Linguistics and Linguistic Theory* since 2005 and *Corpora* since 2006. Corpus linguistics is mainly focused on e-text type 1. As these texts increasingly are immersed in e-text type 2 for instance as web-texts, the notion of corpus as a 'Body of text of finite size, balance, part whole relationship, and permanence' is questioned as in Maristella Gatto's *Web as Corpus – Theory and practice*. *Studies in Corpus and Discourse*, 2014 in which notions like 'non-finiteness, flexibility, de-centering/re-centring, and provisionality' are used to characterize web-based text corpora.

The efforts concerned with e-text type 1 are increasingly put into the landscape of e-text type 2, which influences the delimitation of e-text type 1.

***E text type 2. In the wilderness***

The Humanities Computing is a main source to the conceptualisation of e-text type 1 with its focus on the digitalization of non-digital originals. Further sources are needed for dealing with digital born materials. The most elaborate theories are still often literary and linguistic theories, but now also media studies and media ethnography, media archaeology, HCI studies, hypertext theories, CMC-studies, social media studies, network analyses, 'big data' studies, web studies and a wider range of theories of text and social text brings with them a range of new perspectives manifested in a fast growing range of specialised studies generated from almost any possible discipline concerned with contemporary culture.

During the same process, Humanities Computing became a main pillar within an emerging Digital Humanities community, which embraced a wider range of approaches to digital media initiated by the spread of a still more diversified set of digital media into all spheres of society.[126]

Thus the Humanities today are confronted simultaneously with two different processes of digitization. One process is created by the ongoing digitalisation of non-digital cultural heritage materials, which relate to the Humanities Computing tradition in so far these efforts centers on the digitization of non-digital originals. As an implication hypertext will remain a tool used for navigation, modelling and exploration eventually as a part of scholarly methodologies. It will never be a part of the non-digital originals, though it will inevitably be part of any representation of and transaction with the digitized translations.

A second process emerges as a response to the fast-growing amounts of born digital materials, related to the spread of networked digital media and involving materials produced independently of scientific and scholarly purposes and including complicating features as scripts, interactivity and hypertext in the texts which at the same time are immersed into a global hypertext infrastructure. The two processes interfere both in respect to the materials of attention and to the conceptualisation of digital media and of methods and epistemologies used. The transition from Humanities Computing to Digital Humanities is documented in a series of '*Companions to* …'publications and a range of anthologies, most recently for instance Gold and Flein *Debates in the Digital Humanities* (2016).[127] Steven E. Jones discusses *The Emergence of Digital Humanities* (2014) in a broad perspective and with a strong focus on the US developments. A worldwide Alliance of Digital Humanities Organisations (AODH) has been formed in 2002.[128] The community gradually developed into a rather diversified 'big tent'.[129] Other metaphors have also been applied, but the lack of a consistent delimitation is often addressed within the tradition not least within the 'classicist' part anchored in the study of non-digital originals.[130] In spite of the big tent, Digital Humanities has also been criticised for being narrowly centred on UK/US perspectives, and for lack of wider cultural critical perspectives for instance by Domenico Fiormonte and Alan Liu.[131]

The array of digital materials and related methods is overwhelming. The *New Companion to Digital Humanities, First Edition* (2016) includes 37 chapters covering each their theme or area and types of data – predominantly materials which may be classified as e-text type 1 though often immersed in e-text type 2.[132] In spite of this diversity in materials, e-text type 2 includes materials and methods far beyond the current foci within Digital Humanities even if it might be argued that all sorts of digital materials should be worth to be studied in the perspective of the humanities as they are genuine human artefacts.

While there is a chapter on digital preservation "Saving the Bits: Digital Humanities Forever?" by William Kilbride in the *New Companion…* there is no chapter on web materials or archived web materials.[133] Web materials appear within corpus linguistics

though the web materials studied are primarily linguistic. For the broader range of web materials – itself a moving target – a series of web archives have been established with the American private Internet Archive, archive.org as first mover since 1996. National web archives have been established in a range of countries and often within the auspices of the National Libraries. The archives utilize a variety of criteria both for collecting, preserving and giving access to these materials. Main issues are dealt with in Peter Lyman "Archiving the World Wide Web", 2002 and Julien Masanes (Ed.) *Web Archiving* 2006. In 2003 an International Internet Preservation Consortium (IIPC) was established. Beyond these general archives there is an unknown amount of targeted web-archives. The distinction between digital versions of non-digital originals and born digital materials is discussed in Niels Brügger and Niels Ole Finnemann *The Web and Digital Humanities: Theoretical and Methodological Concerns* (2013) with web materials and archived web materials as examples of digital born materials which include link instructions, scripts, and interactive sequences as well as formats which cannot be captured with existing tools.

In spite of these archiving efforts, web archives are only capable of collecting a very tiny surface from the global data-production. There is no chance to preserve all data, and much might not be worth to preserve. It still makes sense, however, to develop the criteria for what should be considered worth to preserve be it for cultural heritage, for future research, for future commercial purposes and for future civic and personal purposes. The notion of archive and the value of archives are contested, but the choice is not between archiving or not, but complicated issues on Who, What, Where, When, Why archives are produced and kept in a networked culture in which as stated by Mike Featherstone 'the boundaries between archive and everyday life becomes blurred through digital recording and storage technologies'.[134]

The range of digital materials include the fast growing number of multiple source knowledge systems for real-time scanning of everything from outer space to the interior of our bodies, and everything in between.[135] Some aspects are visible in existing analysis of multiple source knowledge systems like Knorr Cetina's analysis of the international currency trading system.[136] The analysis demonstrates that networked digital media today provide the basis for new types of knowledge organisation which cannot be sufficiently analysed within the framework of e-text type 1 because networked digital media come with intricately build time dimensions which need further analysis.

Literature aiming to create an overview and to characterize various sorts of digital materials can be found within a variety of areas as for instance related to web archiving, content analysis, social media analysis, studies of media ethnography and media archeology. More general approaches discussing the character of data materials and issues on which to preserve and how to preserve data are found in Lisa Gitelman (ed.), *Raw data is an Oxymoron* (2013), Christine Borgmann, *Big Data, Little Data, No Data. Scholarship in the networked World*. 2015, Rob Kitchin, *The Data Revolution. Big Data, Open Data, Data*

*Infrastructures & Their Consequences* (2014), and Eric C. Meyer and Ralph Schroeder, *Knowledge Machines* (2015). From an archive perspective, also Arjun Sabharwal, *Digital Curation in the Digital Humanities: Preserving and Promoting Archival and special collections 2015*. The complexity of the materials is reproduced in the humanities' communication outputs both within and outside the peer review domain. This process has led to the establishing of 'altmetrics' as a new branch within or emerging from bibliometrics.[137]

The tensions between established disciplines in the Humanities and Digital Humanities is arguably intensified compared to the rather marginalized position of the Humanities Computing tradition within the humanities at large in 20th century. Digital Humanities now also to some extent include the study of digital-born materials and a growing range of new genres of growing significance in culture at large. The legitimacy of the Humanities Classic is questioned. One of the most ambitious attempts to bridge the gaps by identifying search for principles and patterns as a long-term continuous effort is Rens Bod, *A new History of the Humanities. The search for Principles and Patterns from Antiquity to the Present*, 2013.[138] Others would argue that there are also deviations, exceptions, unique instances, experiences and redundancies calling for richer narratives. The nature inhabited by man is still a culture identified by proper nouns and otherwise named entities. The relation between search for principles and patterns and narrative is still on the agenda and so is what Hayles describe as the tension between 'the strictness of code and the richness of language'.[139] This tension is running throughout the whole history of digitization, from Bar-Hillel's reflections of polysemy to Busa's claim in 1980 that words are 'deeply different from that of numbers and symbols' due for instance to the unique occurrence metaphors and to the multiple diversity of language, to Stephen Ramsay's attempt to bridge the gap by an explorative, algorithmic criticism.[140] Thus the question is still present whether further elaborations or explorative compositions of hypertext configurations is capable to deliver a cure?

**Links to Digital Materials**

Alliance of Digital Humanities Organisations (ADHO) http://adho.org/about

Altmetrics: MikeThelwall, "A brief History of Altmetrics." Research Trends website 2014. Accessed 20.11 2016 https://www.researchtrends.com/issue-37-june-2014/a-brief-history-of-altmetrics/

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Corpus Linguistic Conference series: http://ucrel.lancs.ac.uk/cl2015/past-confs.php

Electronic Literature Organization (ELO): http://eliterature.org/

Electronic Text Center. University of Virginia Electronic Text Center. http://www.library.virginia.edu/research/

Functional Requirements for Bibliographic Records: Final Report/IFLA Study Group on the Functional Requirements for Bibliographic Records. (1998). http://archive.ifla.org/VII/s13/frbr/frbr_current3.htm#3.2 (accessed 28 October 2010).

Hypertext: yearly ACM Hypertext conferences since 1987: https://www.interaction-design.org/literature/conference/proceedings-of-acm-hypertext-87-conference ACM Sigweb conferences, http://www.sigweb.org/resources/sig-archives since 1991

International Internet Preservation Consortium (IIPC) http://www.netpreserve.org/

Internet Archive, http://www.archive.org

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TEI P5: 2016. TEI P5 Guidelines for Electronic Text Encoding and Interchange. Version 3.0.0. Last updated on 29th March 2016, revision 89ba24e http://www.tei-c.org/release/doc/tei-p5-doc/en/html/NH.html;

Text Encoding Initiative Consortium (1994ff): TEI Guidelines for Electronic Text Encoding and Interchange (TEI). Consulted on: 9 December 2013, http://www.tei-c.org/Guidelines/ and http://www.tei-c.org/About/history.xml.

TEI P5: 2016. TEI P5 Guidelines for Electronic Text Encoding and Interchange. Version 3.0.0. Last updated on 29th March 2016, revision 89ba24e http://www.tei-c.org/release/doc/tei-p5-doc/en/html/NH.html

University of Virginia Electronic Text Center. http://www.library.virginia.edu/research/

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**Notes**

[1] In the present text 'binary alphabet' is used to denote the two bits which are often referred to metaphorically as 0 and 1. These metaphors give the impression that they represent numbers and have a particular semantic value except being distinct from each other. In computers bit sequences are used to represent numbers, letters, images, sounds as wellas processing rules. The bits function more like letters in linguistic alphabets than like units in formal languages.

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[36] Gerard Genette 1987.
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[38] McGann 1995, reprint 2001: 56-57.

[39] Humberto Maturana and Francisco Varela (1980, and 1992).

[40] McGann 1995, reprint 2001: 218.

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[45] McGann 1995, reprint McGann 2001: 71.

[46] Turing 1936: 232.

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[66] Kirschenbaum 2008:43.
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[71] Hayles 2002:20.
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[73] Aarseth 1997:19.
[74] Aarseth 1997:18.
[75] McGann (1995) and Michael Joyce (1988).
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