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Literacy Revolution: How the New Tools of Communication Change the Stories We Tell

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LITERACY REVOLUTION: HOW THE NEW TOOLS OF COMMUNICATION

CHANGE THE STORIES WE TELL

A culminating thesis submitted to the faculty of Dominican University
in partial fulfillment of the requirements for the
Master of Arts in Humanities

by

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San Rafael, California
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Advisor's Page

This thesis, written under the direction of the candidate's thesis advisor and approved by the Chair of the Master's program, has been presented to and accepted by the faculty of the Humanities department in partial fulfillment of the requirements for the degree of Masters of Humanities. The content and research methodologies presented in this work present the work of the candidate alone

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ABSTRACT

The transmission of culture depends upon every generation reconsidering what it means to be literate. The way we consider ourselves to be a literate species is changing, which puts us at a unique turning point in human history. Verbal literacy, or the ability to read and write, is slowly being replaced by visual literacy as a primary tool for human communication. As a culture, we tend to underestimate the creative ferment of our increasingly visual world. The linear, structured pathways of traditional literacy are shifting towards a creative and participatory pursuit of unstructured information that emphasize dimensional thinking. The acceleration and disruption of literacy in the 21st century is fueling new patterns of cognition and changing the way we tell stories. As the parent of a ten-year old son, I was perplexed to watch him resist traditional methods of literacy in favor of non-linear, visual storytelling. It seems possible that children of his generation will acquire knowledge by the process of finding information rather than learning it. Reading and writing has served us well for thousands of years and broadened the capacity for logical thought, but our dependency on writing is decreasing as we process and store knowledge in a communal capacity. As a result, the cultural authority of written language is changing along with the cultural memory that it preserves. I wanted to understand what our son might gain and lose as his reading and writing skills are slowly eclipsed by visual literacy. Human brains will continue to grow symbiotically with new technological tools, but will our imagination expand along with our intellect? The wiring of the world gives rise to new narratives, and the modern language of visual literacy provides a potent storytelling medium for the future.

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Introduction

"Man is suspended in webs of significance he himself has spun."[1] *Max Weber*

The idea for this thesis began with a series of perplexed observations about how our ten-year-old son was learning to read and write. Because he is the offspring of two humanities-centric parents, we were caught off guard when he struggled and then resisted to adopt the text-based lens through which we saw the world. The imaginative dimension that written text has provided to us was lost to him. He was a creative thinker, but traditional reading and writing was not the way he absorbed information. He was steeped in the digital nativism of his generation, and as a visual learner, he was able to synthesize visual information at a rate and fluency that left us way behind. We joined the circle of hand-wringing parents who did not recognize this foreign way our child was acquiring, processing and comprehending information. It seemed impossible that such a wide disparity could open so quickly and redefine what it means to be a literate human being. At the critical threshold of his ten-year-old mind, we could not tell if his innate visual fluency would translate to the analytical meaning-mapping that enlivened the way we had learned to read, write and think.   We subscribed to Voltaire's idea that "writing is the painting of the voice and the more it resembles it, the better it is."[2]

It can be hard to keep pace with an intellectual revolution while it is happening, but the way we consider ourselves to be a literate species is changing. Fueled by our increasing digital fluency, the technology of writing is slowly being replaced by visual literacy as a primary tool for human communication. Verbal literacy is the ability to read and write and relies on an understanding of spelling, syntax and grammar, whereas visual literacy is the ability to

understand, create and communicate information graphically. A visually literate person interprets and makes meaning from non-linear information presented in the form of images or multimedia. For the literacy revolution happening in the 21st century, I had a front-row seat watching our son migrate away from verbal literacy as new patterns of his cognition were being fueled by the tools of visual literacy. There were things he would gain and lose as this modern visual language eclipsed his reading and writing skills, and I wanted to move beyond parental bewilderment to understand what Harold Innes called the "bias of the new tool."[3] It seemed unlikely that a literacy divide was going to open up chasm-like and separate the way my son and I perceived the world. The most intriguing shift was his changing cognitive capacities; to use the famous advertising slogan from Apple: I watched him "Think Different." I wanted him to love books, but I recognized what a creative thinker he was without them. It was stories I did not want him to live without.

Clive Thompson points out in *Smarter Than You Think* that studying the past becomes oddly reassuring because a pattern emerges; we can be optimistic about our cognitive future because it closely resembles our cognitive past. In order to find something comparable to the acceleration and disruption happening in digital literacy today, I was curious about the emergence of literacy itself. The invention of the printing press, the Industrial Revolution, the telegraph—each invite comparisons to the modern literacy revolution but represent a revitalization or amplification of verbal literacy. Going back to the pre-literate process that linked visual representation to linguistic and conceptual information is critical to understand the literacy threshold that we stand at now. The cognitive neuroscientist Alison Gopnik offers a long game point of view:

New tools have always led to panicky speculation….the novel, the telegraph, the telephone, and the television were all declared to be The End of Civilization as We Know It, particularly in the hands of the young. Part of the reason may be that adult brains require a lot of focus and effort to learn something new, while children's brains are designed to master new environments spontaneously. Innovative technologies always seem distracting and disturbing to the adults attempting to master them, and transparent and obvious—not really technology at all—to those who encounter them as children.[4]

In the first two chapters of this paper, I weave my observations as a parent with research on the burgeoning field of data visualization, which I consider to be the modern language of visual literacy and a potent storytelling medium in the future. In Chapter 3, I consider the idea of "Cognitive Art"[5] as a critical enhancement of our symbolic capacities that explores the creative intersections of text, image and design. In Chapter 4, I compare our modern metamorphosis of visual literacy to the "tools for thought"[6] that several Mesopotamian cultures used with their respective writing systems, and in Chapter 5, I consider the concept of creative "flow" and the changing ways that we access it.

The spread of literacy relies upon storytellers to enliven the fullness of our human identity. I began this project with a conventional humanities bias: in this digital revolution, we have more to be lost than to be gained by distancing ourselves from written words. The theologian John Dunne called the empathetic experience of reading and writing as "passing over;" this describes the process through which we can leave our own consciousness and pass over into the consciousness of another person, history or culture.[7] It seems impossible to think that traditional literacy will disappear down a digital rabbit hole, since we have too much of our intellectual identity tethered to it. It also seems impossible, and even downright naïve, to deny the growing symbiosis between our human brains and the new tools of communication. It seems

too early to understand exactly *how* this literacy revolution is changing the ways we read, write and think. Yet John Leonhard reminds us that "to learn, we become as children. We seek out our own ignorance. Now and then we follow the mind of someone who knows what we do not. We yield to the rhythm of the storyteller."[8] I was curious to know who the new storytellers are, and to understand how the stories of the future will be told.

[1] Clifford Geertz, *Interpretation of Cultures* (New York: Basic Books, 1973), 5.

[2] Drucker, Johanna. "Art Meets Technology: The History and Effects of the Alphabet," Interview by David Boulton. *Children of the Code*, September 12, 2003.

[3] Ibid., 8.

[4] Alison Gopnik, "Screen Bees," New Yorker, November 28, 2016.

[5] This is a term coined by Philip Morrison, a physicist at MIT who uses it to describe maps, charts and diagrams and graphs.

[6] Clive Thompson, Clive. *Smarter Than You Think, How Technology Is Changing Our Minds for the Better* (New York: Penguin Books, 2013), 9.

[7] Maryanne Woolf, *Proust and the Squid, The Story and Science of the Reading Brain* (New York: Harper Perennial, 2007), 7.

[8] John Leonhard, "The Metaphor of the Book," (lecture given at the Texas Library Association Annual Conference, Texas, April 26, 1996).

Chapter 1 | A Case for Visual Literacy

"Like the bees, we live by the report of others. Unlike the bees, we can invent new worlds, construct them out of sonic vibrations, ink or pixels. Sometimes those worlds deceive and confuse; at other times, they tell us something revelatory."[9] Alison Gopnik

Back-to-school Night

My introduction to visual literacy happened at our son's fourth grade back-to-school night. The teachers carefully told a roomful of parents that they would no longer be teaching cursive handwriting and traditional composition, and planned to replace a portion of the writing curriculum with "Design Thinking." After an expectant hush, they described that a portion of this "curriculum pivot" would focus on new storytelling mediums using visual metaphors. As students absorbed emerging technologies and learned to synthesize increasingly complex information, Design Thinking would teach them some essential, non-linear cognitive tools.

A collective bubble of incomprehension arose over the room. A tentative hand went up. "So you are teaching the kids how to draw?"

"No, this is not an art class. This is practicing new skills of merging written words with visual literacy."

A stony silence ensued. The teacher tried again. "This generation of students will need more than written words to convey complex ideas and express themselves. Their dependency on technology makes them visual learners. This requires a synthesis of both words and images to process the emerging modern language of data visualization."

I was suddenly dropped into a *Peanuts* movie, listening to the omniscient adult voice droning about non-linear storytelling, interdisciplinary collaboration, layered hierarchies of information, and convergent emotive/functional design. Were we really talking about emojis at back-to-school night? What exactly is the modern language of visual literacy? I thought of our son, who struggled to finish a *Hardy Boys* book that summer and boycotted writing in his journal because his hands were not strong enough to hold a pencil for more than twenty minutes. I knew he was not learning as much as he could with books and pens alone and the advice to increase his typing skills was not helping his writing fluency either. Was Design Thinking a fashionable detour from the fundamentals of written expression, or was it a brave new world of interdisciplinary, visual literacy that will define how kids learn and move through the world?

Some New Vocabulary Words

Not to be daunted by a fourth grade curriculum, I left the classroom that night and began to tease out the definitions of these entirely new concepts. Design Thinking is the brainchild of Stanford's Institute of Design, known as the "D School." Founded in 2004, Design Thinking is a collaborative philosophy of innovation that stretches linear thinking into systems thinking. As the educational engine that drives technological innovation in Silicon Valley and beyond, Design Thinking offers a new model of interdisciplinary education and a roadmap away from centuries of intellectual specialization. The D School developed a K-12 curriculum guide to introduce some of these ideas into the classroom by drawing on methods of math and engineering, ideas from the arts, and tools from social sciences.[10] All the new words I heard at

back-to-school night were meant to foster visual, creative and collaborative learning, and so far that was fine with me. However, the drift away from cursive handwriting and traditional composition towards "visual storytelling" is what gave me reason to pause.

I learned that "visual storytelling" was a close cousin to "data visualization"-- a way to uncover patterns with visual representations in text-based information. We recognize these as infographics, the explanatory combinations of text and abstract visuals that can include maps, charts, illustrated diagrams. We see them everywhere from airplane instructions to newspaper graphics. Data visualization compresses information and makes it manageable so that our small working memories can manipulate and ponder it. That helps us see information in new ways, which presumably gives us greater insight for understanding and problem-solving.[11] In the world of visual literacy, data visualization is the modern language of storytelling that expands our meaning-making capacity by integrating complex information with visual metaphors. The best examples feel dynamic even though they are static, because the mind zooms in, measures and manipulates the visual information. A viewer does not so much read an abstract infographic as much as study, analyze and explore it.[12] The quick-time learning increases the cognitive speed, breadth and synthesis of information that our brains can process. As a cornerstone of Design Thinking, data visualization provides a new opportunity for "connect the dots" insights as our human consciousness is reshaped by technology.

But I was not convinced. Teachers, academics and mothers who like to see their children's nose buried in a book or scribbling in a summer journal-- we are verbally literate people. We assume that our most concentrated thinking happens when we are reading and writing. The ubiquitous visual learning on computer screens is held to be a lesser standard for

verbally literate people. Although we are comfortable discerning meaning from the "flatland"[13] of paper, we do not give the same credence to the way visual people can scan, decode and map a visual landscape. Artists occupy the top of the food chain of visual learners; we take their visual learning capacity seriously because they translate it into a craft that we admire. But visual storytelling sounded suspiciously like thought-bubble cartoons or mind mapping— perfectly good tools but not the generative thinking I did while reading and writing text on a page. Yet when I studied a complex data visualization, I realized that the mental experience is similar to studying a work of art, except the "art" is data. If I learned to read infographics the same way I learned to read a book, does it force my mind to process more information with greater speed and fluency, or am I just taking a mental shortcut?

Making Mental Room for New Tools

Theoretical physicist Frank Wilczek argues that three areas of human cognition are being permanently transferred over to our technology: calculation, translation and recognition.[14] Because we can "offload" these cognitive functions, we have more room in our neural networks for associative, creative thinking. Instead of memorizing facts, we only need to learn how to retrieve them. Think of all the ways we are already dependent on computers to perform these functions for us, and consider how nascent most of the technology is. Yet technology writer Clive Thompson describes the impact of communication technology another way: because today's digital tools allow for prodigious external memory, they make it easier to connect between people, ideas and bits of news that were previously invisible.[15] The technology of writing has served all of these functions for thousands of years, but our

dependency on writing is decreasing as we process and store knowledge in a communal capacity. This gradual migration towards a communal mind, or what Marshall McLuhan (1911-1980) referred to as "Global Knowing" has a significant impact on our individual sense of memory and identity.

Visual literacy and Design Thinking emphasize dimensional thinking that can process complex, unstructured information. Educators are just beginning to understand how to teach these skills. With a greater awareness of multiple types of intelligence and learning styles, visual literacy is a powerful communication tool that is constantly and dramatically improving for educators today. Maryanne Wolf explains how teaching to multiple intelligences today compares to the teaching practices of the emerging literacies of Mesopotamian cultures: "The act of teaching not only requires a firm knowledge of the subject, but also forces the teacher to analyze what goes into the learning of a particular content. Moreover, good teaching renders the multiple dimensions of the subject more visible...the gradual process of learning how to teach the earliest writing systems forced our world's first reading instructors to also become the world's earliest linguists."[16]

The digital strategies and tools that support reading and writing in the modern classroom are mind-bending for fans of text-based reading and traditional compositional skills. Using them, kids learn to read "deeply," engage in synchronized editing with their teachers and explore collaborative writing assignments with their peers. An example is the program Screencastify, a Chrome extension, which lets students record a video of what is happening on their screen while voicing an explanation. A student could pull up a digital copy of a book, find evidence to argue a point, and explain her thinking orally. Everything is documented on the

computer, as well as the "writing" which is translated from voice to text, allowing the teacher

to see the student's thought process.[17] This is a visual and oral alternative to note-taking, but is

it a creative work-around of critical writing skills or a way to access the thinking of a student

who may not get the ideas out fast enough on paper? The technology is so new that it is hard

to know the long term impact of these new tools on knowledge acquisition. Emerging literacy

requires new strategies of metacognition, a strikingly similar process that our Sumerian

ancestors experienced:

> A major contribution of early Sumerian writing is the way that teaching methods promoted conceptual development. Requiring Sumerian pupils or any children to learn semantically and phonetically related words helped them recall the words more efficiently, increase their vocabulary, and increase their conceptual knowledge. In current terms, Sumerians used the first known metacognitive strategy to teach reading. That is, Sumerian teachers gave their pupils tools that made explicit how to learn something, and how to remember it.[18]

 The key in modern classrooms is teaching kids to understand their own cognitive needs and

patterns, to advocate for themselves and to recognize how many powerful digital tools are

available to amplify many different learning styles.   The linear, structured pathways to

knowledge acquisition are shifting towards a creative, participatory, hyperlinked pursuit of

information. Children in the 21st century will become literate by finding information rather

than knowing it.

Making Meaning in a Complex World

Digital storytelling uses a range of narrative images, which gives the mind room to scan,

roam and free-associate the different visual components. It might be tempting to assume this

form of storytelling is just playing around with the newest technological tools, but such play can

lead to discoveries and make connections in student's mind that might not have been made

otherwise. Visual literacy brings new dimensions of opportunity to "analytical images"—what

MIT physicist Philip Morrison called "cognitive art"—images that include graphs, charts,

diagrams, and maps. Unfortunately, these tools are usually compartmentalized and confined to

certain disciplines: graphs are traditionally used in math class, diagrams in biology class, and

maps in geography class. Design Thinking and visual literacy are providing a new, interrelated,

interdisciplinary box of conceptual tools in order to match different forms of intelligences with

an increasing amount of information as we move beyond the era of Big Data.

The technology historian George Dyson frames the value of extracting meaning from

increasingly complex information this way: "We now live in a world where information is

potentially unlimited. Information is cheap, meaning is expensive. Where is the meaning? Only

human beings can tell you where it is."[19] Human narratives become aggregated on a massive

scale to glean insights about our patterns and behaviors; we see ourselves through the eyes of

our data but struggle to extract meaning on such a large scale.

Fourth graders do not have to wade through a world of data to glean insights about

their lives, but their tools for mapping meaning as they get older will be very different from

ones their parents used in the late 20th century. In their world of emerging visual literacy, it

makes some sense that the creative engine to fuel cognitive breakthroughs would be a dynamic

hybrid medium of visual narratives.   As we make the transition from a reading and writing

brain to a digitally enhanced visual brain, our astonishing complexity as a literate species

reveals how the brain rearranges itself in order to learn a new intellectual function:

> We now know that groups of neurons create new connections and pathways among
> themselves every time we acquire a new skill. Computer scientists use the term "open

architecture" to describe a system that is versatile enough to change- or rearrange- to accommodate the varying demands on it. Within the constraints of our genetic legacy, our brain presents a beautiful example of open architecture. Thanks to this design, we come into the world programmed with the capacity to change what is given to us by nature, so that we can go beyond it. We are, it would seem from the start, genetically poised for breakthroughs.[20]

What intrigued me was the fact that data visualization—the synthesis of text and images to tell complex stories—is hardly a new invention. The history of art, from pictographs to pop art, provides countless examples of how our species has used this highly effective communication innovation to tell stories. Well-designed visual information provides the combinatorial way that we—and especially children-- can leapfrog to increasingly complex ideas, moving away from linear thought patterns towards holistic systems analysis. Edward Tufte, a pioneer in the field of data visualization who is known as the "Galileo of Graphics,"[21] says, "Most of my work had been about secretly trying to make people smarter—smart in terms of science, seeing, information and art. The science and the art, at least at a high level, have in common intense seeing, a bright-eyed observing and deep curiosity."[22]

In this context, teaching fourth graders how to organize visual information into systems of meaning might be more important than learning traditional reading and writing composition, but change can come at a price. There are certainly skills, like writing a letter to a friend, that my ten-year-old son might leave behind. Socrates argued that alphabetic writing was a mere memory aide that would not benefit humans in any meaningful way, and that only living men who had oratory skills had the power to impress ideas. The same may be said for the slow phasing out of reading and handwriting as a primary communication transmitter, but it is

possible that will we look back on the early 21st century as the irreplaceable communication

shift that catapulted human knowledge into vastly bigger arenas.

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[9] Alison Gopnik, "Screen Bees," New Yorker, November 28, 2016.
[10] "The D School's K-12 Network," Stanford University, accessed April 10, 2017, https://dschool.stanford.edu
[11]LJA Theory of Knowledge, Wordpress, 2015, accessed April 10, 2017, https://www.fastcodesign.com/1665149/why-infographics-matter-video
[12] Ibid.
[13] Edward Tufte, *Envisioning Information*, (Cheshire, CT: Graphics Press, 1990), 1.
[14] Ibid.
[15] Clive Thompson, *Smarter Than You Think, How Technology Is Changing Our Minds for the Better* (New York: Penguin Books, 2013), 8.
[16] Maryanne Woolf, *Proust and the Squid, The Story and Science of the Reading Brain* (New York: Harper Perennial, 2007), 37.
[17] Katrina Schwartz, "18 Digital Tools and Strategies That Support Students' Reading and Writing," KQED Mindshift (2016): Accessed March 1st, 2017, url: *https://ww2.kqed.org/mindshift/2016/08/19/18-digital-tools-and-strategies-that-support-students-reading-and-writing.*
[18] Maryanne Wolf, *Proust and the Squid*, 38.
[19] George Dyson, "Information is Cheap, Meaning Is Expensive," interview by The European. October 17, 2011.
[20] Maryanne Wolf, *Proust and the Squid*, 17.
[21] Edward Tufte, *Envisioning Information*, Introduction.
[22] Edward Tufte, "Edward Tufte Wants You to See Better," interview by Flora Lichtman. *Science Friday*, January 18, 2013.

Chapter 2 | Cartographers of Visual Literacy

"We thrive in information-thick worlds because of our marvelous and everyday capacities to select, edit, single out, structure, highlight, group, pair, merge, harmonize, synthesize, focus, organize, condense, reduce, boil down, choose, categorize, catalog, classify, list, abstract, scan, look into, idealize, isolate, discriminate, distinguish, screen, pigeonhole, pick over, sort, integrate, blend, inspect, filter, lump, skip, smooth, chunk, average, approximate, cluster, aggregate, outline, summarize, itemize, review, dip into, flip through, browse, glance into, leaf through, skim, refine, enumerate, glean, synopsize, winnow the wheat from the chaff and separate the sheep from the goats.[23]" Edward Tufte, *Envisioning Information*

Minard's Map

When our son enters high school, he might learn about Napoleon's Russian Campaign of 1812. He will learn about the epic loss of life and retreat by the French Grand Army that was driven by Napoleon's misguided attempt to invade Russia. 422,000 soldiers left Poland in the spring of 1812, only 100,000 reached Moscow and only 10,000 returned. It is a story that inspires reflection of the merciless thirst of military glory and Napoleon's particular breed of ego-driven madness. There are numerous written narratives of this singular event, but a once obscure map by Charles Minard (1781-1870) captures the details of this disaster with haunting clarity. A French civil engineer, Minard's map is widely considered by modern leaders in the field of data visualization to be one of the best statistical drawings ever made.[24] (see figure 1.)

Figure 1- Charles Minard's map-the brown line indicates advancing troops, the black line represents retreating French troops.
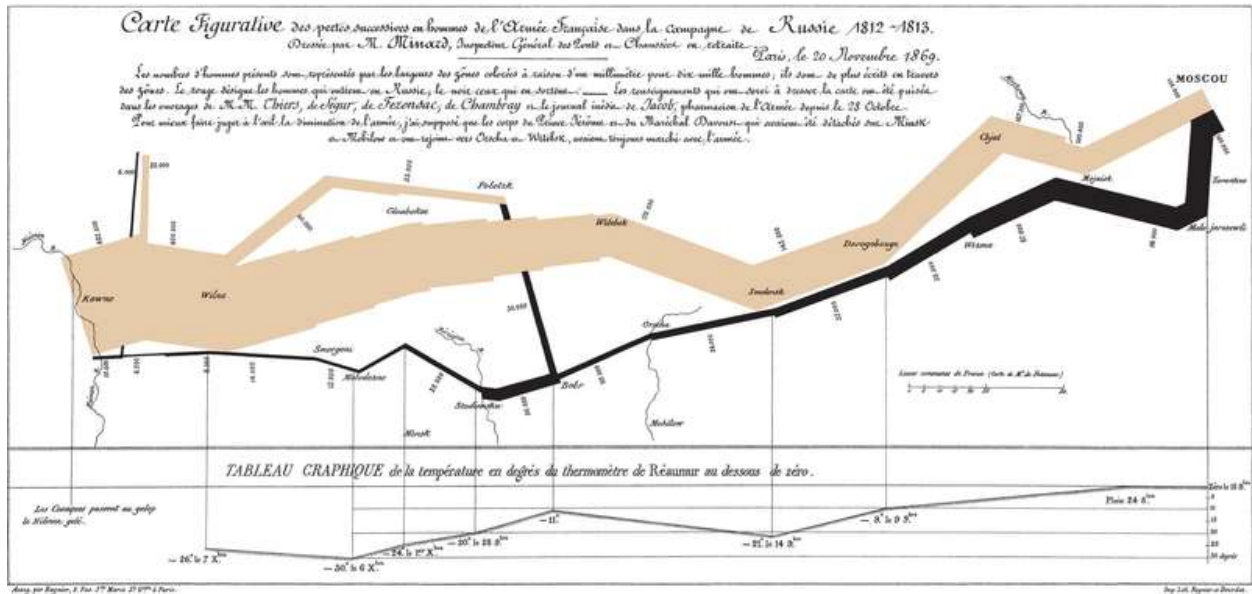
The wide brown band represents the large French army marching to Moscow and the black lines represent the increasingly small band of retreating soldiers. The chart shows geography, time, major battles, plummeting winter temperatures, and the direction of the army's movement, including river crossings. There is a complicated and layered amount statistical detail represented in this image, yet because of its uncomplicated graphics, we get an intuitive snapshot of the event and its sprawling, tragic proportions. Two of the map's visual details evoke a particularly distilled power. The far left corner of the map that shows the beginning and end of the campaign with the comparison of departing troops as a wide brown band and returning troops as a wispy thin black line. The second poignant detail is the Berezena River, represented by a small squiggling line that intersects the retreating army, where 20,000 men died trying to cross under heavy attack. The French now use the expression, "C'est la Berezena" to describe a total disaster.[25] Minard was a cartographic pioneer who made

the map a half century after Napoleon's Russia Campaign, and his dramatic depiction of this tragic tale in a single image "defies the pen of the historian in its brutal elegance."[26]

Minard did not invent the medium of data visualization, but his map is a profound example of synthesizing complex information into a visually expressive image. His map tells a powerful and complex story without a lot of words—like "War and Peace" told by a visual Tolstoy.[27] Unlike an illustrated diagram, Minard's map is an abstract visual that compresses information and makes it manageable so that our working memory can study, analyze and explore it. The quickly gleaned insights from studying Minard's map do not tell the entire historical narrative of the Russian Campaign, but it is remarkable how immediately and intuitively a wide scope of information, and even insight, can be absorbed.

New Storytellers

"The world has changed and it is data that has changed it;"[28] data designers are pulling us into a new frontier of human communication. Data designers are the hybrid artist/statistician/storytellers who are slowly reinventing the way we read visual information. Proponents of this field argue that data visualization provides the necessary semiotic ingredient to catapult our digital trajectory into a new sphere of human language and communication. Well-designed graphic information is the lifeboat from which we can explore the expansive sea of data that washes over us every day. It is a sign of how fluidly this discipline is evolving that nobody can agree on a definitive name: "data design," "design thinking," "data visualization," "information architecture," "information graphics," and "visual analytics" all describe the emergent field that will define the next generation of digital fluency and become more valuable

as our need to understand a more complex world increases. The names may switch around, but the influence of data visualization is profound.

"The purpose of visualization," says Ben Shneiderman, founding director of the Human-Computer Interaction Laboratory at the University of Maryland, "is insight, not pictures."[29] Data visualization is not a new tool for conveying complex information, but rather a tool that has been enhanced in the last decade in order to absorb the deluge of information around us and it is hard to know which came first: the data or our demand for it. Now that our task is to extract meaning from it, we need an upgraded cognitive filter and processing system. Richard Saul Wurman, a pioneer in the field of data visualization and founder of the TED conferences, says that information is all around us, but so is non-information:

> There is a tsunami of data that is crashing on the beaches of the civilized world. This is a tidal wave of unrelated, growing data formed in bits and bytes, coming in an unorganized, uncontrolled, incoherent cacophony of foam. It's filled with flotsam and jetsam. It's filled with the sticks and bones and shells of inanimate and animate life. None of it is easily related; none of it comes with any organizational methodology….The tsunami is a wall of data- data produced at greater and greater speed, greater and greater amounts to store in memory, amounts that double, it seems, with every sunset.[30]

Transparency and New Ways of Looking

What is the best way to communicate meaning from all this data? Journalism is a great example of a storytelling medium that has been completely transformed by data visualization in the last decade. Data journalism has been propelled by a growing movement for transparency across the globe, and is driven by a cross-disciplinary field that combines data analysis, graphics, and spreadsheets with news stories. These tools are slowly decommissioning the writing-intensive field of journalism by presenting a story through a data lens and presenting it

visually so that it immediately communicates meaning. The goal is to present data-based visual

narratives that achieve the same thoughtful analysis as an article or essay. This potentially leads

the reader to draw wide-ranging insights in the same way Minard did with his map—by

transforming rigorous, data-driven, statistical analysis into an elegant, distilled and provocative

visual synthesis. The treasure trove of data in Wikileaks, the wars in Iraq and Afghanistan (two

of the most documented wars in history), patterns of global finance, recession and trade,

political movements; it seems that globalization has made the world smaller while our data

about everything in it has grown infinitely larger.

One of the most important reasons for this shift happened in 2009 when President

Obama, as one of his first legislative acts, announced that the US government would launch a

new site: data.gov. Suddenly, anyone could peruse 1,500 datasets collected by the

government, with mind-boggling scope of the mundane and dramatic details about American

life. The data is not new, but the single portal of access is, as well as the download capacity

because datasets can be published as spreadsheets. Spurred by transparency campaigners,

many governments followed the US, and this data deluge became a boon to journalists whose

access to massive data was previously obscured by the least accessible format possible: books.

Traditionally, statistics of the scope found in data.gov were published in books, then

Adobe PDF files, which are essentially digitally formatted books and have no real use for anyone

who wants to analyze, manipulate or translate the statistics visually. Simon Rogers, a reporter

and editor of the Guardian's Datastore, describes how the demand for transparency grew

alongside the widening statistical and visual skills of journalists: "In the past, we all relied on

official bodies to tell us what we needed to know; it didn't matter if the data was aggregated

and analyzed for us. But now we trust governments very little, and traditional media outlets

even less. We want to know the numbers behind the stories ourselves—to see if we are bring

told the truth and discover our own stories."[31] Big Data provided a whole new capacity for

decentralized storytelling:

> If a dataset is published as a spread sheet it's suddenly easier to use. If that data is
> properly formatted, i.e. country names have codes on them so you can tell the
> difference between "Burma" and Myanmar," suddenly you can start mashing data
> together, combining poverty rates with carbon emissions or crime figures with
> economic growth, for instance. Then you can start to create journalism which either
> works in words or graphics, or both. Sometimes just reproducing a table tells a story.[32]

Rogers claims that when data.gov opened a floodgate of data, the game-changer for

data journalism happened in 2010 when data was released about the military events of

Afghanistan and Iraq. He claimed this was the "Wikileaks war logs."[33] The new format meant

that the data could be visually mapped, not so differently from how Minard did it but with the

added power of technology and complexity of details. This type of analysis was simply not

possible in other wars, where statistics were not as accessible to the press. Minard's map tells

a story of numbers, and there is a clarity that comes from the lack of narrative overlay. Rogers

sees this way of telling stories as an urgent new path for journalism: "There are still reporters

out there who don't get what all the fuss is about, who don't want to know about maths or

spreadsheets. But for others, this new wave represents a way to save journalism: a new role

for journalists as a bridge and guide between those in power who have the data (and are

rubbish at explaining it) and the public who desperately want to understand the data and

access it but need help. We can be that bridge."[34] Giorgia Lupi, a contemporary data designer,

goes even further than being a bridge, and instead stakes her ground firmly in the "data

humanism"[35] camp and the ways that data can speak to the fullness of our humanity:

Big Data doesn't belong to a distant dystopian future; it's a commodity and an intrinsic and iconic feature of our present— like dollars, concrete, automobiles and Helvetica. The ways we relate to data are evolving more rapidly than we realize, and our minds and bodies are naturally adapting to this new hybrid reality built of both physical and informational structures. And visual design—with its power to instantly reach out to places in our subconscious without the mediation of language, and with its inherent ability to convey large amounts of structured and unstructured information across cultures—is going to be even more central to this silent but inevitable revolution.[36]

A Potent Tool

Data journalists are powerful new storytellers using a potent medium. Consider the impact of studying Minard's map for even ten or twenty minutes, and then spending the same amount of time reading an article or a book about Napoleon's Russia Campaign. It is more than the efficiency factor that makes this new information medium seductive; it is the visceral insights that visual analytics provide.

With such a powerful communication tool, the risks are plentiful and there is the potential that these modes will be used as propaganda or to mislead people based on the data designer's biases. Minard's map, it could be argued, tells a powerful antiwar story. Data can be manipulated, or as Simon Rogers says "mashed up", to reflect the journalist's biases; this is hardly something new. The danger with this new medium is that if people only rely on the instant gratification that data journalism provides without digging a few layers deeper into clarifying details, the visual "story" has not created insight, but rather thin or false information. With the exclusive emphasis on visual cognitive enhancement, data visualization winnows the other sensory skills that have played crucial roles at different evolutionary junctures to enhance our communication skills and convey meaning.

The Experiment of "Dear Data"

Like every other information medium of the 21st century, letter writing is being replaced by the progressive brevity of email, texts and social media posts. Yet personal correspondence is a quiet indicator of the semiotic shifts that underlie human communication. Written communication, with its collaborative give-and-take exchange of information, is a way to translate, measure and record the infinite ways people observe and participate in daily life. Two women designers, steeped in the emerging field of data visualization, embraced the "analog" medium of old-fashioned written correspondence with a decidedly modern twist.

Dear Data is the fascinating yearlong experiment of written and visual correspondence undertaken by two information designers, Giorgia Lupi, an Italian woman living in New York and Stefanie Posavec, an American woman living in London. Lupi and Posavec are "data craftswomen" who "switched continents to get to know each other through the data they draw and send across the pond."[37] As data designers who love to draw, they wanted to "speak" the language of data as their mode of communication and get to know each other better by "sketching" the data of their lives. They picked a weekly topic about their daily life—sleep patterns, public transportation use, how often they gave or received compliments—recorded the data, interpreted its meaning, rendered this data on a postcard with a hand-drawn visualization and a code to translate the image, and mailed it overseas every Monday morning. The catalyst for their collaboration was the fact that they shared unusually parallel lives—they are the same age, they are both only children, and they both left their home countries to live in a metropolis across the Atlantic. These letters reveal an exchange of thoughtfully examined

lives in an unorthodox format. They provide a 21st century example of the way that letter

writing as a medium remains the heartbeat of human communication.

Reinvented Correspondence

What emerges from these seemingly mundane daily snapshots is a "slow data

transmission."[38] The culmination of this meticulous adventure in personal data collection is

something entirely different than the "selfie" orientation that pervades how we communicate

on social media: "We've always conceived *Dear Data* as a "personal documentary" rather than

a quantified-self project which is a subtle—but important—distinction. Instead of using data to

become more efficient, we argue we can use data to become more humane and to connect

with ourselves and others at a deeper level."[39] This distinction is a critical departure from the

echo chamber that most people inhabit in their social media bubble, where the only context for

meaning is the quantification of the self.

In this way, the reinvented correspondence in *Dear Data* is an intriguing indicator of

human semiotics that defies the two biggest communication challenges of the modern age: the

centrality of the self in social media, and the disappearance of the self into Big Data. By

sketching hidden patterns as life unfolded around them, Lupi and Posavec exhibit curiosity

about the larger patterns of each other's lives and reveal that letter writing remains a vital

cultural medium. Writing a letter requires time and intention—two dwindling elements of the

social media platforms that have replaced the epistolary form of communication. In this way,

Dear Data embodies the humane quality of letter writing and offers a singular alternative to the

influences of social media.

The *Dear Data* experiment was a side project for Lupi and Posavec, but it has become an underground movement for people working in the field of data visualization. *Dear Data* has become the model of personal correspondence for data designers, who find "data pen pals" to train a greater creative attentiveness to their lives. And although the medium of letter writing seemed to be a quaint, old-fashioned twist to the project, it stirred an awareness that perhaps letter writing deserves a place in the storytelling medium of the future. Our "tools for thought" often angle for efficiency and quicker-wittedness; Lupi and Posavec's work is a reminder that as literacy regenerates in the 21st century and as we bend to each new machine, there is no substitute for attentiveness. Lupi and Posevec hold up the necessary and fallible counterpoint to our infatuation with all this data; it is useful only to the degree that it translates to our humanity.

The "Uncapturability" of Language

A rebuttal to the power of Joseph Minard's map of the Russian Campaign, and perhaps the data visualists in general, is Toni Morrison's acceptance speech for winning the Nobel Prize in Literature in 1993. Minard's map conveys a complex poignancy that we can immediately intuit, yet if we want to understand the map's immense meaning, we have to spend the mental exertion to circle back again and again to what the narrowing lines signify. We have to imagine the humanity embedded in those concrete lines. Morrison points to the agency and impotency of language when it takes flight, and how this "uncapturability" is the underlying source of its power. The language of human expression has the ability to wield great power, but often shows up as a torn butterfly net as it strains to capture the magnitude of meaning:

The vitality of language lies in its ability to limn the actual, imagined and possible lives of its speakers, readers and writers. Although its poise is sometimes in displacing experience, it is not a substitute for it. It arcs towards the place where meaning may lie. When a president of the United States thought about the graveyard his country had become, and said, 'The world will little note nor long remember what was said here. But it will never forget what they did here,' his simple words are exhilarating in their life-sustaining properties because they refuse to encapsulate the reality of 600,000 dead men in a cataclysmic race war. Refusing to monumentalize, disdaining the "final word," the precise "summing up," acknowledging their 'poor power to add or detract,' his words signal deference to the uncapturability of the life it mourns. It is the deference that moves her, that recognition that language can never live up to life once and for all. Nor should it. Language can never 'pin down' slavery, genocide, war. Nor should it yearn for the arrogance to do so. Its force, its felicity is in its reach toward the ineffable.[40]

The tool of the written word is inherently imperfect, and the responsibility of writers is to celebrate the space between what can be captured with words and what cannot. The data visualizations at the heart of visual literacy tell complex stories. The question remains if this storytelling medium of the future offers enough for our human imaginations to yield to the rhythms of these storytellers, or will we always lean towards narratives that leave room for what we cannot explain? Morrison offers a siren's song to every lover of words and word-work and a call to embrace the meaning that rests in the spaces between the imperfectability of words.

[23] Edward Tufte, *Envisioning Information* (Cheshire, CT: Graphics Press, 1990), 50.

[24] Michael Friendly, "Visions and Re-visions of Charles Joseph Minard," *Journal of Educational and Behavioral Statistics* 27, No. 1, 37-57.

[25] Ibid.

[26] Etiennes-Jules Marey, quoted from "A Brief History of Data Visualization," by Michael Friendly, Datavis.com.

[27] Edward Tufte, *Beautiful Evidence* (Chesire, Conneticut: Graphics Press, 2006), 129.

[28] Simon Rogers, "How Data Changed Journalism," *Information Graphics*, (Cologne, Germany, TASCHEN, 2016), 64.

[29] Natasha Singer, "When Data Struts Its Stuff," *New York Times*, April 2, 2011.

[30] Richard Saul Wuman, *Information Graphics*, (Cologne, Germany, TASCHEN 2016).

[31] Simon Rogers, "How Data Changed Journalism," 64-65.

[32] Ibid.

[33] Ibid.

[34] Ibid.

[35] Georgia Lupi, "Data Humanism: The Revolution Will Be Visualized," *PRINT magazine*, Fall, 2016, 76.

[36] Ibid., 77.

[37] Giorgia Lupi, and Stefanie Posavec, *Dear Data* (New York: Princeton Architectural Press, 2016), xi.

[38] Ibid.

[39] Ibid.

[40] "Toni Morrison Nobel Prize speech" Nobelprize.org, accessed March 11, 2017. http://www.nobelprize.org/nobel_prizes/literature/laureates/1993/morrison-lecture.html

Chapter 3 | Art Becomes 21ˢᵗ Century Knowledge

"Artists may sometimes have the illusion of separateness, of isolation from society. But in reality they have always been society's early warning device; the best of them are connected, and more deeply encultured than most. It follows that the sources of their creativity, although partly personal, are also public, outside the nervous system, in the distributed system itself, that is—in culture, which encompasses, but supersedes the individual nervous system."[41] Donald Merlin

Art as a Cognitive, Communal Engine

Our son ended up loving his Design Thinking class. If verbally literate people do their best thinking by reading and writing, he thinks best by doing and collaborating. Perhaps it is a shift in maturity or temperament, but he seems to solve problems differently; where linear thinking may have provided one thought bubble over his head, Design Thinking allows him to pump out a few peripheral alternatives with room for some creative sloshing around. He seems more curious. His complaints about shaky, tired hands during compositional assignments diminished, and by relying more on visual and oratorical capacities, he seems to have tapped more imaginative stamina to hold facts and tell stories. Design Thinking may unlock broader channels of creative awareness that his shaky hands could not easily deliver using text-based tools. Last month, in an intriguing twist of curriculum, he practiced cursive and calligraphy on large canvases with acrylic paint, *in art class.* The parent's initial confusion about Design Thinking as an art class held a partial truth; the creative, communal way that Design Thinking fires cognitive engines is closely aligned to the way artists think and participate in culture. In a period of awakening visual literacy, it is important to understand how art has historically

enriched and modified the cognitive processes of humans, both individually and collectively. As

we migrate towards an increasingly visual frontier and understand more about artistically

rooted forms of intelligence, art becomes an essential springboard for 21st century knowledge.

Donald Merlin describes the communal context of the artist within a cultural-cognitive

community:

> Human cultures can be regarded as massive distributed cognitive networks, involving
> the linking of many minds, often with large institutional structures that guide the flow of
> ideas, memories and knowledge. Artists are highly placed within these cultural-
> cognitive networks, often serving as the creative engine that drives much of the
> enterprise. They influence the cognitive activity of their particular tribe or generation.[42]

The fields of neuroaesthetics and data visualization are coinciding as visual literacy

ascends to a primary form of literacy. By using visual metaphors to ignite pattern recognition

and fuel creative comprehension, these fields make a compelling case for what David

McCandless calls "beautiful information."[43] Neuroaesthetics studies visual perception,

cognition and the neural underpinnings of aesthetic experiences, and has provided a logical

springboard for advocates of visual literacy who see the brain/eye nexus as an essential scaffold

that can reckon with our data-deluged consciousness and construct a whole new realm of

abstract thinking. On the edge of this visually literate frontier is Edward Tufte, an early pioneer

in the field of visual analytics who has "inhabited the intersectionality of image, word, number

and art"[44] for decades. Tufte's rigorous theory of communication via analytical imagery is

grounded by the vision research of Semir Zeki, who coined the phrase "neuroaesthetics". As

creativity moves from a soft to hard science, the aesthetic influences on the human brain are

being reevaluated through the lens of neuroscience, and scientists have taken a new interest in

exploring art's insights on visual perception.

Words, Untethered

Contemporary Chinese artist Xu Bing (b. 1955) explores the fertile and productive

relationship between image, language and meaning. He created "A Book From the Sky" in

1988, which consisted of large installations of books and hanging scrolls with text printed from

woodblocks that Bing carved by hand over several years. Bing invented 4,000 Chinese

characters for the woodblocks that were recognizable elements but were illegible linguistic

signs. He was interested in the idea of "performance language"[45] and how language has the

potential to be reimagined. The Chinese poet Bei Dao says of Bing's characters in A Book From

the Sky: "You are nothing but a pictograph that has lost its sound."[46]   "A Book From the Sky" is

a mesmerizing experience for a non-Chinese reading spectator that creates a sensation of

literally swimming in words. It illuminates the subconscious power of words, and how they

hold silent mirrors for examining the world even if they do not contain meaning. But for

Chinese-reading spectators, the experience is a disconcerting re-evaluation of the attachment

we have to words and the immutability of their meaning. The Chinese critic Hsingyuan Tsao

explains:

> To the extent that "A Book From the Sky" is identifiable as 'language' and yet stands
> empty, we are confronted with linguistical "ruins" that threaten our faith in the
> persistence of a shared dogma, a shared common sense. On the one hand, this is a
> disturbing, even startling experience that undermines our feelings of communal
> solidarity and our assumed competence within our community, underscoring perhaps a
> sense of the ultimate precariousness of the human experience. However, as the
> reassurance of shared linguistic "objectivity" recedes from sight, we are renewed as
> unique, contingent, and provisional beings that struggle with imagination to quite
> literally make sense of the nonsense. Xu Bing's work forces us to appreciate our own
> role in the making of meaning, renewing our confidence in our own subjectivity.[47]

Bing's radical attempt to untether words from their meaning invites comparison to data

visualization's godfather Edward Tufte's concept of Forever Knowledge, but from a

diametrically opposite position. Where Bing hopes that "A Book From the Sky "resists any

reduction to specific abstract explanations,"[48] Tufte wants to create cognitive art so that

limitless information can be understood without words. An example of Forever Knowledge is a

series of stainless steel wire sculptures that Tufte created in the form of Richard Feynman's

famous diagrams that illustrate complex space-time patterns of particle and waves of quantum

electrodynamics. These deceptively simple sculptures embody nature's subatomic behavior—

some of the most complex representations in theoretical physics—yet the Feynman-Tufte

Principle is that a visual display of data should be simple enough to fit on the side of a van.[49]

Tufte wants to apply the fundamental principles of science to visual analytics so that our mental

architectures have a built-in support for learning about cause and effect:

> The findings of (science) are forever, because the laws of nature apply to every particle
> in the universe forever. And so knowledge about that is, in a sense, forever
> knowledge…I wanted to do things that have that universality and forever-ness of
> science. And so I've been preoccupied with how the fundamental tasks of thinking can
> be replicated in our designs of information, so that our architectures support learning
> about causality - that's a forever cognitive task - and support making comparisons,
> which is a fundamental forever task. Our displays help us assess the credibility of a
> display, and how do they know that? That's a forever task. So the mind-information
> relationship and learning from evidence, optical evidence, is a forever problem.[50]

Coming from different disciplines, Tufte and Bing both push us to consider the meaning and

future of cognitive art by studying the relationship between image, language and meaning.

Tufte is an information designer and statistician, yet both he and Bing are working from the

creative edges of their fields to push new cultural terrain by reexamining the meaning of what

Tufte calls "self-confirming" words.[51]

Bing's work provides an unusual comparison to data visualization, yet "A Book From the Sky" resonates with a strange interaction of visual design and language. Our subconscious minds have absorbed words for two millennia, and extracted meaning from the combination of words with images for even longer. In *The Dream of Perpetual Motion* novelist Dexter Palmer writes:

> We are forced to see that words are not themselves ideas, but merely strings of ink marks; we see that sounds are nothing more than waves. In a modern age without an Author looking down on us from heaven, language is not a thing of definite certainty, but infinite possibility; without the comforting illusion of meaningful order we have no choice but to stare into the face of meaningless disorder; without the feeling that meaning can be certain, we find ourselves overwhelmed by all the things meaning might mean.[52]

These ideas resonate with the deconstructive influence of Jacques Derrida's *Of Grammatology*. Derrida (1930-2004) radicalizes Swiss linguist Ferdinand de Saussure's (1857-1913) insight that "language is a system of differences without positive terms."[53] Writers and artists, with perhaps a more indelible influence than philosophers, explore the emptiness of words and the ways we map meaning on our cultural identity. Georgia Lupi, Edward Tufte and other pioneers in their field are reimagining a new world of meaning from the rich contours of visual design "with its power to instantly reach out to places in our subconscious without the mediation of language, and with its inherent ability to convey large amounts of structured and unstructured information across cultures."[54] Will art in the 21st century become cognitively enhanced art, or could we argue that art, equal to writing, has been enhancing human cognition all along? In other words, are data visualizations the cave drawings of Human Art 2.0?

The Thinking Eye

Called the "Leonardo da Vinci of data,"[55] Edward Tufte wants us all to "see without words" and become smarter in the process. His world-view is multidimensional, and he

translates the contours of complex information into a rich, visual world of experience and

measurement. His work embodies a cross-pollination of insightful visual and functional

information. Tufte describes the evolving role of visual cognition as "The Thinking Eye":

> Seeing is thinking. The light comes in through the lens and is focused on the retina. And the retina is pretty much working like brain cells. It's processing. And then the two optic nerves are sending what we now know are 20 megabits a second of information back to the brain. That's sure a lot better than my Wi-Fi at home. So the seeing right then is being transformed into information, into thinking, right as that step from the retina to the brain. And the brain is really busy, and it likes to economize. And so it's quick to be active and jump to conclusions. So if you're told what to look for, you can't see anything else. So one thing is to see, in a way, without words.[56]

 This intense, analytical seeing fuels the attentional engines in science and art, but Tufte argues

that the visual reasoning emerging from this highly efficient retina/brain connection will be

increasingly honed as our information throughput increases:

> Unlike speech, visual displays are simultaneously a wideband and a perceiver-controllable channel…small multiples whether tabular or pictorial, move to the heart of visual reasoning- to see, to distinguish, to choose….their multiple smallness enforces local comparisons within our eyespan, relying on the active eye to select and make contrasts rather than on bygone memories scattered over pages and pages.[57]

Tufte wastes no time hand-wringing about the decline of verbal literacy; he sees the "bright-

eyed observing and deep curiosity"[58] of visual analytics as an efficient adaptation to an

increasingly complex world. Tufte's multi-disciplinary lens provides an early voice and an

academic rigor to the thriving generation of information designers today. Without resorting to

mere simplicity, he pushes this new field to create designs that are so good they are invisible.

Tufte treats data like good writing that needs to be clearly and beautifully conveyed;[59] he shows

us how and why we think visually. For the verbally literate among us, he instructs us to exercise

this neglected dimension of our understandings even if we do not tread into the field of data

visualization ourselves:

We envision information in order to reason about, communicate, document, and preserve that knowledge- nearly always carried out on two-dimensional paper and computer screen. Escaping this flatland and enriching the density of data displays are the essential tasks of information design.[60]

Tufte makes such a compelling case for data design that I began to wonder what took our school (and every school) so long to teach it. My mind scrolled back to that fourth-grade back-to-school-night when I first heard phrases like non-linear storytelling, narrative design, layered hierarchies and visual metaphors; this was the modern language of data visualization that was pushing into our ten-year-old son's life. Yet there is clearly a tradeoff for phasing out the slower paced cognitive train of thought between pen, paper and text. The majority of parents I knew were alarmed that this curriculum interloper called "Design Thinking" was sidelining a portion of the traditional reading, writing and spelling time. Perhaps the fear of embracing new technologies is that we will not recognize our human stories anymore.

For Tufte, the digital medium is not the linchpin that has thrust data visualization into our lives since long ago we scratched words and images on stones and then used pens and paintbrushes and paper.[61] What has dramatically changed is the computing power that now infuses the data:

The digital world has opened up more possibilities with visualizations. But some of the most spectacular visualizations were done of all - in 1610 by Galileo, as he made his remarkable discoveries. So visualization is timeless, and the principles for showing information - like nature's laws - are timeless. So we can - I think I can learn more, a lot more sometimes, from 1610 and Galileo than I can learn from the last five years of looking at visualizations.[62]

The blazing path of data visualization is not necessarily changing the stories we tell, but it is requiring a cognitive shift and introducing what the writer Howard Rheingold calls new "tools for thought."[63] The challenge will be to fold this storytelling medium into our widening

cognitive tools and determine when and how to use it. In *Smarter Than You Think*, Clive

Thompson puts it this way:

> I'm not predicting that the written word, our oldest mass literacy, will disappear. In fact, it's likely to remain the go-to mode for expression. But as we develop ever more new modes for expressing our ideas and recording knowledge, the challenge will be to figure out *when* to use *which* form. When is text the best way to make a point? When is the moving image? Or photos, manipulations, data visualization? Each is useful for some types of thinking and awkward for others.[64]

Like other navigators of this digital sphere, Tufte emphasize that it is the deep, almost

meditative observation of data that provides a narrative, human context. His intense way of

seeing-- his "bright-eyed observations" sound more like an artist than a statistician. Our human

view of life is colored by what we measure, monitor and record, and the quality of our attention

has become the informational infrastructure of our reality.[65] Is data really our new and

necessary art form? It is hard to imagine standing at this transition of human literacy without

the cognitive engines of handwriting, reading and writing that have provided so much meaning

for thousands of years. But new technologies broaden old ones, and what has remained

constant is the creativity that humans bring to reimagined forms of communication.

[41] Donald Merlin, *The Artful Mind: Cognitive Science and the Riddle of Human Creativity* (Oxford, England: Oxford University Press, 2006), 14.

[42] Donald Merlin, 4.

[43] David McCandeless, "Learn data- visualization" Information is Beautiful," accessed December 2016, http://www.informationisbeautiful.net/blog/

[44] Edward Tufte, *Envisioning Information* (Cheshire, CT: Graphics Press, 1990), introduction.

[45] Simon Leung, "Pseudo-Languages: A Conversation With Weda Gu, Xu Bing and Jonathan Hay," *Art Journal*, Fall 1999, 87.

[46] Ibid, 88.

[47] Stanley Abe, "No Questions, No Answers: China and a Book from the Sky," *Duke University Press* 25, no 3 (1998).

[48] Ibid.

[49] Michael Shermer, "The Feynman-Tufte Principle," *Scientific American*, April 1, 2005.

[50] Tufte, Edward. "Edward Tufte Wants You to See Better," interview by Flora Lichtman. *Science Friday*, NPR Public Media, January 18, 2013.

[51] Ibid.

[52] Dexter Palmer, *Dream of Perpetual Motion*. (New York: St. Martin's Press, 2010), 220.

[53] "Derrida: The Father of Deconstruction," accessed April, 2017, https://newderrida.wordpress.com/category/derrida-and-saussure/

[54] Georgia Lupi, "Data Humanism: The Revolution Will Be Visualized," *PRINT magazine*, Fall, 2016, 76.

[55] Joshua Yaffa, "The Information Sage," *Washington Monthly,* May/June 2011.

[56] Tufte, Edward. "Edward Tufte Wants You to See Better."

[57] Edward Tufte, *Envisioning Information*, 32.

[58] Tufte,Edward. "Edward Tufte Wants You to See Better."

[59] Joshua Yaffa, "The Information Sage."

[60] Tufte, Edward. "Edward Tufte Wants You to See Better."

[61] Ibid.

[62] Ibid.

[63] Thompson, Clive. *Smarter Than You Think*," (New York: Penguin Books, 2013), 9.

[64] Ibid.

[65] Maria Popova, "A Lyrical Illustrated Serenade to How Attention Shapes Our Reality," Brain Picking, accessed December 2016, https://www.brainpickings.org/2016/09/07/dear-data-book/

Chapter 4 | History and Symbols

"With words we begin to leave traces behind us like breadcrumbs: memories in symbols for others to follow. Ants deploy their pheromones, trails of chemical information; Theseus unwound Ariadne's thread. Now people leave paper trails. Writing comes into being to retain information across time and space."[66] James Gleick

Imperfect Signposts

The transmission of culture depends upon every generation having to reconsider what it means to be literate. Humans are meaning-seeking animals; we rely on the creative adaptations of words and images to propel our intellectual identity. Clifford Geertz's definition of culture is "an historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic forms, by means of which men communicate, perpetuate and develop their knowledge and attitudes about life."[67] Our associative and analytical abilities allow humans to discern layers of meaning with these imperfect signposts called words: "The linearity of written language can cloud our minds to the multidimensionality of human thought. Many of us have a hard time thinking without the recourse to words. Hamlet, asked what he read, replied hopelessly, "Words, words, words." Imagination is far too complex to be hogtied to anything so limited."[68]

Words, as imperfect as they are, remain our most flexible tool for formalizing and organizing knowledge. We have spent the last two thousand years swimming in words that express, inform, analyze and amplify our cultural record. Is it possible to reach a point of saturation with a particular kind of literacy? This is not suggesting that the written word has exhausted its usefulness, although Zu Bing and Edward Tufte's "Forever Knowledge" offer some

intriguing alternatives, but perhaps the new tools of communication are bumping up against

the limiting nature of words. John Searle calls this a "linguistically-created reality" that

continually refers to other words until words become untethered from their meaning.[69]

Our digital tools are propelling us to reexamine what it means to be literate by

expanding new forms of literacy as well as alter our old ones. Text-based learners like me

sometimes forget that writing and reading are man-made technologies, and writing of any

kind—whether it is on paper, a computer screen, a tablet or a scroll—is not naturally

acquired.[70] Steven Pinker observes that the act of learning to read and write is closer to

cracking a code: "Children are wired for sound, but print is an optional accessory that must be

painstakingly bolted on." [71] Terrence Deacon provides another metaphor of the imperfect,

patchwork engineering that writing and reading requires of our brains:

> The question one has to ask from the present time looking back is: Are we well
> adapted to this? Are we really a symbolic species or is this just a kluge added on top
> of a primate brain not well designed for this? I think the evidence for the age of this
> probably can be best picked out by comparing to writing and reading. Writing and
> reading occurred recently. Therefore, whatever we use to do this was a kluge, that is,
> an engineering patchwork that just sort of barely gets by. We are not well-designed to
> do so and as a result a lot of people have difficulty acquiring writing and
> reading. There are many kinds of difficulty and many people will never be able to read
> or write because their brain hasn't had a chance, so to speak, to keep up with this
> process.[72]

Cuneiform and hieroglyphics were invented because the Sumerians and Egyptians were pressed

to explain the world symbolically by distilling their increasingly complex tracking and storing of

"too much information." Their writing systems were born from the need to meet the growing

communicative demands of a socially organized, trade-based, densely populated culture. The

oldest cuneiform tablets were used for business transactions, whereas hieroglyphics, despite

the fact that only a few people at the time could read them, reflected more of a public

language, documenting things like monumental languages, prayers, and records of historical

events.[73] We could look at the invention of written language as the precursor to stored data--

the original hard drive—that externalized information and organized our information and our

thinking. The written word is the mechanism by which we know what we know. We may wish

to understand the rise of literacy both historically and logically, but history and logic are

themselves the product of literate thought.[74]

For any parent trying to decode the elaborate and creative symbol and acronym-laced

language of their teenage children, studying the formations of Sumerian cuneiform and

Egyptian hieroglyphics draws some mesmerizing parallels. As a culture, we tend to

underestimate the creative ferment in our increasingly visual world that is rearranging our

capacity for symbolic inference. As a parent, I tend to dismiss our son's dependence on

technology, assuming that the text-based way I had leaped to abstract thought could not be

duplicated in a form of visual literacy. The capacity to symbolize expands two important

features of the human brain—our capacity for specialization and our capacity for making new

connections among association areas.[75]

Cuneiform and Hieroglyphics

Around 3300-3200 BCE, Sumerians developed a cuneiform system and Egyptian symbols

became hieroglyphics. To an untutored eye, cuneiform looks a lot like bird tracks imprinted in

clay tablets. The early Sumerian cuneiform was generally pictographic; like emojis, there was

not a lot of abstract thought required since the markings had a visual correlation to the object

represented. Many of these symbols were common visual shapes that could be found in the

natural world—rivers, snakes and trees. Perhaps a harbinger for our giddy emoji chatter, the

simple symbolic representations of cuneiform did not last long. There was a mysterious leap of

complexity as the symbols quickly became more abstract and logographic. This symbolic hurdle

probably had an impact on the Sumerians' cognitive functions, because in order to address the

double function of logosyllabary, "the circuits of the Sumerian reading brain had…considerable

more pathways in the visual association regions (that) would be necessary in order to decode

what would eventually become hundreds of cuneiform characters. Making such

accommodations in the visual areas is basically the equivalent of adding memory to our hard

drive."[76]

Maryanne Wolf, a director of the Center for Reading and Language Research, compares

today's digital "tools for thought" to the ways that Sumerian teachers promoted conceptual

development while teaching an increasingly complex system of symbolic language:

> What is historically humbling about Sumerian writing and pedagogy is not their
> understanding of morphological principles, but their realization that the teaching of
> reading must begin with the implicit attention to the principal characteristics of oral
> language. This is exactly what takes place today in the supposedly "cutting edge"
> curricula in our own lab where we incorporate all major aspects of language in our
> reading instruction. It makes perfect sense. If you believe you are the first reading
> people on earth, and have no prior methods to influence how you teach, you try to
> figure out all the characteristics of your oral language in order to create a written
> version. For the first Sumerian teachers this resulted in a long-lasting set of linguistic
> principles that facilitated teaching and learning and also accelerated the development of
> cognitive and linguistic skills in literate Sumerians. Thus, with the Sumerians'
> contributions to teaching our species to read and write, the story began of how the
> reading brain changed the way we all think.[77]

In current terms, Wolf is describing metacognition—giving students tools that made explicit

how to learn something and remember it.[78] The metacognition of emergent writing systems

like cuneiform present a critical comparison to the way we are struggling to acclimate to digital

literacy today. In *The Language Instinct*, Steven Pinker discusses the creative feature of

language and thought and another equally important combinatorial feature called *recursion*:
"Because human thoughts are combinatorial (simple parts combine) and recursive (parts can be embedded within parts) breathtaking expanses of knowledge can be explored with a finite inventory of mental tools." [79]

An entirely independent invention of writing happened in Egypt around the same time as Sumerian cuneiform was developing. Aesthetically beautiful and mostly logographic, hieroglyphs were very different looking than the crow-feet style of cuneiform, and are considered to be the most difficult and elaborate writing system in the world. Like today's data designers, the readers and writers of hieroglyphics had to possess a spectrum of skills—a highly visual memory, auditory and phoneme analysis and considerable cognitive and spatial flexibility.   Maryanne Wolf explains: "By the first millennium BCE the brain of an Egyptian scribe may well have required far more cortical activation and cognitive resources to handle encrypted meanings than was required for most other writing systems in all history." [80] The opposite of "Forever Knowledge," hieroglyphics was never designed to be widely accessible and became weighed down with layers of complexity and religious meaning (this was referred to as "layered hierarchies of information" at back-to-school night) to the point that it became readable to fewer and fewer people. Examining how our Egyptian and Sumerian ancestors made these cognitive leaps into early writing provides us with a special lens on ourselves as the symbolic representation and memory storage of written language is being expanded in the digital age.

After considering our ancestor's struggles with literacy, my thoughts return to our son. After his introduction to "Design Thinking" in the fourth grade, our son will likely continue to

rely less on narrative writing and reading as he reaches the workplace around 2030. Regardless of almost any professional field he chooses, he will probably need to have a working knowledge in the cross-disciplinary studies of systems analysis, statistics, design, and visual analytics. More importantly, he will need to extract a particular knitted-together meaning from the synthesized knowledge of these fields. As his teachers forewarned us in the fourth grade, he will need to be fully immersed in the modern language of data visualization. The first or second generation of the data cycle will be the distant past of the early 21st century; and like the increasingly complex cuneiform, our communication may become complex in ways we cannot guess. The metaphors to describe data will have evolved from a sea to a silo to a conveyance belt. We will somehow become more comfortable with so much information and connect it to what it really stands for: knowledge, behavior and people.[81]

⁶⁶ James Gleick, *The Information, A History, A Theory, A Flood* (New York: Vintage Books, 2011), 31.

⁶⁷ Clifford Geertz, *Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973), 89.

⁶⁸ John Leonhard, "The Metaphor of the Book," (lecture given at the Texas Library Association Annual Conference, Texas, April 26, 1996).

⁶⁹ Searle, John. "Language, Literacy and the Modern Mind, Meta-Cognitive Implications," Interview by David Boulton. *Children of the Code*.

⁷⁰ Anne Trubek, *The History and Uncertain Future of Handwriting* (New York: Bloomsbury, 2016), xiii.

⁷¹ Maryanne Wolf, *Proust and the Squid*, *The Story and Science of the Reading Brain* (New York: Harper Perennial, 2007), 19.

⁷² Deacon, Terrence "The Co-Evolution of Language and the Brain," Interview by David Boulton. *Children of the Code.* September 5, 2003.

⁷³ Drucker, Johanna "Art Meets Technology: The History and Effects of the Alphabet," Interview by David Boulton, *Children of the Code.* September 12, 2003.

⁷⁴ James Gleick, *The Information, A History, A Theory, A Flood* (New York: Vintage Books, 2011), 30.

⁷⁵ Maryanne Wolf, 29.

⁷⁶ Ibid., 14.

⁷⁷ Ibid., 39.

⁷⁸ Ibid., 38.

⁷⁹ Steven Pinker, *The Language Instinct* (New York: William and Morrow Publishers, 1994), 360.

⁸⁰Maryanne Wolf, *Proust and the Squid*, 46.

⁸¹ Georgia Lupi, "Data Humanism: The Revolution Will Be Visualized," *PRINT magazine*, Fall, 2016.

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Chapter 5 | Finding the "Flow"

"Language maps a boundless world of objects and sensations and combinations onto a finite space. The world changes, always mixing the static with the ephemeral, and we know that language changes, not just from edition to edition of the Oxford English Dictionary but from one moment to the next, and from one person to the next. Everyone's language is different. We can be overwhelmed or we can be emboldened."[82]   *James Gleick*

Unlocking the Creative Flow

With the invention of the Greek alphabet, the enhanced symbolic representations that our brains had adapted from visual cognition began to change. The alphabetic writing system began the era of literacy that we recognize today. Unlike the Sumerians and Egyptians, we associate writing with creative self-expression; externalizing our thoughts onto paper is also one of the best ways many of us think. In his book *Smarter Than You Think*, Clive Thompson explains the "extended mind" theory of cognition: "the reason humans are so intellectually dominant is that we've always outsourced bits of cognition, using tools to scaffold our thinking into ever-more rarefied realms. Printed books amplified our memory. Inexpensive paper and reliable pens made it possible to externalize our thoughts quickly."[83] Thompson gives an example of the way writing on paper is crucial to the thinking process, describing an exchange between physicist Richard Feynman and historian Charles Weiner. Weiner looked at Feynman's notebooks filled with equations and called them a "wonderful record of his work." Feymann responded that they weren't a record of his work—they were his work.

"I actually did the work on the paper," he said.

"Well," Weiner said, "the work was done in your head, but the record of it is still here."

"No, it's not a record, not really. It's working. You have to work on the paper and this is the paper. Okay?"[84]

There is a familiar ring to this exchange with most writers I know. Does the cognitive work happen in the brain or is it an interplay of the brain and hand moving across the page? Is the work on the page just a crutch to prevent us from forgetting the train of thoughts or a critical tool to organize our thinking? As Terrence Deacon points out: "The question is, do you invent words to represent something you're thinking, or do the words help you think things that you couldn't have thought before you had them?"[85] Every writer can attest to the fact that the act of writing, whether on a keyboard or with a pen and paper, cannot be untangled from the thought process itself, and generates the wonderful leaps of creative insights—what French polymath Henri Poincare called "sudden illuminations."[86]

In order to write this paper, I brainstormed ideas longhand on a yellow legal tablet, composed the body of work on a laptop and edited printed copies with a pencil—an inefficient system but a typical example of the simultaneous use of "extended mind" technologies that many of us employ these days. In *The Shallows*, Nicolaus Carr argues that the quality of our thought as a species rose with the ascendance of slow-moving, linear print and began declining with the arrival of the Internet. He claims that "I am not thinking the way I used to think."[87] Most of us would agree; we cobble together our own personal set of tools that can feel awkward at first, "trying on" different metacognitive strategies that slowly become second nature and therefore invisible to our own cognitive process. Writing can transform my thinking only after the point where I no longer have to struggle with the act of writing itself and experience those rare moments of "flow."

Laughing Hands

Our son struggles immensely to find his "flow" with writing. He mostly composes with voice recognition technology (his version of my yellow legal tablet), painstakingly writes the body of a text by knitting his "spoken" ideas together, and edits with profuse cutting and pasting, never once holding a printed product or pen in his hand. We figured out this was the most effective way to access his creative channels after he announced one day in the third grade that he "had a story stuck in his arm." I asked him for clarification before I unraveled the symbolism.

"It's in my head but I can't write fast enough while my ideas spill out fast enough because my hands are laughing. So it is stuck there like a peach pit."

"Your story is stuck because it has too many words in it?"

"Yes, it is too big, and my hands are laughing at me. I can't even hold a pencil for five minutes without my hands just shaking and laughing at me."

Evidently the keyboard was not a helpful tool to dislodge the blocked creative energy that was stuck in his arm in the form of a peach pit. He had a fairy tale project that loomed large in his mind, but his "peach pit" remained stubbornly stuck. After weeks of trial and error that mostly involved strengthening his fine motor skills, he had his own breakthrough one day on the way home from school.

"When I get home I want to a take bath and tell you a story. I mean I want you to write the story that comes out of my mouth because my hands are laughing like crazy today."

My job became clear—he needed a scribe. Two hours and twelve pages later, he was done. I scribbled madly to keep up. Without the inhibition of handwriting to slow him down, a

nine-pound baby of a story fell out of him with ten fingers and toes of fully formed narrative details. It was about a boyhood journey into the wilderness to slay a dragon and save his father's kingdom. He didn't miss a beat in the telling of it; it spilled out in paragraphs. He didn't need his laughing hands to find his voice. We emptied and refilled the bath with warm water three times before the peach pit was dislodged. He had found his flow.

Stretching Metacognitive Skills

In *The History and Uncertain Future of Handwriting*, Anne Trubek argues that voice recognition software may be the "purest" writing technology ever invented. Voice recognition returns us to the realm of speaking which is something most humans learn autonomously, unlike writing that must be taught.[88] Contemporary author Richard Powers has used voice recognition software for years and defends the practice as aiding his creativity: "Writing is the act of accepting the huge shortfall between the story in the mind and what hits the page…For that, no interface will ever be clean or invisible enough to get the passage right."[89] Reading and writing always require some extrinsic tools for thought, and can never be unmediated the way speech is. Andrew Ng, chief scientist at Internet giant Baidu and co-founder of education startup Coursera, says that the cutting edge of artificial intelligence (AI) is voice recognition, and that "in a few years everyone will be using speech recognition. It will feel natural. You'll soon forget what it was like before you could talk to computers."[90] Edward Tufte and other advocates of data visualization might argue that "reading" well-designed data will hone our visual literacy and become as second natured as reading books. The promise of visual literacy is

an expansion of the ways we organize information in our brains, expand our capacity for symbolic representation, map visual landscapes and access those "sudden illuminations."

All of us, including my son's generation, are struggling at the intersection of our mental habits and our creative instincts, trying to figure out the most effective digital tools that are the best fit for our brains. These are the same metacognitive strategies our Sumerian ancestors struggled with as they learned the new and awkward dance steps of emerging literacy. Metacognitive strategies help us find our flow. We spend a lot of time right now, both consciously and unconsciously, thinking about how we think, as well as the most effective tools to organize information and express ideas, and this sets the era of rising literacy apart from other eras of communication revolution.

The printing press, the telegraph, newspapers, even the keyboard—we've had to run to catch up with each novel medium that broadcasted wider circles of literacy and certainly altered our thinking along the way. The phenomena of changing mental habits are embedded so deeply into our modern collective consciousness that it is almost impossible to stand back and gain meaningful perspective on this unique moment in history. How will we define literacy in 20 or 50 years? Will it be primarily visual with foundational text-based systems of knowledge? Or will everything that was ever written down—the history of writing in a single memory chip—become part of our institutional knowledge and memory bank, accessed by our computer-enhanced brains that makes room for some unnamed type of intelligence? Or maybe the new literacy will be a hybrid: a "second orality"[91] that is combined with visually enhanced cognition. The act of writing and the knowledge it held for two millennia might become a new historicism.

I am quickly out of my league by even trying to guess, but that is the liberation of being caught in the middle of a literacy revolution; nobody really knows where this is going, and my guesses as an observant parent sound as plausible as anything else. I stick to the safe ground in this fascinating, modern epic by looking around for the storytellers and understanding how the stories will be told. It is impossible for anyone to know the contours of what Clive Thompson calls "the future of thought,"[92] because while the future is rooted in the present, and "many parts of our future have already arrived, even if they are only dimly understood."[93] The cultural authority of written language is changing, along with the cultural memory that it preserved. Where this story is going at this point in time is anyone's guess.

Why Write a Letter?

Around the time of the fourth grade back-to-school night, my husband and I had a fascinating dinner conversation with our children about writing letters. They knew letter writing to be the compulsory activity following birthdays and Christmas that expressed gratitude with as few words as possible, so they were floored when we told them about an enormous stack of juicy love letters that we wrote to each other before we were married. It never occurred to them to write letters for fun, or to express anything to another person in long- form writing beyond a brief thank-you note.

"Why didn't you just call each other?" Our son asked incredulously. The idea of writing as an act of free will was inconceivable.

"We shared different things in the letters than we would have over the phone." An unknowing silence met us, like the same one that met the teachers at back-to-school night.

"Why didn't you just text each other?" Our daughter's brain stuttered as she tried to image life without texts, Instagram, Snapchat and the other magic wands of communication that emerge from the little tablet velcroed to our hands in 2017.

As we described the epistolary exchange that cemented our family's future life together, they were bewildered by the fact that we would spend hours transmitting onto paper the bits and pieces of our days, with the hope that the descriptions of what we did might illuminate to each other who we were.

"Was it like reading each other's Instagram page?"

"Kind of," we replied. But to them, the idea of letter writing as a form of self-expression seemed hopelessly outdated, time-consuming and deeply unnecessary when you can convey so much more with an image and a few descriptive lines. Our stash of love letters from the prehistoric 1990s is irreplaceable, and I quietly lamented that the meaning and influence of these letters on our children's lives might be lost on them. In fact, they may not even be able to read them if they don't learn cursive in school. It seems impossible to imagine that our handwritten cursive might someday be beyond their reach, like a foreign language.

How many of us hold onto the stack of letters that my husband and I did, to remind us of who we were at a particular time of life? Our children may only guess at the longing, intimacy and hope that threads quietly just below the surface, without any keys, illustrations or clarifications. I wonder how their generation, fully indoctrinated to the world of data visualization, will recognize the art of human subtlety that reaches for words and ideas that can't be quickly conveyed, seen or rendered. In Toni Morrison's Nobel prize speech, she implores us to keep language at the center of our humanity as the necessary tool for knowing

the things that cannot be fully known: "Don't tell us what to believe, what to fear. Show us

belief's wide skirt and the stich that unravels fear's caul."[94] When I consider the invisible layers

of meaning that hover around the edges of intimate communication and come alive in a love

letter, I think even Georgia Lupi and Stephanie Posavec's creative observations cannot capture

this spirit. I admit to a distinct ambivalence when I think about giving up this way of

communicating; I feel that we are losing something immeasurably human. And although the

emerging tools of visual literacy may sharpen our habits of mind, it is hard to imagine being

untethered from the subjective experience of writing a letter. We need our stories, and the act

of writing itself clings like a phantom to our human identity:

> Perhaps writing at its very origins was a particular type of focal identity that by partially separating a thought or experience out from ourselves (putting it out there) allowed us and others to approach it (and us) in another way. So the process was one of partial disassociation and then re-association…almost as the act of cell division allows an organism to grow and develop. No wonder the Chinese thought of writing as incorporating the very energy of life itself.[95]

Despite moments of nostalgia, I remind myself that this is just the shifting sands of an

emerging, hopefully enlarging way of communicating; and trust that our children will figure out

other ways to reinvent a love letter.

[82] James Gleick, *The Information, A History, A Theory, A Flood* (New York: Vintage Books, 2011), 409.

[83] Clive Thompson, *Smarter Than You Think* (New York: Penguin Books, 2013), 6.

[84] Ibid., 7.

[85] Deacon Terrence, "The Co-Evolution of Language and the Brain," Interview by David Boulton. *Children of the Code.* September 5, 2003

[86] "French Polymath Henri Poincare on How Creativity Works," August 15, 2013, accessed March 2017, https://www.brainpickings.org/2013/08/15/henri-poincare-on-how-creativity-works/

[87] Nicolaus Carr, *The Shallows* (New York: W.W. Norton & Co., 2011), 5.

[88] Anne Trubek, *The History and Uncertain Future of Handwriting* (New York: Bloomsbury, 2016), xiii.

[89] Ibid., 91.

[90] "How AI Will Change Everything," interview with Andrew Ng and Neil Jacobstein, Wall Street Journal, March 7, 2017.

[91] *The Information*- Gleick writes: "In the 1960's and '70's, Walter Ong declared the electronic age to be a new age of orality—but a "second orality," the spoken word amplified and extended as never before, but always in the context of literacy: voices heard against the backdrop of ubiquitous print." 28

[92] Clive Thompson, *Smarter Than You Think*, 9.

[93] Ibid.

[94] "Toni Morrison Nobel Prize speech." Accessed March 11, 2017. http://www.nobelprize.org/nobel_prizes/literature/laureates/1993/morrison-l ecture.html

[95] Ewan Clayton, The Golden Thread, (Berkeley: Counterpoint, 2013), 355.

Conclusion

"Just as the brain detects patterns in the visual forms of nature — a face, a figure, a flower — and in sound, so too it detects patterns in information. Stories are recognizable patterns, and in those patterns we find meaning. We use stories to make sense of our world and to share that understanding with others. They are the signal within the noise. So powerful is our impulse to detect story patterns that we see them even when they're not there."[96]

Walter Ong (1912-2003), a Jesuit priest, philosopher and cultural historian, considered what it might be like to stand at the threshold between our pre-literate and literate past by imagining a culture where no one has ever 'looked up' anything.[97] Now try to imagine a culture where no one could ever forget anything; where the tool in your hand-- what H.G. Wells called the "World Brain"[98]—retrieves everything you and everyone else in the world have ever known or remembered. The written word is what binds all of our human knowledge, memory and identity together on that literacy continuum. Yet our dependency on written words decreases as we move closer to the "World Brain" end of the spectrum. Words have served us well as a repository for our thinking, our record keeping and our self-expression. But in the Information Age, our reliance on written words gradually decreases as the processing and storage of knowledge moves away from the individual towards a communal mind. Along the literacy spectrum, the tilt towards the "World Brain" has enormous implications for our singular sense of memory and identity.

It is practically impossible to untangle the formative technology of writing that has been internalized in our brains and has defined our individual and collective identity over thousands

of years. And it is equally hard to imagine memory and knowledge as entities that live in a tool

outside of our minds that are not known to us in a singular way. We are closer to that time

than many of us would like to acknowledge, and perhaps that is the reason for my white-

knuckled moments as a parent. The fact that our son is not learning cursive handwriting is

hardly the point; the idea of sending him out into this wilderness of osmotic minds and

machines is, well, a little terrifying. Will it make him a more dimensional thinker? I hope so.

But I am hedging my bet on the storyteller's power to leave a trail of breadcrumbs so that he

can find his way back to knowing the fullness of his humanity.

Donald Merlin explains how artists and storytellers, as deeply encultured members of

society, provide an early warning system that detects abstract and complex shifts in the cultural

community of mind:

> Human cultures can be regarded as massive distributed cognitive networks, involving the linking of many minds, often with large institutional structures that guide the flow of ideas, memories and knowledge. Artists are highly placed within these cultural-cognitive networks, often serving as the creative engine that drives much of the enterprise. They influence the cognitive activity of their particular tribe or generation (for artists, like everyone else, are situated in space and time), both by preserving and by modifying its symbols, images, and other expressive forms.[99]

Stories are universal, but the way we tell our stories change with every new tide of innovation.

As human thought co-evolves with technology, the narratives today rely more on non-linear,

hyperlinked, participatory information, rather than the structured information that carried us

on a wave of knowledge acquisition over the last two thousand years. Being a literate person in

the Information Age is less about knowing information as it is about finding information. While

we reorganize the information in our global village, "our outsourcing of memory (and) our

increasingly deft, search-engined powered skills (are) replacing the retention of knowledge in

our own brains with the on-demand access to knowledge in the collective brain of the internet." [100] The wiring of the world changes the way we tell stories, but the interplay of memory and identity, the adaption of new tools and the way we employ our symbolic capacities to detect patterns—these are storytelling skills that are upgraded with every reinvention of literacy. During times of disruption and acceleration, we assume that a technology-supported culture is so much better and so much worse than it actually is. After periods of resistance and begrudging adoption, we adapt because there is no other way to get beyond what David Foster Wallace called "Total Noise."[101]

This thesis began as a reflection on the divide of literacy that separated me from our son and the different tools that both of us use to acquire knowledge. From there, I became curious about the type of narratives emerging from this new literacy, along with the revelations and biases of the new storytellers. But for me, the critical takeaway about the literacy revolution we are experiencing today is the way it is changing our relationship with our memory, and consequently, our identity. Memory is embedded as a ghost-like presence in our identity; the progression of Alzheimers reveals how a person's identity recedes as memory fades. If we are increasingly relying on technology to hold our memories in a collective consciousness, what does that say about our sense of personal identity? I realized this is why verbally literate people like me and my husband are so perplexed, and even threatened by the literacy divide opening between us and our son: the predictability between words, knowledge, memory and identity was changing right before our eyes. Perhaps this drives the obsessive self-promotion of social media; "selfies" provide us validation while our personal identities gradually morph into the collective sphere.

I felt a wave of understanding for Socrates when I realized that his apprehension of the "technology" of writing may have stemmed from a similar association with memory and identity. Socrates had a vigorous distrust for the written word, because he believed that writing something on paper was a memory crutch and would undermine the "living knowledge" that existed in the oral tradition of debate. Socrates tells the parable of Thoth, the Egyptian god who invented writing and offered it as a gift to Thamus, the king of Egypt. Thamus warned that writing would make readers presume that they were wise when they were actually empty of knowledge, since knowledge stored is not really knowledge at all.[102] Socrates denied that writing can impress ideas or create memories; in his view, only living, speaking pupils of his (and only men) could imprint ideas reliably and permanently through the oral teaching of dialectical debate:

> The dialectician selects a soul of the right type, and in it he plants and sows his words founded on knowledge, words which can defend both themselves and him who planted them, words which instead of remaining barren contain a seed is vouchsafed for immortality, and its possessor the fullest measure of blessedness that man can attain to.[103]

Socrates imagined his oral teachings as a living writing because the rhythms of highly physical, participatory oral poetry had such a strong sensory appeal that memory linked the words to what the body had experienced. He considered the oral teachings that germinated in his own mind to be the "legitimate sons" that he was passing to the next generation of pupils, who would go on to inseminate the minds of future generations of pupils/progeny: "The goal of this scheme is the continuation of the same through personal renewal, without any mutation (and without any females); Socrates' dream is to clone himself."[104] It is probably safe to assume from this that Socrates had an association between memory and identity and the ways they

shape each other. The abstraction of alphabetic writing pulled oral poetry out of the corporal

realm and into a brave new world of analytical thinking. While the new technology of writing

churned and mingled with the oral traditions, many others besides Socrates "regarded the

abstraction of alphabetic writing, with its apparent censorship of the body, as a threat to the

continuance of cultural values and wanted writing to be used solely as a memory aid: writing

was considered not only impotent to impress but dangerously open to interpretation."[105]

Substitute paper for pixels, and some of us share a similar apprehension with Socrates

about our new communication mediums. Socrates was wrong about the future of writing and

its role in the preservation of cultural memory. But he was right about the incremental

siphoning of human memory as the written record of history grew, and he was also right about

the way our body disassociates from the knowledge in our minds. Ask most freshman in college

how many poems they have committed to memory, or whether second graders need to

memorize multiplication facts anymore. Or try to get through a dinner party without someone

checking their phone for a memory or factual stimulant (never mind a perfunctory plunge into

social media) and you can hear Socrates' howling admonition all the way back from ancient

Greece. Our memory and knowledge is slowly inhabiting our tablets rather than our minds.

Often quoted but rarely bookended together: William Faulkner said "the past is never

dead. It's not even past." William Gibson said, "the future is already here, it's just not evenly

distributed." The reinventions of human literacy live on that slippery timeline. New mediums

give rise to new narratives, and human literacy gleans meaning from information through cycles

of inundation, organization, distillation, extraction and animation. These days we seem to be

floundering somewhere between the inundation and the organization stage, but I'm getting

used to change that arrives and departs before I even wake up to it. As for the storytellers,

they ride out the changes by acclimating their tools of language and knowing what patterns to

look for. Like us, the storytellers of the future will undoubtedly struggle with the impotency

and agency of human language, no matter how wedded that language is with technology. The

power of the narrative transcends and transports, and the storytellers keep their ears pinned

low to the ground. I have an image in my mind of our son, sitting around a table with his

grandchildren seventy years from now, telling stories about his "laughing hands" and regaling

them about his school days as a child when his teachers wanted him to *think and write at the*

same time, with his hands. Imagine that? I think of my great-grandchildren shaking their heads

in disbelief when they consider the web-like way they assimilate knowledge with tools that I

cannot even dream up. However, they will hopefully recognize the stories for exactly what they
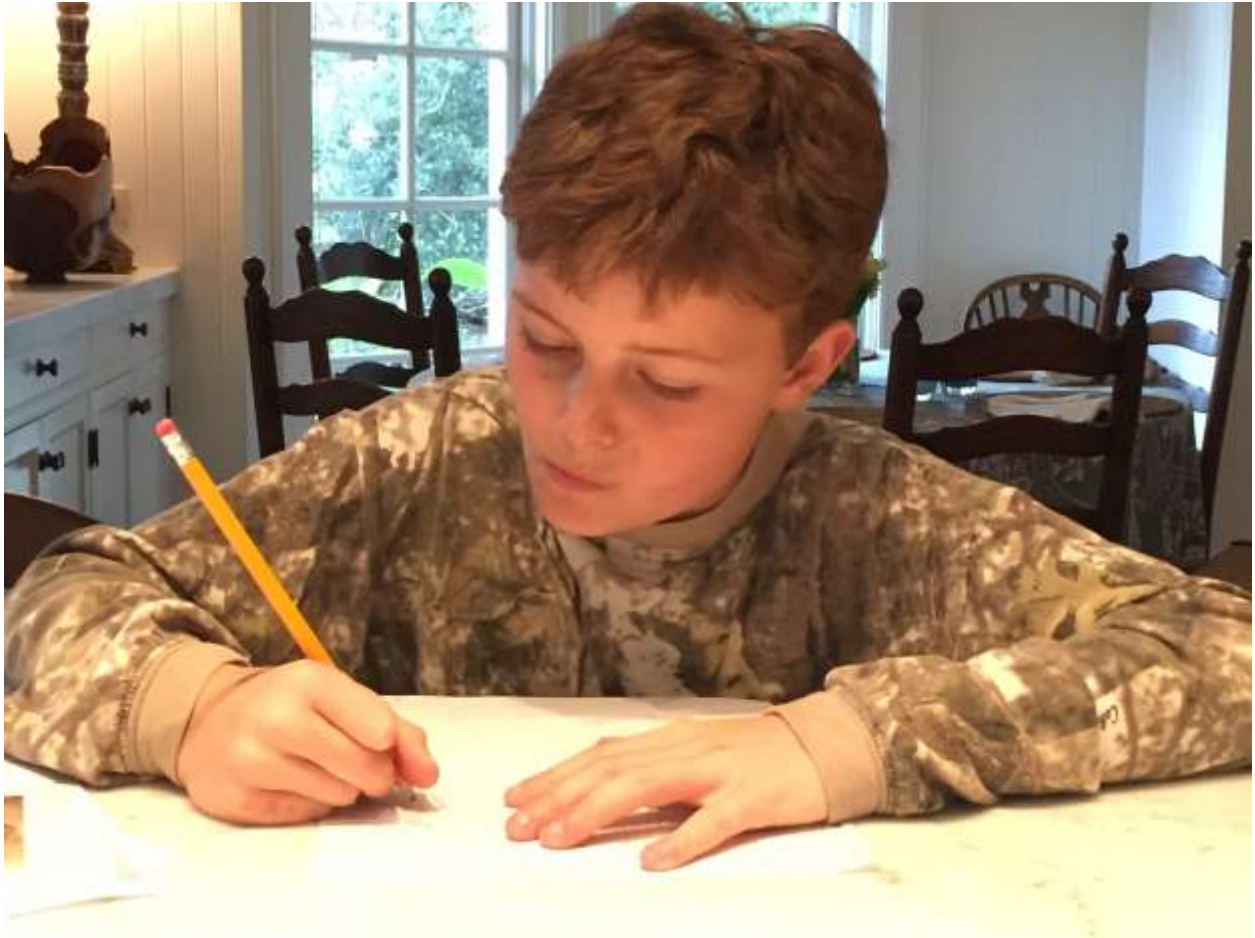
are.

Figure 2- the author's son.

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[96] Frank Rose, "The Art of Immersion: Why Do We Tell Stories?," Wired Business, 3/8/11.

[97] James Gleick, *The Information: A History, A Theory, A Flood*, (Vintage Books, New York, 2011) 28.

[98] Ibid, 415.

[99] Donald Merlin, "The Artful Mind: Cognitive Science and the Riddle of Human Creativity," Oxford University Press, 2006, 4.

[100] Maria Popova, "Tip-of-the-Tongue Syndrome, Transactive Memory, and How the Internet is Making Us Smarter," https://www.brainpickings.org/2013/09/13/clive-thompson-smarter-than-you-think

[101] James Gleick, *The Information*, 403.

[102] Maria Popova, "Tip-of-the-Tongue Syndrome."

[103] Laura Kendrick, *Animating the Letter, The Figurative Embodiment of Writing from Late Antiquity to the Renaissance*, (Ohio State University Press, Ohio, 1999), 26.

[104] Ibid.

[105] Ibid, 27.

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