Seven Hypertexts

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ABSTRACT

What is Hypertext? It has been studied and explored for over 50 years but a complete definition seems ever more elusive. The term is invoked in multiple communities, and applied in radically different domains, but if we cannot reconcile the different perspectives then we will be unable to learn from our shared history, or from each other in the future. In this paper we argue that the longevity and variety of hypertext work makes a simple definition impractical. Instead we suggest different contexts in which hypertext work has been conducted, and then attempt to draw out the relationships and commonalities between them. We describe seven contexts drawn from the literature: Hypertext as a Tool for Thought, as Knowledge Representation, as Social Fabric, as Literature, as Games, as Infrastructure, and as Interface. We argue that these are connected by a common requirement for non-regularity, driven by post-structuralist philosophy, and enshrining existentialist values in our technology. It is the application of these ideas to different problems that gives rise to current Hypertext, as we see the same technical features, and engineering and creative challenges, manifest in otherwise quite different digital domains.

CCS CONCEPTS

• **Human-centered computing** → **Interaction paradigms**; **Hypertext / hypermedia**; *Collaborative and social computing*; • **Software and its engineering** → *Software infrastructure*; • **Information systems** → Multimedia information systems; *Collaborative and social computing systems and tools.*

KEYWORDS

hypertext, hypermedia, hyperfilm, knowledge management, knowledge representation, games, interactive fiction, hypertext literature, metadata, PKM, knowledge bases, linkbases, social networks, stretchtext, blogs, tools for thought, infrastucture, interface, narrative

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1 INTRODUCTION

The ACM Hypertext conference (HT)—and, by extension, its research community—has a habit of self-reflection, if not existential doubt. The turn of the century appears to have been a key time for these questions. At HT'99 Bernstein asked *Where Are The Hypertexts?* [24], at HT'03 Nürnberg discussed *What is Hypertext?* [155], and at HT'04 Wardrip-Fruin tried to answer in *What Hypertext Is* [191]. Perhaps it was the advent of the World Wide Web that cast a long shadow across the wider field of Hypertext and caused such soul-searching.

In the early days of hypertext there was more certainty, a feeling of mapping out the space and its challenges, a vision. The word 'hypertext' itself was defined by Ted Nelson in 1965:

> Let me introduce the word "hypertext" to mean a body of written or pictorial[1] material interconnected in such a complex way that it could not conveniently be presented or represented on paper. [143, p.96]

This gave us hypertext's core notions of linkage between objects and of the non-linear paths amongst them. In the following year Nelson challenged the status quo around publishing [145] and consumption of information [144], asking re change—"Why not?". Separately, Doug Engelbart was already planning a structured information system [64] that drew upon Vannevar Bush's Memex and associative trails [43]. His NLS [67] hypertext system was revealed to the world at the 'Mother of All Demos' in 1968 [65]. Contemporaneously, Nelson and Van Dam collaborated at Brown University to reveal HES [146], the first hypertext system running on a commercially-available computer (rather than in a lab on research systems)[2] and its immediate successor FRESS [56].

The two decades following NLS and HES saw a burgeoning of hypertext experimentation and development both technical and conceptual. In 1987 a workshop was held, notable as being the first concentrating purely on hypertext; this became the first Hypertext Conference.

The first attempt to define this maturing field was Jeff Conklin's milestone paper 'A Survey of Hypertext' [47, 48].

Conklin's overview of hypertext was this:

> The concept of hypertext is quite simple: windows on the screen are associated with objects in a data base ... and links are provided between these objects, both graphically (i.e. as labelled icons) and in the data base (i.e. as pointers). [48, p.2 Sect 1.1]

[1] Implicit here is the wider notion of 'hypermedia'. We use the general term 'hypertext' throughout this paper regardless of the exact media type.
[2] HES also introduced the 'Back button' [152, p.173].

Conklin also provided the first categorisation, in that he saw the field divided into four primary informal groupings [48, p.4 Sect 2]:

- macro literary systems: the study of technologies to support large on-line libraries in which inter-document links are machine supported—all publishing, reading, collaboration, and criticism takes place within the network; (Memex[43], NLS/Augment [67], Xanadu [145, 147] [3], Textnet [185])
- problem exploration tools: tools to support early unstructured thinking on a problem, in which many disconnected ideas come to mind, such as early authoring and outlining ('idea processors'), problem solving, and programming and design; (PIE [81], gIBIS [49], Synview [118], WE [178].
- browsing systems: easy to use systems for teaching, reference, and public information; (ZOG[166], KMS[2], Emacs INFO [180], Hyperties [175], Document Examiner [190])
- general hypertext technology: general purpose systems designed to allow experimentation with a range of applications—commonly applied to reading, writing, collaboration, etc. (Notecards [95], Intermedia [203], Neptune [55], Boxer [58], CREF [162], Hypercard [82], PlaneText [89])

The systems categorised by Conklin provided the foundation for one of the earliest reflections on the challenges for the community as a whole, Frank Halasz's *Seven Issues* [92], which continued to reverberate through the community into the Web era [93, 94].

Much time has passed, and this early work has acquired a certain historicalness. HT is a relatively small conference, and hypertext is seen by some as an historical technology: foundational, but firmly in the past. We believe that it has been a victim of its own success, so ubiquitous and spread thin by its many offshoots that even the HT community has lost track of what it means. The time seems right to revisit the questions posed by Bernstein, Nürnberg, and Wardrip-Fruin in an attempt to re-establish its importance, and to help us plot a new course.

In this paper we will try to follow the threads of hypertext development to present seven perspectives on hypertext, which form the different contexts in which hypertext research has been, and continues to be, undertaken. By setting out these seven, we can show the manifestations of modern hypertext, revealing its continued vibrancy and importance. The seven also provide a way to frame new questions and challenges for the next generation of hypertext researchers.

2 THE SEVEN HYPERTEXTS

Our approach is informed by the work of O'Hara and Hall who identified *Four Internets* [158] each categorised by their own set of values and governing systems[4]. They highlight the importance of Internet governance in preventing a splintering of the Internet under these forces.

Our approach is less grand, but essentially follows a similar methodology. By pursuing the development of different hypertext research trends, each routed in a set of given goals and values, we can map out perspectives of seven hypertexts, their manifestations, and current challenges. This then gives us a frame to look for commonalities between perspectives, and to argue for a philosophical core that is common to all.

These seven hypertexts are not presented as discrete and disjoint. Some systems or uses will fit more than one category and the boundaries of the categories are necessarily blurred. Yet their centres describe a number of clearly different manifestations of hypertext in the 21st century. Our proposed 'Seven Hypertexts' are:

(1) Hypertext as a Tool for Thought
(2) Hypertext as Knowledge Representation
(3) Hypertext as Social Fabric
(4) Hypertext as Literature
(5) Hypertext as Games
(6) Hypertext as Infrastructure
(7) Hypertext as Interface

The following sections present each of these in turn.

2.1 Hypertext as a Tool for Thought

The digital foundations of hypertext were laid by pioneers such as Douglas Engelbart who wanted to 'augment human intellect' [64] by creating systems that supported the (sometimes serendipitous) discovery, learning, and capture of knowledge. These were the early 'Tools for Thought' [163][5], most famously his NLS/Augment [67]. Critically, these tools are not merely about storing knowledge, but about its active processing, with the goal of extending the capabilities of the human mind, drawing on how the non-linear and non-monolithic aspects of hypertext nodes suit themselves to associative trails and close referencing of materials.

Digital tools were themselves extending the capabilities of mechanical or paper-based precursors. For example, Bush's theoretical Memex was based around the manipulation of micro-fiche [42]: Otlet's *Mundaneum* [160] [201, Ch. 8] used a card-based system as did *Zettlekasten* systems such as Harrison's *Arca Studiorum* [75, pp.197–8], or Linnean 'slips' (index cards) [184] which date from the 17th and 18th centuries[6]. A *Zettlekasten* uses complex indexing systems to allow paper cards to refer to one another, and in some cases ingenious mechanical systems (such as edge-notched cards [3][7]) that enabled cards to be quickly selected and filtered.

It was these process aspects that digital systems were able to automate so successfully. The tools that emerged in the 60s, 70s, and 80s introduced hyperlinks as a primary mechanism for navigation. Some relied on text-based screens—such as HES [146], FRESS [56], and Hyperties [175], others such as Notecards [95] were window-based and embraced the card metaphor, although as alternative windows rather than as fixed full-screen-sized cards.

Digital tools also opened the possibility of more complex cross-referencing and indexing. Tools for argumentation were Hypertext's response to the second Summer of AI, a quest for clarity in the face of bias, and a way of encouraging users to engage in more structured thinking. Systems such as gIBIS [49] embedded methodologies for analysing 'wicked problems' (IBIS was originally conceived to help policy formation [165]), whereas AQUANET [121]

[3]Conklin actually cites [149], no longer accessible.
[4]These are: (1) the *Silicon Valley Open Internet* based on openness, ((2) the *Brussels Bourgeois Internet* based on human and legal rights, (3) the *DC Commercial Internet* based on market solutions, and (4) the *Beijing Paternal Internet* based on Chinese state censorship and control. The point is their discreteness within the Internet overall.

[5]The phrase is first attributed to Iverson in his 1979 ACM Turing Award speech [103].
[6]The method is most recently associated with Niklas Luhmann's work [119].
[7]Engelbart's archive shows he used edge-sort cards whilst researching his Augmenting Intellect Intellect paper [91].

took the finer grained approach of using Toulmin structures as its linking model[8].

While the artefacts left behind by the process have value, in this view of hypertext the process itself is the point; the view being that writing is thinking, and that when hypertext dematerializes a lexia it changes fundamentally how we write and thus changes how we think. As Rosenberg puts it "there can exist a natural language in which hypertext carries the very structure of syntax itself: hypertext not as a medium of organizing thoughts, but as a *medium of thought*." [167]

2.1.1 Spatial Hypertext. Many of these early tools for thought had a visual aspect, but mostly these translated from hypertext structure into visual structure, e.g. laying out the network as a (navigational) graph. In the 1990s Marshall et al. realised that moving the other way, from visual structure *to* hypertext structure, would create a much better mechanism for capturing emerging structure [122]. This process they named 'Spatial Hypertext' (SH) and which they formally implemented a year later in the VIKI system [123].

VIKI contained a 'spatial parser', a sub-system that examined the layout and other presentational aspects (colour, shape, etc.) of nodes on a canvas, and suggested structure when it began to become apparent. For example, a sequence of nodes in a row might be a list, a selection of nodes coloured green might be a set. VIKI was created by the core team behind AQUANET, and might be considered as a reaction to the strict structure of argumentation in their earlier system. Notably, the human VIKI user is free to experiment, and is encouraged to change and evolve their (and the parser's) ideas—a process Marshall *et al.* call 'information triage'.

The Fundamental Open Hypermedia Model (FOHM) [133] treats Navigational Hypertext (nodes and links) and SH as two separate 'domains' of hypertext, but also attempts to reconcile their alternative structures, arguing that spatial structure can be experienced navigationally, and that navigational structure can be visualised spatially. This frames the two domains not as fundamentally different, but as different visualisation and interaction modes that reflect alternative ways of exploring and building knowledge.

Another early, but different, spatial approach was seen in Intermedia's Web View [187], but the spatial parsing is informative rather than deductive. Separately, a freer form of SH emerged from 'map' views seen in systems such as Intermedia [187], with systems such as Storyspace [26] and Tinderbox [27] allowing users to manually arrange elements *without* an active spatial parser. Instead, the human user is offered a free-form workspace where explicit links are allowed but not required which is useful for initial triage of new information. Essentially, the human is acting as the spatial parser using associative thinking: where it is is what it is.

2.2 Hypertext as Knowledge Representation

It did not escape early researchers that while hypertext was a powerful tool for thinking, it also resulted in complex knowledge structures that could have value beyond to the author themselves. Thus the second of our seven hypertext contexts focuses on hypertext's ability to store and communicate (established) knowledge to others, and ultimately its capacity to act as a form of Knowledge Representation.

One of the earliest digital examples is ZOG[9] [166]. In appearance ZOG looks very similar to other early text-based systems such as Hyperties, however the focus in ZOG is on exploring an existing sequence of frames, which communicate information from an interlinked knowledge-base (for example, a parts manifest). In fact ZOG is a more generalisable communication layer and navigating between frames is only one possible action—another might be to message a person. ZOG also includes actions to edit a frame (using ZOG's editor, ZED). However, here the focus is on collaborative knowledge building, rather than augmented thinking.

Just as AQUANET brought more structured relationships to Tools for Thought, so systems such as IGD (Interactive Graphical Documents) [71] brought structure to Knowledge Representation. In the case of IGD this was in the form or hierarchical structure, enabling specific navigation choices (e.g. to traverse up and down the hierarchy) as well as specialised visualisations [70]. Similarly the GUIDE system [39] provides a method for browsing documents where the top level document is shown initially, and the user selects 'replacement buttons' to 'unfold' the document to show more details (a mechanism later known as 'stretchtext'[10] or 'fluid links' [204]). Unlike IGD, GUIDE is not a strict hierarchy as the knowledge base also includes 'definitions' which operate like replacement buttons but which can be used in multiple places within the document.

There have been a number of attempts to create significant interlinked online knowledge bases, for example the Victorian Web [115][11], and the largest open public hypertext knowledge-base remains Wikipedia[12], based on the Wiki philosophy [116] of 'to make bad edits easy to correct, rather than hard to make'[13]. Wikipedia is of course a digital facsimile of a traditional paper-based encyclopedia, a traditional form of knowledge representation that dates back almost two millennia (to the *Naturalis Historia* of Pliny the Elder). Its collaborative philosophy has echoes of ZOG's ZED, with a focus of enabling the knowledge base to grow and evolve over time, but otherwise as a hypertext is remains rather straightforward, with a single view of the hypertext, and limited use of its more advanced features such as (content) transclusions [5][14].

Hypertext systems that provide alternative views of a knowledge base are known as Adaptive Hypermedia (AH). They take advantage of a user model to decide dynamically how to present the hypertext to the user [41]. AH systems such as AHA! use conditional statements in the hypermedia content to alter content or to change the presentation of links [54]. Adaptive Educational Hypertext systems use this idea to create a knowledge base that can be used for learning, altering what the user sees according to their level of expertise (potentially measured through digital testing) [139].

[8] Author's Argumentation Assistant [173] combined both Toulmin structures and the IBIS/PHI model.

[9] ZOG's name is not an acronym, but one chosen for its concise and memorable nature. Often overlooked is design influence [77, p.184] from the PROMIS system [174].

[10] Nelson first describes and names 'stretchtext' in his 1968 'Hypertext Implementation Notes' [146, pp.14–19].

[11] Conceived in 1987 within Intermedia, it then migrated via Storyspace to the Web.

[12] Wikipedia Main Page: https://en.wikipedia.org/wiki/Main_Page.

[13] As described by the Wikimedia Foundation's Meta-wiki page 'The wiki way'.

[14] MediaWiki conflates Nelson's original concept of transcluding content with more general templating and server-side includes.

A disappointment of this perspective on hypertext must be the proliferation of commercial digital formats that are not hypertextual at all, but instead seek to replicate paper based formats. PDF, developed initially by Adobe as a mechanism to capture documents for printing [105], has become the defacto standard for scientific documents, despite attempts in the area of eScience to promote alternative approaches [18]. In commercial publishing, eBook formats such as ePub[15] are open, and allow flexibility in how materials are presented, but offer limited interactivity [136].

The last twenty years has seen a focus on new types of hypertextual knowledge bases that are machine-readable. The roots of this are hypertext systems where nodes and links are typed, allowing for alternative presentation styles or even queries to be run over the structure, an approach known as Rich Hypertext [142, 154]. In 2001 Tim Berners-Lee launched a new initiative that took rich hypertexts even further; the Semantic Web eschews unstructured content almost completely, expressing knowledge as interlinked concepts connected by typed relationships and described by a schema [20]. The technologies and tools associated with the Semantic Web (RDF, RDFS, OWL, SPARQL, etc.) have gone on to form the foundation of the Linked Data movement, focused on the open release of machine readable data [109].

Another modern incarnation of Rich Hypertext is in the form of Semantic Wikis which use Wiki mark-up to express types [44, 154], these have resulted in large services such as DBPedia[16], which attempts to convert structured information from Wikipedia (for example, written as infoboxes) into Linked Data (RDF that can be queried through SPARQL) [198]. The view of Hypertext as a Knowledge Base has always struggled with the question of how much knowledge should be formalised into a machine-readable element and how much should be left in the text and links, and the separation of written and machine knowledge illustrated by DBPedia is perhaps an indicator that (despite initiatives such as RDFa [200]) this remains an unsolved problem.

2.3 Hypertext as Social Fabric

The lack of networking among early computer systems initially limited practical opportunities for multi-user hypertexts[17]. A notable early exception was IRIS' client-server system Intermedia [90] (late 80s). Despite its innovations, the choice of Apple UNIX as OS limited adoption and visibility of its features. So it was the advent of the Web, with its radical distribution, and massive user-base, that provided a context where Hypertext could be seen as more than a web of text, but also as a web of people: as social media.

Digital social networks have their routes in the 1970s, with novel systems such as Community Memory (which used teleprinters and acoustic modems to allow a digital flea market to evolve in a San Francisco record store [117, Ch.8]) leading to direct dial bulletin board systems (including significant sites such as 'The Well' [72]), and later Usenet. When personal websites appeared in the 1990s they included social aspects, with sites like Geocities (1994) popularising web rings, buddylists, and blogrolls - literally encoding social relationships as static links. The first social network site was SixDegrees.com (launched in 1997) which established a more managed and egocentric social hypertext environment, allowing for friendships to be confirmed, and posts to be circulated to different degrees within the network.

SixDegrees set the template for an explosion of social media sites and users in the 2000s: Friendster (2002), MySpace (2003), Orkut (2004), Facebook (2004), Flickr (2004), Youtube (2005), Twitter (2006), Tumblr (2007), and Sina Weibo (2009). This new generation of websites was popularised as 'Web 2.0' by Tim O'Reilly in 2005[18] [159], and recognised as a new generation of hypertext system [135].

Social media systems have continued to proliferate, often specialising in aspects of the social experience such as direct messaging (WhatsApp, Snapchat), photo sharing (Instagram), video snippets (TikTok), or even location sharing (FourSquare). As websites they present through a hypermedia interface, and might be considered a specialist type of structured hypertext (where nodes have types such as profiles, channels, or hashtags, and are populated dynamically based on the latest information and updates). However, this is a superficial interpretation, and the real contribution of Hypertext as a Social Fabric is to consider people as nodes, and the network structure of their relationships or interactions as the fundamental structure being analysed and navigated.

Research has blossomed alongside social network popularity, and it would be impossible to cover here the myriad of topics explored in social informatics. However, if we focus on work around the structures of social networks and the links between people, we find examples of researchers exploring algorithms to measure influence [182], to calculate trust [80], to see how networks evolve over time [13], and to explore how information propagates through those networks [45].

As the impact of social networks became clearer through the 2010s, research turned outward, looking at the impact of social networks on aspects of our society, especially in the digital humanities. In some spheres this led to entirely new activities, such as the work on learning environments and open education which led to the development of MOOCS [17, 51]. In others, it raised serious ethical questions, such as the discussion of our rights as citizens over our private data and its uses [86].

Perhaps a key contribution of this view of hypertext is that hypertext does not happen in a vacuum, and that when deployed at scale its links become a currency in a financial and political economy that transcends the technology itself, meaning there is 'no moral high ground' [188] where we can think only of their functionality or rhetorical power. When hypertext becomes a social fabric it leaves the purely technological realm, and becomes a social and cultural object that deserves study at that level.

2.4 Hypertext as Literature

Hypertext as a media and a form of expression, Hypertext that is literary, unsurprisingly pre-dates digital technologies. Early examples are Talmudical annotation and medieval argumentation diagrams [69], or the *I Ching* (The Chinese Book of Changes). In the 20th century, we see the Oulipo movement—such as Queneau's *Cent mille milliards de poèmes* [183, pp.8–17], or Saporta's *Composition*

[15] ePub descends from IRIS, via Electronic Book Technologies's Dynatext [179].
[16] DBPedia: https://www.dbpedia.org/resources/.
[17] NLS was already four years old before, in 1967, it could move to actual concurrent multi-user use with the arrival of a time-sharing SDS-940 [14, p.125].
[18] The term was actually coined in 1999 by Nancy DiNucci [59].

No. 1 [170]. A dearth of early literary hypertexts reflects the technical hurdles, there being neither enough suitable computers outside research spaces nor suitable authoring programs. The flowering of this genre came at the end of the 1980s, with the affordability of personal computers and the new availability of hypertext systems outside of research labs. Malloy's 1986 work *Uncle Roger* was made using Apple BASIC and her own Narrabase tool[19], the work evolving from earlier paper card-based work from the late 1970s [83, p.368][120].

Best known from this era is Joyce's 1987 *afternoon, a story* [106] written in Storyspace [35, 107]. At the same time, Apple's free [sic] distribution of Hypercard made it a popular authoring tool for early works such as McDaid's *Uncle Buddy's Phantom Funhouse* (1993) [125]. In the mid 1990s Adobe Flash was popular for those wanting a more dynamic, multimedia, experience. As early literary hypertexts were essentially both written and read in the authoring environment, the loss of those environments is problematic; of the three systems mentioned only Storyspace is still available for modern OSs and hardware (although efforts are being made to preserve and restore orphaned and endangered works [62, 85]).

Perhaps a key difference between hypertext as literature and hypertext as a knowledge base is that literature does not necessarily focus on clarity or understanding: embracing multiplicity of meaning, it may legitimately employ obfuscation or deception. For example, Nelson rejects *afternoon* for its lack of a clear navigational structure: "The purpose of computers is human freedom, and so the purpose of hypertext is overview and understanding; and this, by the way, is why I disapprove of any hypertext (like Michael Joyce's 'Afternoon' discussed by Jay Bolter) that does not show you the interconnective structure." [150, p.56]. Whereas hypertext literature tended to content itself with changing the sequence in which a story was experienced (the Syuzhet), interactive fiction[20] (written in tools such as Inform[21] or Twine [78]) goes further and changes the reality of the storyworld (the Fabula) in response to reader's choices [196]. It thus goes beyond Adaptive Hypermedia, and not only shows you different versions of the truth, but potentially different truths.

This plasticity was exciting for post-modern literary critics, who used it to argue that hypertext literature was the ultimate expression of Barthes's 'Death of the Author' [16], the idea that meaning is partly constructed by the reader rather than exclusively embedded in the text. Landow argues that hypertext enables the reader to see their role in this process through their link choices [114]—not only is the interpretation constructed by the reader, but now they had the power to change the narrative events themselves. However, writing for all possible outcomes is clearly impossible, as in an endless *Garden of Forking Paths* [36], and so the author also makes choices, to scope a work and to control the agency of readers. As Brooker quotes from Thomas à Kempis, "Man proposes, God disposes" [38, p.46].

[19]Used for v3+ of the work. v1 used Picospan (on The Well), v2 used Unix shell scripts.
[20]This is not always a clear distinction, and perhaps best describes the communities rather than the work itself. Hypertext literature implies a more self-conscious/intentional/deliberate avant-garde movement, whereas interactive fiction is more popularist and playful.
[21]Inform: https://ganelson.github.io/inform-website/.

A focus on poetics distinguishes the literary context within the scope of hypertext research, this includes subjects such as the identification of structural patterns [23, 129], the rhetorical usage of links [124], discussions of closure [60], or consideration of rereading/rewinding [138]. It also opens up new concerns, such as the form and value of criticism and the pitfalls of a new literary economy [29], or the process of remediation of old media into new [34, p.45].

Originally, both literary and technology focused researchers were well integrated within the hypertext community, but something of a gulf between them has emerged in recent years. Representation of literary theory has become far less common in the ACM Hypertext Conference [6]. In our view, this disconnection is a loss. The transferable insights, that may benefit the technologists, are not just superficial but show how a literary perspective challenges the sometimes lazy assumptions of hypertext technology orthodoxy that we have inherited from the Web. Recent efforts to mend this rift, such as the invitation to Grigar's *Tear Down the Walls* exhibition at ACM Hypertext 2019 are deliberate steps in the right direction [84].

2.5 Hypertext as Games

Espen Aarseth distinguishes between hypertexts and *cybertexts*, arguing that cybertexts are "a self-changing text, in which scriptons and traversal functions are controlled by an imminent cybernetic agent, either mechanical or human" [1]. While AH, with its conditional links and content, might fulfill this condition (with the adaptive engine as the agent) static hypertexts do not.

Bernstein defined *Strange Hypertexts* as those with unusual data models, presentation, or interaction systems [25], using a card-based prototype (*Card Shark*) and a virtual location based prototype (*Thespis*) as examples. Originally intended as a call-to-arms for system developers to be more playful and experimental [99], the paper also extends the scope of what we might consider to be hypertext systems, firmly placing them in the space mapped out for cybertexts by Aarseth.

Narrative Games take this even further, radically changing the presentation of scriptons (lexia), and extending interactions into a wide set of game mechanics. From a Game Design perspective we can consider traditional literary hypertexts as "a subset of games, with a constrained set of mechanics based around textual lexia and link following, albeit with a history of pushing those boundaries with strange structures and alternative behaviours." [128].

Interactive Digital Narrative might be considered the umbrella term that covers all of these permutations [111], the term reflects a change in emphasis to a higher level conceptualisation where users are exploring fictive worlds (whether through texts or via other means) as exemplified by Janet Murray's vision of *Hamlet on the Holodeck* [140]. From hypertexts to strange hypertexts to narrative games this is not a spectrum where the value of hypertext diminishes, but one where it is joined by other elements and new design considerations [131]. A purely hypertextual reading of narrative games is valid, but incomplete.

Locative games, games experienced on a smart device with interactions triggered by location, are a good example. StoryPlaces is one such, based on a sculptural hypertext model that has been

extended to include location and time constraints [32, 100]. It can be analysed as a hypertext, for example using the *Canyons, Deltas and Plains* model [132], but whilst its mechanics may be very simple this is not enough to describe the design of its locative experiences as the affordances of the physical location and its influence on the experience must be taken into consideration [134].

The extended mechanics and interfaces of narrative games are not merely laid over a narrative, they are also inherent to telling that narrative [137]. This implies that authors will want to extend their creative control over hypertext narratives to include the way in which hypertexts are presented and to change the interaction methods that readers can use. There is thus a challenge both in applying hypertext theories to games, but also in learning from games in order to make literary hypertext environments more powerful and flexible.

2.6 Hypertext as Infrastructure

The need for interoperability has long been understood and manifested in initiatives such as the Dexter Model [96] which attempted to create a standard architectural view of hypermedia systems. This led to a generation of *Open Hypermedia Systems (OHSs)*—for example, Microcosm [76], DHM [88], HyperDisco [192], HOSS [157]—that attempted to break out of a monolithic view of hypertext and bring hypertext services to a wide array of desktop tools and operating systems (utilising the pre-existing idea of linkbases that are combined with documents at run-time: q.v. Intermedia's link service [90, pp.45–48]). This new context of heterogeneous tools caused the formation of the OHS Working Group within the Hypertext research community, and drove the development of the Open Hypermedia Protocol, which operationalised Dexter and specified a generic hypertext link model and a set of possible actions embedded in a human readable API [52].

Dexter and OHP represent a view of Hypertext as a core computational service, operating as an infrastructure that sits below the application level, and makes itself available widely across a user's desktop. The 1990s saw the development of Service-Oriented Architectures using technologies such as CORBA[22] followed later by SOAP and REST. OHSs developed further into Component-Based OHSs (CB-OHSs) where the navigational services of OHP were just one component of many. Systems such as Callimachus [186] and Construct [195] connected multiple hypertext clients to multiple hypertext structure servers, allowing for structures specialised for navigation, spatial, or other types of domain.

The philosophy behind this approach was best captured by Nürnberg et al. when they appealed for the 'primacy of structure over data' [156], and called for a new approach of *Structural Computing* that made the definition and manipulation of these structures (e.g. links, or spatial hypertext collections) as fundamental a part of a computing environment as is the file system [193]. They were not alone. Ted Nelson, more than three decades after arguing for a global hypertext system and coining the word 'hypertext', also appealed for a more versatile but structured view of data in the form of the *ZigZag* model based on zzstructures [151]. At a high level ZigZag can be understood as a kind of multidimensional spreadsheet where users can pivot their view at any time to see alternative dimensions.

While this view of generalisable hypertext infrastructures lives on in modern systems such as Mother [10], much of the work on hypertext infrastructure was displaced by the vertiginous rise of the Web. As Atzenbeck puts it (in 2017): "A research gap can be witnessed between the original hypertext infrastructure work around the year 2000 and today which has not been compensated by the growing Web." [11]. The desire for open systems has been replaced by an acceptance of the Web as a common platform for developing applications and tools (the Web 2.0 era [59]), whilst Linked Data [21, 199] took the role of versatile structure [97]. Nevertheless, the view of hypertext as infrastructure was an important part of historical hypertext work, and is one of the antecedents of modern service, cloud, and linked data platforms.

2.7 Hypertext as Interface

Hypertext is associated with a variety of interfaces for interacting with and navigating information. The early hypertext systems (such as NLS [66], or Hyperties [175, 176]) already had the core mechanism of link following in place. A clickable 'hotspot' in the text that when selected (whether by mouse, cursor, or lightpen) caused that link to be activated and for the user's viewpoint to be navigated to the destination of that link. In later multimedia systems this hotspot (technically defined as a 'source anchor') was extended to cover not just ranges of text, but also areas in an image or video, stretches of time in video or audio, or even location extents [52, 130]. Links were typically highlighted by emphasis (underline, italic, etc.)[23] or by colour[24]. However, later systems allowed this to be controlled (for example, through a presentation specification in OHP [53], or CSS [197] on the Web).

Source anchors were not always visible. StorySpace used hidden anchors, which were only revealed on a key-press. StorySpace also allowed authors to create a default 'next' link, which would be activated via a different key-press. The destination of a link could be a whole document or a section of that document (a 'destination anchor'). NLS and Hyperscope used viewspecs to allow documents to be opened from a specific link in a specific view (for example, with line numbers, or content filtering) [68]. The destination was typically swapped in to replace the source, but in later windowing systems they could also open up new windows and display the destination as well as the source, what Rosenberg calls conjunctive rather than disjunctive linking [168], and which Bernstein identified as a *montage* pattern [23]. The more complex links in OHSs allowed these systems to support n-ary links with arbitrary numbers of source and destination anchors [4]. Combining linkbases and documents at runtime also allowed them to calculate links and inset them into documents. Microcosm's 'generic links' were defined with key terms as anchors, users would then select a passage of text and 'calculate links' causing any matching generic links to appear [98]. Transclusion was also an option for a link-following action,

[22] CORBA (1991) see: https://www.corba.org/history_of_corba.htm.

[23] Some early systems used marginal or interlineated link icons.

[24] The blue links we associate with the early Web were a result of research work undertaken by Ben Shneiderman on Hyperties years earlier [101].

embedding the destination anchor within the current document, a process known as stretchtext or fluid links (q.v. 2.2).

Despite this prodigious array of interaction methods (or perhaps partly because of them) significant issues have been noted with hypertext interfaces. The lost-in-hyperspace problem (disorientation within an endless network of nodes and links with few navigational markers) was identified relatively early [61, 63], as well as the difficulty that authors face as they struggle to maintain intention and argument [28, 112]. Solutions included following structural design principles [102], patterns such as an identifiable neighbourhood [23], breadcrumbs [22, pp.42–3], or the automatic identification of hierarchies [37]. Although some have argued that these digital 'sprawling places' have a value in terms of their complexity and non-linear utility [113], and in the literary context disorientation can have a valued aesthetic effect [106].

Links have been hailed as the new punctuation [124], and shown to influence reading even when not used for navigation [104], but they are not the only interaction associated with hypertext; over the years many interfaces have been proposed for searching and browsing hypertext structures. Maps are a common approach and were present in the earliest systems [35, 95], they use a visual representation to show the architecture of the hypertext and its connections, and can be based on spaces, sequences of scenes, network visualisations, and other approaches [141]. Rich hypertexts lend themselves towards concept mapping, with the different types effecting the presentation of links or nodes [205], 'hashtags' are a folksonomic way of defining types, and also popularised 'word clouds' as representations of tags and their frequency [74][25].

Structured browsing methods include dictionaries, glossaries, or sitemaps [181] which might be constructed automatically or manually. Facetted browsing makes this structure interactive, allowing users to manipulate a series of filters to locate items in which they have an interest [79, 172]. Alternatively systems might include a search interface, typically this is based on content although structural search is also possible [161]. Famously, it was the invention of 'pagerank', a Web-based search algorithm resistant to manipulation, that was the foundation of Google's success [162].

Many Web 2.0 systems used their social aspects to improve the browsing experience. Collaborative filtering uses social similarity to find things that might appeal to people-like-you [135], and recommendation systems based on content or network analysis have become a research field in their own right [164]. This glimmer of intelligence is perhaps a sign of things to come, large language models such as ChatGPT offer not only free text search, but free text results—that combine and reinterpret data into the form that was requested (albeit with the dangers of hallucinations [153], and being only backwards-looking[26]), it remains to be seen how this interaction paradigm will change user's expectations of the systems with which they interact.

[25]Made popular by the Flickr photo site c.2006, their word clouds used Flanagan's earlier technique.

[26]An LLM (Large Language Model) only knows the facts that were in its training set.

3 DISCUSSION

The seven hypertexts are not strict categories, but ways of framing hypertext that help to focus major areas of research. There are clear relationships between them. For example:

- Adaptive Hypermedia techniques sit between Knowledge Representation and Literary Hypertext; the techniques outlined by Brusilovsky in the context of educational hypertext are exactly those used in Literary platforms such as Twine [40].
- Social activities can be constructive as well as merely expressive, and so the area of Computer Supported Collaborative Work (CSCW) [87] draws on both Hypertext as a Tool for Thought, and also as a Social Fabric; take as testament the existence of the Wiki Gardner [50].
- Linked Data is a key outcome of the decades of work on Hypertext Infrastructure but is also a key technology in machine readable Knowledge Representation [97].
- Spatial Hypertext, while driven by the activity of Tools for Thought [123] draws on visual maps from Hypertext Interface research.
- The mechanics of Games are an extension of Hypertext Interfaces, where we follow links not by clicking on hotspots, but by collecting items, entering areas, or by defeating the big boss [131]. This implies that if game mechanics can convey story [137], than so to might non-ludic interactions.

Despite these permeable edges our research communities can be fractured, ideas and concepts are reinvented, and our terminology diverges [128]. Our task here is to point out that there are other Hypertexts out there, and we might all learn from them.

The importance of understanding hypertext's multiple personalities is a long-standing theme in the community, especially bridging the gap between writers and engineers, as Wardrip-Fruin noted: "those working in the literary community must reconsider hypertext definitions focused on the link, and those working in hypertext research must reconsider definitions that privilege knowledge work over media." [191]. Our seven hypertexts are far from the first time that this heterogeneous view of hypertext has been presented.

Early hypertext researchers such as Conklin and Joyce tended to make the distinction between authoring and reading. Joyce terms this exploratory vs constructive hypertexts (his so-called 'Siren Shapes' [108]), exploratory hypertexts would tend towards Hypertext as Knowledge Base, whereas constructive lends itself to Hypertext as a Tool for Thought. Conklin identified four general types of hypertext system: macro literary, browsing, problem exploration, and general purpose [48, p.4, Sect 2]. Macro literary is a large scale knowledge base, and browsing would also be in the knowledge base space, but with emphasis on Hypertext as Interface. General purpose is more aligned with Tools for Thought, and problem exploration is the same, but with an emphasis on structure (similar to rich or argumentation based hypertext systems).

Halasz and Nürnberg take a different approach, providing a set of axes against which any given hypertext project might be mapped. Both were delivered as keynotes at the ACM Hypertext conference.

Halasz (1991) focused on the values and goals of the people developing the system, describing the axes as diametrically-opposed roles [93] navigators and architects is about the focus on content

vs. structure (which applies universally across our seven); literalists vs. the virtualists is concerned with static vs. computed links (and perhaps the lines here have blurred through innovations such as linkbases [98, Ch.3.5] or sculptural hypertexts [25]); card sharks vs. holy scrollers reflects the early distinction between card-based hypertexts with short atomic nodes, and longer-form interlinked texts (an interface debate and a distinction that lives on in Tools for Thought methods such as the *Zettlekasten*[27]); finally the literati vs. the engineers is captured by Hypertext as Literature and to a certain extent as Games—speaking more than thirty years ago Halasz celebrated the diversity of the community. Here, we note the gulf that has since developed, and welcome recent attempts to bridge it.

Nürnberg's address was more than a decade later (2003), and attempted to explicitly address the question of 'What is Hypertext?' [155]. The Manual vs. Automatic axis attempts to address the question of whether hypertext is augmenting our thinking or doing our thinking for us, which echos to some extent the distinction between Tools for Thought and Knowledge Representation—this question seems equally as relevant today, especially with recent advances in AI. The Contextual vs. Essential is about the emphasis on structure or data (an echo of the card sharks vs. the holy scrollers); finally, Perceived vs. Implemented is concerned with whether hypertext structure is overlaid upon or interpreted from our data, or whether it is the fundamental building blocks of that data. These last two points are mostly orthogonal to our seven, although the work on Hypertext as Infrastructure developed from a position that information was essential and perceived (stored as data in nodes and augmented via hypertext) to a position where it was contextual and implemented (where data is expressed as fine grained networks of structure (e.g. zzStructure [151], or Linked Data [19]).

In retrospect it is clear that Nürnberg's comments reflect his view of the necessity of this journey and his philosophy of Structural Computing [156] (that was reflected in CB-OHSs [194] that were contemporary to his comments). It was not clear to researchers at the time that the 'Data Border' should retreat so far [126], and the intervening years have arguably shown that both developers and users tend to be pragmatic, finding a place for both approaches as required [97].

Wardrip-Fruin notes that Nürnberg's conceptualisation of Hypertext as "structured knowledge work" [191] is clearly not inclusive to the Literary and Games aspects of hypertext, and we can qualify that by noting that it mostly applies to Tools for Thought, Knowledge Representation, and especially Infrastructure.

Given the tensions between these axes, and the different values, systems, and communities in our seven, it does beg the question that if these things express our differences, what are the aspects that we have in common?

3.1 The Requirement for Non-regularity

At a superficial level what unites all seven hypertexts is that they embrace non-regularity in information structures. They are non-linear, non-hierarchical, and when they do embrace patterns they do so in a way that is non-exclusive, and open to constant change and revision [129]. This has its roots in Nelson's *Computer Lib/Dream Machines* from 1974, where Nelson pointed out that "Everything is deeply intertwingled" [148]—unlike the mainstream computing environment (at least, of the time) hypertext does not impose one structure on information, but embraces the many.

In this way it is a mirror of the way in which we hold information in our own minds, using verbal and non-verbal memory to store *Logogens* and *Immogens* with referential connections between them [46]. Hypertext as a Tool for Thought is about supporting the capture of information in this form, Hypertext as Knowledge Representation or Social Fabric is about using it once it is captured, Hypertext as Infrastructure is about how it is stored, and Hypertext as Interface is about how it is navigated.

Hypertext as Literature and as Games are in many ways extensions of the Hypertext as Knowledge Representation, extending that view with aesthetic and poetic considerations. Koenitz has described the possibility space of interactive digital narratives as a *Protostory* [110]—the sum of all things that might be told, and we might think of our own memories as protostories, ready to be expressed differently to different audiences. Human communication is not normally linear (that is a convention associated with the invention of writing[28]), oral storytelling is interactive and conversational, we use language to explore each others protostories, to deviate to where our interest takes us, to navigate together. Hypertext is about enabling this process. It is not writing but pre-writing, writing for thinking.

What makes Hypertext challenging in the literary and narrative game spaces is that it is not just about defining protostory, but about the whole process of interaction. Writers therefore have to ensure that every path is valid, that all routes are satisfying, and that—despite the paradox of reader agency—the conventions of narrative are respected [12, 28]. It thus requires that we understand and operationalise these rules (drama, rhetoric, dispositio), bringing engineering into spaces usually occupied by the humanities. At its core hypertext thus demands interdisciplinarity.

3.2 Philosophical Context

But non-regularity is just the manifestation of hypertext's philosophical underpinnings. Again these are writ large in Nelson's work. *Computer Lib* has a battle cry, "You can and must understand computers NOW" [148], because Nelson understood that this new technology would empower those that used it and, more than this, that its shape would come to define the way in which we think about the world. Taking charge of that shape was therefore of the greatest importance. Hypertext is thus rooted in existentialism, in the necessity for the individual to build their own meaning and perspectives, manifest in the digital realm as the need to choose our own tools, structures, and ultimately medium of expression. Writing is thinking, so we must choose how we write. To Nelson and those that followed him, regularity was to be avoided precisely because it constrains our expression.

As Bernstein explains in *On The Origins Of Hypertext In The Disasters Of The Short 20th Century* [30], during the Cold War the funding that poured into US technical innovation and enabled hypertext systems was matched by a collapse of existing certainties about the understanding of text. The structural patterns previously

[27] See: https://zettelkasten.de/communications-with-zettelkastens/.

[28] This is implicit in Fischer's *A History of Writing* [73, Ch.1–3].

of such use to the physical sciences proved less sure-footed in the deconstructed medium of hypertext.

Hypertext is thus also rooted in post-modernism, and especially post-structuralism. Although naively a structuralist technology (what are link networks if not structures?), hypertext's insistence on non-regularity, and its polymorphic nature, make it an idiosyncratic technology built for Derrida's '*jeu libre*' (free play) [57], not because it eschews structure, but rather because it is a source of structure.

3.3 Hypertext as Method?

In their 2019 ACM Hypertext paper, Atzenbeck and Nürnberg make a case for an alternative view (separate to the seven that we have set out here), that of *Hypertext as Method* [9]. In this perspective hypertext is not a set of technologies, nor a data structure, but a way of looking at arbitrary systems—a method of inquiry. We would describe this as applying the philosophical underpinning of hypertext to other domains to both critique them and see how they might be reformed (they use the example of AI, highlighting the tension between augmenting and replacing human knowledge work).

In *Hypertext as A Lens* [131], Millard applies the method of inquiry approach to Interactive Fiction and Games, but in this case working more concretely with the structures and interactions from Hypertext research, showing to what extent they can provide explanatory power, and where there are limits.

So why do we not include Method as an eighth perspective on hypertext? Our Seven Hypertexts are really applications of the underpinning hypertextual philosophy we described above to different domains: knowledge, learning, sociality, literature, play, software, and interactions. *Hypertext as Method* describes not one of these domains, but rather the application process itself. It separates the process from where it has been applied, and argues that it could be applied elsewhere. It is therefore a useful meta-abstraction that helps explain where the seven hypertexts come from.

3.4 A New Ferality

In 2005 Jill Walker presented a paper on *Feral Hypertext* in which she argued that hypertext had escaped the research lab into the wild, and urged the Hypertext community to begin acting as hunter-gathers rather than farmers—to study what was happening and how it was being used [189]. In 2008 Millard, writing in the SIGWEB newsletter, observed that this call had been heeded, and that the Hypertext Conference had become "a great safari" [127].

Since 2005 the Hypertext conference has explicitly included social networks, and perhaps these are the ultimate feral systems, but today we see a new ferality across all of the seven hypertexts. Bernstein's repeated question of *Where are the Hypertexts?* [24] (referring to lack of a substantive body of hypertext literature) has been answered—in a slightly different context: they are in the games we play. And in the productivity sphere we see a surge of new productivity applications, 'PKM'[29] tools, come to join more established systems such as Tinderbox [27]. Obsidian, Roam, Remnote, Notion, Tana and Loqseq are all relatively new hypertext tools that do not even call themselves hypertext tools, and yet they have millions of users, and are busy rediscovering all of the old problems, and finding exciting new solutions. Their popularity has driven Microsoft to release an equivalent product, Loop[30], that has the potential for even larger audiences.

Artificial Intelligence, Virtual Reality, and Augmented Reality are domains where rapid progress means there is a danger of history repeating itself again, despite the fact that both have been targets for hypertext for decades [33, 177]. Hypertext as Method is an approach that will help the Hypertext community to address them. There is a specific opportunity as the Human in The Loop is often overlooked in AI [202] and hypertext can offer a neutral collaboration space for both human and AI actors.

Walker's instinct is still correct—as a community we need to study the real uses of our technology, even when (especially when) we are not the direct source of that technology.

3.5 What was left behind?

This new ferality begs the question of what has been left unfinished and rusting in the long grass. In 1987, Halasz famously put forward 'Seven Issues' for hypertext [92] revised in 1991 [93] and further expanded in 2001 [94] to thirteen items; these covered issues such as search, composites, collaboration, and hypertext markets. Viewed from today's distance, we would argue that all of Halasz's 'Seven Issues' are, in their original sense and the context of the time, essentially resolved. The engineering challenges of networks, scale and interoparability have been subsumed by Web technologies and advanced development platforms (like Unity) that enable flexible and bespoke structures and behaviours. Whilst HTML remains permissive of poor user encoding, in its intended form the semantic structure of the document model offers a robust nexus for re-purposing content. The divisions are more about access, privacy, and trust and these reflect more on the 'dimensions' that Halasz raised alongside his better-known 'issues'.

While not an exhaustive list, the following shows a range of observations and associated questions across the seven hypertexts, many rooted in ferality, or raised by new technological developments:

- The failure (or at least limited fulfillment) of the promises of Linked Data and the Semantic Web. These were the branches of Hypertext as Infrastructure that stretched furthest, but they did so by sacrificing much of the initial Semantic Web stack. Programmer friendly formats such as JSON provide a powerful incentive for three star data [19] and quick scripting solutions keeps the costs of those decisions low. LLMs as co-pilot programmers may reduce the cost even further. Does hypertext have a future as an infrastructure technology?
- PKMs have been slow to learn the past lessons about linkage. In particular aspects such as rich hypertexts and first class links, this is a missed opportunity for Tools for Thought. How can the simple interfaces required by PKMs be applied to more powerful link structures?
- Spatial Hypertext has become dormant[31]. Spatial maps or canvases are popular (e.g. Apple Freeform, Microsoft Whiteboard) and fulfil the same need for information triage as

[29] PKM: Personal Knowledge Management.

[30] See: https://www.microsoft.com/en-us/microsoft-loop.

[31] A notable exception is the work of Atzenbeck and collaborators [7, 8, 11, 169, 171].

identified in VIKI three decades ago [123], they are thus a key aspect of Tools for Thought. But there are no commercial spatial parsers, and no ways to resolve spatial structure into more formal organisations structure (that could then be navigated in an alternative view). How can we revive this area of work?

- A lack of integration between Artificial Intelligence and Adaptive Hypermedia: both in terms of LLMs generating hypertext output, but also as hypertext incorporating prompts for AI generation. How can AI and AH be meaningfully combined for Knowledge Management, Literature, and Games?
- The disconnection between Hypertext Literature and Games. Popular tools for Hypertext Literature (such as Twine) are often used to draft interactive scripts for games, but they are poorly suited to the task. Alternative models of hypertext (e.g. sculptural hypertext) seem better suited and have had some commercial success [32] but the awareness of these techniques within the games industry remains poor, and the tools used there are closed. How can hypertext knowledge be applied to games in a way that makes a meaningful difference to commercial development?
- The rise of ebooks and PDF to dominance. ebooks represent the majority of commercial activity in Literature, and PDF the majority of publishing in research (Knowledge Representation). Both formats are a digital facsimile of their paper equivalents, with very little additional functionality or benefit. How can we create more powerful representations of these formats within existing commercial and social structures?
- The wild west of extended reality interfaces. Extended reality interfaces (such as Virtual Reality, Augmented Reality, and Locative Systems) suggest new interfaces with information, with new affordances and possibilities. There is a danger that just as paper was replicated onto our digital desktops, our desktops will be replicated into the 'metaverse'. How should we re-imagine hypertextual interaction for these radically new environments and shed legacy constraints?
- Our writing tools remain stuck in a linear world. Our writing tools are not structured to produce text that is suitable for remediation and remix. Text published online is often dragged into these processes (e.g. through web scraping, or privileged APIs that are hidden from the authors) with few mechanisms for acknowledgement or financial reward. This has implications for both Hypertext as a Tool for Thought, and as a Social Fabric. How do we help authors become proactive and empowered participants in the process?
- Hypertext doesn't kill people, people kill people. As a Social Fabric, hypertext technology places power unevenly into the hands of bad actors [31]. How can we 'by design' deal with real human behaviour in open hypertextual environments?

Our analysis of the seven hypertexts was partly inspired by O'Hara and Hall's view of the *Four Internets* [158], their work scopes out contexts with common technology but with separate value systems. In contrast we find wide ranging research with different technological focuses but a consistent set of values that have been applied to different problems and domains. Despite this we are faced with the same existential question—how do we avoid balkanisation? Hypertext was fragmented originally by the lack of persistent networks and common formats/protocols. Now it is direction that separates us. Not to mention the risk that the balkanisation of the Internet could permeate back into hypertext.

Given the blurred edges of the Seven Hypertexts, this should be a timely reminder that these aspects of hypertext need not go their separate ways. Interdisciplinarity is our strength. Cross-pollination revitalises the whole.

4 CONCLUSIONS

Hypertext is one of the oldest research communities in computer science, it has spawned many other fields, and helped to develop technologies that are now fundamental to our everyday lives. Yet the breadth of hypertext, and its myriad offshoot communities, can make it difficult for the hypertext research community to define what hypertext research is - what sets it apart, and how that difference might continue to make a contribution into the future. In fact, this seems to be a perennial question - both a healthy focus of reflection, and an unhealthy source of existential doubt. Does hypertext still have a place in the world?

In this paper we have attempted to change this narrative, not by defining hypertext, but by embracing its many forms. We have followed the threads in the literature to present Seven Hypertexts, perspectives on hypertext that reflect particular contexts in which Hypertext research work is undertaken. These are Hypertext as a Tool for Thought, as Knowledge Representation, as Social Fabric, as Literature, as Games, as Infrastructure, and as Interface. These are not distinct categories, but loci, with clear relationships between them, and shared technology or approaches.

We have then looked for commonalities between these seven, identifying the common philosophical underpinning of both post-structuralism and existentialism, which manifests through an embrace of non-regularity. Each of the seven hypertexts is an application of this philosophy to a particular area: knowledge, learning, sociality, literature, play, software, and interactions. This application has been identified by others as *Hypertext as Method* with the suggestion that it might yet be applied in new places and to help solve new problems.

Our analysis also reveals a field rich with a new ferality, especially in narrative games and commercial productivity tools, that raise new questions, and suggests that it might be time to revisit old ideas. We urge the hypertext community to broaden its safari to include these burgeoning areas. Hypertext systems as envisaged by the pioneers, and of the creative trailblazers, exists - with an audience of millions. Hypertext research has never been so relevant.

This is in stark contrast to the view held by some outside the community that hypertext as a discrete field is 'done', subsumed by the Web. Yet this is to misunderstand hypertext and see it only as a technical affordance. In fact, the Web's richer, deeper parent survives and is still making a contribution [33].

As yet another summary of hypertext concludes we may be tempted to ask, from the back seat, "Are we there yet?". Given all of the above, the answer is surely a resounding "No". The values

[32] For example, Failbetter's development of storylets for games such as *Sunless Skies*.

[33] As it has from outset: HES was used to help send humans to the Moon [15, p.106].

inherent in the hypertext approach are still a challenge to the great technical and commercial forces at work today, and offer valuable perspectives on new initiatives and technologies.

Hypertext still has much to say and it needs its champions. We have work to do.

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REFERENCES

[1] Espen J Aarseth. 1994. Nonlinearity and literary theory. In *Hyper/text/theory*, George P. Landow (Ed.). Johns Hopkins University Press Baltimore, Baltimore, MD, USA, 51–86.

[2] Robert M. Akscyn, Donald L. McCracken, and Elise Yoder. 1987. KMS: A Distributed Hypermedia System for Managing Knowledge in Organizations. In *Proceedings of the ACM Conference on Hypertext*. ACM, New York, NY, 1–20. https://doi.org/10.1145/317426.317428

[3] G. L. Anderson. 1953. The McBee Keysort System for Mechanically Sorting Folklore Data. *The Journal of American Folklore* 66, 262 (1953), 340–343. https://doi.org/10.2307/53673

[4] Kenneth M. Anderson, Richard N. Taylor, and E. James Whitehead. 1994. Chimera: Hypertext for Heterogeneous Software Environments. In *Proceedings of the 1994 ACM European Conference on Hypermedia Technology*. Association for Computing Machinery, New York, NY, USA Edinburgh, Scotland, 94–107. https://doi.org/10.1145/192757.192783

[5] Mark W. R. Anderson, Les A. Carr, and David E. Millard. 2017. There and Here: Patterns of Content Transclusion in Wikipedia. In *Proceedings of the 28th ACM Conference on Hypertext and Social Media*. ACM, Prague, Czech Republic, 115–124. https://doi.org/10.1145/3078714.3078726

[6] Mark W. R. Anderson and David Millard. 2022. Hypertext's Meta-History: Documenting in-Conference Citations, Authors and Keyword Data, 1987-2021. In *Proceedings of the 33rd ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 96–106. https://doi.org/10.1145/3511095.3531271

[7] Claus Atzenbeck, Eelco Herder, and Daniel Roßner. 2023. Breaking The Routine: Spatial Hypertext Concepts for Active Decision Making in Recommender Systems. *New Review of Hypermedia and Multimedia* 29 (2023), 1–35. https://doi.org/10.1080/13614568.2023.2170474

[8] Claus Atzenbeck, Peter Nürnberg, and Daniel Roßner. 2021. Synthesising augmentation and automation. *New Review of Hypermedia and Multimedia* 0 (2021), 1–27. https://doi.org/10.1080/13614568.2021.1942237

[9] Claus Atzenbeck and Peter J. Nürnberg. 2019. Hypertext as Method. In *Proceedings of the 30th ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 29–38. https://doi.org/10.1145/3342220.3343669

[10] Claus Atzenbeck, Daniel Roßner, and Manolis Tzagarakis. 2018. Mother: An Integrated Approach to Hypertext Domains. In *Proceedings of the 29th on Hypertext and Social Media*. ACM, New York, NY, 145–149. https://doi.org/10.1145/3209542.3209570

[11] Claus Atzenbeck, Thomas Schedel, Manolis Tzagarakis, Daniel Roßner, and Lucas Mages. 2017. Revisiting Hypertext Infrastructure. In *Proceedings of the 28th ACM Conference on Hypertext and Social Media*. ACM, New York, NYA, 35–44. https://doi.org/10.1145/3078714.3078718

[12] Ruth Aylett. 2000. Emergent narrative, social immersion and "storification". In *Proceedings of the 1st international workshop on narrative and interactive learning environments*. University of Leeds, Edinburgh, UK, 35–44.

[13] Albert Lásló Barabási, Hawoong Jeong, Zoltán Néda, Erzsébet Ravasz, András P. Schubert, and Tamás Vicsek. 2002. Evolution of the social network of scientific collaborations. *Physica A: Statistical Mechanics and its Applications* 311, 3 (2002), 590–614. https://doi.org/10.1016/S0378-4371(02)00736-7

[14] Thierry Bardini. 2000. *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*. Stanford University Press, Stanford, CA. 320 pages. https://www.sup.org/books/title/?id=308

[15] Belinda Barnet. 2013. *Memory Machines: The Evolution of Hypertext*. Anthem Press, London, UK. 192 pages. https://anthempress.com/memory-machines-pb

[16] Roland Barthes and S. Heath. 1977. Death of The Author. In *Image, Music, Text*. Fontana Press, London, UK, 142–148.

[17] Meltem Huri Baturay. 2015. An overview of the world of MOOCs. *Procedia-Social and Behavioral Sciences* 174 (2015), 427–433.

[18] Sean Bechhofer, Iain Buchan, David De Roure, Paolo Missier, John Ainsworth, Jiten Bhagat, Philip Couch, Don Cruickshank, Mark Delderfield, Ian Dunlop, et al. 2013. Why linked data is not enough for scientists. *Future Generation Computer Systems* 29, 2 (2013), 599–611.

[19] Tim Berners-Lee. 2006. *Linked Data*. World Wide Web Consortium (W3C). https://www.w3.org/DesignIssues/LinkedData.html

[20] Tim Berners-Lee, James A. Hendler, and Ora Lassila. 2001. The Semantic Web. *Scientific American* 284, 5 (2001), 34–43. http://www.jstor.org/stable/26059207

[21] Tim Berners-Lee and Kieron O'Hara. 2013. The read–write Linked Data Web. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 371 (2013), 1–5. https://doi.org/10.1098/rsta.2012.0513

[22] Mark Bernstein. 1988. The Bookmark and the Compass: Orientation Tools for Hypertext Users. *SIGOIS Bulletin* 9, 4 (1988), 34–45. https://doi.org/10.1145/51640.51645

[23] Mark Bernstein. 1998. Patterns of Hypertext. In *Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia : Links, Objects, Time and Space—Structure in Hypermedia Systems*. ACM Press, New York, New York, USA, 21–29. https://doi.org/10.1145/276627.276630

[24] Mark Bernstein. 1999. Where Are The Hypertexts?. In *Proceedings of the Tenth ACM Conference on Hypertext and Hypermedia : Returning to Our Diverse Roots: Returning to Our Diverse Roots*. ACM, Darmstadt, Germany New York, NY, USA, 101–109. https://doi.org/10.1145/294469.294495

[25] Mark Bernstein. 2001. Card Shark and Thespis: Exotic Tools for Hypertext Narrative. In *Proceedings of the 12th ACM conference on Hypertext and Hypermedia*. ACM, New York, NY, 41–50. https://doi.org/10.1145/504216.504233

[26] Mark Bernstein. 2002. Storyspace 1. In *Proceedings of the Thirteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 172–181. https://doi.org/10.1145/513338.513383

[27] Mark Bernstein. 2002. *Tinderbox*. Eastgate Systems. http://www.eastgate.com/Tinderbox/

[28] Mark Bernstein. 2009. On Hypertext Narrative. In *Proceedings of the 20th ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA, 5–14. https://doi.org/10.1145/1557914.1557920

[29] Mark Bernstein. 2010. Criticism. In *Proceedings of the 21st ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 235–244. https://doi.org/10.1145/1810617.1810660

[30] Mark Bernstein. 2022. On The Origins Of Hypertext In The Disasters Of The Short 20th Century. In *Proceedings of the ACM Web Conference 2022*. ACM, New York, NY, USA Virtual Event, Lyon, France, 3450–3457. https://doi.org/10.1145/3485447.3512280

[31] Mark Bernstein and Clare J. Hooper. 2018. A Villain's Guide To Social Media And Web Science. In *Proceedings of the 29th on Hypertext and Social Media*. ACM, Baltimore, MD, USA New York, NY, USA, 246–250. https://doi.org/10.1145/3209542.3210576

[32] Mark Bernstein, David E. Millard, and Mark J. Weal. 2002. On Writing Sculptural Hypertext. In *Proceedings of the Thirteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 65–66. https://doi.org/10.1145/513338.513355

[33] Jay David Bolter. 1992. Virtual Reality and the Future of Hypertext (Abstract). In *Proceedings of the ACM Conference on Hypertext*. ACM, New York, NY, USA Milan, Italy, 2. https://doi.org/10.1145/168466.168473

[34] Jay David Bolter and Richard A. Grusin. 2000. *Remediation: Understanding New Media*. MIT Press, Cambridge, MA, USA. 295 pages. https://mitpress.mit.edu/9780262522793/remediation/

[35] Jay David Bolter and Michael Joyce. 1987. Hypertext and Creative Writing. In *Proceedings of the ACM Conference on Hypertext*. ACM, New York, NY, 41–50. https://doi.org/10.1145/317426.317431

[36] Jorge Luis Borges. 1941. *The Garden of Forking Paths*. Penguin Classics, London. 17 pages.

[37] Rodrigo A. Botafogo, Ehud Rivlin, and Ben Shneiderman. 1992. Structural Analysis of Hypertexts: Identifying Hierarchies and Useful Metrics. *ACM Transactions on Information Systems* 10, 2 (1992), 142–180. https://doi.org/10.1145/146802.146826

[38] Sam Brooker. 2019. Man Proposes, God Disposes: Re-Assessing Correspondences in Hypertext and Anti-Authorist Literary Theory. In *Proceedings of the 30th ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 39–48. https://doi.org/10.1145/3342220.3343649

[39] Peter J. Brown. 1987. Turning Ideas into Products: The Guide System. In *Proceedings of the ACM Conference on Hypertext*. ACM, Chapel Hill, North Carolina, USA New York, NY, USA, 33–40. https://doi.org/10.1145/317426.317430

[40] Peter Brusilovsky. 2001. Adaptive Hypermedia. *User Modeling and User-Adapted Interaction* 11, 1 (2001), 87–110. https://doi.org/10.1023/A:1011143116306

[41] Peter Brusilovsky, Alfred Kobsa, and Julita Vassileva. 1998. *Adaptive Hypertext and Hypermedia*. Kluwer Academic Publishers, Dordrecht. 274 pages. https://doi.org/10.1007/978-94-017-0617-9

[42] Colin Burke. 1991. A Practical View of Memex: The Career of The Rapid Selector. In *From Memex to hypertext: Vannevar Bush and the mind's machine*, James M. Nyce and Paul Kahn (Eds.). Academic Press, Boston, 145–164. https://www.elsevier.com/books/from-memex-to-hypertext/nyce/978-0-12-523270-8

[43] Vannevar Bush. 1945. As We May Think. *The Atlantic Monthly* 176, 1 (1945), 101–108. http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/

[44] Christoph J. Bussler, John Davies, Dieter Fensel, and Rudi Studer (Eds.). 2004. *The Semantic Web: Research and Applications*. Vol. First European Semantic Web Symposium. Springer Berlin Heidelberg, Berlin, Heidelberg. https://link.springer.com/book/10.1007/b97867

[45] Meeyoung Cha, Alan Mislove, and Krishna P. Gummadi. 2009. A Measurement-Driven Analysis of Information Propagation in the Flickr Social Network. In *Proceedings of the 18th International Conference on World Wide Web*. Association for Computing Machinery, New York, NY, USA Madrid, Spain, 721–730. https://doi.org/10.1145/1526709.1526806

[46] James M. Clark and Allan Paivio. 1991. Dual coding theory and education. *Educational Psychology Review* 3, 3 (1991), 149–210. https://doi.org/10.1007/BF01320076

[47] Jeff Conklin. 1987. Hypertext: An Introduction and Survey. *IEEE Computer* 20, 9 (1987), 17–41. https://doi.org/10.1109/MC.1987.1663693

[48] Jeff Conklin. 1987. *A Survey of Hypertext*. Microelectronics and Computer Technology Corporation, Austin, TX. 40pp pages. http://csis.pace.edu/~marchese/CS835/Readings/conklin95survey.pdf

[49] Jeff Conklin and Michael L. Begeman. 1988. gIBIS: A Hypertext Tool for Exploratory Policy Discussion. *ACM Transactions on Information Systems (TOIS)* 6, 4 (1988), 303–331. https://doi.org/10.1145/58566.59297

[50] Cunningham & Cunningham, Inc. 2005. *Wiki Gardener*. Cunningham & Cunningham, Inc. http://wiki.c2.com/cgi/wiki?WikiGardner

[51] Nada Dabbagh and Anastasia Kitsantas. 2012. Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and higher education* 15, 1 (2012), 3–8.

[52] Hugh C. Davis, Andy Lewis, and Antoine Rizk. 1996. OHP: A Draft Proposal for a Standard Open Hypermedia Protocol (Levels 0 and 1: Revision. In *2nd Workshop on Open Hypermedia Systems*. ACM, Washington, DC. https://doi.org/10.1145/231738.231740

[53] Hugh C. Davis, Siegfried Reich, and David E. Millard. 1997. A Proposal for a Common Navigational Hypertext Protocol. *OHSWG 3.5* 3.5 Open Hypermedia System Working Group Meeting (1997). https://www.southampton.ac.uk/~hcd/ohp/ohp35.htm

[54] Paul M. E. De Bra and Jan-Peter Ruiter. 2001. AHA! Adaptive Hypermedia for All. In *Proceedings of WebNet World Conference on the WWW and Internet*. AACE, Waynesvile, NC, 262–268. https://wwwis.win.tue.nl/~debra/webnet2001/debra.pdf

[55] Norman M. Delisle and Mayer D. Schwartz. 1986. Neptune: A Hypertext System for CAD Applications. In *Proceedings of the 1986 ACM SIGMOD International Conference on Management of Data*. ACM, Washington, D.C., USA New York, NY, USA, 132–143. https://doi.org/10.1145/16894.16867

[56] Steven J. DeRose and Andries van Dam. 1999. Document Structure and Markup in the FRESS Hypertext System. *Markup Languages: Theory & Practice* 1 (1999), 7–32. https://doi.org/10.1162/109966299751940814

[57] Jacques Derrida. 1967. La structure, le signe et le jeu dans le discours des sciences humaines. In *L'écriture et la différence*. Éditions du Seuil, Paris, 278–293.

[58] Andrea A. Di Sessa. 1985. A Principled Design for an Integrated Computational Environment. *Human–Computer Interaction* 1 (1985), 1–47. https://doi.org/10.1207/s15327051hci0101_1

[59] Darcy DiNucci. 1999. Fragmented Future. *Print Magazine* 53, 4 (1999), 32, 221–222. https://web.archive.org/web/20111110143942/http://darcyd.com/fragmented_future.pdf

[60] J. Yellowlees Douglas. 1994. "How do I stop this thing?": Closure and Indeterminacy in Interactive Narratives. In *Hyper/Text/Theory*, George P. Landow (Ed.). The Johns Hopkins University Press, Baltimore, MD, USA, 159–188. https://www.press.jhu.edu/books/title/1752/hypertexttheory

[61] Deborah M. Edwards. 1989. Lost in Hyperspace: Cognitive Mapping And Navigation in A Hypertext Environment. In *Hypertext: Theory Into Practice*. Intellect Books, Oxford, 105–125. https://www.intellectbooks.com/hypertext-1

[62] Electronic Literature Organization. 1999. *Electronic Literature Organization (ELO)*. Electronic Literature Orgaization. https://eliterature.org

[63] William C. Elm and David D. Woods. 1985. Getting Lost: A Case Study in Interface Design. *Proceedings of the Human Factors Society Annual Meeting* 29, 10 (1985), 927–929. https://doi.org/10.1177/154193128502901006

[64] Douglas Carl Engelbart. 1962. Augmenting Human Intellect: A Conceptual Framework. *SRI Summary Report AFOSR-3223* 1 (1962), 2007. https://www.dougengelbart.org/pubs/augment-3906.html

[65] Douglas Carl Engelbart. 1968. *The Mother of All Demos*. YouTube. https://www.youtube.com/watch?v=yJDv-zdhzMY

[66] Douglas Carl Engelbart. 1984. Authorship provisions in AUGMENT. In *Proceedings of the 1984 COMPCON Conference*. Morgan Kaufmann, Burlington, MA, 465–472. https://books.google.co.uk/books?id=JRZPAAAAMAAJ

[67] Douglas Carl Engelbart and William K. English. 1968. A Research Center for Augmenting Human Intellect. In *Proceedings of the December 9-11, 1968, Fall Joint Computer Conference, Part I*. ACM, San Francisco, California New York, NY, USA, 395–410. https://doi.org/10.1145/1476589.1476645

[68] Douglas Carl Engelbart and Eugene E. Kim. 2006. The Augmented Wiki. In *Proceedings of the 2006 International Symposium on Wikis*. ACM, New York, NY, USA Odense, Denmark, 11–12. https://doi.org/10.1145/1149453.1149458

[69] Ayelet Even-Ezra. 2021. *Lines of Thought*. University of Chicago Press, Chicago. 272 pages. https://press.uchicago.edu/ucp/books/book/chicago/L/bo63098990.html

[70] Steven Feiner. 1988. Seeing the Forest for the Trees: Hierarchical Displays of Hypertext Structures. In *Proceedings of the ACM SIGOIS and IEEECS TC-OA 1988 Conference on Office Information Systems*. ACM, Palo Alto, California, USA New York, NY, USA, 205–212. https://doi.org/10.1145/45410.45432

[71] Steven Feiner, Sandor Nagy, and Andries Van Dam. 1981. An Integrated System for Creating and Presenting Complex Computer-Based Documents. In *Proceedings of the 8th Annual Conference on Computer Graphics and Interactive Techniques*. Association for Computing Machinery, New York, NY, 181–189. https://doi.org/10.1145/800224.806805

[72] Cliff Figallo. 1993. *The WELL: small town on the Internet highway system adapted from a paper presented to the" Public Access to the Internet" conference, Harvard University*. Internet Archive. https://archive.org/details/CliffFigallo

[73] Steven Roger Fischer. 2020. *A History of Writing*. Reaktion Books, London, UK. 368 pages. https://reaktionbooks.co.uk/work/a-history-of-writing

[74] Jim Flanagan. 2003. *Search Referral Zeitgeist*. tsengrity.net. https://web.archive.org/web/20030604113002/http://twiki.tensegrity.net/bin/view/Main/SearchReferralZeitgeist

[75] Judith Flanders. 2020. *A Place For Everything*. Pan Macmillan, London. 272 pages. https://www.panmacmillan.com/authors/judith-flanders/a-place-for-everything/9781509881581

[76] Andrew M. Fountain, Wendy Hall, Ian Heath, and Hugh C. Davis. 1990. MICROCOSM: An Open Model for Hypermedia with Dynamic Linking.. In *Proceedings of the First European Conference on Hypertext*. Cambridge University Press, The Pitt Building, Trumpington Street, Cambridge, 298–311. https://eprints.soton.ac.uk/254308/

[77] Mark S. Fox and Andrew J. Palay. 1979. The BROWSE system: an introduction. In *42*. American Society for Information Science, Minneapolis, MN, 14–18. http://eil.mie.utoronto.ca/wp-content/uploads/2015/06/fox-asis79.pdf

[78] Jane Friedhoff. 2013. Untangling Twine: A Platform Study.. In *Proceedings of the 2013 DiGRA International Conference: DeFragging Game Studies*. DiGRA, (online), 10. http://www.digra.org/digital-library/publications/untangling-twine-a-platform-study/

[79] David Gibson. 2004. The Site Browser: Catalyzing Improvements in Hypertext Organization. In *Proceedings of the Fifteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA Santa Cruz, CA, USA, 68–76. https://doi.org/10.1145/1012807.1012829

[80] Jennifer Golbeck and Jim Hendler. 2006. FilmTrust: Movie Recommendations using Trust in Web-based Social Networks. In *1*. IEEE, New York, NY, 282–286. https://doi.org/10.1109/CCNC.2006.1593032

[81] Ira P. Goldstein and Daniel G. Bobrow. 1980. *A Layered Approach to Software Design*. Vol. CSL-80-5. Xerox, Palo Alto Research Center, Palo Alto, CA. https://archive.org/details/bitsavers_xeroxparctyeredApproachtoSoftwareDesign_2452915

[82] Danny Goodman et al. 1988. *The Complete Hypercard Handbook*. Bantam Books, New York, NY. 912 pp. pages.

[83] Dene Grigar. 2017. The Legacy of Judy Malloy. In *Computing Literature:# WomenTechLit*, María Mencía and N Katherine Hayles (Eds.). West Virginia University Press, Morgantown, WV, 361–374. https://muse.jhu.edu/pub/20/edited_volume/chapter/2008794

[84] Dene Grigar. 2019. Tear Down the Walls: An Exhibition of Hypertext & Participatory Narrative. In *Proceedings of the 30th ACM Conference on Hypertext and Social Media*. ACM, New York, NY, USA Hof, Germany, 1. https://doi.org/10.1145/3342220.3345459

[85] Dene Grigar, Nicholas Schiller, Vanessa Rhodes, Veronica Whitney, Mariah Gwin, and Katie Bowen. 2018. *Rebooting Electronic Literature, Volume 1*. Vol. 1. Nouspace Publications, Washinton State University, Vancouver, WA, USA. https://doi.org/10.7273/NKQK-H488

[86] Dimitris Gritzalis, Miltiadis Kandias, Vasilis Stavrou, and Lilian Mitrou. 2014. History of Information: The case of Privacy and Security in Social Media. In *Proceedings of The History of Information Conference*. Athens University of Economics and Business (AUEB), Athens, GR, 283–310. https://www.infosec.aueb.gr/Publications/INFOHIST-2014%20Legal%20Publications.pdf

[87] Jonathan Grudin. 1994. Computer-Supported Cooperative Work: History And Focus. *Computer* 27, 5 (1994), 19–26. https://doi.org/10.1109/2.291294

[88] Kaj Grønbæk and Randall H. Trigg. 1994. Design Issues for a Dexter-Based Hypermedia System. *Commun. ACM* 37, 2 (1994), 40–49. https://doi.org/10.1145/175235.175238

[89] Eric Gullichsen, Dilip D'Souza, and Pat Lincoln. 1986. *The PlaneText Book: Technical Report STP-333-86 (P)*. Technical Report. Microelectronics and Computer Technology Consortium (MCC).

[90] Bernard J. Haan, Paul Kahn, Victor A. Riley, James H. Coombs, and Norman K. Meyrowitz. 1992. IRIS Hypermedia Services. *Communications of the ACM*

(CACM) 35, 1 (1992), 36–51. https://doi.org/10.1145/129617.129618
[91] Sean Haas. 2022. Doug Engelbart, Edge Notched Cards, and Early Links. In *Proceedings of the 5th Workshop on Human Factors in Hypertext at HT'22*. ACM, New York, NY, USA Barcelona, Spain. https://doi.org/10.1145/3538882.3542792
[92] Frank G. Halasz. 1987. Reflections on NoteCards: Seven Issues for the next Generation of Hypermedia Systems. In *Proceedings of the ACM Conference on Hypertext*. ACM, New York, NY, USA Chapel Hill, North Carolina, USA, 345–365. https://doi.org/10.1145/317426.317451
[93] Frank G. Halasz. 1991. "Seven Issues": Revisited. In *Proceedings of ACM Hypertext '91 Conference*. ACM, San Antonio, Texas, 1–18. https://web.archive.org/web/19970605120053/http://www.parc.xerox.com:80/spl/projects/halasz-keynote/
[94] Frank G. Halasz. 2001. Reflections on "Seven Issues": Hypertext in the Era of the Web. *ACM Journal of Computer Documentation (JCD)* 25, 3 (2001), 109–114. https://doi.org/10.1145/507317.507328
[95] Frank G. Halasz, Thomas P. Moran, and Randall H. Trigg. 1986. NoteCards in a Nutshell. *ACM SIGCHI Bulletin* 17, SI (1986), 45–52. https://doi.org/10.1145/29933.30859
[96] Frank G. Halasz and Mayer Schwartz. 1990. The Dexter Hypertext Reference Model. In *Proceedings of the Second Hypertext Standardization Workshop*. National Institute of Standards and Technology, Gaithersburg, MD, 95–133. https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication500-178.pdf#page=103
[97] Wendy Hall. 2011. From Hypertext to Linked Data: The Ever Evolving Web. In *Proceedings of the 22nd ACM Conference on Hypertext and Hypermedia*. ACM, Eindhoven, The Netherlands New York, NY, USA, 3–4. https://doi.org/10.1145/1995966.1995969
[98] Wendy Hall, Hugh C. Davis, and Gerard Hutchings. 1996. *Rethinking Hypermedia: The Microcosm Approach*. Kluwer Academic Publishers, Dordrecht, Netherlands. https://doi.org/10.1007/978-1-4613-1335-9
[99] Charlie Hargood, Rosamund Davies, David E. Millard, Matt R. Taylor, and Samuel Brooker. 2012. Exploring (the Poetics of) Strange (and Fractal) Hypertexts. In *Proceedings of the 23rd ACM Conference on Hypertext and Social Media*. ACM, New York NY, USA, 181–186. https://doi.org/10.1145/2309996.2310027
[100] Charlie Hargood, Mark J. Weal, and David E. Millard. 2018. The StoryPlaces Platform: Building a Web-Based Locative Hypertext System. In *Proceedings of the 29th on Hypertext and Social Media*. ACM, Baltimore, MD, USA New York, NY, USA, 128–135. https://doi.org/10.1145/3209542.3209559
[101] HCIL Archive. 2018. *Hypertext Research: The Development of HyperTIES*. University of Maryland. https://www.cs.umd.edu/projects/hcil/hyperties/
[102] Robert E. Horn. 1989. *Mapping Hypertext*. The Lexington Institute, Arlington, VA. 289 pages. https://ia800905.us.archive.org/28/items/mappinghypertext0000horn/mappinghypertext0000horn.pdf
[103] Kenneth E. Iverson. 1980. Notation As A Tool of Thought (ACM 1979 Turing Award lecture). *Commun. ACM* 23, 8 (1980), 444–465. https://doi.org/10.1145/358896.358899
[104] Lewis Jayes, Gemma Fitzsimmons, Mark Weal, J. K. Kaakinen, and Denis Drieghe. 2022. The Impact of Hyperlinks, Skim Reading And Perceived Importance when Reading on The Web. *PLoS ONE* 17, 2 (2022), 1. https://doi.org/10.1371/journal.pone.0263669
[105] Warnock John. 1995. *The Camelot Project*. Technical Report. Adobe Systems, Inc. https://www.pdfa.org/resource/the-camelot-project/
[106] Michael Joyce. 1987. *afternoon: a story*. Eastgate Systems, Inc., Watertown, MA. http://www.eastgate.com/catalog/Afternoon.html
[107] Michael Joyce. 1991. Storyspace As a Hypertext System for Writers and Readers of Varying Ability. In *Proceedings of the Third Annual ACM Conference on Hypertext*. ACM, San Antonio, Texas, USA New York, NY, USA, 381–387. https://doi.org/10.1145/122974.125110
[108] Michael Joyce. 1995. Siren Shapes. In *Of Two Minds: Hypertext Pedagogy And Poetics*. THe University of Michigan Press, Ann Arbor, MI, 38–59. https://www.press.umich.edu/10603/of_two_minds
[109] Sabrina Kirrane, Marta Sabou, Javier D. Fernández, Francesco Osborne, Cécile Robin, Paul Buitelaar, Enrico Motta, and Axel Polleres. 2020. A decade of Semantic Web research through the lenses of a mixed methods approach. *Semantic Web* 11 (2020), 979–1005. https://doi.org/10.3233/SW-200371
[110] Hartmut Koenitz and Kun-Ju Chen. 2012. Genres, Structures and Strategies in Interactive Digital Narratives – Analyzing a Body of Works Created in ASAPS. In *Interactive Storytelling*. Springer, Berlin, DE, 84–95. https://doi.org/10.1007/978-3-642-34851-8_8
[111] Hartmut Koenitz, Gabriele Ferri, Mads Haahr, Diğdem Sezen, and Tonguç İbrahim Sezen. 2015. *Interactive Digital Narrative: History, Theory and Practice*. Routledge, New York, NY. 302 pages. https://doi.org/10.4324/9781315769189
[112] David A. Kolb. 2004. Twin Media: Hypertext Structure Under Pressure. In *Proceedings of the Fifteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 26–27. https://doi.org/10.1145/1012807.1012817
[113] David A. Kolb. 2010. *Sprawling Places*. University of Georgia Press, Athens, GA. 280 pages. https://ugapress.org/book/9780820329895/sprawling-places/
[114] George P. Landow. 2006. *Hypertext 3.0: Critical Theory and New Media in an Era of Globalization*. The Johns Hopkins University Press, Baltimore, MD, USA. 456 pages. https://www.press.jhu.edu/books/title/8902/hypertext-30
[115] George P. Landow and Paul Kahn. 1992. Where's the Hypertext: The Dickens Web as a System-Independent Hypertext. In *Proceedings of the ACM Conference on Hypertext*. ACM, New York, NY, 149–160. https://doi.org/10.1145/168466.168515
[116] Bo Leuf and Ward Cunningham. 2001. *The Wiki Way: Quick Collaboration on The Web*. Addison-Wesley Boston, MA, New York, NY. 435 pages. https://www.pearson.ch/Informatik/Addison-Wesley/EAN/9780201714999/Wiki-Way-The
[117] Steven Levy. 2010. *Hackers: Heroes of the Computer Revolution - 25th Anniversary Edition*. O'Reilly Media, Sebastopol, CA. 520 pages. https://www.oreilly.com/library/view/hackers/9781449390259/
[118] David G. Lowe. 1986. Synview: The Design of a System for Cooperative Structuring of Information. In *Proceedings of the 1986 ACM Conference on Computer-Supported Cooperative Work*. ACM, New York, NY, USA Austin, Texas, 376–385. https://doi.org/10.1145/637069.637116
[119] Niklas Luhmann. 2015. *Der Zettelkasten Niklas Luhmanns*. Niklas Luhmann-Archiv, Universität Bielefeld. https://niklas-luhmann-archiv.de/nachlass/zettelkasten
[120] Judy Malloy. 1991. Uncle Roger, an online narrabase. *Leonardo* 24, 2 (1991), 195–202. https://muse.jhu.edu/article/606523/summary
[121] Catherine C. Marshall, Frank G. Halasz, Russell A. Rogers, and William C. Janssen, Jr. 1991. Aquanet: A Hypertext Tool to Hold Your Knowledge in Place. In *Proceedings of the Third Annual ACM Conference on Hypertext*. ACM, New York, NY, 261–275. https://doi.org/10.1145/122974.123000
[122] Catherine C. Marshall and Frank M. Shipman, III. 1993. Searching for the Missing Link: Discovering Implicit Structure in Spatial Hypertext. In *Proceedings of the Fifth ACM Conference on Hypertext*. ACM, New York, NY, 217–230. https://doi.org/10.1145/168750.168826
[123] Catherine C. Marshall, Frank M. Shipman, III, and James H. Coombs. 1994. VIKI: Spatial Hypertext Supporting Emergent Structure. In *Proceedings of the 1994 ACM European Conference on Hypermedia technology*. ACM, New York, NY, 13–23. https://doi.org/10.1145/192757.192759
[124] Stacey Mason and Mark Bernstein. 2021. On Links: Exercises in Style. *New Review of Hypermedia and Multimedia* 27, 1-2 (2021), 29–50. https://doi.org/10.1080/13614568.2021.1889693
[125] John McDaid. 1992. *Uncle Buddy's Phantom Funhouse*. Eastgate Systems, Inc., Watertown, MA. https://dtc-wsuv.org/projects/uncle-buddy/archival/index.html
[126] David E. Millard. 2003. Discussions at the Data Border: From Generalised Hypertext to Structural Computing. *Journal of Network and Computer Applications* 26, 1 (2003), 95–114. https://doi.org/10.1016/S1084-8045(02)00063-2
[127] David E. Millard. 2008. Hypertext 2008: A Great Safari. *SIGWEB Newsletter* 2008, Autumn (2008), 1–6. https://doi.org/10.1145/1408940.1408941
[128] David E. Millard. 2020. Games/Hypertext. In *Proceedings of the 31st ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 123–126. https://doi.org/10.1145/3372923.3404775
[129] David E. Millard. 2022. Strange Patterns: Structure and Post-structure in Interactive Digital Narratives. In *The Authoring Problem: Challenges in Supporting Authoring for Interactive Digital Narratives*, Charlie Hargood, David E. Millard, Alex Mitchell, and Ulrike Spierling (Eds.). Springer International Publishing, Cham, CH, 147–169. https://doi.org/10.1007/978-3-031-05214-9_10
[130] David E. Millard, David C. De Roure, Danius T. Michaelides, Mark K. Thompson, and Mark J. Weal. 2004. Navigational Hypertext Models For Physical Hypermedia Environments. In *Proceedings of the Fifteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 110–111. https://doi.org/10.1145/1012807.1012839
[131] David E. Millard and Charlie Hargood. 2021. Hypertext as A Lens into Interactive Digital Narrative. In *Interactive Storytelling*. Springer International Publishing, Cham, CH, 509–524. https://doi.org/10.1007/978-3-030-92300-6_51
[132] David E. Millard, Charlie Hargood, Michael O. Jewell, and Mark J. Weal. 2013. Canyons, Deltas and Plains: Towards a Unified Sculptural Model of Location-Based Hypertext. In *Proceedings of the 24th ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 109–118. https://doi.org/10.1145/2481492.2481504
[133] David E. Millard, Luc Moreau, Hugh C. Davis, and Siegfried Reich. 2000. FOHM: A Fundamental Open Hypertext Model for Investigating Interoperability between Hypertext Domains. In *Proceedings of the Eleventh ACM on Hypertext and hypermedia*. ACM, New York, NY, 93–102. https://doi.org/10.1145/336296.336334
[134] David E. Millard, Heather Packer, Yvonne Howard, and Charlie Hargood. 2020. The Balance of Attention: The Challenges of Creating Locative Cultural Storytelling Experiences. *Journal on Computing and Cultural Heritage* 13, 4 (2020), 1–24. https://doi.org/10.1145/3404195
[135] David E. Millard and Martin Ross. 2006. Web 2.0: Hypertext by Any Other Name?. In *Proceedings of the Seventeenth Conference on Hypertext and Hypermedia*. ACM, New York, NY, 27–30. https://doi.org/10.1145/1149941.1149947

[136] Bradley N. Miller and David L. Ranum. 2012. Beyond PDF and EPub: Toward an Interactive Textbook. In *Proceedings of the 17th ACM Annual Conference on Innovation and Technology in Computer Science Education*. Association for Computing Machinery, New York, NY, 150–155. https://doi.org/10.1145/2325296.2325335

[137] Alex Mitchell. 2022. Game Mechanics as Narrative Mode. In *The Authoring Problem: Challenges in Supporting Authoring for Interactive Digital Narratives*, Charlie Hargood, David E. Millard, Alex Mitchell, and Ulrike Spierling (Eds.). Springer International Publishing, Cham, CH, 251–269. https://doi.org/10.1007/978-3-031-05214-9_16

[138] Alex Mitchell and Liting Kway. 2020. "How Do I Restart This Thing?" Repeat Experience and Resistance to Closure in Rewind Storygame. In *Interactive Storytelling*. Springer International Publishing, Cham, CH, 164–177. https://doi.org/10.1007/978-3-030-62516-0_15

[139] Catherine Mulwa, Seamus Lawless, Mary Sharp, Inmaculada Arnedillo-Sanchez, and Vincent Wade. 2010. Adaptive Educational Hypermedia Systems in Technology Enhanced Learning: A Literature Review. In *Proceedings of the 2010 ACM Conference on Information Technology Education*. ACM, New York, NY, 73–84. https://doi.org/10.1145/1867651.1867672

[140] Janet H. Murray. 1998. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. MIT Press, Cambridge, MA, USA. 336 pages. https://mitpress.mit.edu/9780262631877/hamlet-on-the-holodeck/

[141] John T. Murray and Anastasia Salter. 2022. Mapping the Unmappable: Reimagining Visual Representations of Interactive Narrative. In *The Authoring Problem: Challenges in Supporting Authoring for Interactive Digital Narratives*, Charlie Hargood, David E. Millard, Alex Mitchell, and Ulrike Spierling (Eds.). Springer International Publishing, Cham, CH, 171–190. https://doi.org/10.1007/978-3-031-05214-9_11

[142] Jocelyne Nanard and Marc Nanard. 1991. Using Structured Types to Incorporate Knowledge in Hypertext. In *Proceedings of the Third Annual ACM Conference on Hypertext*. ACM, New York, NY, 329–343. https://doi.org/10.1145/122974.123006

[143] Theodor Holm Nelson. 1965. Complex Information Processing: A File Structure for the Complex, the Changing and the Indeterminate. In *Proceedings of the 1965 20th National Conference*. ACM, Cleveland, Ohio, USA New York, NY, USA, 84–100. https://doi.org/10.1145/800197.806036

[144] Theodor Holm Nelson. 1966. *Hard and Fast Thoughts for a Softcopy World*. The RAND corporation. https://archive.org/details/HardAndFastThoughts1966

[145] Theodor Holm Nelson. 1966. *Xanadu Manifesto*. Theodor Nelson. https://archive.org/details/TheFirstXanaduProposal1966/page/n1

[146] Theodor Holm Nelson. 1968. *Hypertext Implementation Notes*. Theodor Nelson. https://archive.org/details/hin68

[147] Theodor Holm Nelson. 1972. As We Will Think. In *Proceedings of the International Conference on Online Interactive Computing, Volume 1*. Online Computer Systems Ltd, Brunel University, Uxbridge, 439–454. https://archive.org/details/AsWeWillThinkbyTNx

[148] Theodor Holm Nelson. 1974. *Computer Lib/Dream Machines*. Self-published, n/a. 336 pages. https://computerlibbook.com

[149] Theodor Holm Nelson. 1980. Replacing The Printed Word: A Complete Literary System. In *Information Processing, Proceedings of the 8th IFIP Congress*. North-Holland/IFIP, Amsterdam, NL, 1013–1023.

[150] Theodor Holm Nelson. 1992. Opening Hypertext: A Memoir. In *Literacy Online: The Promise (And Peril) of Reading And Writing with Computers*, Myron C. Tuman (Ed.). University of Pittsburgh Press, Pittsburgh, PA, 43–57. http://books.google.co.uk/books?id=HYckAQAAMAAJ

[151] Theodor Holm Nelson. 2001. *Some Alternative Computer Universes*. Vol. Creative Digital Media: Its Impact on the New Century. Keio University COE International Symposium. Keio University Press„ Tokyo, Japan. 33–38 pages. https://archive.org/details/somealternativec00tedn

[152] Theodor Holm Nelson. 2011. *Possiplex*. Mindful Press, (online). 382 pages. http://www.thetednelson.com/possiplex.php

[153] Dziri Nouha, Milton Sivan, Yu Mo, Zaiane Osmar, and Reddy Siva. 2022. *On the Origin of Hallucinations in Conversational Models: Is it the Datasets or the Models?* arXiv, (online). https://doi.org/10.48550/arXiv.2204.07931

[154] Kurt Nørmark and Kasper Østerbye. 1995. Rich Hypertext: A Foundation for Improved Interaction Techniques. *International Journal of Human-Computer Studies* 43, 3 (1995), 301–321. https://doi.org/10.1006/ijhc.1995.1048

[155] Peter J. Nürnberg. 2003. What is Hypertext?. In *Proceedings of the Fourteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA, 220–221. https://doi.org/10.1145/900051.900052

[156] Peter J. Nürnberg, John J. Leggett, and Erich R. Schneider. 1997. As We Should Have Thought. In *Proceedings of the Eighth ACM Conference on Hypertext*. ACM, New York, NY, 96–101. https://doi.org/10.1145/267437.267448

[157] Peter J. Nürnberg, John J. Leggett, Erich R. Schneider, and John L. Schnase. 1996. Hypermedia Operating Systems: A New Paradigm for Computing. In *Proceedings of the the Seventh ACM Conference on Hypertext*. ACM, New York, NY, USA Bethesda, Maryland, USA, 194–202. https://doi.org/10.1145/234828.234847

[158] Kieron O'Hara and Wendy Hall. 2021. *Four Internets: Data, Geopolitics, and the Governance of Cyberspace*. Oxford University Press, Oxford, UK. 361 pages. https://global.oup.com/academic/product/four-internets-9780197523681

[159] Tim O'Reilly. 2005. *What Is Web 2.0?* O'Reilly. https://www.oreilly.com/pub/a/web2/archive/what-is-web-20.html

[160] Paul Otlet. 2015. *Traité de Documentation: Le Livre sur le Livre*. Les Impressions Nouvelles, Paris, FR. https://lesimpressionsnouvelles.com/catalogue/le-livre-sur-le-livre/

[161] Seongbin Park. 1998. Structural Properties of Hypertext. In *Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia : Links, Objects, Time and Space—Structure in Hypermedia Systems: Links, Objects, Time and Space—Structure in Hypermedia Systems*. ACM, New York, NY, 180–187. https://doi.org/10.1145/276627.276647

[162] Kent M. Pitman. 1985. CREF: An editing facility for managing structured text. *AI Memos (1919–2004)* AIM-829 (1985), 23pp. https://dspace.mit.edu/handle/1721.1/5619

[163] Howard Rheingold. 2000. *Tools for Thought: The History and Future of Mind-expanding Technology*. MIT Press, Cambridge, MA, USA. 360 pages. https://mitpress.mit.edu/9780262681155/

[164] Elaine Rich. 1979. User modeling via stereotypes. *Cognitive Science* 3, 4 (1979), 329–354. https://doi.org/10.1016/S0364-0213(79)80012-9

[165] Horst W. J. Rittel and Melvin M. Webber. 1973. Dilemmas in A General Theory of Planning. *Policy sciences* 4, 2 (1973), 155–169. https://link.springer.com/article/10.1007/BF01405730

[166] George Robertson, Allen Newell, and K. Ramakrishna. 1977. *ZOG: A man-machine communication philosophy*. Technical Report. Dept. of Computer Science, Carnegie-Mellon University. https://apps.dtic.mil/sti/pdfs/ADA049512.pdf

[167] Jim Rosenberg. 1994. Navigating Nowhere/Hypertext Infrawhere. *SIGWEB Newsl.* 3, 3 (1994), 16–19. https://doi.org/10.1145/195477.195479

[168] Jim Rosenberg. 2001. And And: Conjunctive Hypertext and The Structure Acteme Juncture. In *Proceedings of the 12th ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA, 51–60. https://doi.org/10.1145/504216.504235

[169] Daniel Roßner, Jae-Sook Cheong, and Claus Atzenbeck. 2022. From Maintenance in Industry to Bibliographic Data: Spatial Hypertext as Communication Medium between User and Machine. In *Proceedings of the 5th Workshop on Human Factors in Hypertext*. ACM, New York, NY, 1–6. https://doi.org/10.1145/3538882.3542803

[170] Marc Saporta. 1962. *Composition No. 1*. Éditions du Seuil, Paris. 155 pages.

[171] Thomas Schedel and Claus Atzenbeck. 2016. Spatio-Temporal Parsing in Spatial Hypermedia. In *Proceedings of the 27th ACM Conference on Hypertext and Social Media*. ACM, New York, NY, 149–157. https://doi.org/10.1145/2914586.2914596

[172] m. c. schraefel, Max Wilson, Alistair Russell, and Daniel A. Smith. 2006. mSpace: Improving Information Access to Multimedia Domains with Multimodal Exploratory Search. *Communications of The ACM* 49, 4 (2006), 47–49. https://doi.org/10.1145/1121949.1121980

[173] Wolfgang Schuler and Smith. John B. 1990. Author's Argumentation Assistant (AAA): A Hypertext-Based Authoring Tool for Argumentative Texts. In *Proceedings of the First European Conference on Hypertext*. Cambridge University Press, Cambridge, UK, 137–151.

[174] Jan R. Schultz. 1986. A History of the PROMIS Technology: An Effective Human Interface. In *Proceedings of the ACM Conference on The History of Personal Workstations*. ACM, New York, NY, 159–182. https://doi.org/10.1145/12178.12188

[175] Ben Shneiderman. 1987. User Interface Design for the Hyperties Electronic Encyclopedia. In *Proceedings of the ACM Conference on Hypertext*. ACM, Chapel Hill, North Carolina, USA New York, NY, USA, 189–194. https://doi.org/10.1145/317426.317441

[176] Ben Shneiderman, Catherine Plaisant, Rodrigo A. Botafogo, Don Hopkins, and William Weiland. 1991. Designing to Facilitate Browsing: A Look Back at the Hyperties Workstation browser. *Hypermedia* 3, 2 (1991), 101–117. https://doi.org/10.1080/09558543.1991.12031193

[177] Patrick Sinclair, Kirk Martinez, David E. Millard, and Mark J. Weal. 2002. Links in the Palm of Your Hand: Tangible Hypermedia Using Augmented Reality. In *Proceedings of the Thirteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, 127–136. https://doi.org/10.1145/513338.513371

[178] John B. Smith, Stephen F. Weiss, and Gordon J. Ferguson. 1987. A Hypertext Writing Environment and Its Cognitive Basis (Panel Session). In *Proceedings of the ACM Conference on Hypertext*. ACM, Chapel Hill, North Carolina, USA New York, NY, USA, 195–214. https://doi.org/10.1145/317426.317442

[179] MacKenzie Smith. 1993. Technical review. *Computers and the Humanities* 27, 5 (1993), 415–420. https://doi.org/10.1007/BF01829391

[180] Richard M. Stallman. 1981. EMACS the Extensible, Customizable Self-Documenting Display Editor. In *Proceedings of the ACM SIGPLAN SIGOA Symposium on Text Manipulation*. ACM, New York, NY, USA Portland, Oregon, USA, 147–156. https://doi.org/10.1145/800209.806466

[181] Robin Stewart, Gregory Scott, and Vladimir Zelevinsky. 2008. Idea Navigation: Structured Browsing for Unstructured Text. In *Proceedings of the SIGCHI*

Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA Florence, Italy, 1789–1792. https://doi.org/10.1145/1357054.1357332

[182] Jie Tang, Jimeng Sun, Chi Wang, and Zi Yang. 2009. Social Influence Analysis in Large-Scale Networks. In *Proceedings of the 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. Association for Computing Machinery, New York, NY, 807–816. https://doi.org/10.1145/1557019.1557108

[183] Philip Terry. 2019. *The Penguin Book of Oulipo*. Penguin UK, London. 592 pages. https://www.penguin.co.uk/books/312110/the-penguin-book-of-oulipo-by-philip-terry-ed/9780241378458

[184] The Linnean Society. 2023. *The Linnean Collections*. The Linnean Society. https://linnean-online.org/information.html

[185] Randall H. Trigg and Mark Weiser. 1986. TEXTNET: A Network-Based Approach to Text Handling. *ACM Transactions on Information Systems (TOIS)* 4, 1 (1986), 1–23. https://doi.org/10.1145/5401.5402

[186] Manolis Tzagarakis, Michail Vaitis, and Nikos Karousos. 2006. Supporting the Design of Behaviors in Callimachus. In *Proceedings of the Seventeenth Conference on Hypertext and Hypermedia*. ACM, New York, NY, 115–118. https://doi.org/10.1145/1149941.1149963

[187] Kenneth Utting and Nicole Yankelovich. 1989. Context and Orientation in Hypermedia Networks. *ACM Transactions on Information Systems (TOIS)* 7, 1 (1989), 58–84. https://doi.org/10.1145/64789.64992

[188] Jill Walker. 2002. Links and Power: The Political Economy of Linking on the Web. In *Proceedings of the Thirteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA College Park, Maryland, USA, 72–73. https://doi.org/10.1145/513338.513358

[189] Jill Walker. 2005. Feral Hypertext: When Hypertext Literature Escapes Control. In *Proceedings of the Sixteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA Salzburg, Austria, 46–53. https://doi.org/10.1145/1083356.1083366

[190] Janet H. Walker. 1987. Document Examiner: Delivery Interface for Hypertext Documents. In *Proceedings of the ACM Conference on Hypertext*. ACM, Chapel Hill, North Carolina, USA New York, NY, USA, 307–323. https://doi.org/10.1145/317426.317448

[191] Noah Wardrip-Fruin. 2004. What Hypertext Is. In *Proceedings of the Fifteenth ACM Conference on Hypertext and Hypermedia*. ACM, New York, NY, USA, 126–127. https://doi.org/10.1145/1012807.1012844

[192] Uffe Kock Wiil and John J. Leggett. 1997. Workspaces: The HyperDisco Approach to Internet Distribution. In *Proceedings of the Eighth ACM Conference on Hypertext*. ACM, New York, NY, 13–23. https://doi.org/10.1145/267437.267439

[193] Uffe Kock Wiil, Peter J. Nürnberg, and David L. Hicks. 2003. Structural Computing: Research Directions, Systems And Issues. *Journal of Network and Computer Applications* 26, 1 (2003), 3–9. https://doi.org/10.1016/S1084-8045(02)00056-5

[194] Uffe K. Wiil, Peter J. Nürnberg, and John J. Leggett. 1999. Hypermedia Research Directions: An Infrastructure Perspective. *ACM Computing Surveys (Electroic Symposium)* 31, 4es (1999), 1–9. https://doi.org/10.1145/345966.345971

[195] Uffe Kock Wiil, Samir Tata, and David L. Hicks. 2003. Cooperation services in the Construct structural computing environment. *Journal of Network and Computer Applications* 26, 1 (2003), 115–137. https://doi.org/10.1016/S1084-8045(02)00065-6

[196] Hannah Wood. 2017. Dynamic Syuzhets: Writing and Design Methods for Playable Stories. In *ICIDS 2017*. Springer International Publishing, New York NY, 24–37. https://link.springer.com/chapter/10.1007/978-3-319-71027-3_3

[197] World Wide Web Consortium (W3C). 1996. *Cascading Style Sheet (CSS)*. World Wide Web Consortium (W3C). https://www.w3.org/Style/CSS/Overview.en.html

[198] World Wide Web Consortium (W3C). 2008. *SPARQL Query Language for RDF*. World Wide Web Consortium (W3C). https://www.w3.org/TR/rdf-sparql-query/

[199] World Wide Web Consortium (W3C). 2015. *Linked Data*. World Wide Web Consortium (W3C). https://www.w3.org/standards/semanticweb/data

[200] World Wide Web Consortium (W3C). 2015. *Rich Structured Data Markup for Web Documents*. World Wide Web Consortium (W3C). https://www.w3.org/TR/rdfa-primer/

[201] Alex Wright. 2014. *Cataloging the World: Paul Otlet and the Birth of the Information Age*. Oxford University Press, New York, NY. 360 pages. https://global.oup.com/academic/product/cataloging-the-world-9780199931415

[202] Xingjiao Wu, Luwei Xiao, Yixuan Sun, Junhang Zhang, Tianlong Ma, and Liang He. 2022. A survey of human-in-the-loop for machine learning. *Future Generation Computer Systems* 135 (2022), 364–381. https://doi.org/10.1016/j.future.2022.05.014

[203] Nicole Yankelovich, Bernard J. Haan, Norman K. Meyrowitz, and Steven M. Drucker. 1988. Intermedia: The Concept and the Construction of a Seamless Information Environment. *Computer* 21, 1 (1988), 81–96. https://doi.org/10.1109/2.222120

[204] Polle T. Zellweger, Bay-Wei Chang, and Jock D. Mackinlay. 1998. Fluid Links for Informed and Incremental Link Transitions. In *Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia : Links, Objects, Time and Space—Structure in Hypermedia Systems*. ACM, Pittsburgh, Pennsylvania, USA New York, NY, USA, 50–57. https://doi.org/10.1145/276627.276633

[205] Kasper Østerbye and Kurt Nørmark. 1994. An Interaction Engine for Rich Hypertexts. In *Proceedings of the 1994 ACM European Conference on Hypermedia Technology*. Association for Computing Machinery, New York, NY, 167–176. https://doi.org/10.1145/192757.192795