

**Back to the Future**

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**Indianapolis Literary Club**

**April 15, 2013**

**Communicate: To impart knowledge, to make known to, divulge, announce, disclose, reveal, impart, transmit**

Several advances in the way we do all of this occurred around the middle of the 19<sup>th</sup> century, starting with the telegraph, that had far reaching effects on life. But I believe advances in communication a hundred years later had an even greater effect on how we function on a day to day basis. These include fundamental changes not only in lifestyle but in the workplace affecting those whose careers began in the 1950s and 60s, and that includes most of us here! Communication and computing since in the middle of the 20<sup>th</sup> century is what this talk is about

Standing in line at a McDonald's in Brunswick Georgia, I looked to my right and saw a family sitting in a booth. They were not paying attention to their meals or to each other. There was nothing special about them except each had her head slightly bowed looking down at a smallish object in her hand. There was no evidence of communication, at least between the occupants of the booth, but each was apparently involved in communicating, only with someone else, maybe not in Brunswick, or Georgia, or even the United States and maybe not with a person. Now my imagination takes over. I assume the two preteen age girls are playing a computer game on their smart phone or checking Facebook. The mother is texting her husband who is driving to Atlanta reminding him to.....(whatever). The grandmother is checking tomorrow's weather, why? just because she can and besides there is no one to talk to!

It is easy now and is becoming even easier to find a place to connect to the internet with Wi-Fi widely available. Prices for this service can vary according to where the service is being used and how long you sign up for. Compare \$3.00 an hour in a food court in Cartegena to as much as \$40.00 an hour on the Queen Victoria. Now, McDonald's, Starbucks and thousands of other businesses offer

this service to their customers free just to make them more likely to visit, remain, and spend money in their establishments.

Not the internet, but phone is the principal means of communication on a person to person basis. This requires both the sender and the receiver to have a phone as well as a contract with a provider. Cell phone service through towers is available nearly everywhere in the U.S.

Cell phones are even supplanting traditional phones for many who now consider the land line redundant and an unnecessary expense. Cell phone connection is designated 3 or 4G with the only difference being speed of signal transmission. Cell phone signals travel between phones through a network with an estimated 190,000 towers each with a maximum range of 21.7 miles.

A wireless call, not using cell towers, can be completed using a satellite phone with a signal going up to a satellite and then back to earth. Because of the extra distances travelled, there is an inherent delay in this transmission something that you all have heard during newscasts on your television.

Cell phones as cheap as \$14.99 can be purchased in the supermarket or convenience store. They use pre-paid minutes costing around \$30.00 for 500 minutes. The most expensive cell phone is the smart phone costing around \$500.00. These have many of the features of a computer. They can surf the net and access thousands of programs called Apps for everything from playing games to finding the closest pizza place and just about everything in between. Apple's Siri answers your questions with a computerized voice telling you the location of the nearest gas stations and the price of gas to the Zagat rating of a restaurant you may choose and it doesn't stop there. The GPS feature on the smart phone knows where you are and offers a voice supported navigation system that does nearly everything a \$2,000 in-car navigation system can do.

When a guest at a dinner party I attended asked what she should see visiting Copenhagen someone said, the "little Mermaid". From there a conversation took place around just how big this statue is. Guesses ranged from pretty big to pretty

small. Then one of the guests said, "The Little Mermaid is 4 ft 10 inches tall, Siri told me".

It is estimated there are 6 billion cell phones in the world of 7 billion plus people for a density of 87%. In the US, the number of cell phones is also 87% of the population. Those countries with the highest density of cell phones are Hong Kong 189% and Saudi Arabia 169%. The smallest cell phone density is in N. Korea at 4%, (compared to S. Korea at 108%)

The communication revolution that took place in the middle of the 19<sup>th</sup> century was the most important such advance since the printing press 400 years earlier. This revolution started with a successful telegraph communication between Washington DC and Baltimore in 1844. This was followed in 1858 by completion of a transatlantic telegraph cable. This cable functioned less than 3 weeks, but by 1866 reliable cable service was re-established and it has been in effect continuously since that time. The transcontinental telegraph was completed in 1861, and the railroad, in 1869. Finally, in 1902 completion of the Trans-Pacific telegraph cable made possible telegraph communication around the world.

When a big change occurs, as it did in the mid 19<sup>th</sup> century, the population responds. For example: Abraham Lincoln, an avid user of the telegraph, became the first "connected" president, but his messages were sent and received by an operator while the president composed and read them. Compare this with the communication/computing revolution of the digital age a century later that demanded active participation.

I believe response to change is either passive or active. With a passive response we are not required to take charge or immerse ourselves in the process to benefit. Passive involvement is like buying a ticket for the roller coaster, and then just going for a ride or purchasing an automobile and sitting in the back seat while the chauffeur drives. The second kind of involvement is active. In that case, we take part in the action as we benefit. This requires a certain understanding of what is behind the process. With our Smart phone we make a call, and if there is no answer, leave a voice message, or we can send a text message, or launch a Tweet. We can connect with Facebook, take and send a picture, select an App, or surf the net. On our computer we set our own e-mail address, create a password,

figure out how to create a document, revise it, save it, print it, and much more. With processes like this that require our active response we can make mistakes and are more likely to seek expert help. At the same time we are less likely to delegate work. This applies especially to our phones and personal computers.

A mundane challenge of modern communication that each of us faces on a regular basis is how to operate our television. It has a provider box from Comcast, U-verse, Direct TV, or whatever, maybe a player that is either just DVD or includes BlueRay, the ability to record programs and play them back at a convenient time, HDM cables, and more. Then there are remotes, each for a specific device. Then the grand daddy of all, the **Universal** remote developed by Stephen Wozniak the genius who created the Apple I and II. With as many as 53 individual buttons designed to tie all of the components together the universal remote demands more than mere man can deliver and may be the ultimate "consumer challenge".

Communication started when people began using spoken language and gestures. Over the ensuing years, primitive cave paintings, then more sophisticated images called petroglyphs, were developed leading to pre-alphabet hieroglyphics. This forerunner of the alphabet appeared around 7,000 BC. Next came the Gutenberg printing press in 1450 making possible mass production and distribution of printed material. Four hundred years later, in 1844, the electronic telegraph of Morse was developed enabling contemporaneous distance communication beyond the constraints of line of sight. "Beyond the line of sight" is an important concept when you realize that until the telegraph some variation of semaphore was the principal means of communication over distance, and the pony express was the fastest way to send a message across the continent. In 1876 the telephone carried voice over wire. In 1902 the wireless radio made possible connection with ships at sea. Sending a picture over wire beginning at the turn of the 20<sup>th</sup> century became electronic television by the middle of the 20<sup>th</sup> century, and then came the amazing digital revolution of the mid 20<sup>th</sup> century.

A characteristic of progress is that changes heralded as a breakthrough and with great fanfare invariably result from the work of many people who we never hear about. Their contributions are like builders who construct a wall over a long period, each putting in a block or two, and then a Samuel Morse or an Alexander Graham Bell comes along to place the capstone and that is the only name we ever know.

This leads me to introduce two people who I believe fit the definition of "genius in obscurity". These are George Boole (1854) and Claude Shannon (1948), two men who made possible the digital revolution.

George Boole, a Scot, developed a system of algebra in 1854 with binary values for the variables denoted as 1 and 0 respectively. For Boole, this concept replaced analog elementary algebra where the values of the variables are numbers, and the main operations are addition and multiplication.

Claude Shannon, inspired by Boolean algebra, used "1 for on and 0 for off" to revolutionize electrical switching in 1940. Then in 1948 he introduced a concept for communication that earned him, in the eyes of many, the title **Father of Digital Communication**. Shannon's components of digital communication are:

1. An information source that produces a message
2. A transmitter that operates on the message to create a signal that can be sent unambiguously
3. A channel over which the signal is sent
4. A receiver, which transforms the signal back to its original form
5. A destination, which can be a person or a machine, for whom the message is intended

The special features of Shannon's system are the transmitter that reduces the message to 1s and 0s, and the receiver that decodes the message. Shannon's theories formed the basis for the bit which is a 1 or a 0, the smallest components of communication. These bits are combined in groups of 8 to make up a byte (the number 8 was chosen arbitrarily and is instrument dependent). The byte represents a single character. The possible options for a byte are 0 to 255. For pictures, the pixel is the smallest element and each pixel is made up of 2 bytes. Claude Shannon was born in Petoskey Michigan in 1916, grew up a few miles south in Gaylord Michigan, graduated from the University of Michigan and M.I.T. and was a distant relative of another Michigan native, Thomas A. Edison.

The digital revolution eventually made profound changes in the way we work, and how we communicate in the workplace including presentations connecting

colleagues in different locations, as well as the ways we manipulate, share, and store mountains of data. These digitally based changes even extend to the physical arrangement of the workplace that now is largely made up of cubicles with each worker having his own computer; that is, unless the worker is allowed to work from home something made possible by seamless computer connection.

Before digitization, analog computers, such as those used in WWII, and shortly after, were both low capacity and huge. They could fill a whole room, and required up to 18,000 vacuum tubes for electrical transfer. Such a computer was in the basement of the Union Building on the Indiana University Medical School Campus in the 1970s cranking out programmed IBM cards some of which I used. These monsters have given way to smaller, cheaper, and more powerful computers made possible by a small, inexpensive device that replaced the vacuum tube.

The transistor, capable of both amplifying and switching small electronic signals, was developed by the team of Shockley, Bardeen, and Brittain who were awarded the Nobel Prize in 1956. The highly effective transistor is really quite simple consisting of a few small wires imbedded in silicon. This transistor made it possible to produce inexpensive electronic devices starting 60 years ago. Some of the first devices to use a transistor were miniature portable radios many of which were cheaply made and mostly a novelty. Then Robert Noyce combined a series of transistors to create the integrated circuit. This breakthrough made it possible to design and produce hardware for the computer age. Robert Noyce who went on to found Intel was later dubbed the Mayor of Silicon Valley.

A convergence of software and hardware and a bunch of smart people brought us the real digital revolution. First a system analogous to an alphabet but with only two "letters" 1 and 0 and two choices "off" and "on", devised by George Boole in 1854, was refined and made usable by Claude Shannon a century later. This concept provided the common denominator for software or language developed by Xerox better known for copiers and others who created systems to manage trillions of iterations.

In another area, Shockley, Bardeen and Brittain developed the workable transistor used by Robert Noyce to complete the integrated circuit that was used by IBM and Hewlett Packard and others to develop the computer or hardware capable of using the software. Two geniuses, Steve Jobs and Bill Gates, then

created a way for this thing, the computer, to enter nearly every household in the country and to most of the world by building more creative software and better hardware.

Jobs founded and brought to fruition the Apple Corporation developing exquisite hardware, that he combined with fully integrated and elegant software, for use exclusively on his own Apple computers. The Steve Jobs concept was to create and perpetuate a lifestyle around his computer with an emphasis on social activities including music, games, communication, but also useful for business. In contrast, Bill Gates, who became the wealthiest man in America and also one of the country's largest philanthropists, created versatile and user friendly software. The Microsoft concept aimed at better ways to do business with entertainment as a secondary goal. An advantage of the Microsoft system was that it worked with any computer and was available to any customer willing to agree to terms and to pay. This resulted in Microsoft products being modified and in some cases downgraded, anathema to Jobs, but an acceptable trade off to Gates. Both born in 1955, Jobs and Gates were friends and at times even collaborators, but always promoting their own chosen path while pointing out flaws in the plan of the other. In spite of differences, these men had much more to agree on than they had in dispute and when it came to defending each other against the "world" they remained friends and mutual supporters.

Electric books or e-books, are "cousins" of the computer that are becoming increasingly popular. This is in spite of many serious readers finding it difficult to give up on the "physical book" with its look, feel, and when it comes down to it, their love affair with this venerable institution. This is understandable. I felt that way at first, but succumbed to the many positives of the electronic book such as:

1. You can take as many books as you want on vacation with no additional weight or bulk.
2. You can preview books at no cost,
3. You can share a book you have purchased with your spouse, each having a copy on their own device.
4. The print size and illumination can be changed to meet the special needs of the eyes of some older readers.
5. Many books are free. I read an 1895 edition of "Two Years Before the Mast" that I downloaded at no charge.
6. Your electronic library is always at hand and never needs dusting.
7. There are numerous ways to make notes in the text for future reference (but I have not found this feature useful and have never used it).
8. My Barnes and Noble Nook can hold more than 2,000 books.
9. Book prices are slightly lower than the bookstore.
9. And finally, having an e-book does not limit you to this device. You can always buy a physical book if

you want. There are some books I read on an e-book but wanted to have in my library for future reference, and to be honest just to look at. In this case I read the book on my Nook, but also bought the book for my traditional library. Some recent examples are: volume 1 of "Mark Twain's Autobiography", David McCullough's "Path between the Seas", and "The Singularity is Near" by Ray Kurzweil.

A 2012 survey showed that 1 in 5 Americans had read at least one book on an electronic reader and that those who used an electronic book read on average 8 more books each year. However, the electronic book seems to be a popular place for romance novels, mysteries, and other less serious books like those of James Patterson and his cadre of co-authors who write fast-paced lightly plotted books with a hundred 3 page chapters. Tablets like the iPad and Samsung Galaxy combine e-book capabilities with many aspects of computing, but do not run Microsoft Windows or its applications and do not have CD/DVD drives.

Some high schools and even middle schools are providing *all* students with tablets enabling teachers to post assignments and maintain communication with students at any time. Electronic communication could make significant inroads into the need for traditional books as more educational material becomes available electronically.

Popular options for communication in addition to the phone are: text messaging but don't do it while driving or send compromising images, Twitter: a message limited to 140 characters and available to an unlimited number of "followers" with 400 M Tweets sent each day, Facebook is social networking to tell invited friends what you are doing, Linkedin could be called business Facebook. One study showed that the average worker using these diversions and surfing the web spends 2.09 hours out of 8 in non-productive time while at work.

I see three identifiable age groups when it comes to using information technology. 1. First is the 20 something's and below in age. For them "computer" is their first language. 2. The second category is made up of those in or near mid-career who have made an effort to learn as much as required to be able to function effectively in the workplace and in society. A small sub-group of these make up a valuable computer support cadre for the mature and older population, and the business enterprise that depend on computers. This group has the skills of the younger group and in addition life experience to understand and deal with

the “older folks” 3. The third group comprises those in their 60s, and 70s and beyond who have widely different skills with information technology. A few, probably very few, have good skills across the board. But most senior’s computer skills are limited to sending e mails, surfing the web, and maybe buying something on Amazon. Still a few hold outs say “I don’t use a computer at all and am not too keen about a cell phone”.

Those born between 1990 and 2010 have been called “Digital Natives”. I visited one of these, my granddaughter, born in 1993, in her 3<sup>rd</sup> grade classroom a decade ago. She was attempting to create a PowerPoint slide, banging away at the computer and creating a lot of stuff on the screen that didn’t make any sense to me. I thought this was a total waste of time. Now she is a twenty year old DePauw freshman and a “digital native” who having been introduced to the computer early on is now comfortable with the technology and uses it naturally. It is a good thing I was not teaching that 3<sup>rd</sup> grade class.

A different example of a “digital native” was a 22 year-old Butler graduate in chemistry who was working with us for a year waiting to enter medical school. I asked her to bring a stack of 2x2 slides from the store room. She asked, “What is a 2x2?” OK I guess I can understand that, maybe. I said that it is what we used with a Carousel projector. “What is a carousel projector?” was her response. Wow! A few minutes later I asked her to look into the possibility of putting a computer voice to speaker’s notes on a series of PowerPoint lectures in our online teaching program. Within the hour she reported: “We can purchase a “text to voice” program for a one-time cost of \$40.00. I have created narration for several sets of speaker’s notes. The results are good and for the most part accurate, but it will take some training to teach the program all of the medical terms. There are four voices available, two female and two male. My favorite is a British voice called Nigel.” This, in my opinion, is what can be the advantage of dealing with a really smart “digital native”.

Some amazing success stories have been associated with the computer/information generation including the “genius leaders” Steve Jobs and Bill Gates who both developed great products and became billionaires. An example of financial success from creating a popular “novelty” is that of social network entrepreneur, Facebook founder, Mark Zuckerberg. Carmel’s own Scott Jones has become a multimillionaire developing voice mail and several other computer based innovations. The dark side of this information /communication

revolution is seen with the lives ruined by sexting involving young people mostly younger girls but also damaging the reputation of football hero Bret Favre. Aaron Swartz, a computer genius who copied and made available huge amounts of copyright material just to provide a service to students, committed suicide when he was faced with serious charges. Another example is that of Private Manning currently jailed for his part in the Wikileaks scandal.

How has all of this affected people, like many of us here, whose careers began in the 1950s and 60s? My guess is a lot, regardless of our field of endeavor.

In the 50s and 60s people wrote and read cursive and if you had been asked, "should this be done away with?" the answer would be NO are you crazy? Now there is serious consideration for discontinuing the teaching of cursive. Even starting out, many of us had a personal secretary or at least access to a secretarial pool to manage our correspondence, maybe our calendar, and other business-related issues. We typed our school papers on a portable typewriter and probably still had one that we used at home. Our principal office tool was a hand held or desk top dictating machine, and our secretaries had transcribing equipment. The lucky secretary typed on the new IBM Selectric typewriter. The office had a new copying machine that we could operate if we had to. The new FAX, could send a page of text or a picture over a phone line, but this was a duty for our secretary. Our first, probably tentative, encounter with a computer in the office was sometime in the early 80s.

Instead of a secretary or clerk behind a typewriter, nearly everybody in the office now has his or her own computer, and this includes the boss who may be expected to send his own e-mails and much more. A dictated "snail mail" letter is now becoming a special event. Each of us can do much of our own research and are able to contact anyone, about anything, at any time. Our secretary is now assuming the position of co-worker. There is not much to file because everything we create can be saved reliably, especially with the new "Cloud computing", and there is much more. At home we can use our computer to buy a plane ticket or register a trademark, and that is just the beginning.

Even in your doctor's office, you may encounter the doctor paying more attention to a lap top computer than to you! This is progress because more information available, but it comes at price.

What does the future hold? Those of us in the senior age group will be passing the torch to a generation with considerable computer skills. We are in a sense a "bridge generation" for communication and computing, like our grandfathers who started their life with a horse and buggy, a trolley, and a train only to be confronted in middle life, to embrace (or not), the automobile. I suspect that some did and some didn't, leaving it to our parents to become the first "automobile natives".

For now we should do as much or as little with the computer and information technology as we choose. We should not dismiss e-mail, surfing the web, and using an e-book, but should find our own comfort level. There is too much information on Google to ignore. Not all is accurate but one of the great things about being experienced is that we should have the ability to find the "good stuff". We probably should use a cell phone if for no other reason than personal safety. We should not expect too much of ourselves, but also not too little.

Finally, I predict information technology will enter a state of consolidation with a period of relief from the great breakthroughs, at least for a while or until the 40 something's take over as the most experienced. We are likely entering an "S" in the curve that occurs regularly even in the exponential path like that experienced by information technology. In the meantime it makes sense for us to use the special thing we possess and should never lose sight of -- EXPERIENCE -- a value that still has no match. Thank you.