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THESIS

SHAPING THE TOOLS OF TOMORROW:

HOW TO MAKE NEW PERSONAL KNOWLEDGE MANAGEMENT SOFTWARE MORE EFFECTIVE?

WITH A CASE STUDY OF OBSIDIAN

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Abstract

This thesis begins with an overview of the interactions between users, technological tools, and their environment in three contemporary periods in the human quest for knowledge. It introduces key thinkers and theories from the dawn of the Information Age (1920s-1980s), the Knowledge Management era (KM; 1990s-2000s), and the recent surge in Personal Knowledge Management (PKM; 2010s-present). This historical survey reveals and confirms the anomalous nature of the KM period, as well as the reversion to the norm represented by the current PKM revolution. It analyzes impacts of the recent emergence of "tools for thought" currently propelling the PKM movement, then presents a case study of the application Obsidian. One of the most promising tools of this era, the author argues, Obsidian nevertheless contains a flaw that risks hindering its potential and that of the ongoing economic revolution. The author proposes a solution—a plugin concept called SmartOutline—and validates it through feedback from domain experts and the Obsidian user community. The confirmation of the hypothesis and of the proposed solution's relevance resolves some questions while raising others about this fast-growing field.

Keywords: personal knowledge management, knowledge management, tools for thought, information overload, Obsidian

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Abbreviations and Translations

Abbreviation or term	Explanation
Ba	Enabling context
IDE	Integrated development environment
AI	Artificial intelligence
ITE	Integrated thinking environment
KM / OKM	(Organizational) knowledge management
Locus communis	“Commonplace books”; a collection of texts
MVP	Minimum viable product
OCR	Optical character recognition
PIM	Personal information management
PKM	Personal knowledge management
TfT	Tools for thought
Zettelkasten	Note box

I. Introduction

What distinguishes man from beasts? It is a question that philosophers have debated since antiquity, and for good reason: the answer goes to the heart of what makes us human. After centuries of conjecture about thumbs, agriculture, fire, and other factors, today a scientific consensus is emerging around a phenomenon known as "cumulative culture" and centered upon knowledge. According to the research that has helped establish this consensus (well summarized in Whiten et al. 2022), the answer is our ability to learn information and, through our contextual understanding, to convert it into knowledge that we can then retain and share.[1] Most importantly, it is our ability to access, learn from, then build on prior knowledge that has facilitated our species' unique degree of progress.

The choices and behaviors of animals are driven almost exclusively by the information encoded in their genomes and by the information they accumulate over their lifetimes. Humans draw from the same sources, but we are also able—thanks to this cumulative culture—to tap into the knowledge of our ancestors, which is taught to us by our parents and our education systems, then reinforced throughout our lives by various media. Only by standing on the shoulders of previous generations do we reach new heights of achievement.

A Three-Body Problem

If knowledge is the key to human progress, then it is in our interest to master it. It is precisely this notion that since antiquity has motivated the quest for knowledge as well as a meta-reflection on the nature of knowledge and its relation to humanity.

The evolution of these parallel searches across human history has seen ups and downs: periods of stagnation and momentary surges of great progress. At the most fundamental level, these fluctuations are the result of interactions between three essential elements: **users**, **tools**, and **the environment**.

In principle, users invent and exploit tools for two reasons: first, to be able to understand their environment (including the constraints it imposes and the opportunities it offers) and second, to remake the environment for their own purposes. But in reality, the exploitation, intermediation, and other relationships between these three factors are complex and sometimes counterintuitive. John M. Culkin was right when he wrote, paraphrasing his collaborator Marshall McLuhan, "We shape our tools and thereafter they shape us." (Culkin 1967) Indeed, the lines of interaction are multiple and sometimes unleash unpredictable side effects, a fact which will be considered throughout this analysis.

[1] Twenty years ago, a researcher in the information sciences surveyed about 50 of his colleagues on their definitions of the terms "data", "information," and "knowledge." Even among these experts in the field, the results showed a wide diversity of views. (Zins 2007) In this thesis, I will adhere to one of the most common views, which defines data as symbols, information as data that contains meaning, and knowledge as information that has particular meaning for one or more people in a given context. The distinction between "information management" and "knowledge management" is discussed in section 2.3.

The Three Historical Eras

Section II of this thesis will present a literature review around three major contemporary movements, each a particular manifestation of the quest for knowledge, with its respective thinkers and theories:

1. **The Dawn of the Information Age**: In the mid-20th century, major structural changes in societies of the developed world resulted in widespread information overload. To cope with this deluge, innovative thinkers devised a wide variety of approaches and tools that, for the time being, nonetheless remained mostly marginal and on an experimental scale.

2. **Knowledge Management (KM)**: Driven by private companies since the 1990s and oriented around their owners' objectives, this discipline focuses on the transfer of knowledge within firms, and how to stimulate and cultivate it for strategic purposes.

3. **Personal Knowledge Management (PKM)**[2]: Most recently, a new movement has been emerging. Unlike KM, which is a mature and developed discipline that has been studied for 30 years, PKM is less formalized, but is flourishing thanks to a community of passionate users who are developing techniques and tools to navigate profound economic and societal changes.

While the latter movement is the least studied of the three, the relationships between these movements (including the reasons for the shift from one to another at precise historical moments) are even less frequently interrogated by researchers or practitioners.

In view of their names, many imagine that PKM simply represents the *personalization of* KM, or the adaptation to the private sphere of certain knowledge management tools developed in business settings. I will show that the PKM movement is in fact the result of another, much longer and richer intellectual heritage: the one that preceded the Information Age and that was oriented around the individual rather than the enterprise.

New PKM Tools

The PKM movement is in full swing today, offering a paradigm shift that promises to empower workers, free them from the narrow KM frameworks imposed by their employers, and re-center the human being as the key player in the quest for knowledge.

Within the "users, tools, environment" triad, there are many factors that could prove decisive for the movement's future. In this thesis, I will focus particularly on the tools. If these applications are insufficient to meet (current and future) users' needs, then the PKM movement will never reach its full potential. In Part III of this thesis, I will present a case study on Obsidian, one of the fastest growing new PKM tools of recent years. I will show that it is achieving this impressive growth despite a major flaw that will need to be addressed if the tool is to contribute fully to the PKM ecosystem. After defining my hypothesis, I propose a solution to this problem in the form of an Obsidian plugin concept,

[2] It is worth noting that the term *personal knowledge management* contains an ambiguity: it is not clear whether the word *personal* refers to *knowledge* or to *management*. Two valid interpretations are thus possible: that we are concerned with managing personal (individual) knowledge, or that we are concerned with knowledge management at a personal (individual) level.

illustrated by a video I published online to solicit feedback from the Obsidian user community and domain experts. Their reactions are presented and analyzed.

Following the analysis of feedback on the proposed solution, Section IV presents reflections on this research experience, as well as a discussion of the implications for the Obsidian application and future prospects for the PKM movement. The Conclusion summarizes the lessons learned from this research and the value of continuing to pursue these questions through further study.

II. The Quest for Knowledge

The quest for knowledge is driven by an innate desire to understand one's environment, a desire that very likely unites humans across all societies. In the Western world, this phenomenon can be traced back to antiquity, when Greek, Roman, and other thinkers debated the nature of knowledge, its relationship to the human spirit, and the best methods for cultivating and preserving it. Some recorded their experiences and thoughts in diaries or accumulated proverbs, scientific precepts, quotations, or fragments of text in collections known in Latin as *locus communis* or "commonplace books." After a thinker's death, his commonplace books would pass to his students, serving as guides to his thoughts and influences, and as an index to navigate the texts published up to that date. (Darnton 2000)

The number of texts to be read and processed increased greatly after Johannes Gutenberg invented the movable type printing press in the mid-15th century. The practice of commonplace books was still in use, but the advent of unprecedented volume of texts greatly complicated the task of organizing them. The English philosopher John Locke encountered the practice of commonplace books at Oxford University and adapted it to make organizing the books more flexible and expandable. His 1685 publication of the *Méthode nouvelle de dresser des recueils* (New Method of Compiling Collections) modernized the practice for a new era, giving it new life at the dawn of the Enlightenment. (Johnson 2010; Stolberg 2014)

This pattern recurs continually: faced with a new challenge (often imposed by technological advances), innovative thinkers draw on old techniques, innovate on them, and develop new strategies to revive the quest for knowledge. While the circumstances change from one era to the next, the goal remains the same: to collect information from diverse sources and weave it together to create knowledge.

2.1 Information Management at the Dawn of the Information Age

The start of the 20th century imposed radical changes on Western societies. Economically, the second industrial revolution contributed to the emergence of a new middle class with more time for leisure and cultural consumption (previously the exclusive privileges of the elite). This period saw an increase in school enrollment rates, the electrification of cities, the establishment of free public libraries, an explosion of new magazines and newspapers, and the birth of new media such as movies, radio, and mass-market paperback books. All these factors led to a profusion of cultural production and the emergence of a new era defined by mass media. The arrival of the television a generation later would only accelerate the resulting impacts.

Meta-Reflections

The term "Information Age" is often used to refer to the age of the computer, but in fact the flood of information began well before that. Some thinkers anticipated these changes and began early on to develop theories to explain the new dynamics. In 1926, the Russian-Ukrainian scientist Vladimir Vernadski published a treatise dividing the world into seven categories: the *lithosphere* and *pedosphere*

(mineral categories), the *atmosphere* and *hydrosphere* (gaseous and aqueous categories), the *biosphere* (category of living beings), the *technosphere* (category of human activity) and the *noösphere* (category of thought and information). (Rispoli and Grinevald 2018) This last concept, that of a domain of existence specific to knowledge that interacts with other domains on our planet, was adopted by French anthropologist and theologian Pierre Teilhard de Chardin, who added a theological twist before popularizing it. Vernadski's concept faded away before returning in different forms, such as the "infosphere" proposed by Kenneth Boulding in 1970 (Boulding 1970, 15).

British biologist Richard Dawkins broke down this subject to its most atomic level in 1976, when he proposed the concept of the "meme." (Dawkins 1976, 189-201) The informational equivalent of the gene in biology, Dawkins' meme is the elementary unit of knowledge and its transmission.

Two years later, the Austrian-British philosopher Karl Popper proposed a new vision, that of the "three worlds." Popper divided the universe into three realms: World 1, composed of physical matter and energy; World 2, composed of "mental or psychological states or processes, or of subjective experiences"; and World 3, composed of "products of the human mind." (Popper 1978) Each world, Popper postulated, is a product of the world that proceeds it. These worlds interact and sometimes overlap; concepts from world 3 can also manifest themselves in World 1, as when an artist creates a sculpture or a printer prints a work of Shakespeare. In this vision, the challenge for humanity is to build stronger knowledge, theories, and ideas (World 3) to better direct our conscious efforts (World 2) to then effect desired changes in our environment (World 1).

All of these thinkers sought to make sense of the new reality of the 20th century, a time when information was assuming a place alongside the world's traditional elements. Unfortunately, the impact of these theories at the time of their creation was limited, but the time would come when their influence would be felt.

Combatting the Flood

For another set of thinkers, the deluge of information that humanity experienced during the 20th century was a source of inspiration not for metaphysical theories, but for practical solutions.

In 1944, a study in the United States concluded that the nation's research library collections were doubling in size every 16 years, threatening to overwhelm university campuses and become unmanageable for the librarians and researchers who depended on them. (Rider 1944) Several months later, Vannevar Bush, head of the U.S. Office of Scientific Research and Development during World War II, published an article titled "As We Might Think" in which he lamented the plight of scientists: "There is a growing mountain of research" that causes "truly significant attainments [to] become lost in the mass of the inconsequential." (Bush 1945) For Bush, the tools of the day were not up to the challenge of indexing and organizing the heaps of information to make it useful: "Thus far we seem to be worse off than before—for we can enormously extend the record; yet even in its present bulk we can hardly consult it."

As this problem touched on "the entire process by which man profits by his inheritance of acquired knowledge," Bush concluded that it was imperative to find a solution. The one he envisioned in his paper, the "*Memex*," was a dynamic workspace for an individual researcher, filled with "all his books, records, and communications." Equipped with the state-of-the-art technologies of the day

(photocopier, microfiche, projection screen, etc.) the *Memex* allowed the researcher to jump from one resource to another at nearly the speed of thought. (Bush saw no role for the computer in his system, believing that "...the users of advanced methods of manipulating data are a very small part of the population.") In view of the technological limitations of the time, Bush's most interesting innovation was not technological, but rather the system of organizing resources: "associative indexing" where "paths" laid out by researchers link works not chronologically or alphabetically, but thematically. The reason was simple: "The human mind does not work that way. It operates by association." Bush envisioned a world where scholars could build these trails and exchange them with each other, and where "Wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them, ready to be dropped into the *Memex* and there amplified."

Bush's *Memex* is an essential pillar of the networked reasoning approach, which breaks from traditional systems of organization by hierarchy. With even more rudimentary tools, another researcher succeeded in making a system that embodies the spirit of the *Memex*. Niklas Luhmann, a German sociologist active from the 1970s to 1990s, used to take literature notes on small paper cards while reading. According to the system he invented, he noted interesting facts or ideas that came to him while reading, always in his own words and at an atomic level (only one indivisible idea per card). He numbered each note in such a way as to associate it with related notes, and stored everything in a note box (*Zettelkasten* in German). (Luhmann 1981) Over the years, Luhmann accumulated a collection of 90,000 interrelated cards which, thanks to his numbering system, he was able to navigate quickly to relocate whatever information he desired. While searching, he often stumbled upon related concepts, which helped him to tease out, expand, or enrich arguments in a way that would never have been possible with a more linear system. Luhmann, who published more than 50 books and 600 academic articles during his career, attributed his productivity to this system. (Ahrens 2017; Luhmann 1981) Indeed, the *Zettelkasten* served as his "extended brain," organized by an indexing system that mimicked the associative reasoning of his actual brain.

While Bush and Luhmann devised solutions to help the individual researcher cope with information overload, others proposed broader solutions. Among the latter, one of the most ambitious was Ted Nelson, the young author of the term "hypertext," which signifies texts interconnected by links. In 1972, Nelson published a response to Bush entitled "As We Will Think" in which he first unveiled his "Project Xanadu": a new vision for how to link human knowledge through a network of digital consoles. (Nelson 1972) Nelson envisioned the creation of a global network of researchers and document providers (libraries, publishers, authors, etc.) who would exchange information across this network. Only one version of each document would exist on the network; to cite it, one would insert a bidirectional link that would insert the citation by "transclusion." (Another term coined by Nelson, transclusion means creating a direct view of the original, rather than a static copy disconnected from its source). This link would alert the author of the use (to trigger payment, if necessary) and ensure that the link would remain intact if either party changed its address in the future. Leaving only one copy of each document on the network also guarded against redundancy, which both Bush and Nelson pinpointed as a major source of archive bloat.

In Xanadu, Nelson found a solution to many of the difficulties that plague us even today, including lack of copyright protection, inability to monetize content through micropayments, "link rot" in a network of one-way links, lack of version control, and many others. But hindered by financial concerns and by

technology that lagged behind his vast ambitions, Nelson was unable to realize his Project Xanadu before the arrival, in 1990, of a less ambitious but simpler alternative vision: the *World Wide Web*.

2.2 Organizational Knowledge Management

In the 1990s, fundamental changes in the tools, actors, and environment caused the quest for knowledge to take a detour.

Rise of the Enterprise

Thanks to technological advances in line with Moore's Law, by the early 1990s the price and physical size of computers had dropped considerably. At the same time, new software accessible even to non-experts entered the market, and an ecosystem of firms and consultants emerged to guide and facilitate the transition from paper to digital media.

This evolution in tools made the digital transition feasible for companies, which consequently leapt ahead of individuals. As a result, companies eclipsed individual researchers to become the main player of the day. Control was thus in the hands of business leaders, who made decisions based on their own objectives, chief among them being growth. For them, the most important challenge was not the data overload that had concerned researchers in the previous era, but loss of knowledge due to the fact that employees did not coordinate sufficiently with each other and took their knowledge with them when they left the firm. (With the end of the industrial era, employee loyalty had declined, making turnover more widespread).

To address knowledge loss, business leaders of the day sought to implement a social culture of continuous learning and knowledge sharing, commonly referred to as "organizational knowledge management." Drawing on new advances in psychology, they looked to recent theories such as experiential learning (Kolb 1984) and situated learning, which emphasized the social dimension of the learning process (Lave and Wenger 1991). The new technological tools helped them to establish digital repositories where employees were compelled to store the information they possessed and the know-how they developed in the course of their work.

Learn from Your Competitors

The other factor that propelled this new movement was globalization, which exposed many industries and firms to international competition during the 1990s and 2000s. To overcome this challenge, business leaders sought every possible advantage, more aware than ever of the need to better leverage the knowledge of their existing employees. But how?

The publication, in 1995, of *The Knowledge-Creating Company* by Japanese researchers Ikujiro Nonaka and Hirotaka Takeuchi made waves because it offered an innovative solution to business leaders' difficulties in mining this precious resource. And not just any solution: for Western firms, the fiercest competitors at the time, those that inspired the most fear and respect, were the large Japanese conglomerates. Nonaka and Takeuchi's book offered the possibility of understanding the keys to the success of Japanese stars like Honda, Canon, Matsushita (Panasonic), Nissan, and others (even if the authors explicitly said in their introduction that these Japanese firms should be analyzed "as representative case studies [of broader realities] and not as 'success stories'" (Nonaka and Takeuchi 1995, ix)).

According to Nonaka and Takeuchi, the key was the ability of these firms to detect the "tacit knowledge" (an idea they borrowed from the Austro-Hungarian economist Karl Polanyi and extended) of their employees and establish mechanisms to convert it into "explicit knowledge" to facilitate its transmission to other employees. In Chapter 3, the authors presented two views of what they call the SECI process, following its four phases: socialization, externalization, combination, and internalization. (Nonaka and Takeuchi 1995, 61-73) Alongside a visualization of SECI as an iterative cycle, the authors demonstrate how the process leads to growing both types of knowledge within the firm, visualized by a climbing spiral. This model was reinforced by examples and case studies drawn from their many years spent observing Japan's leading firms.

Thanks to Nonaka and Takeuchi's contributions, knowledge management was recognized by the mid-1990s as an essential ingredient for the success of any large enterprise. Other scholars also contributed important theories that have advanced the field. For example, American researchers Thomas Davenport and Laurence Prusak studied over 30 large American and British firms and proposed a method for mapping and quantifying their internal knowledge, best practices for integrating KM activities with other corporate activities, and a concept of "knowledge markets" complete with "buyers" and "sellers" and "market forces." (Davenport and Prusak 1998) Wenger detailed the "communities of practice" approach designed to exploit social dynamics among employees to cultivate internal informal structures intended to serve as knowledge reserves. (Wenger 1998) Along with other collaborators, Nonaka has also popularized the Japanese concepts of "*ba*" (the particular context in which knowledge is generated) and "knowledge assets" (the assets that must be linked to develop sustainable knowledge). (Nonaka, Toyama, and Konno 2000)

The Human Factor

Alongside these advances in organizational knowledge management theory, computer scientists were pitching new tools to help business leaders implement their ideal visions of KM. But the installation of intranets (on Microsoft SharePoint or other platforms) and later of knowledge bases (on Atlassian's Confluence software, or various open-source platforms or Wiki models) rarely delivered the expected results—often due to the naive belief that the latest technologies would automatically provide the right solution.

Having started my professional career in the mid-2000s, I encountered some of these systems personally, which allowed me to experience the disconnect between those who developed and purchased the software and those who were expected to use it. Driven by business leaders, the KM of the 1990's and 2000's often prioritized their goals above all else.

This is one of the many criticisms made by Thomas Wilson, an English expert in information studies, in his article "The Nonsense of Knowledge Management." (Wilson 2002) For Wilson, "'Knowledge management' is an umbrella term for a variety of organizational activities, none of which are concerned with the management of knowledge." According to his detailed analysis of the offerings and practices of that time, the activities called "knowledge management" by companies are in fact nothing more than information management (a well-established field that they wanted to repackage under a new buzzword) or micromanagement of employees according to unrealistic notions (he criticizes communities of practice in particular). In the end, Wilson denounced KM as "a management fad, promulgated

mainly by certain consultancy companies, and the probability is that it will fade away like previous fads."

While these criticisms were sometimes exaggerated, the KM of the 1990s-2000s overlooked numerous important factors, particularly human ones, that often caused organizational KM systems to fail, typically due to a lack of employee buy-in. But that failure did not occur because employees were unaware of the problem; many called for KM initiatives themselves in the face of internal disorganization caused by proliferating data. (Even the definitive invention of the era, the World Wide Web, was motivated by organizational knowledge management concerns: Tim Berners-Lee's proposal to his bosses at CERN in March 1989 that gave birth to the web was basically a proposal for a new method of internal knowledge management. (Berners-Lee 1989)) Nor was it because individuals were unwilling to contribute to knowledge bases intended to help others; the rise of Wikipedia during this period testifies to Internet users' altruistic spirit.

The difference largely comes down to purpose: while Wikipedia is meant to serve humanity, corporate knowledge bases only serve corporate profits. Organizational style is also crucial: for many, being forced by the software application *du jour* to stock one's knowledge—which is not naturally organized by hierarchy, as Bush and Nelson repeatedly noted in the previous era—in linear and hierarchical systems seemed forced and unnatural. Those who did not contribute enough risked being accused of "information hiding," even if their non-participation was not maliciously motivated. For all these reasons, many employees dissociated from corporate KM initiatives.

Not having found the means to satisfy their intellectual ambitions or curiosity at work, some instead invested their efforts in creating first personal or thematic websites, then blogs, and then social media. These platforms served as outlets for their desire to follow their curiosity: to read, learn, explore, understand, and create freely.

Soon, the marriage of this irrepressible urge with a new generation of tools would trigger a renaissance in the quest for knowledge.

2.3 Personal Knowledge Management: A New Boom

In 1969, the Austrian-American professor and management consultant Peter Drucker predicted the emergence of a "knowledge economy," an economy that would revolve not around physical goods but around knowledge. (Drucker 1969) But in the following years, the central actors of this knowledge economy, those whom Drucker called "knowledge workers", did not dominate as predicted. For the reasons explained in the previous section, companies instead led the choices around KM strategy and tools, making them the decisive actors of that period.

But individuals did not give up the quest for knowledge. Nor had the information overload that had motivated earlier thinkers to seek new solutions abated either. On the contrary, the need was even more urgent for knowledge workers. (The same could not be said for companies, who could afford the cost of "big data" solutions to manage the information overload.) Moreover, very few knowledge workers were satisfied with the practice of KM within firms. Drucker himself denigrated it, saying, "You can't manage knowledge. Knowledge is between two ears, and only between two ears." (Wilson 2002) For Drucker, the individual knowledge worker had to be at the center of the action.

It is for these reasons that a new movement, PKM, emerged in the late 1990s, partially overlapping with KM in time but not in its basic philosophy. Drawing its inspiration rather from the thinkers of the dawn of the Information Age and exploiting new technologies to realize these visions, today PKM is opening new horizons for individuals.

The First PKM Theories

The foundations of the PKM movement and the origin of the term are often attributed to either Jason Frand and Carol Hixson of the University of California Los Angeles or Paul Dorsey of Millikin University. Frand and Hixson, who in 1998 presented some of the earliest work on PKM, said they were motivated by the question, "How are we going to manage all the information that is flooding us in this Information Age?" (Frand and Hixson 1998) For them, the solution lay in technology, as well as in developing the capacity to effectively run a series of operations on information: "1) search/finding, 2) categorizing/classifying, 3) naming things/making distinctions, 4) evaluating/assessing, and 5) integrating/relating." Similarly, Dorsey defined PKM as a series of seven actions performed on information, supported by technology. (Dorsey 2000) Both relied on organizational KM theories to justify their visions—a practice that would not last, given the direction of the field's evolution.

During the 2000s, many theorists proposed lists of actions and tools in trying to define PKM. These proposals closely resembled those of another field, personal information management (PIM). At the time, PKM was often criticized as a repackaging of PIM, and members of the fields still argue about the relationship between the two. Jones 2010, for example, defends PKM as just one component of PIM. But among the arguments that seem most compelling today, Hwang, Kettinger, and Yi 2015 argue that PIM "is a subset" of PKM, because PKM goes beyond PIM's simple information manipulation operations to incorporate social aspects as well as the conversion of simple information into rich knowledge.

With a few exceptions, the tools available to someone who wanted to put these PKM theories into practice evolved little in the early 2000s. On the academic side, some researchers proposed enterprise architecture-inspired systems, such as Semex (Cai et al. 2005), to help individuals manage their collections of digital resources and information. These systems saw very limited adoption. Outside the academy, the success of the "wiki" model, particularly in the form of free online encyclopedia Wikipedia, has inspired a system for managing personal knowledge bases called TiddlyWiki, which is an important pioneer in this area.

The advent of more interactive "Web 2.0" technologies, including social networks, in the mid-2000s raised hopes of a PKM renaissance driven by new tools. (Paroutis and Al Saleh 2009) It has also served to broaden the concept of PKM and distinguish it from PIM, in particular by introducing a social dimension that was absent from PIM. Mohamed Chatti's influential work has helped others to reconsider knowledge "as a personal network rather than an object or a process." (Chatti 2012) However, in the years that followed, social network exchanges proved useful for some but negative, or even toxic, for many others. At the same time, companies have struggled to develop a useful model for adapting social networks to the professional world. With this failure, enthusiasm for PKM among researchers has stagnated since peaking in 2014 (see Figure 1).

The PKM movement, on the other hand, did not stagnate. On the contrary, it was about to experience its brightest days.

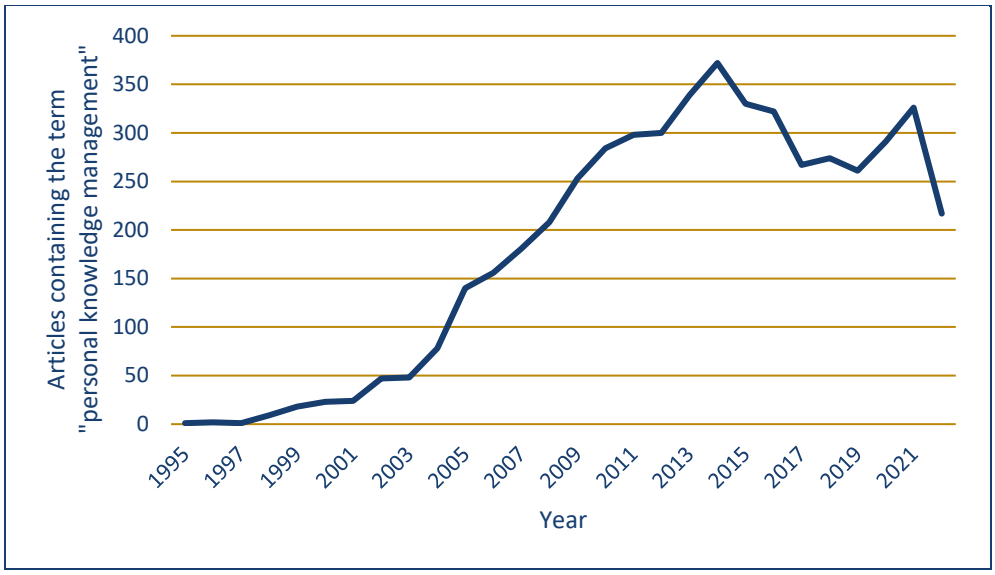


Figure 1: Presence of the term "personal knowledge management" in the academic literature, 1995-2022
Source: Author's analysis of Google Scholar data (Google Scholar 2022). Data for 2022 are still only partial.

Old Ideas for a New Economy

Since the beginning of the Information Age, most advanced economies have witnessed a common trend: the average duration of employment is declining, especially among younger generations. (OECD 2019) This trend reflects the influence of several factors: the increasing precariousness of employment, some employers' preference for short-term hires or consultants, the globalization of labor markets (which expands options for job-seekers but also increases competition), the rise of the "gig economy," and the fact that many workers (especially younger ones) value their independence over loyalty to a specific employer. Recent data indicate that these trends have accelerated since the start of the Covid-19 pandemic. (Serenko 2022)

These labor market shifts represent a profound transition in our economies and societies. One of the most profound impacts is that the independent, individual knowledge worker is now becoming the primary economic actor. At the extreme, new remote work tools may enable these individuals to become fully mobile, jumping from one continent to another as they please as what some call "knowmads." (Moravec et al. 2013)

For four main reasons, the contemporary knowledge worker has sparked a renaissance in the PKM movement. First, without an attachment to a particular firm, these freelancers are obliged to manage their own careers, and therefore train themselves and develop their skills in order to remain competitive in the job market. As a result, they are constantly seeking better ways to retain and utilize their personal and professional knowledge. Second, in our present hyper-connected age, today's knowledge workers are even more inundated with information than previous generations were, adding new urgency to the need for solutions to manage the information deluge and to transform it from a burden into a valuable resource. Third, they have the technology to handle these needs. While their predecessors in the 1990s were forced to depend on their employers for access to high-tech tools, this is no longer the case today thanks to the rapid evolution of PCs and smartphones.

Finally, and most importantly, they have a clear vision of what they want. This vision is inspired by new non-hierarchical models of information organization such as social networks and the knowledge graph that underpins Google, Wikipedia, and other pillars of the contemporary semantic web. Already familiar to young users, these systems differ profoundly from the tools in place at the height of the KM movement. This new vision is also inspired by the theories and thinkers of the 20th century mentioned in section 2.1, whose ideas are currently experiencing a renaissance.

For example, the concepts of Vernadski's and Chardin's "noösphere" or Popper's "World 3" are now reemerging under other names, such as Luciano Floridi's "infosphere" or Caleb Scharf's "dataome," which the latter describes as "all the non-genetic data we carry around outside and inside." (Floridi 2014; Scharf 2021) Since 2013, Locke's "commonplace books" have been reborn, with a new emphasis on productivity, as "bullet journals." And the makers of Dendron and TheBrain, two new PKM tools, explicitly cite Vannevar Bush's "Memex" among the influences for their products, which aim to put into practice the ideas that Bush was unable to realize due to the limited technological means of his day. (Lin 2020; TheBrain 2022) German researcher Sönke Ahrens and other devotees of the Zettelkasten method are working to popularize Luhmann's system through media appearances, books, and the development of specialized digital tools. Ahrens' book *How to Take Smart Notes* is an entry point for many in the PKM field today. (Ahrens 2017) It interprets Luhmann's lessons for our times while offering tips for overcoming information overload, writer's block, and other difficulties familiar to modern knowledge workers.

These factors have led to a new boom in PKM, especially since the onset of the Covid-19 pandemic, when many knowledge workers found themselves with free time to design and experiment with new tools. (For proof of this growing interest, see Figure 2.)

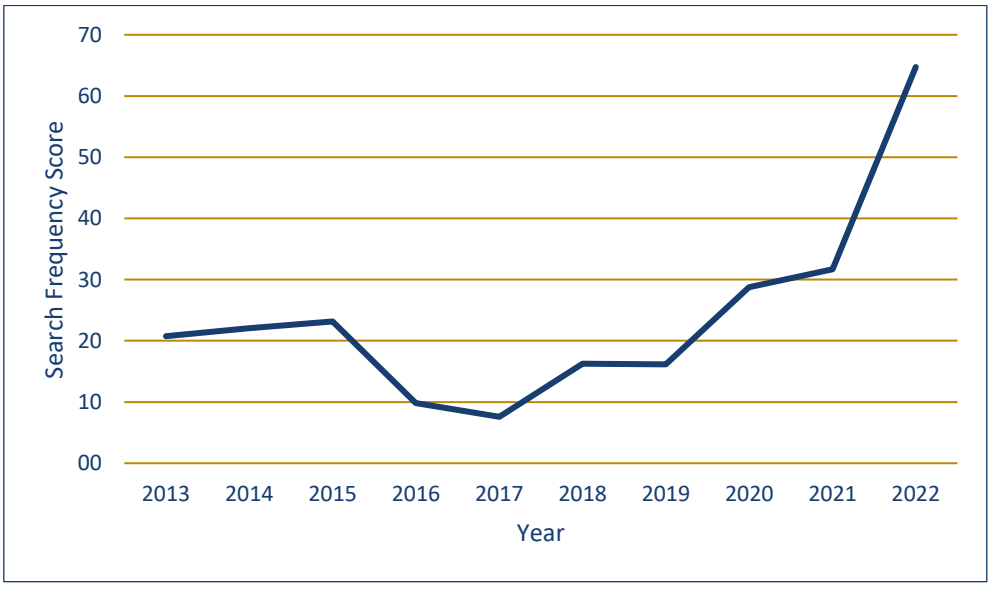


Figure 2: Frequency of the term "personal knowledge management" in Google searches, 2013-2022
Source: Author's analysis of Google Trends data (Google Trends 2022). Data for 2022 are still only partial.

New Tools for Thought

This boom both feeds and is fed by the development of new digital tools, collectively known as "tools for thought." In many cases, one person first developed the tool for personal use before discovering

that other users shared the same needs. Other applications are the result of a more traditional development process, often supported by fundraising (though the amounts invested are minimal compared to other domains).

All these tools offer new "affordances" to the user. This term, coined by James Gibson to describe ecological phenomena, means the new capabilities or possibilities offered by a tool. (Gibson 1979) Gibson emphasized that it is not only the qualities of the tool that determine its affordance, but also its relationship to the user and his/her environment. A tool's affordance can therefore vary depending on who wields it and in which context they do so.

The majority of the latest PKM tools offer the following affordances:

- Write anything you want as a note
- Link your notes as you wish
- Navigate easily between your notes
- Organize and structure your notes the way you want
- Visualize your notes and their interconnections
- Navigate via the visualization
- Publish your notes to the web
- Secure your notes
- Maintain a single copy of all content, without redundancies
- Discover new connections between your ideas
- Find a note quickly
- Extend affordances further as needed

Most of them offer these affordances through the following features:

- **Markdown files**: Everything is saved in simple text files that are easy to export to other software. Writing is simpler (compared to Word documents or other rich-text formats) and the chances that the files will become obsolete or unreadable by future software are minimal.
- **Bidirectional links**: Unlike the one-way links that connect elements on the World Wide Web, bidirectional links allow for two-way navigation. The software keeps these hyperlinks up-to-date when a filename changes to ensure that the link is never lost (unlike the norm on the web, where link rot continually degrades the network's utility).
- **Transclusion**: Ability to integrate text from one note into another without duplicating it, through a dynamic "view." When the source text is updated, the change is instantly reflected in the other note.

- **Automatic organization**: The application saves files according to its prerogatives; the user is not obliged to choose the folder each time. Navigation is done by means other than the file path. Hierarchical folders may be possible, but are not necessary.

- **Semi-structured data**: Ability to tag your notes or add other metadata to better search, sort, filter, or summarize them.

- **Graph view**: Capacity to visualize one's notes and the linkages between them as a network of interconnected nodes, which can be explored or navigated easily by tapping into human users' strong spatial and visual abilities. The visualization resembles the neural network that it supports.

- **Extensibility**: Possibility to develop additional plugins or to install plugins made by a third party.

- **Backup in the cloud**: Automatic and secure backups to prevent data loss or leakage.

- **Online publishing**: Publish all or part of your notes online as static pages, enhanced by a graph view and navigation functions like those of the software. Instant and automatic update in case of changes, allowing the user to practice "digital gardening," a recent trend where the author publishes notes in their current state and then updates them as the ideas evolve.

These applications are being developed in a highly competitive context, contributing to a partial convergence of features and affordances. At the same time, the unique profile and positioning of each tool attracts different users, who collaborate and exchange to develop different plugins and extensions, which keeps the dynamism and creativity of this sector flourishing.

Notion, released in 2016, was one of the first advanced text editors to unify writing and organizational features previously distributed across multiple software programs. In 2017, German programmers launched The Archive, which aimed to recreate Luhmann's Zettelkasten system on the computer. It was one of the first applications to incorporate bidirectional links. Roam Research launched in 2019 after the publication of a white paper (White-Sullivan, Brown, and Meadows 2018) that generated considerable discussion and interest, especially in Silicon Valley, establishing Roam as the industry leader. The arrival the following year of Obsidian, a free and highly extensible platform, alongside many smaller alternatives, injected even more momentum into the sector. More recently, the arrival on the scene of Tana, a tool oriented around structured data, is prompting great interest as well. (For a list of the most important tools for thought, see Appendix A.)

Of all these platforms, very few offer multi-user collaboration features. In almost all cases, the founders have instead prioritized the *personal* nature of PKM, leaving each user free to choose how to employ the system and its affordances.

The question of how to use these highly flexible and extensible systems, with their unique interfaces and intriguing yet unfamiliar affordances, is one that generates substantial curiosity and sometimes frustration among the general public. As a result, a class of experts has emerged to offer solutions, which they do through free online videos and/or paid courses or coaching offerings. One of the best known, American consultant Tiago Forte, offers online courses under the title "Building a Second Brain." Others, like Nick Milo, an American PKM trainer and creator of the "Linking Your Thinking"

brand, offer courses and other solutions specific to a single tool (Obsidian, in Milo's case). Some experts do not seek to market their expertise, such as Ryan J.A. Murphy, a Canadian computer scientist, PhD student in information systems, and creator of the "integrated thinking environments" concept—his attempt to build a theoretical framework for these tools for thought and their use. (Murphy 2021)

For new users exploring these tools for the first time, these resources can be of great help, as there is little understanding of these tools among the public. In addition, neither the academic theories of PKM developed in the 2000s nor the standard practices of organizational KM apply directly to these tools' use. Where KM's focus was on knowledge transfer between employees, PKM as practiced with these tools today is an individual exercise, focused instead on collecting and structuring one's own knowledge. And where KM focused on converting tacit professional know-how into explicit instructions, today's PKM is more interested in pure knowledge, and does not require the user to set a specific goal from the start. Freed from the rigid structures of organizational KM, many users of these tools for thought seem to prefer to engage in open-ended explorations guided only by their curiosity.

Updating Theories

The rapid evolution in PKM tools is obliging researchers to review and update their theories of PKM as practiced by today's knowledge workers.

In 2016, researchers Gary Gorman and David Pauleen from New Zealand re-edited a definitive account of PKM that summarized 20 years of research and established the starting point for this new phase. In their introduction, in an effort to end the debates that had long divided the field, they reviewed the lists of activities and skills proposed by many researchers to establish a definitive list of skills that a PKM practitioner must master: "management, learning, communication, and use of technology." They also noted that a fifth skill, "forecasting and anticipating," would be highly desirable. (Gorman and Pauleen 2016) They outlined the contours of the information overload problem, as well as the economic evolution that has made the individual knowledge worker the key player of this era, replacing the "knowledge-creating company" with the knowledge-creating individual. They noted the importance today of information literacy as a cornerstone of the "lifelong learning" approach required of anyone who hopes to succeed in today's knowledge economy. They concluded by suggesting that all of these aspects ultimately resemble a longstanding concept: wisdom.

Mohammed Jarrahi, who stands out as one of the most influential researchers of this period, co-published an important 2019 article on the specifics of PKM for modern "digital nomads." (Jarrahi et al. 2019) These individuals often work in flexible, mobile contexts organized around time-limited projects, and thus have very unique needs. Jarrahi and colleagues worked to adapt Gorman and Pauleen's findings to this new context, with a perspective informed by Gibson's ecological approach. To succeed independently of any organizational support structure, they argued, nomads must cultivate "personal knowledge ecologies" by relying on personal networks and continually filtering information flows to avoid overload. For these "*bricoleurs*" of information (the authors used the French term meaning "tinkerer" or "handyman"), Jarrahi and his collaborators noted, technology thus plays a key role and must not be omitted from analyses of these new work methods. In a second book, Jarrahi and another group of contributors concluded that, provided by their employers with inadequate digital tools, these do-it-yourselfers find their own solutions through "shadow IT," or the use of software not sanctioned by the employer. (Jarrahi, Reynolds, and Eshraghi 2021)

Shujahat et al. 2020 presented one of the few empirical studies on this topic, developed through a survey of knowledge workers in Pakistan. Their research showed employers the importance of considering new work patterns when developing job descriptions for recruiting and supervising workers, with tips on how to structure work to promote desired outcomes and avoid employee burnout. Based on their findings, they cautioned employers about the need to provide a modicum of structure to knowledge workers, who benefit from regular meetings and other mechanisms that hold them accountable for establishing and following an orderly work plan.

Finally, German researcher Ulrich Schmitt, based in South Africa, has published an important series of papers that review previous theories in order to draw lessons to inform the creation of new PKM tools. He reviewed philosophical treatises such as Popper's 1-2-3 Worlds, then organizational KM theories such as Nonaka and Takeuchi's SECI, before distilling them into a new practical model based on a cycle of information-seeking activities interacting with a parallel cycle of information-processing activities. (Schmitt 2017; 2019; 2020)

Given the rapid evolution of PKM tools since 2020, researchers continue to revise their theories and approaches. It is likely that even more relevant research will be published in the coming months to help further structure this burgeoning movement.

III. Case Study: Obsidian, A Model for a New PKM

Among the new personal knowledge management tools, Obsidian (obsidian.md) is probably best positioned to revolutionize the way knowledge workers collect and process information and develop knowledge. But to realize this potential, it will have to address a major gap. In this case study, I present the Obsidian application, outline this gap, propose a technical solution, and solicit feedback from experts and the user community to validate the proposed solution.

3.1 Exploring Obsidian

The Obsidian application is the result of a collaboration between Erica Xu and Shida Li, Chinese-Canadian computer scientists who studied at the University of Waterloo in Ontario. Xu and Li have already been collaborating since 2015 as co-founders of Dynalist, a tool for hierarchical information organizing. In January 2020, Xu initiated the new project that would become Obsidian after testing other advanced note-taking tools without finding one that met all her needs. Obsidian is built on the Electron software framework—the same one that powers the popular Google Chrome browser. After four months of working with Li, in May 2020 the co-founders released the first beta version of Obsidian for testing. At that time—which coincided with the first wave of the Covid-19 pandemic—Obsidian quickly generated enthusiasm from the nascent PKM community.

Since then, Obsidian has evolved slightly while retaining the core features that Xu and Li incorporated from the early versions:

- Creation of one or more “vaults” containing the user’s notes
- Creation of notes in Markdown files, along with ability to access several other file types (PDFs, texts and images)
- Insertion of bidirectional links via simple brackets: [[example of a link]]
- Automatic link renaming when renaming a file
- Graph view to visualize your notes
- Full-text search
- Option to organize your notes by folders and/or tags
- Settings to adjust basic functionality and appearance
- Directory of user-generated plugins
- Application available in PC, Mac, and mobile versions
- Cost: Free for all core functionality

- Paid option: Cloud sync
- Paid option: Publish notes to the web

Since its launch, Obsidian has been one of the most extensible, scalable, and powerful tools for thought and one of the only free options. These factors contributed to immediate success and to exponential growth of its user community. In online forums, passionate users exchange tips on how to structure and operate their personal PKM system, and share new plugins to adapt or extend the tool's functionalities. The dynamism, creativity, and generosity of this new community recalls the collective spirit of the World Wide Web in the 1990s.

The Obsidian team does not publish detailed user statistics, but the official forum and official Discord channel have more than doubled in size since mid-2021, and now contain over 41,000 and over 78,000 members, respectively. A true ecosystem surrounds the application, composed of coaches and experts, plugin developers, weekly newsletters and practical guides either in writing or on YouTube.

After many updates, Obsidian, which currently counts just six members on its development team, released its version 1.0 in October 2022. The number of plugins developed by the community members and approved for inclusion in the official directory now exceeds 700. In light of the flexibility of the tool, the use cases are as diverse as the users. Some use it for classic purposes, such as taking literature notes and writing research papers. Others maintain their diaries, track their media consumption, or organize their personal media libraries (books, movies, music). Doctors manage patients' medical records, personal trainers manage clients' sessions, genealogy enthusiasts trace family trees, and gamers organize Dungeons and Dragons competitions.

Obsidian's extensibility allows it to accommodate all of these diverse cases, but also means that any sub-community that wants to adapt the platform for a specific use case must develop its own specific features.

Identified Problem

As a researcher at a think tank specializing in international relations, my use case for Obsidian follows a fairly standard pattern. I use the app to collect daily information about my field, then I sort and process that information to try to identify general trends. Then, in moments of inspiration, I set myself the goal of writing an article on a particular topic or trend.

To do so, I begin by asking myself a question: How can I filter this information I have collected, select what I need, and organize it in order to easily write a well-structured text?

I am not the only person facing this challenge, in Obsidian or in general. Ted Nelson already raised this issue 50 years ago:

> *"As Bush pointed out in his own terms, we think in hypertext. We have been speaking hypertext all our lives and never known it. It is usually only in writing that we must pick thoughts up and irrelevantly put them down in the sequence demanded by the printed word. Writing is a process of making the tree of thought into a picket fence."* (Nelson 1972)

Today one can find guides on the internet that aim to simplify the task: "How I Optimize Book Writing with Obsidian Plugins," "Turning Obsidian into my Perfect Writing App," or "9 Must-Have Obsidian

Plugins for Writers." Reading through these guides, one notices the lack of either native functionalities or custom plugins well-suited for selecting and organizing information with an eye toward extracting it from the app as a written product.

This reflection led me to identify what I call "the black hole problem" in Obsidian:

> **<u>Problem</u>: Among the various tools for thought available today, Obsidian is one of the best for collecting and connecting ideas and information easily, but it does not facilitate reorganizing these elements and outputting them as new products.**

In short, the tool doesn't allow me to easily reorganize content into an article outline and extract it to a new document to write my text. Instead, Obsidian imposes friction on this process: to build an outline for an article, I have to jump between several documents, which increases the cognitive load and often causes me to lose my train of thought. As a result, writing each article takes much more time and effort than it should.

The graph view and the various visualization plugins that are one of Obsidian's greatest strengths only work for the representation of existing information; no functionality exists to visually assemble a series of facts or ideas into a coherent whole that can then be extracted.

The imbalance in the affordances and functions of the tool is quantifiable. Following a natural power law, the 50 most downloaded plugins in Obsidian's directory collectively account for 65% of total downloads. But only 7 of those 50 are related to extracting content as finished products.[3] These 7 are distributed as follows:

- 3 to make mind-maps (Mind Map, Enhancing Mindmap, Obsidian Markmind),
- 1 to create diagrams (Excalidraw),
- 1 to create presentations (Advanced Slides),
- 1 to export to other file formats (Obsidian Pandoc), and
- 1 to create outlines (Outliner).

The last one, Outliner, has limited functionality: it merely introduces keyboard shortcuts to make it easier to move elements within an existing outline. The vast majority of the plugins are used to facilitate inputting information, reconfiguring information in different views, or adjusting the app's appearance.

One might simply consider Obsidian a tool made exclusively for collecting and connecting information and ideas, with correspondingly limited options for reorganizing and extracting. But this gap has potentially important consequences for knowledge workers. Notably, it can feed what Italian scholar Umberto Eco called "the vertigo of accumulation," a phenomenon in which an intellectual becomes

[3] Source: Author's analysis of the Obsidian plugins list available at obsidian.md/plugins (page accessed on November 18, 2022).

endlessly focused on collecting resources to avoid grappling with the real work of thinking and writing. (Eco 2015, 125) This problem Eco warns about is a serious risk today, when the deluge of information threatens to overwhelm not just scholars but all of us, trapping us in information-rich black holes with no way out.

Absent a solution to this problem, over time, powerful tools like Obsidian risk slowing down knowledge sharing and preventing knowledge workers—the engines of today's economy—from increasing their productivity and advancing the quest for knowledge.

Hypothesis

With this problem as my starting point, I established the following hypothesis to define the objective of my proposed solution:

> **Hypothesis: It is possible, by developing a custom plugin, to simplify the task of organizing existing content into structured outlines, thus increasing the productive capacity of knowledge workers who use Obsidian.**

3.2 Proposed Solution: The SmartOutline Plugin

Solving the "black hole problem" implies extending Obsidian's affordance to better assist users to develop coherent texts or other outputs (presentations, speeches, etc.) from information and ideas collected in their Obsidian vault.

To begin, I verified that there is not already a solution among the existing plugins in Obsidian, nor elsewhere on the internet. Many related products exist, but all of them present partial solutions; none would fully solve the problem.

Next, I searched for solutions or theoretical leads in the academic literature. But because contemporary tools for thought have evolved so rapidly, the literature does not yet consider their particular affordances or functionality. Even among the most recent articles, the vast majority only discuss theoretical approaches without exploring the operation of specific tools in detail.

Therefore, I concluded that the best solution would be to design a new plugin in Obsidian.

Specifications

To overcome the problem identified, we need a plugin to help the user to develop a visually structured outline. We can call this plugin "SmartOutline."

The plugin should extend Obsidian's affordances by offering the following features:

a) A vertically divided interface including a "source" pane at left and a "destination" pane at right

- A button to activate the plugin, located in the left menu bar
- A "Convert to Markdown" button in the top menu bar

b) Ability to open files of any type in the source pane and extract text, including via OCR

c) A table on the destination side where the user builds their outline from elements entered directly or dragged from the source documents

d) Detection of the active cell of the table and application of the appropriate font (different colors and sizes indicate the outline level of each line)

e) Ability to drag-and-drop any content from the source files to the outline, with transclusion of any content to the source document (to avoid redundancy and maintain fidelity in case of changes in editable source documents)

f) Automatic insertion of a citation link after any source text added to the outline, to ensure traceability to the source file

g) Possibility to reorganize the outline elements with keyboard shortcuts (borrowed from the Outliner plugin and Roam Research software, and thus already familiar to many users)

h) Underline any text extracted from the same source when the user hovers over a piece of text

i) Convert to a Markdown file while preserving the outline levels, at the user's request (using the dedicated button)

j) Addition of new options to the Settings menu:

    - Adjust the visual style of the outline levels (colors, sizes, fonts)
    - Select the default destination for exported outlines
    - Reassign keyboard shortcuts for moving sections of text within the outline
    - Adjust visual style for conversion into Markdown

Methodology

The ideal way to illustrate the concept detailed above in order to test the functionality and solicit feedback from the Obsidian community would have been to code a prototype using TypeScript, JavaScript, and CSS—the languages typically used in Obsidian plugins. Unfortunately, without a background in software development and without sufficient time to learn how to program such a plugin, I was obliged to seek an alternative.

Ultimately, I chose to produce a video in which I present a visual demo of the plugin concept. This realistic simulation of the plugin allowed me to present its purpose and main features in just eight minutes without having to attempt to write any code.

I considered presenting the plugin in written form, but was concerned that members of my target audience might interpret the concept in different ways, thus reducing the coherence and overall value of their feedback. Producing a video proved to be more complicated than developing a written presentation, but I found that it succeeded in rendering the concept more tangible and explicit, which both helped me to clarify my ideas and to avoid misunderstandings. By making the video instead of coding

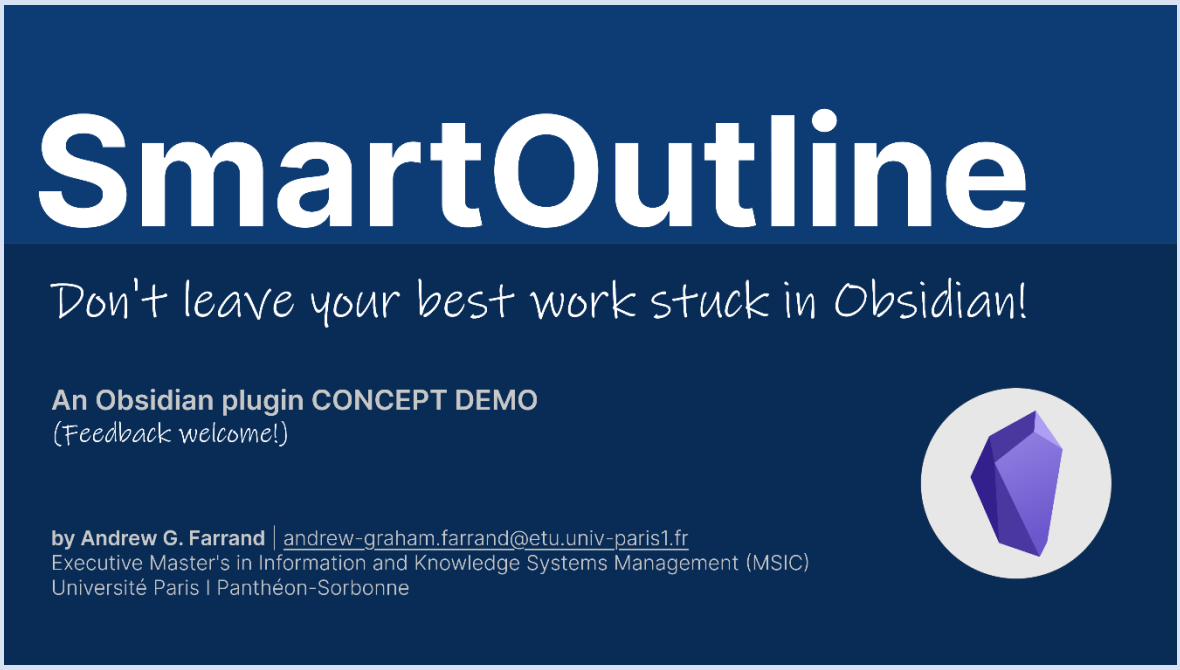
the full plugin, I also hoped to attract an experienced developer to the idea in order to request their help in coding the actual plugin.

The first step in producing the video was to create a test vault in Obsidian, filled with sample articles. (To stimulate engagement among the PKM community, I opted for articles and literature notes that discuss PKM itself.) Next, I used Adobe XD software to create a visual simulation of the plugin and its features, based on screenshots of the test vault. Next, I recorded video clips in which I triggered the visual simulation while describing the various features orally. Because the majority of Obsidian users and of active forum users speak English among themselves, I opted for English in the on-screen materials and the oral presentation (with subtitles available in English and French).

The video, found in Appendix B and available online to the public[4] , consists of eight sections as follows:

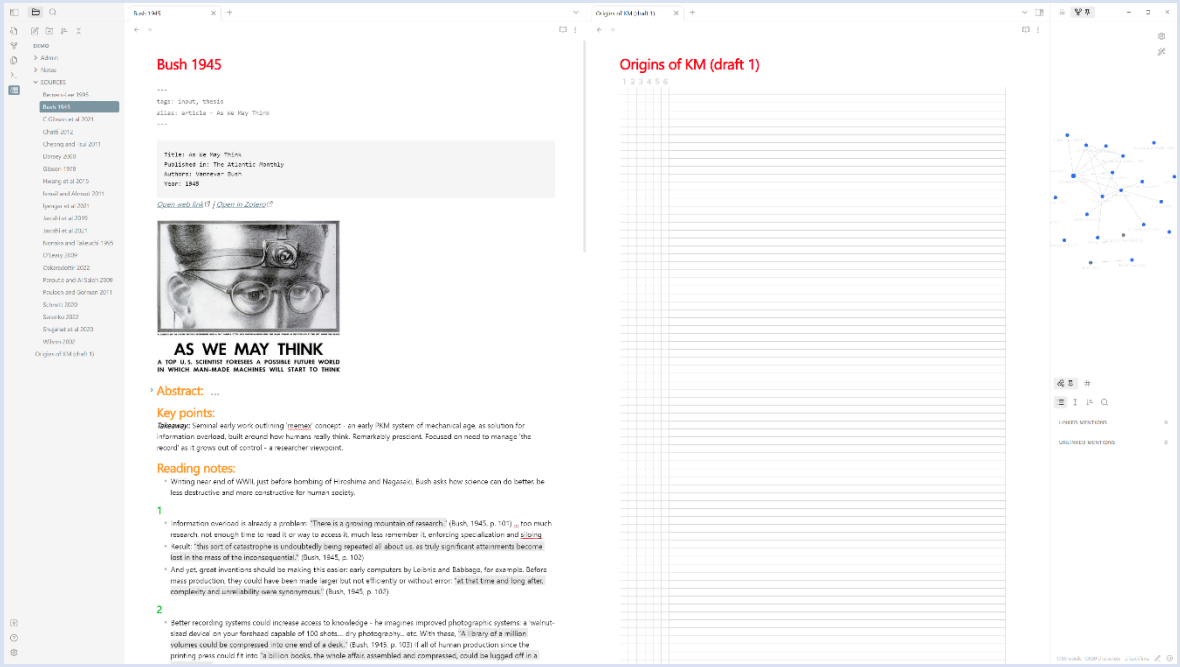
Table 1: Summary of the SmartOutline plugin concept demo video

Introduction: Presentation of myself, the SmartOutline plugin concept, the problem it seeks to solve, and my objectives—including gathering feedback on the concept, its usefulness, and its feasibility.

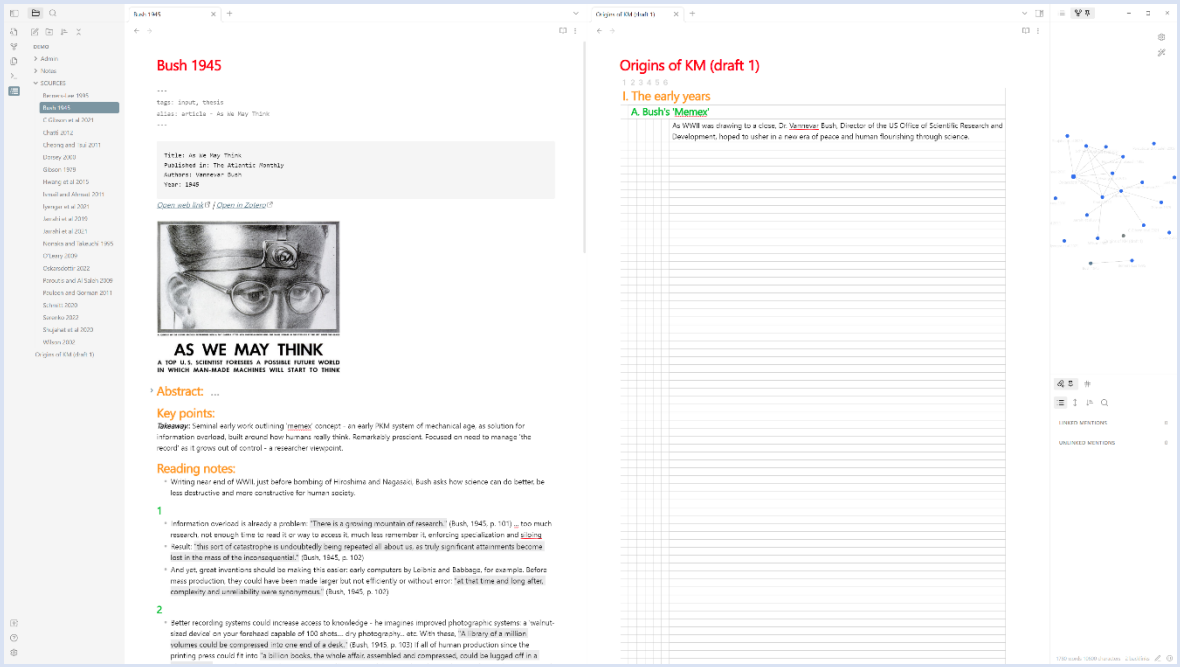


[4] Watch the video online at youtube.com/watch?v=J0EuJF2kf3E.

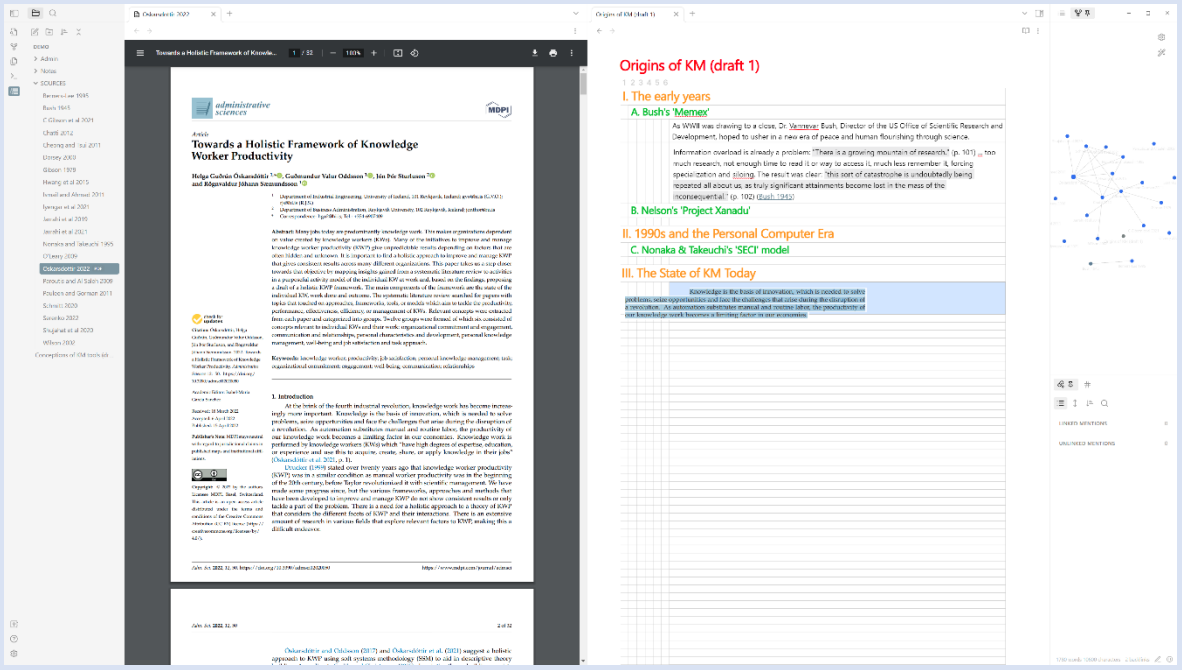
Function 1: Pre-configured workspace. The plugin automatically loads a standard workspace divided into a "source" pane and a "destination" pane where the user builds an outline in a dynamic table that captures all content imported from source documents or entered manually.



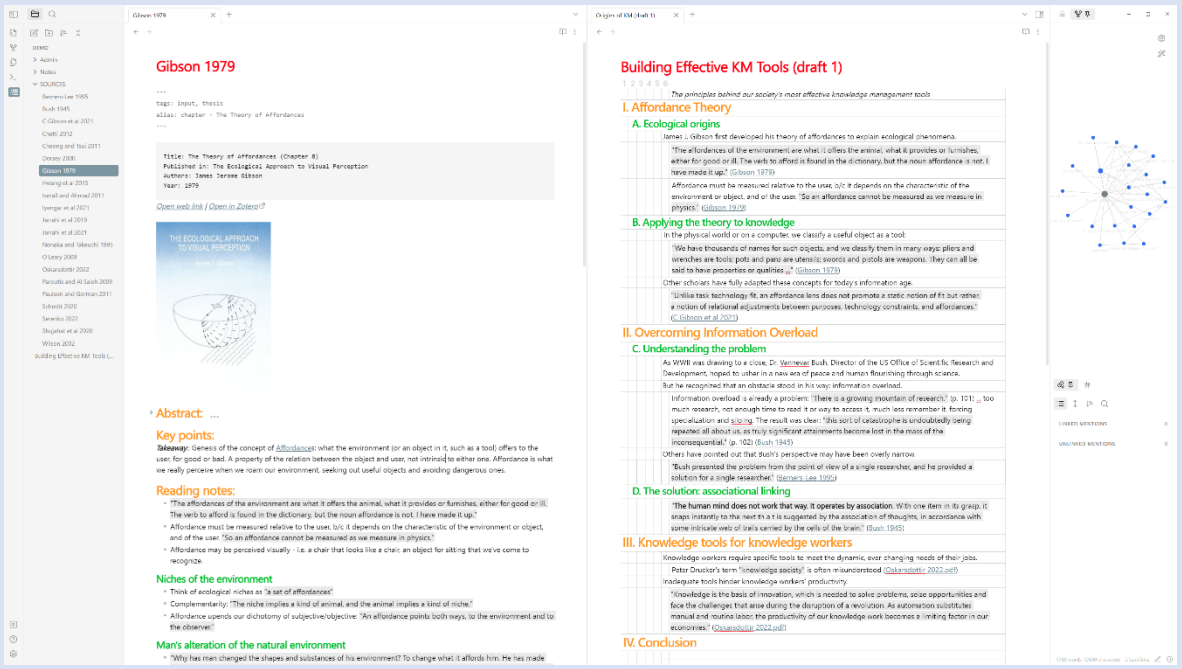
Function 2: Text entry. The plugin allows the user to enter text directly. It defines the size and the color of the text according to its level in the outline. (Associated options can be customized in the plugin's settings menu.) The cells expand to accommodate the content.



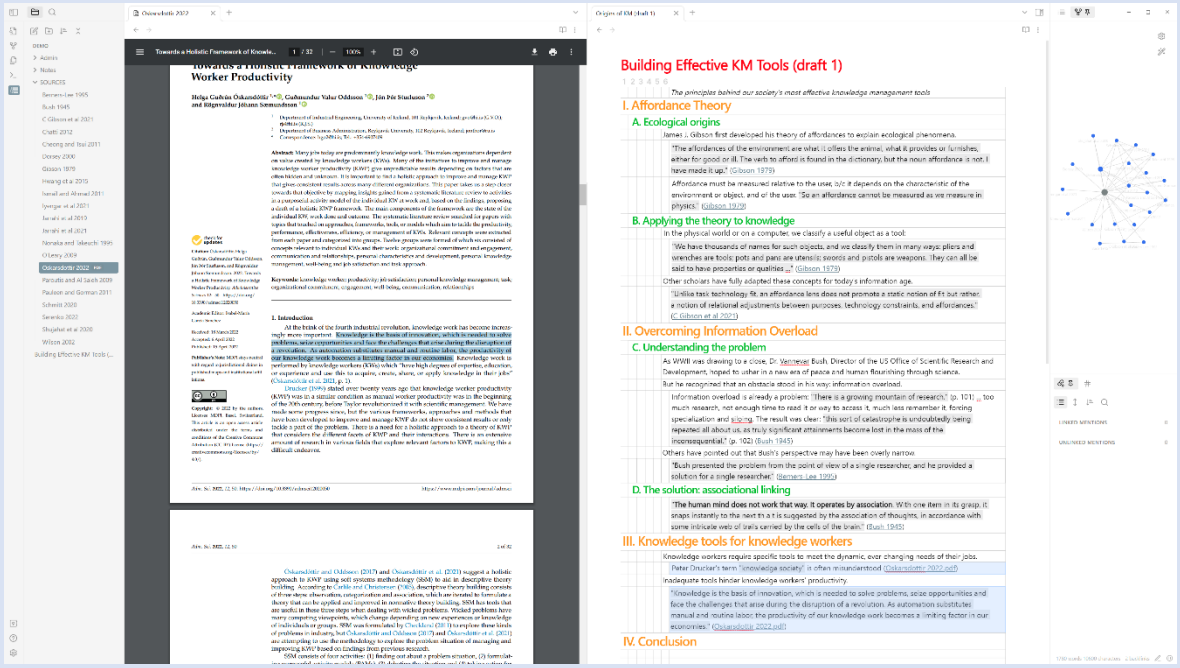
Function 3: Drag and drop. The user can select text in the source document (left) and drag it to the outline (right). The plugin performs a transclusion of the text and automatically appends a citation in the format defined by the user (in the settings menu). This ensures that the text remains up-to-date if the source document changes and that a link between the documents is maintained and also reflected in the graph view. The plugin accepts any document format, even images (via OCR).



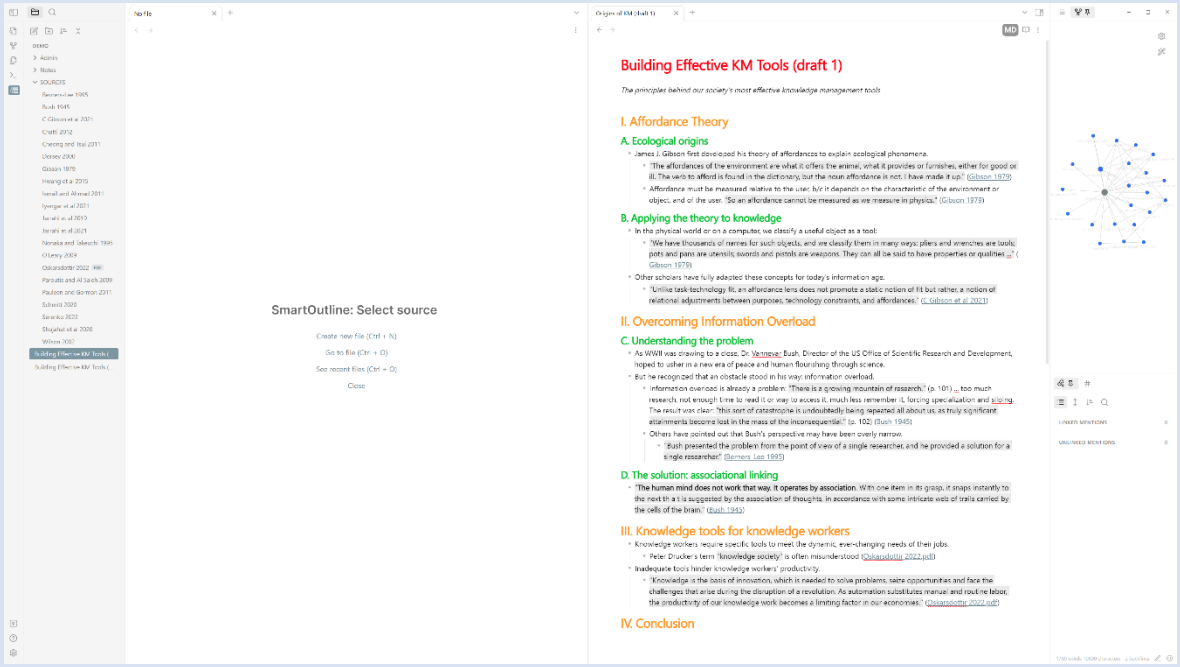
Function 4: Restructuring the outline. With simple keyboard shortcuts, the user can move elements in order to quickly restructure the outline. The default shortcuts are borrowed from another Obsidian plugin (Outliner) and another application (Roam Research) and are thus already familiar to many users.



Function 5: Revisit a source. To revisit one of the sources already consulted, double-click on the extract in the outline. Other extracts from the same source are selected and the Source pane reveals the extract in its original context.



Function 6: Convert complete outline. Once satisfied with the outline, the user clicks a single button to convert it into a standard Markdown document, from which he/she can then begin writing based on the outline. The plugin maintains the outline elements in the correct hierarchy, along with the transclusions and citation links to the source documents.



Conclusion: The video ends with a request for viewers to share their feedback to help refine the plugin concept, as well as their suggestions on how to develop it.

After preparing the video and subtitles, I uploaded it to YouTube. Then I shared the link in several forums where Obsidian's most passionate users exchange questions and tips, accompanied by a short message to attract interest. The video was shared on the following platforms in November 2022:

- **Discord**: the Obsidian/#plugin-general channel
- **Reddit**: the subreddit @ObsidianMD
- **Obsidian Forum** (official forum): "Plugin ideas" section

I also contacted the managers of Obsidian's two most widely read online newsletters to ask them to recommend the video to readers, which they agreed to do:

- **Obsidian Roundup**: presented in the November 19, 2022 issue
- **Linking Your Thinking**: to be presented in the next edition

Thanks to these efforts, the video garnered over 600 views on YouTube in its first week and continues to attract attention to this day. This interest has also translated into feedback from many users via public comments (a selection of which are presented in the next section).

To supplement this feedback with the views of subject-matter experts, I also wrote directly to 10 leading members of the Obsidian community to request interviews. In selecting experts to target, I prioritized the following characteristics:

- **Knowledge of the community**, broad view of the diversity of users and their use cases;
- **Technical expertise**, including experience developing Obsidian plugins;

- **Academic perspective**, ideally in a relevant field;
- **Visibility** in the community and good relations with its members, including renowned developers.

Of the 10 experts contacted, I was able to schedule interviews with four to validate my hypotheses, collect their opinions on my proposed solution, and discuss several related issues. The results of these discussions are summarized in the following section.

3.3 Validating the Solution

The reactions of the four experts interviewed, as well as a selection of comments received on various online platforms, testify to the Obsidian community's interest in the SmartOutline solution and also offer food for thought on how to improve the concept before developing it.

Experts' Reactions

Expert feedback is presented in the order in which the interviews took place:

Nick Milo | United States | linkingyourthinking.com

Founder of Linking Your Thinking, which offers PKM courses and coaching on how to leverage Obsidian

(interviewed by video call on November 19, 2022)

To begin, Milo confirmed my analysis of the imbalance that exists within the Obsidian ecosystem:

> *"Yes, that is accurate. Most of the attention is on the input side. Almost equal, but lesser attention is on the connections and exploring relationship side. (That's certainly my interest.) Even less is on the packaging and outputting side."*

Of the experts interviewed, Milo was the most enthusiastic about the SmartOutline concept, which would fill an important void, he believes:

> *"I'm excited for the solution like you're offering.... If Obsidian had better export features, it would really unlock whole new markets... It's really lacking, and that lack is getting in the way. What's interesting about the workflow that you're proposing is that it's very clear what the workflow is and I think it appeals to any aspiring individual in today's creator economy."*

Milo noted that every Obsidian user utilizes it for their own purposes, which makes it difficult to develop mass-market solutions. The SmartOutline plugin would not be as useful for those who practice an "emergent" workflow, he said, but would be very beneficial for those who instead follow a "linear" process:

> *"I run across a lot of people who have that sort of workflow, because it's the workflow that's just naturally encouraged with the amount of information we have to deal with. So being able to capture it safely and then reference it through transclusion is great.... This is*

really, really good for those who want a linear workflow that ends with an output—and that is a huge market."

He did not provide any direct criticisms of the concept, but noted that he would also be interested in seeing how users proceed once they have their outline in place: "That's where it will get interesting."

Additional feedback from Milo is included in the subsequent sections.

Marcus Olsson | Sweden | marcus.se.net

Independent software development trainer, developer coach, occasional consultant for Obsidian

(interviewed by video call on November 22, 2022)

Regarding Obsidian's ecosystem, Olsson said the existing focus on information capture is a natural outcome of its users' goals:

"People want to build their personal 'second brain' in Obsidian, so they want to bring stuff into it.... People want to consolidate their knowledge into one place. So that's the theme among a lot of the plugins out there."

Olsson said he does not know of any existing plugins with the same functionality as SmartOutline, but noted that the timing of the concept may be right. The recent release of the software Tana has stimulated new thinking among the Obsidian community around plugins that help to structure information:

"My first instinct when I looked at it was that it felt like what Tana is trying to do in their new product... We saw a few plugins popping up [in Obsidian] that kind of emulated that, in certain aspects... From that perspective, I think the plugin you're looking to build could ride the wave of Tana."

Drawing on his experience as a developer and a developer coach, Olsson also offered some tips to follow when trying to have the plugin developed. He noted that drag-and-drop, for example, is extremely complex to integrate into Obsidian plugins, due to certain aspects of Electron, the software framework on which Obsidian is built. If I decide to try to code the plugin myself, he stressed the importance of pursuing an iterative development process using the agile method and the "minimum viable product" approach. Finally, he recommended a channel in the Obsidian Discord forum where I can find experienced developers to help.

Additional feedback from Olsson is included in the subsequent sections.

Eleanor Konik | United States | obsidianroundup.org

Historian, founder and manager of the weekly "Obsidian Roundup" newsletter

(interviewed by video call on November 23, 2022)

Konik said that, because of her particular workflow, said she does not have difficulty organizing her content in Obsidian:

"I'm not an outliner. I never liked outlines... But I know that's not how other people work."

Nonetheless, she expressed frustration with other Obsidian features, such as the lack of options for exporting notes in multiple formats and the inadequacy of the PanDoc plugin, which is intended for that purpose. But this is an issue that will not go away, she said, due to dynamics in the community:

> *"All of the people who have the technical skills to make Pandoc easier for non-technical people to use don't need the Pandoc plugin…. If there's a problem that can be solved technically and annoys technical people, those problems get solved."*

She also noted the wide variety of use cases among the Obsidian community, whose members continually help each other to find solutions to their problems:

> *"That's one of the beautiful things about the community is that it self-selects for people who don't want to be spoon-fed stuff. If you want to be spoon-fed stuff, go use Notion."*

Additional feedback from Konik is included in the subsequent sections.

Ryan J.A. Murphy | Canada | axle.design

Computer scientist, PhD student in information systems management at Memorial University, plugin developer and moderator of the official Obsidian forums

(interviewed by video call on November 25, 2022)

Like the previous experts, Murphy noted the diversity of Obsidian's user base, which makes it difficult to find a set of tools to satisfy everyone. But he suggested that there may be a more limited number of user archetypes that one could use to categorize them and then address their needs.

For those like me, who are looking to "extract from different places and stitch those things together into something new," he said, he has already attempted to develop a solution. His Workbench plugin is not among the 50 most downloaded plugins I analyzed above in section 3.1, and he stopped maintaining it a year ago. However, he explained its functionality (Workbench copies text to a "destination" file through keyboard shortcuts rather than drag-and-drop) before comparing it to the SmartOutline concept:

> *"It's actually kind of close to SmartOutline. What it doesn't have is the ability to shift back and forth by dragging, the way that you showed, and the smart recognition of the heading level from that. And the other piece it doesn't have is the automatic back-linking, which is quite clever.... I think the Workbench approach is faster... but not as flexible. That's the downside."*

Murphy mentioned that the ability to move text extracts with a drag-and-drop function is one of the most common requests he receives from users of his plugin. He said adjustments to Workbench could make it more capable along the lines of SmartOutline, perhaps by adding a "quote" mode that would add automatic citations whenever a piece of text is copied.

He also explained that when he writes texts, he rarely uses outlines before he starts writing, but that this kind of demo makes him question his approach:

> *"The SmartOutline plugin, that's not how I work. It's not how I work but it could be, and I've been wondering for the past couple months... When I see a tool like yours, it makes me pause and wonder if the workflow that I use should change."*

Additional feedback from Murphy is included in the subsequent sections.

Community Feedback

This selection features comments collected during the month of November 2022 on the four platforms where the video was shared: YouTube, Obsidian's official forum, and Obsidian's channels on Discord and on Reddit.

@TfThacker, developer of several popular plugins in Obsidian, wrote:

> *"It's a great concept that you wrote up. I think many of us would like outlining features in Obsidian. I did also like your concept of dragging and dropping in other blocks into the outline."*

On the subject of development, he also offered advice that echoes Olsson's:

> *"It's not an overly difficult project but there are some hurdles. Obsidian drag and drop is really weak, for example."*

@WhiteNoise, a moderator on the Obsidian forum, responded with simple words of encouragement:

> *"Yes, there is definitely interest for having this sort of workflow in Obsidian."*

On Reddit, @PartTimeCouchPotato introduced himself as a developer before saying:

> *"Very good presentation! I'd like the drag-to-transclude function (which I think is a pending feature request.) ...I'd like to keep tabs on this project."*

@Brublios on Reddit wrote:

> *"It looks like movable blocks of text. Notion already has it, but you make it even better. I would love if someone created a plugin like that... wink, wink..."*

@president_josh on Reddit reacted:

> *"I would use it. It looks like a version of a Roam sidebar with extra functionality. It looks like a good way to assemble something."*

@konetidy on YouTube wrote:

> *"Good concept. I would use the plugin; can do nothing to help with making it. Is it necessary to bind the tool solely to be used when 'outlining?' Other visualization modes (concept maps) might be useful too...."*

@The Mind's AI on YouTube reacted:

> *"Looks great, sign me up. Some of this can be done with the plugins Text Transporter, Zotero for the PDF part, Outliner, etc. Not nearly all though, and the workflows are clunky workarounds."*

These reactions and their significance for this case study are analyzed in the next section.

IV. Discussion

The research conducted and activities undertaken for this thesis point to several reflections on the SmartOutline concept experience, the emerging PKM field, and related issues.

Analysis of the SmartOutline Experience

The reactions to the SmartOutline concept plugin demo were largely positive, indicating that demand exists for such a tool. More specifically, the feedback allowed me to validate my diagnosis of the problem, my hypothesis, and the value of my proposed solution:

- **Problem**: Thanks to the opinions of the four experts interviewed, I was able to confirm my "black hole" theory (though they did not all express it in such extreme terms). The Obsidian ecosystem contains a substantial imbalance, leaving content creators without the affordances they need to produce at the rate they would like. Absent a solution, this imbalance hinders their productivity and will likely prompt them to continue searching for alternative platforms and tools.

- **Hypothesis**: The feedback from experts and especially from online commenters suggests that I am not alone in believing that a technological solution to this problem is possible and that it would be of great benefit to users who seek to produce distinct outputs from their Obsidian collections.

- **Solution**: My SmartOutline plugin concept has been generally well received. The only negative comments have been that other plugins already exist that can perform some (but never all) of its functions. (Of these alternatives, Ryan J.A. Murphy's Workbench plugin is probably the most comprehensive and most similar to SmartOutline). This resemblance is not a negative point; on the contrary, it shows that this problem is important and that others are also searching for a solution.

My exchanges with the experts and members of the Obsidian community have also given me additional ideas about the SmartOutline plugin's design. Even if it has been validated overall, the concept remains perfectible. As a next step, I plan to review a number of alternative plugins proposed during my discussions, in order to understand what problems their developers sought to solve and how they approached them. This exercise of re-examining existing plugins should allow me to reach a decision on how to proceed with my own concept.

Here, I face two options. I can collaborate with the developer of an existing plugin to try to extend its affordances through new features, in line with the SmartOutline vision. Or I can collaborate with a developer to build SmartOutline from scratch. The choice will depend on the result of my analysis of existing plugins. This iterative process seems to me the most coherent and prudent, as well as the most likely to lead to a lasting solution to the problem identified.

Compatibility between PKM and OKM?

For years, there has been a palpable tension between the PKM and OKM movements. In the business world, many CEOs continue trying to control the information and knowledge of their employees. In their eyes, knowledge developed in the workplace remains the intellectual property of the firm. Many employers institute blocks to prevent employees from installing private PKM software on their work computers. Meanwhile, outside large companies, the PKM movement is advancing rapidly, promising to free knowledge workers from having to develop knowledge that will be utilized only by their employers. In the eyes of PKM evangelists, the person doing the work has the right to learn from that work (just like employees who for centuries have kept personal diaries). Is there common ground between these opposing views?

Clearly, the rise of PKM has complicated the situation for many firms. But both sides have an interest in finding a solution; Metcalfe's Law tells us that the more nodes one introduces into a network, the more valuable the network becomes to all its members.

Several initiatives have been launched in hopes of uniting these two worlds. Some are motivated by economic interests, as a viable solution to this dilemma would open up a huge global market. Private firms such as Athens, As We Think, TheBrain, and many others are looking to develop a technological solution to satisfy both camps. For other reasons, the PKM community is also getting involved. Several developer teams have already tried to create plugins to facilitate team collaboration in Obsidian, for example, but the scale and complexity of this challenge is probably too great to be solved by plugins alone. German researcher Ulrich Schmitt is looking to develop a solution from scratch, based on his years of research at the intersection of PKM and OKM. Under the name "Knowcations," he proposes a PKM solution for individuals, who would populate a collaborative "global meme heritage repository"—a central, global knowledge base capable of structuring all human knowledge. (Schmitt 2018)

Such an ambitious solution seems doomed to failure. More realistically, we should accept that the two systems will need to continue to coexist for as long as it takes them to renegotiate their borders and their areas of overlap. In the meantime, it could be advantageous to help each appreciate the other. For PKM practitioners, this will involve more thinking about how to perform KM in a collective context, where common taxonomies must be developed and respected. And business leaders also need to start recognizing the benefits of PKM. As Milo told me in our interview, "Having their own PKM system makes an employee that much more valuable. When you have a universe of ideas in your back pocket, as an employee you are better equipped to solve all kinds of company-related issues."

What Promise Does Artificial Intelligence Hold for PKM?

Algorithms are the steam engines of our time. And yet, they are totally absent from Obsidian and many other contemporary tools for thought—but not all. Some have already integrated "AI assistants" that help users either generate text or organize their information by automatically tagging files according to their contents or locating related texts. Last month, Notion rolled out an AI assistant that can write complete sentences. And Obsidian developers are currently working on plans to connect their vaults to AI programs via plugins.

One of the problems that appears to have been overlooked is the deluge of information that will follow the eventual introduction of content-generating assistants at scale. Using AI for this purpose will only exacerbate the problem of information overload that humanity has faced for the past century. This

will put even more pressure on PKM systems and their users, who are already overwhelmed by the current information flows.

A more positive potential effect of introducing AI into the PKM domain will be to boost software development capabilities, including for amateurs like me. An AI assistant could easily help a user translate their desired affordances (expressed in natural language) into concrete functionalities and deploy them. In this scenario, I might have deployed SmartOutline the same day I developed the concept. But with such ease of code creation, the volume problem will reappear, requiring new information management tools to be able to find what one is seeking.

Another possibility is that AI will increase our organizational capabilities within our tools for thought. For Milo, this kind of assistant seems very useful: "It's going to help all of us think better. It might be kind of scary now, but it will be a natural evolution to just thinking constantly with somebody who is very helpful." But for Konik, an assistant that offers us resources similar to those we already have on-screen doesn't contribute to the creative process: "The whole value add that I have as a writer is that I'm making unusual connections. Having an AI make the kind of connections that everybody on the planet has trained it to make is not worthwhile, it's not useful." Murphy agrees with Konik on this point, noting that what distinguishes humans' creative thinking is our capacity to identify novel connections and subtle patterns.

But to the extent that AI focuses on the more administrative tasks of PKM, including basic information processing tasks, it will be able to free up users to spend more time developing these kinds of novel connections.

Risks for the Future of Obsidian?

The Obsidian tool may have more potential to change the world than any other tool for thought, but many factors could prevent it from realizing that potential. So far, Obsidian has not established a strong business model, which could put the company at risk of insolvency—if, for example, part of its user base switches to a competitor. Even to grow further and expand its influence at a greater scale will probably require more resources.

Another issue, one raised by Olsson, is security. The decision to put user-generated plugins at the center of Obsidian made it the dynamic tool that its users love today. But it also imposed a sacrifice: The Obsidian team loses some control over its environment, which can leave it vulnerable to bad actors. According to Olsson, the code for every user-developed plugin is reviewed by the Obsidian team when it is first released. After that, updates are not reviewed. It would therefore be possible to introduce a virus through an update to an already approved plugin, for example a virus that steals users' data. These security flaws will become increasingly critical to solve as the Obsidian community continues to grow.

Finally, there is the possibility that the PKM community will go in another direction and Obsidian will become obsolete. But the presence of the community should keep this risk to a minimum. Obsidian's passionate and talented user base provides the energy powering the ecosystem around the software. As long as the founders continue to cultivate this dynamic community, Obsidian itself should have a bright future.

V. Conclusion

This thesis explored the principal thinkers and theories of the three major contemporary periods in the human quest for knowledge, studying the evolution of interactions between users, tools, and the environment.

Table 2: Summary of the three eras presented in section II

Era	Main Actor	Tools	Environment
The Dawn of the Information Age (1920s-1980s)	The individual researcher, motivated by curiosity and the desire to advance science	Advanced analog media (efficient printing, photocopier, microfiche, telephone, radio, television, etc.) Very first digital tools	Era of unprecedented scientific progress Rise of mass media Information overload (compared to the past)
Organizational Knowledge Management (1990s-2000s)	The company, motivated by economic interests	Mediocre but expensive digital tools: software that imposes a hierarchical logic, held in the hands of company managers	Personal tools lagged behind enterprise tools, then caught up Globalization, fierce competition especially with Japan, inferiority complex
Personal Knowledge Management (2010-present)	The individual knowledge worker, independent of the company, motivated by curiosity and the desire to succeed in their career	Highly capable and inexpensive digital tools Software that facilitates organizing information by association	Strong ties between employers and employees have dissolved Remote work, "knowmads"

The first era, in the mid-20th century, saw important theoretical advances in how to overcome the challenge of information overload. But the innovative thinkers of that epoch struggled to put their ideas into practice due to the limited technological means available. Propelled by globalization and competition with Asia, the KM movement of the 1990s-2000s coincided with a technological revolution. But decision-making power remained with business leaders, who made decisions based on their own objectives, creating a break with the past that would only be repaired by the emergence of a new movement. The PKM wave has been attracting the attention of researchers for the past 25 years, but the movement only really took off in 2019-2020 with the arrival of tools for thought, which have finally allowed the ideas of the 20th century visionaries to be realized. The rise of this movement has finally

realized the transition to a knowledge economy dominated not by corporations, but by individual knowledge workers, freed to pursue their careers in parallel to their personal quest for knowledge.

But if this movement is to achieve its full potential, it must succeed in meeting the particular needs of these knowledge workers. One of the most powerful tools of the PKM movement, Obsidian, offers a range of affordances biased toward information gathering, leaving content creators still unsatisfied. By diagnosing this problem, formulating a hypothesis for solving it, and designing SmartOutline, a new plugin for Obsidian, I attempted to provide a practical solution to this challenge. The reactions to my demo video validated the relevance of this approach and the proposed solution, and illuminated interesting lines of thought around these issues, which I intend to explore further in my search for a real-world solution.

The emergent PKM field deserves more effort and attention from concerned individuals, companies, and researchers alike. Its potential to revolutionize the relationship between humanity and the world of information and knowledge we inhabit compels us to continue trying to shape better tools for tomorrow. It is up to all of us together to answer the question Nick Milo asked me at the end of our interview:

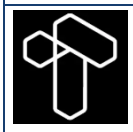
> *"PKM is growing massively because information overload is not going way. And when we want to feel in control of the chaos somehow, we need a space. What is that space going to be?"*

ANNEXES

A. PKM Tool List

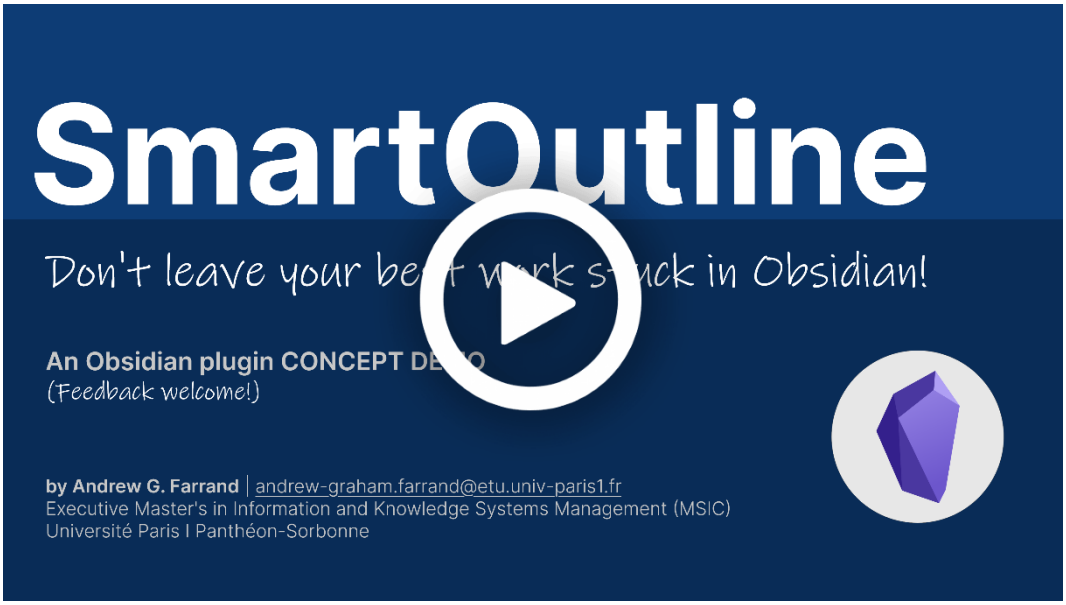
A non-exhaustive list of PKM applications that make up the new "tools for thought" movement, organized chronologically by launch date:

Application	Specificities
 **TiddlyWiki** tiddlywiki.com 2004 · UK	Lightweight, self-hosted system for creating personal wikis based on the WikiWikiWeb model, the precursor to Wikipedia.
 **TheBrain** thebrain.com 2009 · USA	Productivity, notetaking, and visualization software, launched (under the name "PersonalBrain") around mind-mapping, since expanded to follow new market entrants.
 **Workflowy** workflowy.com 2010 · USA	Software for managing lists, workflows, and notetaking; added bidirectional links functionality in 2021. Counts 3 million users since its launch.
 **Notion** notion.so 2016 · USA	Collaborative platform for data, project, and task management, with support for Markdown, wikis, and databases. Currently over 20 million users.
 **Bear** bear.app 2016 · Italy	Elegant Markdown text editor with cloud sync (only on Apple products) and bidirectional links since 2020. Over 100 million users.
 **The Archive** zettelkasten.de 2017 · Germany	Simple text files, organized according to Luhmann's philosophy; aims to be the digital version of a Zettelkasten.
 **Zettlr** zettlr.com 2017 · Germany	Open-source competitor to "The Archive."
 **Roam Research** roamresearch.com 2019 · USA	Following the release of its white paper in 2018, Roam is attracting ardent supporters (#roamcult), especially in Silicon Valley. Its proprietary system, with interconnected notes visualized in a graph view, remains a leader (and one of the most expensive) in the field and has inspired many competitors.
 **Amplenote** amplenote.com 2019 · USA	Similar to Notion; manages daily and evergreen notes, tasks, and calendars.
 **Obsidian** obsidian.md 2020 · Canada	Free Markdown notetaking platform with graph view, extendable by plugins generated by the user community. Allows user to develop personal knowledge base with a wide range of features. Free, with paid options: synchronization in the cloud and publishing notes to the web.

	**RemNote** remnote.com 2020 · USA	Similar to Obsidian and Roam; developed at MIT, offers flashcards and other features to help retain information and promote learning. Surpassed 15,000 daily users last year.
[[Athens]]	**Athens** athensresearch.org 2020 · USA	Open-source note editor with graph view; development stopped since August 2021 for conversion into a forthcoming collaborative tool.
	**Neuron** neuron.zettel.page 2020 · Canada	Markdown note editor based on the concept of Zettelkasten, but aims to facilitate the creation of static web pages. Currently being replaced by a successor project, Emanote.
	**Dendron** dendron.so 2020 · USA	Open-source notation and visualization tool, organized around standardized templates based on the notion of *Integrated Development Environments* (IDEs)
	**Logseq** logseq.com 2021 · USA	Similar to Obsidian and Roam; local hosting for security and privacy.
	**Scrintal** scrintal.com 2022 · Sweden	Visual system for organizing resources and ideas; a sort of advanced, collaborative, multimedia mind-mapping. Beta launch in August 2022 with public launch expected soon.
	**Tana** tana.inc 2022 · Norway	New knowledge base and data management tool; very data-centric, less text-centric. Currently in limited access beta, with public launch expected soon.

B. Video: Demo of the SmartOutline Plugin Concept

Eight-minute video produced by the author, presenting the SmartOutline plugin concept and its essential functions; in English with French subtitles, available at youtube.com/watch?v=J0EuJF2kf3E:



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