Technology and Western perception of time

Mankind have always been fascinated with time, a force so pervasive that we cannot imagine existence without it, yet so intangible that we hardly can explain it. Like many other natural phenomena, we have sought to understand time by measurements and extrapolations, though our efforts often seem to say more about ourselves and our perception of time, than about the nature of time itself. In this essay, I will sketch a *longue durée*[1] outline of how emerging time technology and measurement have influenced the evolution of western perception of time. By focusing on the longue durée, I hope to identify and discuss some of the underlying historical and social structures that are central to the way we perceive time in the Western world today.

Time and the perception of time is a much discussed subject matter. Philosophers and scientists from both the social and the natural sciences have pondered on the nature of time and our perception of it. As the German philosopher Martin Heidegger noted, we cannot directly represent time, though we feel it passing[2], in Western languages we can only explain it through spatially descriptive words and metaphors (Hillis Miller 2003:87). Thus, we can best understand time as movement – of celestial bodies moving across the sky, of birds migrating or of seasons passing. Almost all cultures have used natural phenomena to give cues to social and religious activities (Landes 2003:20). And this was the basis for the earliest measurements of time. The astrologers of the ancient Babylonian and Sumerian cultures (ca. 2000 BC) observed the movement of the moon and the sun to create calendars and and used sun dials to institute the 24 hour day still in use today, and created the 7-day week based on the seven (then) observable planets of our solar system (Young 1988:63-65).[3]
These observed cycles of nature, as well as the cyclical nature of everyday agrarian life with its organic time rhythms based on the seasons and animal and crop life cycles (and the human life cycle for that matter) made it obvious that the passage of time was cyclical as well. Ancient and independent cultures such as the Greek, the Indian and the Maya saw time as a repeating pattern determined by divine power, a "wheel of life" of smaller and greater recurring events[4] (cf. Farriss 1995 & Trautmann 1995).
By the rise of the ancient Athenian democracy (ca. 500 BC) the constant of falling water or sand was used in clepsydrae (water clocks) and hourglasses to measure –

1 The term "longue durée" was introduced by the French historian Fernand Braudel in his book "The Mediterranean" (1949). He used it to describe the deep lying, stable structures of history. Longue durée structures are so grand that they can only be seen developing over centuries. This sets them apart from historical "conjonctures" of 10 to 50 years, and what Braudel calls "event time" which is the day to day time that we observe in our everyday life.

2 The Roman philosopher and theologian St. Augustine (354-430 AD) famously said of time: "If no one asks me, I know: if I wish to explain it to one that asketh, I know not" (Hillis Miller 2003:88).

3 Other units of time seem to be more arbitrary, such as minutes and seconds, which did not become measurable until the the invention of the minute and second hands in the 17th century (Lee & Liebenau 2000:47-48)

4 The Maya society was divided into cycles: A sacred almanac of 260 days, and an astronomical year of 365 days divided into 18 months of 20 days, and a surplus 5 days fast and chastity. The almanac and year were bound into greater cycles of 52 years, and those were again bound in greater cycles of 260 years, in which history (though not history as we have come to understand it) was expected to repeat itself (Farriss 1995:112-114).

amongst other things – the apportioned time for public speeches (Dohrn van Rossum 1996:23). In this way, time became an abstraction, a specific amount of time could be specified and identified by the man-controlled movement of sand from one glass to another (or of gears and cogs driving the hands of a clock). The German sociologist Norbert Elias has compared this acceptance of the clock as a mask of passing time with the masks worn by witch doctors in tribal societies: They are taken as spirits, accepted and believed, even though everyone can see that it is people who are making them move (Nowotny 1994:6-7).
With the rise of Judeo-Christian religion with its belief in God's finite creation of the universe before which there was no time, perception of time slowly changed from cyclical to linear, moving irreversibly forward from the moment of creation (Young 1988:130-131). The study of time (chronology) became one of the central medieval sciences, revising calendars, computing the end of time, and paving the way for the science of historiography (Grafton 1995:139-147).

The first known mechanical clocks appeared in the monasteries of the 14th century Western Europe, apparently resulting from the increased need for exact measurement of time in relation to the strict scheduling of monastic life, though this claim has been contested (Dohrn van Rossum 1996:33-48). The measurement of time entered the public sphere with the ringing of the church bells from which the clock has its name. This public time was local, with countries and cities counting their hours each in their own way, forcing travellers to carry with them conversion tables to recognise the local measuring of time (Landes 1983:93-94).
The driving forces in the development of new clockwork were astronomers and navigators who realised that with precise clockwork, they would be able to determine positional longitude,[5] something that so far had been impossible, and had made travel across the great oceans very dangerous. Kings all over Europe offered princely sums to the "discoverer of the longitude" as that invention would give them a great advantage in travelling to the new world, and such luminaries as Galileo (1564-1642), Pascal (1623-1662), Leibniz (1646-1716), Huygens (1629-1695) and Newton (1642-1727) were among those who worked and theorized on the measurement of time, though none of them were able to construct a seaworthy chronometer (Ibid.:103-113). But their efforts did produce much more precise time measurement,[6] and the handicraft of clockmaking were slowly perfected over the years, spreading smaller and sturdier clocks from the public into the private sphere. The clock became a prestige item, and by 1764, when the autodidact clockmaker John Harrison (1693-1776) won the prize for the first accurate marine chronometer,[7] the clock was a part of

5 By having the exact time of your port of origin and the local time determined by measuring the height of the sun, mariners can calculate longitude based on the Earth's rotation of 15° of longitude pr. hour.

6 Before 1657, clocks usually lost 15 minutes pr. day, by 1677, they could be counted on to be precise down to a few seconds (Lee & Liebenau 2000:47)

7 The American historian and clock aficionado David Landes argues that this invention was central to the British dominance of the world seas that was the foundation the British colonial empire. Still, given the fact that Landes magnifies the influence of clockwork on history at every chance he gets, this proposition must be taken with some reservation.

almost all proper bourgeois homes (Ibid.:128-131, 145-157).
The American historian of technology, Lewis Mumford (1895-1990) called the mechanical clock "the key-machine of the modern industrial age" (Mumford 1934:14), and noted how it, in conjunction with artificial light – candles at first, later gaslight and electricity – that allowed people to use all the hours of the day, created an abstract time that became "a new medium of existence" (Ibid.:17). Time was no longer just a sequence of experiences, but a set total of hours that could be planned, divided, added and saved, and even expanded by labour-saving devices. The merchants of the Italian renaissance city states were among the first to embrace this abstract time, and count the minutes as obsessively as their money (Grafton 1995: 140-141).
"Time is money" said Benjamin Franklin (1706-1790) and the world around him proved him right. Clocks were essential in regulating life in the rapidly growing cities of the 19th century. The new urban population was to a wide extent migrating farm workers who suddenly were separated from the natural rhythms of agrarian work and had to learn to live by the clock, at first working 12 hours a day, as nothing less than a full day's work (according to the clock) would be acceptable to their greedy employers (Nowotny 1994:37). In the 18th and 19th century, the rise of capitalism and the industrialised division of labour as advocated by Adam Smith put the focus on saving time. It was abstract time that decided the working hours rather than the cycles of natural and organic time. In the new factories with their steam powered machines, paid labour was no longer measured in the products produced, but rather in the hours *spent* working. The socialist theorist Friedrich Engels (1820-1895) recognized the factory clock as the symbol of the industrial exploitation and domination of the workers (Dohrn van Rossum 1996:9).
Abstract time began to decide social and organic time: Meals were served at set times, not just when people were feeling hungry, people slept and woke at the bid of the clock, and meetings and events were to greater extent scheduled according to the clock (Mumford 1934:15-17).
Enlightenment and its increased focus on the scientific measuring and understanding of the world, perhaps culminating in Charles Darwin's (1809-1882) theory of evolution (and later the Big Bang theory as set forth by the Belgian astronomer Georges-Henri Lemaître (1894-1966) in 1927), secured the idea of linear time as part of modern science (Lee & Liebenau 2000:47). With the great revolutions of France (1789) and Russia (1917), attempts were made to completely rationalise time. Instead of the antiquated 7-day week, the French introduced a 10-day week in 1793 to fit with the rest of the decimal system and to move away from a religiously founded unit of time. The Russians introduced a 5-day week in 1929 where the workers had every fifth day off, so that one fifth of the workers were absent any given day. Both systems failed within 20 years of their introduction, as people would not easily accept the new division of time (Ibid.:46).

With the spreading of railroads and the telegraph through the 19th century, not just in the Western world, but throughout the colonized world, it became necessary and possible to synchronize time over great distances, resulting ultimately, in 1884, in the

time zones we know today (Nowotny 1994:24-25). Time was no longer local, but universal. This new feeling of simultaneity – that time was the same and shared across the globe – was reinforced with the sudden rush of invention of turn to the 20th century: airplanes, cars, radio and the telephone all helped to make it almost possible to be two places at once: When the Titanic sunk in 1912, it was on the cover of newspapers on both sides of the Atlantic the following morning (Nowotny 1994:22). This new technology opened new avenues of thinking, among others Albert Einstein's Special Theory of Relativity (1905) which collapsed the Newtonian idea of time as an absolute, and laid the foundation of our modern and scientific understanding of the nature of time as a relative fourth dimension (Galison & Burnett 2003:41-43 and Nowotny 1994:1-5). The amazing speed with which the idea of the relativity of time spread and influenced the mindset of the 20th century is a testament to the power of the idea rather than the clarity of Einstein's theory (indeed, he focused on the on the invariants of his theory such as the speed of light rather than the relativity of time (Galison & Burnett 2003:53)).

By the early 20th century, pocket watches and wristwatches were almost ubiquitous, enabling people to carry time with them, synchronizing their watches with time signals transmitted by telephone or radio. With everyone carrying their own time with them, the perception of time did indeed become an individual and relative social construction. A construction that to some extent is formed by the requirements and possibilities imposed by culture and technology[8] (cf. Lee & Liebenau 2000:44-46). The Austrian sociologist Helga Nowotny calls this individual and subjectively constructed time "proper time" (*Eigenzeit*), a term she borrows from Einstein's Relativity Theory. She argues that the proper time of the individual is at conflict with the syncronized social time of society, and that this is one of the main conflicts of the latter half of the 20th century, where the most precious commodity seems to be free, individual time (Nowotny 1994:36-41). As Einstein said, "Simulaneity is relative to observer."

The abstract, synchronized time of society is imbedded in the dominant technological systems of the 20th century: The time tables and peak hours of mass transportation, the taylorized timing of mass production, the programmes of mass entertainment such as radio and tv – even telecommunications and electricity consumption are measured in time. The greater the number of people and resources involved, the more precise the scheduling and planning must be (Giddens 2001:100). Given the increasing importance of advertisements, telemarketing and superficial entertainment, even the proper time of momentary attention is being measured for value and effectivity. The everyday urban life of the individual is left little time unstructured by some external circumstance.

With the globalisation of market capitalism, the Western perception on time has spread to the rest of the world. Greenhouses, hydroponic farming and global trade has cancelled the seasons as determinant for the food available in the cities. Worldwide

8 For examples of cultural variances to the perception of time, see R. Levine: *A geography of time (*1997) or D.O. Hughes & T.R. Trautmann (eds.): *Time – Histories and Ethnologies* (1995). There are, for instance, great differences in perceptions of the concept of punctuality or the shape of time (whether it be cyclical, linear or something else).

tourism and supersonic airtravel has decreased the distance between local cultures and economies, while the space launches and satellite television of the 1960's made it possible to share the same events as they happened all over the globe, all adding to a global sense of simultaneity.
The French philosopher Paul Virilio (b. 1932) argues that these technological advances and especially this feeling of simultaneity, a feeling of competing against the whole world at once, have been increasing the speed of modern Western society throughout the 20th century. This velocity is best observed in the apparent crashes that this increasing speed causes. The sinking of the Titanic, the Wall Street crashes of 1929 and 1987, the oil crisis of 1973 and the destruction of the World Trade Center in New York in 2001 can all be seen as the crashes of an accelerating global society whose globalised technological and economic systems make the crash felt all over the world in intricate patterns of speculation and support (Der Derian 1998:1-6). Each crash slows the growth of the global market as it shifts wealth and makes everyone involved painfully aware of the inherent insecurity that lies in a global capitalism obsessed with speedy growth.
Information and Communication Technologies (ICT) such as computers, mobile phones and the Internet have been welcomed as yet another cylinder firing in the speeding engine of Western society. Communication and information has become more than instantaneous, it has become almost omnipresent, allowing the rising class of information workers to work wherever they want, whenever they want, to a certain degree liberating them from the strict rhythms of the syncronized time of society (Lee & Liebenau 2000:48-50). Yet, at the same time, emails, instant messaging and mobile phones are changing social patterns, allowing people to be in touch with and available to others at any given moment, thus blurring the distinction between work and free time. To reflect this freedom from local space and daily rhythms, the Swiss watchmaker Swatch introduced Internet Time in 1998. Instead of using seconds, minutes and hours, the 24-hour day was divided into 1000 internet “beats”, synchronized all over the world so that the time in beats was the same everywhere, and midnight would fall on a new “beat” for each time zone (Ibid.: 43-44). Despite receiving a fair amount of attention, this new Internet Time did not have any miraculous effect, and is now mostly forgotten, in favour of the old system with the difficult time zones.
The effects of ICT on Western perception of time are still evolving *conjonctures* that fall outside the longue durée scope of this essay. Here it will suffice to say that these recent technological and social changes are showing how Western perception of time continues to be malleable by both technological and social influences, and that this field is beginning to attract increasing academic interest (such as Lee & Liebenau 2000).

The British sociologist Michael Young (1915-2002) has tried to rehabilitate the concept of habit from the behavioral sciences (rather than using Bourdieu's concept of habitus or the concept of nonlinguistic “scripts or schemata” of the cognitive sciences (cf. Young 1988:82, Bloch 1998:6-7)). “A habit” he says, “is a memory unconsciously edited for action” (Young 1988:85). That is to say, a habit is a network

of concepts, actions and routines that we have used so often and learned so well, that our doing or using them has become unconscious, automated and embodied. Our perception of the cyclical movement of the hands of the clock as the passing of time has unquestioned, unconsidered and habitual. We more or less blindly accept the face of the clock as the face of time. Because, as Young would argue, we would spend all our time being indecisive, considering the meaning of time, if we had not gotten used to the fact that, time is there to be used.

Our perception of time is a habitual framework for our individual habits. We are used to doing certain things at certain times of day, until it is a matter of unquestioned routine. Habits are in this way based in a cyclical perception of time, as repetition is the basis of any habit. Despite the fact that we abstractly consider time to be linear, so as to facilitate that wondrous prospect of progress that is felt in all aspects of our society, we perceive and feel our everyday life as cyclical. This is supported to a great extent by the way society is structured, most reasonably to appease our habitual perception of time. Taxation, sports, academia, religion, politics and consumption all follow comforting cycles of iterative tradition that remain the same year after year. Modern life is integrated into the ancient, almost organic cycle of the working week: Five days of work and two days of rest, repeated throughout most of the year. Western everyday life is habitually cyclical, and this forms to great extent our perception of time.

This way of structuring our lives is not the scientifically or rationally optimal one, but attempts to radically change our perception of time, such as the days of the week or the hours of the day, have all failed.

Yet, while we feel our everyday life in cycles, we think of it in terms of abstract, linear time, moving forward from an arbitrarily set point in time. A scientific, yet arbitrary time that we cannot even keep precisely. Our best atom clocks lose parts of a second each year, the rotation of the Earth is not exactly 24 hours, yet it is the best we can do. We are constantly reminded of this abstract time through the technological systems that fill Western everyday life. We are acutely aware that we have a limited amount of time to our disposal, that this time is running and irreversible, and that it is worth money if we spend it right. All of these ideas have been introduced or strengthened by new time technology, yet they are now part of our habitual perception of time.

We live with an apparent paradox – that we think of time as a line, a river that flows irreversibly forward, yet we experience it as cyclical, of days and weeks passing again and again. We *know* it's not the same day we experience over and over again, but sometimes it sure *feels* like it.

Even something as simple as Daylights Savings Time confounds us – we don't feel that we win or lose an hour, we feel that the days are now longer or shorter. Linear and cyclical time are two different aspects of Western perception of time, coexisting and complementing each other, one mainly technological, the other mainly organic.

Young argues that all tools of any complexity carries with it “a kind of material habit which encapsulates in the present the past experience of countless generations, and which is further elaborated before being handed on in a modified form, to be discarded or modified again” (Ibid.:163). In this way, even the new technology we

create is based on generations of habitual use, and we can learn how to use it because it reminds us of something we already know by habit. The “desktop metaphor” that is so common in computer operating systems is an example of connecting new technology to old through habitual concepts. In much the same manner, we have not yet fully substituted the old agrarian, organic, cyclical rhythm of day and night with the new abstract, linear time made possible by the wealth of technologies of the 20th century. Though there are now 24-hour supermarkets, night-shifts, electric streetlights, constant television and transportation, our daily lives have hardly changed that much. We do not take easily to changes of the embodied, unquestioned cyclical time of our habits that constitutes our everyday life.
Still, changes have occurred. With the increasing sense of simultaneity of a socially, economically and technologically globalised world the proper time of the individual is freed from a set location. Even though this relative, organic proper time invariably is full of the individual's own habits and cycles, the independence of this proper time from the society it is part of, is new.
A new, further acceleration of modern society that is seen by all the theorists of the technologies of time that I have referred to here, as a threat to the organic life we know. Mumford, Nowotny, Virilio and Young all see this acceleration of society and the resulting lack of proper time as a problem to be solved. For them it is a question of reconciling these new technologies with our old, rhythmic perception of time, in order for us to stabilise and increase the quality of our everyday lives.
Even so, the new generations of ICT-users seem to feel at ease with the speed, simultaneity and unlimited information of this new technology in ways that the older generations hardly even can comprehend (cf. Nowotny 1994:39). And though these young people may hardly seem very sociable, the structure of their habits may already be shaping their perception of time into one different from the current one of seeing time as disappearing and moving too fast. The new instantaneous omnipresence that the new technologies of simultaneity creates, may result in a synthesis of the linear and cyclical time, as it allows a further acceleration of Western society to the point where it, like a quickly rotating wheel, can create an illusion of not moving at all.
Of course, this technology may equally well turn out as so many other technological advances of recent years and let us do what we always have done, merely faster, more effectively and in limitless auraless copies, not changing our perception of time to great extent. In any case it seems certain that our perception of time will continue to change in its own slow habitual manner.

As I hope to have showed with this very general and limited historical overview of the technologies of time, the longue durèe historical and social structures of Western perception of time is tied up in social habits, customs and traditions. The evolution of Western technologies and perception of time have not so much been determined by the level of technology alone, as they have been forced by such habitual traits as faith, greed and curiosity when the moment seemed ripe. Even though emerging technologies quickly can open up new ways of living everyday life and perceiving time, our habits – especially our perception of time – are tied to what we can feel and recognize in our everyday lives. And though technological progress has changed

many aspects of everyday life over the past four millennia, the basic cycle of human life is still, to a great extent, the same, and with it our habitual perception of time.

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