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Moore's Law In Reverse

In our world, technology is a vital aspect of all our daily lives. For the past 50 years, technology has shaped human history. Generations have bared witness to this technological evolution. Older generations have seen the telephone booth transform into a mobile phone. While younger generations who grew up watching the movies on VHS now watch on streaming online with Netflix. Even though younger generations will never use a floppy disk as we all have experienced something together, Moore's Law. We have all witnessed today's newest most innovative gadget, turn into yesterday's news. For example, seen anyone with an iPhone3 lately? The trend in technology is to become faster, smaller, better and cheaper. Fifty years ago no one could have imagined how far technology would evolve. However, the trajectory it has followed was predicted.

Moore's law is the idea that every two years technology doubles. However, no one expected that this empirical observation would start a revolution and pave the way for our current digital society. According to Shontell (2014), "personal computers, cell phones, self-driving cars—Gordon Moore predicted the invention of all these technologies half a century ago." Moore's Law is symbolic for the acceleration in computer technology, which has accelerated everything else.

Moore's law has impacted almost every aspect of our life; it has done more to change fundamentally how all of us work, live, and learn more than anything else in history.

In 1965, computer scientist and co-founder Intel Gordon Moore made an observation. Only four years after the discovery of the integrated circuit, Moore (1965) published an article in *Electronics magazine* where he stated, "The future of integrated electronics is the future of electronics itself" (p.1). In his article, Moore predicted that the number of transistors per integrated circuit would double every 18 months. In 1975, Moore revised his law to predict that this exponential increase would double every two years.

The impacts of this would lead to smaller, faster, cheaper and more effective computing products in the years to come. According to Kelly (2010), "by making things smaller, everything gets better simultaneously. The speed of our products goes up; the power consumption goes down, system reliability improves by leaps and bounds, but especially the cost of doing things drops as a result of the technology."

The impact of Moore's law is all around us. However, Moore's law was never a physical law; it was a self-fulfilling prophecy. For the past 50 years, Gordon's prediction has set the pace of innovation and development. Moore (2015) states "it has evolved into something that was a measure of what goes on in the industry to something that drives it" (50 Years of Moore's Law).

This law has had an economic, societal, and technological impact on our world. According to Sneed (2015), "his prediction has led us to the incredibly fast growth of computing power without an associated expense and has led to laptops and pocket-size gadgets with enormous processing ability at relatively low prices." Moore's Law has been pushing technology to be smaller, faster, cheaper, better, thus changing the way we work, communicate and play. It has transformed computing from a rare and expensive

enterprise into a universal and affordable necessity. His foresight laid a fertile foundation from which all modern technology could spring (50 Years of Moore's Law). Everything from the Internet itself to social media and modern data analytics, all these innovations stem directly from Moore and his findings

In the past decade alone, we've been introduced to YouTube, Twitter, iPhone, iPad, Netflix, Facebook and much more. However, technology evolved in the form of innovation not invention. According to Gilfillan (1935), "technological change is often a perpetual accretion of little details. . . probably having neither beginning, completion nor definite limits" (p.5). Pointing to the notion that with the evolution of technology besides the microchip and the Internet, nothing is new, but it might be different.

According to Hughes (1983) "even what we want to call revolutionary tech has been long in the making" (p.80). For example think about the revolution MP3 its history belong to the history of music. The revolution of the digital camera belongs to the history of photography. It's technology's job to succeed the old and leave it for the landfill (Kelion, 2015). Alternatively, as Moore puts it "just remember whatever has been done can be outdone".

Technology creates new spaces for humans to inhabit and exist, and physically mentally (Heidingerm, 2011). As society adapts to the new spaces they evolve. According to (Hrynyshyn, 2002) "Society must keep up, we are told, in the information age, because if we do not adapt to the new reality with its new technologies, we will be left behind and will suffer for it. Asking whether or not it is desirable to adopt these new technologies has become simply unthinkable" (p.84).

Within these 50 years live five generations, the Silent, the Baby Boomers, Generation X, Generation Y, and Generation Z. Each generation approached daily life quite differently. The difference lies in one major factor; technology. They differ in the way they use it, remember it, think of it, and navigate it. However, the greatest difference lies in what certain technologies mean to them.

Each decade has unique artifacts of technology. With each technological advance, culture changed. According to McLuhan (1964), “many people would be disposed to say that it was not the machine, but what one did with the machine, that was its meaning or message” (p.95). We as a culture define the meaning of tech we use, through how we use them.

When we look at the changes in society, there is a direct correlation to the changes in tech. This idea is known as technological determinism, which explains the concept that technology shapes a society (MacKenzie, 2004). It points to the question of how technology has shaped our human evolution. According to Hrynyshyn (2002), “the source of the historical change can be identified as the technology itself since its introduction can be represented as inevitable, since it merely manifests objectively existing powers in nature.” (p.83).

Over the past century, technological determinism has been used to explain historical change long before the development of the Internet. Just like society Kelly (2010) explains that “technology wants what life wants: increasing efficiency, opportunity, emergence, complexity, diversity, specialization, ubiquity, freedom, mutualism, beauty, sentience, structure, evolvability” (p.20).

Technology has changed every aspect of our lives. As fast as we advance our technologies, we remake ourselves. We are evolving along with our technology, as well as becoming deeply dependent on it. According to Kelly (2010), “if all technology—every last knife and spear—were to be removed from this planet, our species would not last more than a few months. We are now symbiotic with technology”. With Moore's law altering the technology of the world, society has changed and adapted at the same time.

After five decades of Moore's law the end it insight. Moore himself says that his predictions as applied to integrated circuits will no longer be applicable after about 2020 (Friedman, 2015). If Moore's law were to continue, the smaller and more powerful a processing chips become, they get hotter and present power management challenges. Interesting to think the law that has made certain technologies go extinct will now become extinct itself. However, this does not mean that progress in computing will stop, but that it is taking a different shape, a shape that doesn't need transistors or circuits (The Future of Computing, 2016). The future of computing is moving beyond raw hardware or according to Shontell (2014), the end of Moore's law “ will be disguised as cloud computing.”

However, reflecting on Moore's law one can distinguish many implications of the 50 years of accelerated evolution. However, we rarely reflect on its meaning and impact, from an individual as well as a socio-cultural standpoint. With evolution, many things have been gained, and many things lost. To reflect on the Moore's law is to think about the developments in technology as a whole. It is to map out the evolution of our obsession, attachment, necessity, and relationship with technology. Where did it start? How did we get here?

Even though Moore's law hones itself in looking to the future, it is impossible to the future without the steps of you took in the past. "The reality is that without Moore's Law, we wouldn't have the technology that we love today ... smartphones, tablets, PCs, game consoles, 4K displays. We wouldn't have content like Twitter, Netflix, and YouTube" (Saver, 1970 p.13).

However, with the technologies we love, are technologies that have been elapsed with time. Technologies replaced with a faster, cheaper version. Which leaves us unable to imagine a time where entertainment was not instant, where the TV was black in white. Alternatively, when communication involved words and not characters on a screen. However, for generations that lived through Moore's Law, it is a memory.

Even when there is a critical reflection of tech objects, some only experience the emotional or physical memories. The Younger generations see a cassette tape as an object while older generations see it as a memory. Without Moore's law, "we would have the technology that our parents had 20 years ago. According to Kelion (2013), "instead of having all the computing power of a smartphone in your hand today, we'd still be using desktop computers from 10 to 15 years ago".

So what if Moore did not make his prediction? We would currently have the technologies our parents had at our age. Moore's law in reverse will visually guide viewers into a perspective, to see how their professional life would look in the past and how it has changed.

Just like when one starts a new relationship, it is common to inquire about one's past considering one's history makes one who they are in the present. However, what about technology? There is no question that we have a relationship with technology,

so we know about its past, and what steps and revision have made that technology what it is today. By looking at Moore's law in reverse, one can notice the different stepping-stone for and phases of all the technologies we know and love today. By positioning how our daily life would look like in a different decade would give a unique perspective to analyze critically the technologies we use daily and our attachment to them.

(n.d.). Retrieved March 6, 2016, from http://en.wikipedia.org/wiki/List_of_generations

50 Years of Moore's Law. (n.d.). Retrieved March 6, 2016, from <http://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html>

Friedman, T. L. (2015). Moore's Law Turns 50. Retrieved March 6, 2016, from <http://www.nytimes.com/2015/05/13/opinion/thomas-friedman-moores-law-turns-50.html>

Heidinger, K. (2011, April). Technological Determinism: What it is. Retrieved March 7, 2016, from <http://biocitizen.org/technological-determinism-what-it-is-what-we-can-do-about-it>

Hrynshyn, D. (2002). "Technology and Globalization." *Studies in Political Economy*. 67, Spring: pp.83-106.

D. P. (2015). How Moore's Law Changed History (and Your Smartphone). Retrieved March 11, 2016, from <http://www.pcmag.com/article2/0,2817,2482134,00.asp>

Kelion, L. (2015, April). Moore's Law: Beyond the first law of computing - BBC News. Retrieved March 11, 2016, from <http://www.bbc.com/news/technology-32335003>

Kelly, K. (2010). *What Technology Wants*. New York: Viking.

MacKenzie, D. A., & Wajcman, J. (2004). Introductory essay: The Social Shaping of Technology.

McLuhan, M. (1964). *Understanding media ; the extensions of man*. New York: McGraw-Hill.

Moore , G.(1965) "Cramming More Components onto Integrated Circuits," *Electronics*, Apr. 1965, pp. 114–117.

Rosen, L. (2004, March). Understanding the Technological Generation Gap, *The National Psychologist*, March-April 2004. Retrieved March 10, 2016, from <http://www.csudh.edu/psych/tnp45.htm>

Saver, J. L. (1970). "The Evolution of Technology". *Stroke (1970)* (0039-2499), 44 (6), p. S13.

Shontell, A. (2014, June 16). The Next 20 Years Are Going To Make The Last 20 Look Like We Accomplished Nothing In Tech. Retrieved March 10, 2016, from <http://www.businessinsider.com.au/the-future-of-technology-will-pale-the-previous-20-years-2014-6>

Sneed, A. (2015, May). Moore's Law Keeps Going, Defying Expectations. Retrieved March 10, 2016, from <http://www.scientificamerican.com/article/moore-s-law-keeps-going-defying-expectations/>

Strawn, G., Strawn, C.(2015) Moore's law at fifty. IEEE IT Professional **17**(6), 69–72 (2015)

The Future of Computing. (2016). Retrieved March 10, 2016, from <http://www.economist.com/news/leaders/21694528-era-predictable-improvement-computer-hardware-ending-what-comes-next-future>