On Digital Gardening: A Feral Hypertext in Practice

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ABSTRACT

This paper investigates "digital gardening" as a form of feral hypertext and a network of practice for personal information organization. Through an observational study of digital gardens in practice, we examine the structure of conceptualization and the diverse implementation of digital gardening. Our exploration aims to contribute to the ongoing discussion on the democratization of hypertext and its implications for individuals in the increasingly complex digital landscapes of the modern age.

CCS CONCEPTS

• **Human-centered computing** → **Hypertext / hypermedia**; • **Information systems** → **Document structure**; **Document representation**; • **Applied computing**;

KEYWORDS

Digital Garden, Information Organization, Personal Information Management, Digital Network of Practice

1 INTRODUCTION

> *Thus he builds a trail of his interest through the maze of materials available to him.* ***Vannevar Bush [16]***

The notion of "feral hypertext," as remarked by Jill Walker in her 2005 article [51], highlights a significant shift in the history of hypertext as it transitioned from a controlled, scholarly environment to the untamed expanse of the World Wide Web. Since then, hypertext has been implemented in various scopes of work, including the broad concept of information organization, which has been closely tied to hypertext since its advent.

This paper investigates the relatively new practice known as "digital gardening," as a form of feral hypertext that has recently gained popularity online addressing personal information organization. Utilizing hypertext, individuals "cultivate" personal information bases using scattered yet interconnected digital notes and ongoing curation, allowing practitioners to organize and connect their information in a way that is meaningful to them. From the perspective of hypertext history, the concept encapsulating the MEMEX [16] has been implemented. Although they may not intend to mimic Bush's concept, their solutions occasionally resemble his vision. This presents an interesting case on how the system organically emerged in the wild as people seek to address their information management needs.

As Anderson and Millard discuss in their work, *Seven Hypertexts* (2023) [2], "the surge of new productivity applications" as more modern hypertext tools emerge and "are busy rediscovering all of the old problems and finding exciting new solutions." While this may indicate the recurrence of the subject of concern, it reinforces the ongoing relevance of Walker's idea and underscores the importance of studying the actual use of technology. The evolving nature of hypertext necessitates a shift in the methodology used to study it. As proposed by Walker, this paper adopts a "hunter-gatherer" approach, advocating for a multidisciplinary view of the system. This approach is crucial in addressing the complexity of feralization, the practical implementations, and the context surrounding them.

Through this work, we aim to contribute to the ongoing discussion in two key areas. First, the conceptualization section elucidates the structure and formation of hypertext systems in practical usage, shedding light on how hypertext concepts are disseminated in the public sphere, giving rise to a network of practice. Second, the observation section statistically and analytically highlights the varied implementation of feral hypertexts, which retain affordances from multiple concepts, and identifies open questions and potential paths for multidisciplinary research.

2 TOWARDS DIGITAL GARDENING

2.1 Overview

> *This is all my take on gardening, but knowledge and neologisms always live within communities.*
> ***Maggie Appleton [4]***

The concept of digital gardening has emerged as a loosely connected network of practice within the online sphere, focusing on personal information organization.[1] Since the late 2010s, the popularity of this practice has grown, with practitioners often identified as "digital gardeners," curating their own information spaces called "digital gardens," many of these which are published online, which present the put them in an unique place in the public-private spectrum on online sphere, which we discuss in detail in §3.6. One compelling feature commonly found in digital gardens is that, as personal information bases, many practitioners also encapsulate their formulation of what they perceive as a digital garden, who they refer to it from, and how they implement the idea in their digital garden. These characteristics of a digital garden as a practice that lies on an interesting spectrum within the public-private spectrum, along with the gardeners' documentation of their formulation of the concept, present a unique case for observing how a form of feral hypertext has come into practical usage in it own state without interference, as well as the structure and pattern of the formulation and development of a digital network of practice as a whole.

As Rowberry remarks in his 2023 *Historiographies of Hypertext* [44], a linear mechanism of chronological history "can fail to embrace the rich messiness of historical events," this holds even

[1] We adopt the neutral term "information organization" to describe the act of managing information, with "information" roughly based on the prevalent DIKW hierarchy [45]. We primarily use "information" to address the subject of organization in the discussed practice, arguing that people organize data into information, but knowledge does not always emerge.

when examining a more limited scope, such as the history of digital gardening. With the affordances of digital gardening evolving through the collective contributions of practitioners rather than stemming from a single, authoritative definition, these contributions compete, combine, fork, and reemerge [28]. Thus, emphasizing the impact of networks on conceptualization, we turn our attention to the practitioners themselves and examine their notes on the foundational ideas underlying the formation of their gardens. The detailed methodology for data collection is presented in §3.1. For this section, we separate the observation into two parts: the structure of reference to observe the overall influence in the sphere and the implication of the practice itself.

2.2 Structure of the Conceptualization

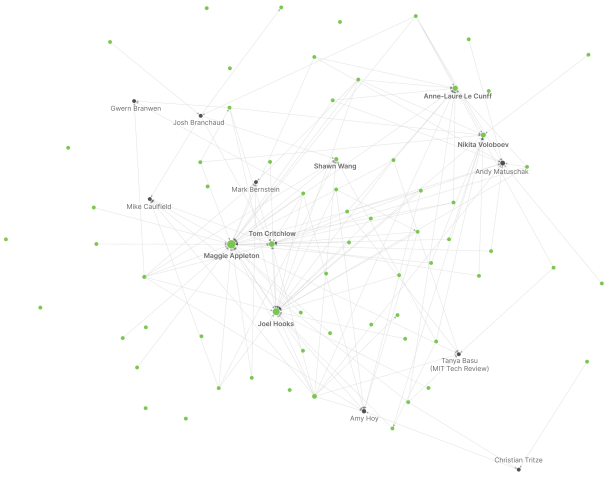

Figure 1: Key Contributors on the Conceptualization of Digital Gardening based on the Amount of References

Among the 68 digital gardens, 52 explicitly mention the conceptualization of the gardener's practice. We created a graph connecting each garden to the sources they cite, revealing six notable contributors (n>5) who are explicitly practitioners and four who are not. The graph is visualized in figure 1.

Maggie Appleton is the most frequently referenced contributor (n=25), with a variety of contributions to the concept. Including her writing investigating the emergence and practice of digital gardening, *A Brief History & Ethos of the Digital Garden* [4], which is heavily mentioned and ranks among the top results on search engines[2], and a GitHub repository [5] containing resources for digital gardeners and a curated list of public digital gardens, which is the most starred (3.7k) repository for the keyword "digital garden" on the website as of April 2024.

Appleton's work points to Mark Bernstein's *Hypertext Gardens* (1998) [10] as the earliest recorded mention of the term "hypertext garden"[3], then presents a semi-chronological account of contributions to the conceptualization, which may be due to one significant direct line of reference from each contributor to another: Joel Hooks's *My blog is a digital garden, not a blog* (2019) [30] referred to Tom Critchlow's *Of Digital Streams, Campfires and Gardens* (2018) [21], which in turn referred to Mike Caulfield's *The Garden and the Stream: A Technopastoral* (2015) [19], who referred to Bernstein. Observing the reference patterns from other practitioners in our study, we can see a line of influence: a third of the gardeners who cite Critchlow also cite Hooks, while all gardeners who cite Caulfield also cite Critchlow or Hooks. Although this may not imply a direct chronological exposure, it captures the fact that gardeners are exposed to this referential line. In addition to this direct lineage, there are also branching contributions: Hooks cites Amy Hoy's *How the Blog Broke the Web* [31], which criticizes the "chronostream" format as opposed to more free forms of possibilities of the web, as another inspiration alongside Critchlow, which all gardeners in the sphere who cite Hoy also cite Hooks, while references to Critchlow's are found within several gardens. From the structure, while practitioners may have different expositions to digital gardening, it might be argued that the concept may organically still form some degree of dominant narrative structure.

However, besides this referential lineage in the dataset's subregion, some nodes emerged as notable contributions to some gardeners' ideas. From the six practitioner contributors mentioned at the beginning of the section, three are Appleton, Critchlow, and Hooks[4], while the other three are Anne-Laure Le Cunff who write several articles on digital gardening [22], Shawn Wang (swyx) who write *Digital Garden Terms of Service* [52][5], and Nikita Voloboev [50] who curate a large digital garden of more than 1,000 entries, while he does not provide extensive writing on the concept[6], he is a creator and moderator of the subreddit r/digitalgarden with more than 3,500 members and curate an extensive list of public personal information repository.

Outside the practitioner contributor sphere, eight and ten gardens point out to Amy Hoy and Andy Matuschak, respectively; as mentioned, Hoy's linkage to the conceptualization of digital gardening came from the reference from Critchlow. Meanwhile, even though Matuschak is not an explicit digital gardener himself, his concept of Evergreen Note [39] has inspired several gardeners[3, 17, 27], which may reflect the multiplicity and the loose notion of the practice.

2.3 Neologism, Metaphors, and Practices

> *But the multi-linear nature of the garden means that there is no one right view of the bridge, no one correct approach.*
> ***Mike Caulfield [19]***

This section delves deeper into the contributions of the works mentioned in the previous section to the affordances of digital gardening, focusing on three key aspects: neologism of the term "digital garden", metaphors around the discussion, and the conceptualization of the practice. Returning to Bernstein, Appleton notes that his work *Hypertext Garden* represents the first use of the term yet remarks that the creation of neologisms was part of a broader historical

[2] Considering the significant impact of search engines on information discovery [18, 29]
[3] not explicitly "Digital Garden"
[4] While Caulfield provides a notable contribution of the concept, he himself is not the explicit practitioner, but curating his own private "personal wiki"
[5] Le Cunff and Wang are also cited in Appleton's
[6] He directly link the first mention of "digital gardens" in his front page to Hook's

context in the 1990s "around hypertext and its metaphorical framing." Caulfield briefly observes that "The Garden is an old metaphor associated with hypertext," citing examples such as Borges's 1941 *The Garden of Forking Paths*[11], the concept of WikiGardener, and Bernstein's Hypertext Gardens. However, it can be viewed that the metaphors in these three examples embed two different meanings, that is, the discussions around Borges' work in the hypertext and hyperfiction field[25] and Bernstein's work addressing the "navigation problem"[35] primarily focus on the navigation or topology of the system, while Cunningham's *WikiWikiWeb* page on "WikiGardener" emphasizes the role of the WikiAgent who "plants things, tends, prunes, tidies and generally nurtures"[24]. Interestingly, both metaphors concerning topology and practice have come to play a role in the conceptualization of digital gardening.

Yet, neither Bernstein nor Caulfield directly mentioned the neologism "digital garden." Focusing on the topological models of hypertext, Caulfield categorizes two metaphors as approaches to the web: a garden, encompassing the three mentioned metaphors, and a stream, representing the linear, chronological path found in many forms of online media. From this, he emphasizes a practice to "de-stream" the linear information flow to be applied to tools, primarily referring to federated wikis. He also points to Bush's MEMEX as "The Original Garden," effectively tying this classical idea in hypertext into play. This perspective suggests a view of technologies as tools that require a set of practices to address them, yet Caulfield does not explicitly use the metaphors around the act of gardening in his post. Critchlow expands Caulfield's metaphor of garden and stream by adding a third approach, "campfire," as a space between stream and garden. He then presents more technical aspects of implementing the practice on a self-created wiki in his four subsequent posts from 2018-2020, in his "Digital Gardens" writing series.[7]. From this lineage, he is the first person to directly use the neologism "digital garden" while also emphasizing the concept of the digital garden as a metaphor and practice imposed on tools. Shortly after, Hooks' more conceptual writing explicitly employs gardening metaphors, such as pointing out the similarity between posts and plants that are "in various stages of growth and nurturing."

Several works aside from the lineage play different roles in contributing to the affordance of the concept and practice. Appleton's and Tanya Basu's 2020 *Digital gardens let you cultivate your own little bit of the internet* on MIT Technology Review [7] contribute to retrospective speculation on the concept by providing a historical overview. Meanwhile, work by Appleton and Le Cunff provides a conceptual model for the practice, as the former offering "6 patterns" as guiding principles of the term: Topography over Timelines, Continuous Growth, Imperfection & Learning in Public, Playful, Personal, and Experimental, Intercropping & Content Diversity, and Independent Ownership, and the later focusing on thought cultivation through the concept of a "mind garden" and provides several curated lists of examples, including Matuschak, Critchlow, and Hooks [23]. Wang's *Digital Garden Terms of Service* suggests three "terms of service" each for visitors and gardeners, focusing more on the social aspect than the practice itself, e.g., Constructive Criticism for visitors and Epistemic Disclosure for gardeners. This has implications for two aspects: the growing popularity and adaptation of digital gardening as a practice that considers the more social aspects, and, with the ToS for visitors, the emergence of a culture of publicizing the garden.

[7]Or, in his terminology, blogchain

3 ON FERALITY: SURVEY AND TAXONOMY

3.1 Methodology

In this section, we observe the actual implementation of digital gardens. We gather public "digital garden" websites from the 3 most-starred compilations of digital gardens on GitHub [5, 36, 54], resulting in 306 entries. However, many of the websites are not explicitly identified as a digital garden nor the creator of the web as a digital gardener. Therefore, for the scope of this paper concerning digital gardening as a practice, we limit the observation to those explicitly identified as digital gardens, which, after removing duplications, resulted in 68 gardens. We use a mixed method for observation, combining quantitative coding for binary code, such as the presence of a search system or backlinks, and numerical code, such as a number of categories and tags, with qualitative observation for nuanced data. This reduces bias in manual coding while providing a richer observation [43]. Acknowledging the public/private and author/subject discussion in online research [15], we follow the rationales by Mazanderani and Powell (2013) [40]. With public gardens being overtly public, we treat digital gardeners as authors, citing their works while maintaining anonymity for those not directly cited as perceivable in previous sections. The aim of this section is not to define specific characteristics or propose an ideal method for information organization, as research in related fields has shown that individuals employ diverse methodologies when organizing information. Instead, the section seeks to shed light on the wide range of implementation of hypertext system addressing personal information organization adopted by different individuals and to raise open questions that can guide future research in relevant areas.

3.2 Categorization and Navigation

Jones' (2007) framework for personal information management (PIM) proposes a curation cycle of personal data: Keep-Manage-Exploit [33], in which categorization and navigation in digital gardens respectively reflect the actions in the latter two stages. Research in group information management (GIM) highlights the differences in individuals' methodologies for information organization [9]; this is also evident when observing the diverse organizational structures of digital gardens. We classify categorization into two types: category, where information within a category is mutually exclusive, and tag, where information may have multiple tags. Our data shows that 47% of the gardens do not utilize categories or tags, 38% use categories without tags, 12% use tags without categories, and 3% use both. However, the categorization methods vary in prominence and implementation across gardens. For example, 60% of category users place their categories in the left sidebar, while others display them on various scales, from small [41] to nearly covering the entire front page [21].

Categories can be further classified as flat or nested, yet there is no clear correlation between the number of categories, which

ranges from less than 10 to over 100, and the likelihood of them being nested. For instance, while Volobeov's garden contains around 85 categories, it still employs subcategories. Additionally, categories function in two ways: non-content categories, which only are non-actionable name labels or index pages for the entries [49], and content categories, where the category itself serves as an information page [34]. The data also reveal a correlation between the structure of the tools used and the categorization method. All users of technical documentation tools, such as GitBook and Material MKDocs, which provide a default categorical structure in the left sidebar, imposed category categorization in their gardens. In contrast, none of the Roam users employ categories or tags, as they are constrained by the limitations of the tool, which also reflects their design philosophy and choice.

Regarding navigation, the three main elements are backlinks (34%), search (26%), and tags (8%). Interestingly, while 53% of gardeners use category or tag systems, only 30% of backlink practitioners also employ them. This may indicate a conceptual preference for navigating the garden through paths rather than categorization systems based on several conceptual contributions of the digital gardens. In addition to explicit navigation elements and standard page hyperlinks, gardeners use other methods for navigation, such as latest or recent changes index [12, 50], top of mind or featured index [30], and alphabetical order index [13]. The statistic in this survey can imply popularity of the method, yet, it is not sufficient for the performance of each exploitation method. However, this present a unique possibilities for survey information retrieval in the unique public/private spectrum of the information repository.

3.3 Content

We explore three dimensions of content in digital gardens: length, linkage, and content-to-link ratio, all exhibiting significant diversity within the dataset. **Length** of writing in digital gardens spans a wide range, from concise snippets to extensive posts. For example, several developer gardeners often use each entry to store a code snippet with minimal linkage between each entry (as mentioned in the next topic). While others write long-form content resembling traditional blog posts. In addition, several gardeners further classify each post into several states. Appleton, for example, employs three stages of entries: Evergreen, Budding, and Seeding; similarly, Luciano Strika [46] uses three emoji symbols to make the hierarchical classification. **Linkage** can be divided into two subtypes: internal links connecting entries within the garden and external links pointing to outside sources. Internal links are a crucial feature of wiki systems. However, the extent to which internal links are utilized varies among digital gardens. Some gardeners heavily rely on internal linking to create a network of interconnected thoughts, while others prioritize external links to curate and store valuable resources. This inconsistency in the use of internal links may be influenced by factors such as the garden's purpose, the gardener's personal preferences, and the constraint of the tools used to create the garden; for example, all gardens using Roams heavily utilize internal links. Considering the **content-to-link ratio** and the usage of digital gardens as repositories for information dumps, several gardeners use entries for collections of links, references, and reading lists without personal writing or just minimal comments and notes. Others use each entry similarly to long-form writing. These diversities underscore the idea that, despite the several important roots of digital gardening in wiki practices, the implementation of digital gardens does not always adhere to typical wiki conventions. This divergence can be attributed to the highly personal nature of digital gardens, which allows for greater adaptability and customization based on individual requirements, preferences, and objectives. The personal aspect of digital gardens enables gardeners to tailor their spaces to their specific needs, resulting in a wide range of content organization and presentation styles.

3.4 Design

The design of digital gardens also contributes to the diversity of the practice, influencing navigation and usage patterns. The majority of gardens (91%) present entries in a single-page format, while the remaining 9% display entries on top of the previously clicked entry. The latter type, reminiscent of the WikiWikiWeb and Matuschak's note, offers a unique navigation pattern rarely found in online spaces. Interestingly, 67% of the practitioners employing this design use Roam as their primary tool, and one practitioner directly cites Matuschak as an inspiration for their system. This suggests that the choice of tools and exposure to influential examples play a significant role in shaping the design of digital gardens. In addition to the content format, digital gardens often incorporate subtle cues to enhance navigation and readability. For instance, 35% of the gardens differentiate between internal and external links using various methods, such as distinct colors or double bracket symbols for internal links.

3.5 Metaformulation

Around a third of gardeners (37%) use their gardens as their primary online presence, i.e. structure of their main website, while others choose to embed their gardens within their existing websites, sometimes using alternative names such as "wiki," "notes," "brain," or "knowledge." Some gardeners highlight the similarities between these terms [34], while others actively integrate practices like zettelkasten and evergreen notes into their gardens. This variation in implementataion and terminology reflects the diverse perspectives on the relationship between digital gardens and personal information organization perception of an individual. In addition, several gardeners also adopt metaphors around the concept of digital garden, for instance, Neil Mather [38] employs the metaphors "stream" and "garden" to distinguish between two sections of his website, emphasizing the different purposes and levels of refinement for each area.

3.6 Perception on Public-Private Spectrum

As mentioned throughout the paper, one compelling characteristic of digital gardening is that many practitioners choose to publicize their gardens on the web. This practice is influenced by several factors, including the use of common form hypertext technologies for the implementation, which is being on the web; the influence of web blogging and wiki systems; and the concept of "learning in public" as documented in several gardens [12, 37]. Some gardeners explicitly welcome visitors to their repositories, and several writings, notably including Shawn Wang's *Digital Garden Terms of*

Service [52], suggest terms of service for both visitors and gardeners, addressing issues related to publicizing gardens and providing methods for addressing them.

The nature of digital gardens positions them in a unique spot on the public-private spectrum, with implications from various perspectives. From an information organization perspective, it raises questions about how to view and approach these knowledge repositories. While digital gardens are inherently individualistic, they often include cues to enable others to utilize the repository effectively. Additionally, the use of hypertext as a personal information repository highlights characteristics such as nonlinear navigation and blurred boundaries between entries, presenting subjects for research that are not commonly considered in information organization studies. And, as may implied in §3.1, this position of digital gardens can also introduce new elements to discussions surrounding public-private information and the authorship of online creations.

4 IMPLICATION: ON HYPERTEXT AND INFORMATION

The art and science of information organization have evolved over time [14], with diverse perspectives and concerns. Traditional works often focus on managing large public collections in libraries [20, 26], archives [6], and museums [1, 48]. However, technological advancements since the 20th century have significantly impacted the nature of individual collections, which have been constantly growing in size and complexity. This growth highlights two crucial aspects: the changing role of individuals from consumers of public collections to curators of their own personal collections [53], and the need for methodologies specifically tailored to individual collections, which differ from those of public collections [8, 32].

The emergence of hypertext in the 1960s [42] presented a unique perspective on addressing information organization problems. While it did not heavily put an emphasis on personal information organization at first, the development of personal computers and the utilization of hypertext on the World Wide Web marked a crucial turning point in the history of hypertext. As Walker remarked, hypertext "Escapes Control" and turns "feral," which can be viewed as a democratization of hypertext, enabling more people to utilize it. Meanwhile, several methodologies for personal information organization have emerged from different backgrounds, including PIM and PKM. Interestingly, while feral hypertext and personal information organization are seemingly highly linked through the democratization of personal technology, the two matters are not commonly studied together.

Two interesting problems emerge from these backgrounds, as addressed in this paper. First, how are feral hypertexts disseminated in the "wild"? Most papers referring to feral hypertext usually address the history of hypertext or its behavior but not the pattern of emergence. Second, how is personal hypertext being used to address personal information organization, as long envisioned by Bush? §2 and §3 address these topics from different viewpoints, rooting for multidisciplinary observation to address the subject matter, which has developed from many domains.

In §2, we observe a pattern of conceptualization and adoption of hypertext concepts, which, in turn, reflects the structure of an online network of practice. The quote by Anderson and Millard regarding the rediscovery of "all of the old problems" and the discovery of "exciting new solutions" has interesting implications for the difference between the invention of ideas and solutions and their adoption, obfuscated by the path to discovering them. Differences in perspectives and attributing lexicons may play an important role in this occurrence. While earlier contributions to the affordance of digital gardening are highly related to hypertext, explicit mentions of hypertext are not commonly found in later contributions, which arguably address a wider audience. This provides further evidence of the wilderness of hypertext, where tools "do not even call themselves hypertext tools" [2]. The observation also illustrates the development and integration of ideas as individuals adopt and utilize them differently, resulting in variations of elements found in practice, as shown in §3.

Looking from the past to the future, Szybalski's 2005 article *"Why it's not a wiki world (yet)"* [47] remarked that "non-technical individuals had no way to set up a personal wiki." However, nearly two decades later, the further development of technologies might render this statement irrelevant. While many of the gardeners in the dataset have technical programming backgrounds, several utilize more modern and accessible tools such as Roam and Obsidian. Outside the dataset, others also address different types of personal information organization from various perspectives while using diverse tools. The improvement in the accessibility of these tools may present even more interesting and diverse approaches to how people construct and navigate the increasingly complex digital landscapes of the modern age.

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