{Introduction}

The astonishing speed with which we have embraced the emerging age of ubiquitous computing has prompted calls to abandon paper and move to a completely digital information environment.[1] [2] For example, in 2012 the Office of Management and Budget (OMB) and the National Archives and Records Administration (NARA) announced that "the Federal Government should commit immediately to the transition to a digital government."[3]

Our precipitous adoption of this visionary goal should be tempered through a sober evaluation of the best strategies for utilizing all the resources in our communication and memory toolbox to meet the full panoply of our information needs. This evaluation cannot ignore the lessons from previous introductions of new communication and memory technologies. While an imperfect window, history is the only valid laboratory for examining the potential future consequences of decisions.[4] [5] [6]

One lesson is that instead of replacing previous language modalities, the newest technology [7] [8] becomes one more component of our increasingly complex and powerful cognitive and communication toolbox.[9]

Yet another lesson is that new media are initially managed as the previous until experience demonstrates how to take advantage of their unique features and power.[10] [11] [12]

{Language and Memory}

While our brains do not need language (Old French *langage* = tongue)[13] to create memories (Latin *memoria* = faculty of remembering), language would be impossible without memory.[14]

The Greek philosopher Socrates (469-399 BCE) described memory as a gift from Mnemosyne, the goddess of memory and mother of the Muses. He compared it a wax tablet on which people could record what they wanted to remember, but which could be erased or fade away.[15] [16]

Wax tablets more than 2,500 years old have been found in what is now Iraq. They were widely used in ancient Egypt, Greece, and Rome.[17] [18] Archeologists recently found a 14th-century notebook used by a German merchant in which the first and last pages were wax tablets. [19]

{Repertoires}

Everyone has unique and constantly changing cognitive, linguistic, and lexical repertoires consisting of their knowledge of the world. These are the memories of experiences and conceptual frameworks, the languages we can use to share information, and the vocabulary we

have to express our thoughts. These repertoires enable and constrain how we interpret information and our ability to communicate and cooperate with others.[20] [21] [22] [23] [24] [25]

{Information Environments}

Just as each person has their own set of repertoires, every discrete community of interest has a unique information environment shaped by the opportunities and threats in which it functions.[26] [27] [28] [29] [30] [31] Also referred to as 'information spaces' and 'information islands' they are assembled from what we have learned from the various information environments we participate in and are exposed to.[32]

The various definitions of information environments concur that they are dynamic and adaptive ecosystems incorporating the entire universe of information learned, shared, and acted upon within each community of interest. They encompass all of the language and communication modalities, physical environments, social and culture norms, and entities (work, educational, religious, cultural, etc.) utilized by those within (and who are impact by) each environment. They are the facts, data, and social conventions that surround us daily as we move through different contexts of home, work, and social activities that require specific knowledge and skills to successfully navigate life.[33] [34] [35] [36] [37] [38] [39] by enabling and constraining our interpretation and response to information.[40] [41]

The glue for every information environment is the factors that create a cognitive and language community, including (but not limited to) family, community, age, occupation, faith-based, education, culture (music, literature, theatre, etc.), and sports.[42] [43] [44] [45] [46]

Each person is engaged in, and exposed to, a multitude of information environments based on factors of age, family, community, formal and informal education, employment, and interests such as religion, sports, or music.[47] [48] [49] [50] [51] [52] [53] [54]

{Information Environment - Digital Ecosystems}

Our emerging age of ubiquitous computing is being studied and employed under the umbrella of digital ecosystems.

> ['Digital ecosystem: The journey of a metaphor' by Maroš Krivý. *Digital Geography and Society*, Volume 5, December 2023, 100057. https://doi.org/10.1016/j.diggeo.2023.100057 [Accessed April 24, 2026 at:]

{Information Environments - Subsystems and Components}

As with all complex systems information environments have multiple, interoperable, and mutually dependent operating subsystems and components.[55] [56] [57] [58] [59] [60] There seems to be agreement that most of those subsystems and components are related to context (physical,

cultural, and communication modalities) rather than to what we normally think of as language (words, grammar, etc.).[61] [62]

{Ambiguity of Spoken and Written Language}

One reason for the the unavoidable ambiguity inherent in spoken and written language might be illustrated by how the context of an information exchange disambiguates the semantics of the word “right” when used in the binary logical question of weather something is the correct answer, versus when giving directions. Another would be using the word “value” in a discussion of religion versus a decision over whether to invest in real estate or precious metals.

These factors contribute to the ambiguity of spoken and written languages.

> [‘Toward a Deeper Lexical Semantics’ by Ray S Jackendoff and Katrin E Erk. Top Cogn Sci. 2025 Oct;17(4):962-972. doi: 10.1111/tops.70013. Epub 2025 Jun 5. PMID: 40472343; PMCID: PMC12560853.]
> [‘Environmental context scaffolds children's semantic representation of novel words’ by Elise Breitfeld and Jenny R. Saffran. *Cognition*, Volume 262, September 2025, 106162]
> [‘Semantic diversity: A measure of semantic ambiguity based on variability in the contextual usage of words’ by Paul Hoffman, Matthew A. Lambon Ralph, and Timothy T. Rogers. *Behavior Research Methods*, 45, 718–730 (2013). https://doi.org/10.3758/s13428-012-0278-x
> [‘Speakers Fill Lexical Semantic Gaps with Context’ by Tiago Pimentel, Rowan Hall Maudslay, Damián Blasi, and Ryan Cotterell. *arXiv.org*, 2021-06; Ithaca: Cornell University Library, arXiv.org]

(((“Sachs inferred from these results, and later experimentation has amply confirmed her inference, that the original form of a sentence is rapidly lost to memory, whereas an accurate memory for its meaning is retained.” [*Cultural literacy : what every American needs to know*, by E.D. Hirsch, Jr. ; with an appendix, What literate Americans know [by] E.D. Hirsch, Jr., Joseph Kett, James Trefil. Boston : Houghton Mifflin, 1987. See page 37

{ Memory is one of the Major Subsystems of Every Information Environment}

{Memory Subsystem Component - The Internet}

And now the vast expanse of the Internet is a common component of this extended human memory.

> [‘The Digital Expansion of the Mind: Implications of Internet Usage for Memory and Cognition’ by Elizabeth J. Marsh and Suparna Rajaram. *Journal of Applied Research in Memory and Cognition*, Volume 8, Issue 1, March 2019, Pages 1-14.]

{Information Environment Subsystem - Memory}

Memory is one of the subsystems in every information environment.

memory is the capacity to store and retrieve information

Those memories can be stored in the brain of each individual, in the social and collective memory of those interacting within each information environment, or in the myriad of formats now available that are external to the human mind.

> ['Expanded taxonomies of human memory' by Jason R. Finley. Department of Psychology, Southern Illinois University Edwardsville, Edwardsville, IL, United States. ((Saved to Library)) Accessed online January 31, 2026 at: https://www.frontiersin.org/journals/cognition/articles/10.3389/fcogn.2024.1505549/full]
>
> ['Memory: An Extended Definition' by Gregorio Zlotnik by Aaron Vansintjan. *Frontiers in Psychology*. 2019 Nov 7;10:2523. doi: 10.3389/fpsyg.2019.02523. PMID: 31787916; PMCID: PMC6853990.]

Memory is a vital subsystem of every information environment, and libraries are an essential component of the memory subsystem.

> [*Libraries as communication systems* by James M. Orr. Greenwood Press, Westport, Conn., 1977.]

{Language- Definition}

One definition of language is "a fuzzy cloud in the space of all possible communication systems, a cloud defined by the intrinsic requirements of communication, the constraints and biases of the human brain."[63] A more functional definition is that languages have a lexicon (words or vocabulary), semantics (meanings or definitions of the words), and syntax (rules for structuring a message).[64]

{Sixth Language}

Digital communication and memory technology is the just the latest in an evolutionary chain of languages that includes speech, writing, and mathematics.[65] [66]

{Studied Separately}

Although our minds are effortlessly able to simultaneously utilize all language modalities, we are compelled to study them separately because each has distinct combinations of capabilities and constraints relating to composition, communication, capture, storage, preservation and recall.[67] [68] [69] [70] Ironically we are compelled to study each modality in isolation because they have different sets of mechanical and cognitive characteristics which determine the type of information that can be identified, preserved in memory, and shared with others within that language community.[71] [72] [73] [74] [75] [76] [77]

This means that no single language or communication modality can meet our perhaps infinite information needs.[78] [79]

{Mimetic Communication}

Before spoken language its is believed that our distant ancestors exchanged information through mimetic communication, [80] a quasi-symbolic communication[81] that metaphorically expresses meaning [82] through the intuitive use of imitation, mimicry, facial expressions, posture, gestures, and a variety of vocalizations.[83] [84] [85]

Instead of words, meaning is encoded in signs that are multimodal combinations of vocalizations and physical gestures (such as pointing). Each combination constitutes a complete holistic unitary utterance (holophrastic) in which the separate components of these signs lack discrete meanings.[86] [87] [88] [89] [90]

The "vocabulary" of signs would have focused on facilitating cooperation in essential tasks such as foraging, hunting, alloparenting, and protection from predators.[91] [92] [93]

For example, someone might have signaled the desire to catch, cook, and eat a fish by displaying the holophrastic signs for spear, fish, fire, and eat in that sequence.[94] [95] [96] [97] [98] [99]

{Hunter-Gatherer Lifestyle}

Language provided crucial advantages to our distant ancestors in their brutal and uncertain struggle for survival. They faced threats from predators, the high cost of caring for infants during their extended period of juvenility, and in performing the myriad of cooperative tasks needed to gather essential provisions.

Our most distant ancestors lived in balance with nature as nomadic hunter-gatherers, a cognitively demanding lifestyle. Success required the ability to communicate about the various sources of food, the variations caused by geography and seasons,[100] manufacture tools, [101] [102] and the ability to cooperate in securing and sharing the bounty.

Successful hunting required the ability to share knowledge of the prey, knowledge of the vegetation they preferred to eat, a mental nap of where those plants grow, and seasonal variations when each animal might be found there.[103] [104] [105]

{Foraging}

Survival as a hunter-gatherer is cognitively demanding,[106] [107]

{Foraging}

For example, one community was found to exploit nearly 30 species of game animals, more than 60 plants, and a variety of other resources,[108] while another utilized more than 170 plants just in their various hunting practices.[109] [110] [111]

FIX
The use of fire[112] [113] and manufacturing tools.

{Tools}

Tools are memory.[114] [115] [116]

{Alloparenting - Pedagogy}

Another burden was the fact that human infants have extended period of juvenility before they could start contributing to the needs of the community. Other members of the group to participate in raising the young, a practice referred to as alloparenting.[117] [118] [119]

{Protection from Predation}

It is believed that group size increased from these improved skills in food provision and as protection from predators such as leopards.

FIX
There are reasons to believe that another motivation for living in larger groups was as a protections from falling prey to predators such as crocodiles, hyenas, leopards, and lions. [120] [121] [122] [123] [124] [125]

{Group Size = Language}

As our Stone Age ancestors used language to improve their hunting and foraging knowledge, learned to manufacture tools for specific tasks, and to control fire, the size of their groups increased to just over 100 members. Fire allowed them to cook, reduce the risk of predation, and is believed to have encouraged them to create and share stories about their culture, their knowledge, and about the unknown.[126] [127] [128]

FIX division of labour and food sharing, and to be able to conduct large-scale, efficient, coordinated hunting

There is an estimate that average group size increased to more than 100 members.[129] [130]

{Scaffolding}

Cultural transmission of the accumulated knowledge improves as the group size increases, creating a “ratchet effect” of increasing the pool of knowledge, which in turn increased the accumulated cultural knowledge.[131] [132] Over untold generations this enabled the development of technologies that no individual could have invented alone.[133] [134]

This success created a need overcome the limitations on share information inherent in mimetic communication because because mimesis cannot meet the basic information sharing needs[135] of groups larger than 150 members.[136] [137] Thus, where the benefits of mimesis made the emergence of spoken language possible, population growth made it necessary.[138] [139]

{Multimodality}

Even in spoken language ambiguity is unavoidable because words, intonation, and body language (facial expression, gestures, and body postures) are used in combination to encode a message.[140] [141] [142] [143] [144] [145] that are clarified by mimesis and context. Spoken exchanges also have frequent shifts of subject resulting from interruptions when participants ignore the expectation of turn-taking.[146] [147] [148] [149] One study found an average of 107 interruptions in every five minutes of conversation.[150] This aspect is being studied to improve the performance of conversational robots.[151] [152]

{Preservation}

Specific face-to-face spoken information exchanges can only be preserved in the memory of participants.[153] [154]

{Community or Collective Memory}

With spoken language, however, the gist can be melded into collective memory through storytelling and songs that can teach when shared during community rituals.[155] [156] [157] [158] [159]

These include epic stories set in poetry, such as the Iliad and the Odyssey, that have been referred to as tribal encyclopedias that were used to preserve and teach cultural memory.[160] [161] [162] [163]

{Collective Memory}

“One of the first scholars to talk about a collective present in society was Emile Durkheim. Before the term collective memory was established, Emile Durkheim discussed collective consciousness in his work The Elementary Forms of Religious Life. Durkheim asserts that “society is a reality sui generis; it has its own peculiar characteristics” and that you cannot derive “the whole from the part, the complex from the simple” (Durkheim, 1912, p. 29). He is saying that society provides an external structure that defines how people live and conceptualize their reality. Society is something more than the sum of individual ideas and actions; society is the umbrella over everyone.”

[‘Collective memory: history, memory, and community’ by Abigail V. Aldis. (2020). Master's thesis/Doctoral dissertation, University of Texas. University of Texas Repository. https://repositories.lib.utexas.edu/items/79c4eb75-e0e7-4257-b441-e2807b5010cd] See page 19/2/2, see also page 252.
[*Elementary forms of the religious life* by Émile Durkheim (1858-1917) : Swain, Joseph Ward, 1891- Published: G. Allen & Unwin, ltd., London, [1915] See page 29.

{Preservation}

After written language was added to our cognitive and communication tool box about 5,000 years, knowledge could be shared with anyone who understood the language it was r3corded in, and preservation expanded to the durability of the media on which it is recorded.

When writing became available about 5,000 years ago a few of these stories (think Gilgamesh, the Iliad, and the Odyssey) were among the first to be set in the new modality that could be preserved for the durability of the media on which it is recorded.

German Merchant’s Notebook

Clay, papyrus, velum

{Pedagogy}

Our distant ancestors are believed to have been nomadic hunter-gatherers, which is a cognitively demanding lifestyle.[164] For example, one community was found to exploit nearly 30 species of game animals, more than 60 plants, and a variety of other resources,[165] while another utilized more than 170 plants just in their various hunting practices.[166] [167] [168]

{Information Definition}

Information underlies all human activities, making any definition of that term dependent on the context in that term is used.[169] [170] The current default definition is from the seminal 1948 paper ‘A Mathematical Theory of Communication’ by Claude Shannon. In the first two paragraphs he explicitly noted that it was focused on the fundamental problem of efficient transmission of a communication signal, and that the meaning (semantics) of a message was irrelevant to the engineering problem.[171]

However, in the context of this discussion about factors that should be considered when designing an information environment, information will be defined as all conceivable observations that can be detected by human senses.[172]

{Semiotics}

It might help to consider this definition from the perspective of semiotics, the interdisciplinary study of how signs and symbols are used to communicate meaning. Language is considered a subset of semiotics.[173] [174]

When biosemioticians discuss memory in bacteria, they are referring to chemical receptors in those one cell organism that can detect and respond to signals by moving away from threats, and moving toward opportunities.[175] [176] [177]

Black holes, an example at a massively larger scale, are hyper dense concentrations of matter with gravity so intense that nothing can escape from them. When astro semioticians discuss black hole memory they are referring to the theory that their outer boundary, or event horizon, retains the encoded information and properties of everything that falls into them. [178] [179] [180] [181]

While these examples of information are obviously not within the boundaries of human memory, information about them can be detected and interpreted by biosemioticians and astrosemioticians and must therefore be included in what is preserve and made available by libraries.

Memories are created through a process that begins with ingestion of stimulus through our dedicated (unimodal) neural networks for each of our five senses of sight (iconic), sound (echoic), smell (olfactory), taste (gustatory), and touch (haptic).[182] [183] [184] [185] at a rate of about billion bits per second.[186]

The vast majority of sensory intake is devoted to subconscious regulation of essential body functions such as breathing, heart rate, sleep, and digestion.[187] [188] [189] [190] About 80% of those signals are sight (iconic) and 10% are sound (echoic), with the last 10% distributed between olfactory, gustatory, and haptic.[191]

{Short-Term Memory}

Within milliseconds[192] [193] those signals either decay or are passed along to short-term and working memory where they might be retained for 15 to 30 seconds while being evaluated and categorized for use in cognitive tasks such as learning, reasoning, comprehension, and decision making.[194] [195] [196] [197] In both short-term and working memory all the sensory signals are processed in a blended (supramodal) manner [198] [199] [200] at a rate of just 10 bits per second.[201] [202] [203] [204]

{Rehearsal}

Retention in short-term and working memory can be extended through “rehearsal” (also called “maintenance rehearsal” and “rote rehearsal”) by recurrent repetition.[205] [206] [207] [208]

{Long Term Memory - Memory Consolidation}

Some of that information is encoded into long-term memory through a process termed system consolidation. Somewhat akin to an archive, these memories have a more stable form that is resistant to decay.[209] [210] [211] [212] [213] [214]

{Subsystems and Components of Memory}

Memory is an essential subsystem in all information environments. It can be stored in a biological brain, in community memory, and in modalities external to the human mind (books, computers, the Internet, etc.)[215] [216] [217] [218]

{The Individual Brain}

Brains are physical organs with an estimated 86 billion neurons, special nerve cells that receive, process, and store information when they receive electrochemical signals from our sensory organs. Neurons communicate with each other by transmitting electrical and chemical signals through synapses connectors located in gaps between them. Each neuron cell has between a few synapses to many thousands of synaptic connections, with perhaps more than a trillion in the average brain.[219] [220] [221]

Neurons are organized into neural circuits, ensembles of cells defined by their synaptic connections that dynamically adjust to the strength and frequency of electrochemical signals by modifying the strength and durability of syntactic junctions to encode experiences and behaviors. This “syntactic plasticity” underlies our cognitive functions including learning, memory, and decision-making.[222] [223] [224] [225] [226] [227] [228]

{Sensory Registers}

Memories are created through a process that begins with ingestion of stimulus through dedicated, (unimodal) neural networks for each of our five senses of sight (iconic), sound (echoic), smell (olfactory), taste (gustatory), and touch (haptic)[229] [230] [231] [232] at a rate of about billion bits per second.[233] The vast majority of sensory intake is devoted to subconscious regulation of necessary body functions such as breathing, heart rate, sleep, and digestion.[234] [235] [236] About 80% of those signals are iconic and 10% are echoic, with the last 10% distributed between olfactory, gustatory, and haptic.[237]

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{Memory and Retrieval Cues}

The encoding process also stores "retrieval cues" that assist in recalling information when it might be useful.[257]

The memory encoding process also stores "retrieval cues" that assist in recalling information when it might be useful. This phenomena applies to a remarkably wide range of factors, including the when and where, other people who were present, and other situational details such as appearance, smell, and colors.

> ['Memory-Related Encoding-Specificity Paradigm: Experimental Application to the Exercise Domain' by Danielle Yanes, Emily Frith, and Paul D Loprinzi. *The European Journal of Social Psychology*, 2019 Sep 27;15(3):447-458. doi: 10.5964/ejop.v15i3.1767. PMID: 33680140; PMCID: PMC7909183.]
>
> ['The effect of contextual cues on the encoding of motor memories' by Ian S. Howard, Daniel M. Wolpert, and David W Franklin. *Journal of Neurophysiology*, 2013 May;109(10):2632-44. doi: 10.1152/jn.00773.2012. Epub 2013 Feb 27. PMID: 23446696; PMCID: PMC3653044.

{The Doorway Effect}

The power of cues for recall can be observed in the common "doorway effect" - forgetting why we have walked into a room until returning to where we started and observing the cues. This is due to context-dependent memory, leaving a space where the cues are observable. Perhaps we remember we went to get scissors after seeing gift wrap spread on a table, or that we wanted to retrieve a tape measure after seeing an open catalogue for carpet.

> ['Doorways do not always cause forgetting: a multimodal investigation' by Jessica McFadyen, Christopher Nolan, Ellen Pinocy, David Buteri, and Oliver Baumann. *BMC Psychology*, 2021 Mar 8;9(1):41. doi: 10.1186/s40359-021-00536-3. PMID: 33685514; PMCID: PMC7938580.]
>
> ['The Encoding Specificity Principle: The Silver Lining of Remote Exams' by Dr. Sean Hutchins (May 6, 2020). The Royal Conservatory. Accessed online May 25, 2026 at: https://www.rcmusic.com/about-us/news/the-encoding-specificity-principle-the-silver-lini]

['The neurobiological foundation of memory retrieval' by Paul W Frankland, Sheena A Josselyn, and Stefan Köhler. *Nature Neuroscience*, 2019 Oct;22(10):1576-1585. doi: 10.1038/s41593-019-0493-1. Epub 2019 Sep 24. PMID: 31551594; PMCID: PMC6903648.]
['Walking through doorways helps remembering, but not for long' by Noah A. Crockett, Dani Parra, Abigail C. Doolen, and Gabriel A. Radvansky. *Memory & Cognition* (2026). https://doi.org/10.3758/s13421-025-01832-8]

Cues might also might be that we remember the meaning of a sentence much better than we remember the specific words in that sentence.[258] [259]

{Memories and Language}

We can perceive information and create memories without language, but without memories language would be impossible.[260] [261] [262]

Ironically, our linguistic and lexical repertoires shape the memories that we store, and our interpretation of them. If our language community does not have a word capable of conveying a our interpretation of a memory we cannot share it with others in our information environment.
['From Humboldt to Wittgenstein-Linguistic Picture of the World' by Natalia Tomashpolskaia (2022).]
['Language is more abstract than you think, or, why aren't languages more iconic?' by Gary Lupyan and Bodo Winter. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 2018 Aug 5;373(1752):20170137. doi: 10.1098/rstb.2017.0137. PMID: 29915005; PMCID: PMC6015821.]
['"The Limits of my Language are the Limits of my World": The Scientific Lexicon from 1350 to 1640' by Begoña Crespo García and Isabel Moskowich-Spiegel Fandiño. *SKASE Journal of Theoretical Linguistics*, 6(3), 20-33. [1]]\[*Tractatus Logico-Philosophicus*. Wittgenstein, Ludwig 1922. London: Kegan Paul, Trench, Trubner Co., Ltd.]

For example, near the equator some languages do not have a specific word for snow,
['Foggy connections, cloudy frontiers: On the (non-)adaptation of lexical structures. Front Psychol. 2023 Mar 1;14:1115832. doi: 10.3389/fpsyg.2023.1115832. PMID: 36936013; PMCID: PMC10014924.]
['Languages Support Efficient Communication about the Environment: Words for Snow Revisited' by Terry Regier, Alexandra Carstensen, and Charles Kemp. *PLoS One*. 2016 Apr 13;11(4):e0151138. doi: 10.1371/journal.pone.0151138. PMID: 27073981; PMCID: PMC4830456.]
and some language communities that do not utilize mathematics lack words for numbers.
['Exact Number Concepts Are Limited to the Verbal Count Range' by Benjamin Pitt, Edward Gibson, and Steven T. Piantadosi. *Psychological Science*, Volume 33, Issue 3. https://doi.org/10.1177/0956797621103450]

[‘You can't do the math without the words: Amazonian tribe lacks words for numbers’ by Caleb Everett. *Cognitive Science*, February 21, 2012.]

{Ambiguity in Spoken and Written Language}

{Memory Minders - Poetry}

Just as beer was a way to preserve food before refrigeration, poetry and song were used to retain information by encoding information using rhyme, meter, alliteration, and predictable phrasing.[263] [264] [265] [266] In the modality of spoken language contrast to our expectation about remembering the exact words in literary text, poetry and song modalities fix the gist of the story instead of requiring fidelity in words and punctuation. [267] [268] [269]

{Decoding}

This speaks to the power of collective memory before writing was available (about 5,000 years ago) when stories were how our ancestors captured, preserved , and taught their cultural knowledge and beliefs through entertainment and rituals.[270]

[1] ‘Engaging patients and citizens in digital health technology development through the virtual space’ by Romina Helena Barony Sanchez, Laurie-Ann Bergeron-Drolet, Maxime Sasseville, Marie-Pierre Gagnon. *Frontiers in Medical Technology*. 2022 Nov 25;4:958571. doi: 10.3389/fmedt.2022.958571. PMID: 36506474; PMCID: PMC9732568.

[2] ‘From Paper to Screen: Transitioning conventional posters to digital posters for environmental sustainability’ by Petrus Gogor Bangsa (2024). Environment-Behaviour Proceedings Journal, 9(SI23), 321–326. https://doi.org/10.21834/e-bpj.v9iSI23.6175

[3] *Managing Government Records Directive, M-12-18*. Jeffrey D. Zients, Acting Director, Office of Management and Budget, and David S. Ferriero, Archivist of the United States, National Archives and Records Administration. August 24, 2012.

[4] *Athenäum* by Friedrich Schlegel (1772–1829). Volume 1, Part 2, Fragment 80 (1798).

[5] ‘Secretary of Defense James Mattis’ by David Lauterborn. *Military Magazine*. December 1, 2016. Accessed February 22, 2026 at: https://www.historynet.com/interview-with-general-james-mattis/

[6] *The idea factory : Bell Labs and the great age of American innovation* by Jon Gertner. Penguin Press, New York, 2012. See page 200/1.

[7] *The mirage of continuity : reconfiguring academic information resources for the 21st century*. Brian L. Hawkins and Patricia Battin editors. Council on Library and Information Resources ; Association of American Universities, Washington, D.C., 1998. See page 7/4.

[8] *The mirage of continuity : reconfiguring academic information resources for the 21st century*. Brian L. Hawkins and Patricia Battin editors. Council on Library and Information Resources ; Association of American Universities, Washington, D.C., 1998. See page 7/4.

[9] *Origins of the modern mind : three stages in the evolution of culture and cognition*, by Merlin Donald. Cambridge, Mass. : Harvard University Press, 1991. See pages 2-3.

[10] *The sixth language: learning a living in the Internet age*, by Robert K. Logan. Caldwell, N.J. : Blackburn Press; 2004. See page 19/2/2.

[11] *The information: a history, a theory, a flood* by James Gleick. New York: Pantheon Books; 2011. See pages 411-412.

[12] *The idea factory : Bell Labs and the great age of American innovation* by Jon Gertner. Penguin Press, New York, 2012. See page 200/1/2.

[13] *Barnhart Concise Dictionary of Etymology*, Robert K. Barnhart, editor. New York : Harper Collins Publishers, c1995. See page 419.

[14] ‘Language and thought are not the same thing: evidence from neuroimaging and neurological patients’ by Evelina Fedorenko and Rosemary Varley. *Annals of the New York Academy of Sciences*. 2016 Apr;1369(1):132-53. doi: 10.1111/nyas.13046. Epub 2016 Apr 20. PMID: 27096882; PMCID: PMC4874898.

[15] *Metaphors of memory : a history of ideas about the mind* Douwe Draaisma. Cambridge University Press, Cambridge, U.K. ; New York, 2000. See pages 24-25.

[16] *Theaetetus*, lines 191a–196c

[17] ‘Assurbanipal’s iPad: Wax Boards in the Ancient Near East’ byMichele Cammarosano and Katja Weirauch. *The Ancient Near East Today* 9.7. Accessed at: https://anetoday.org/wax-boards-near-east/

[18] ‘Material characterisation of the Neo-Assyrian writing boards from Nimrud’ by Diego Tamburini, Joanne Dyer, Francesco Palmas, Caroline Cartwright, Jonathan Taylor, and Rebecca Stacey (2025). Journal of Archaeological Science, 178, 106218. doi.org.

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