# eCommunication and the Theory of the Optimisation of Human Communication

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## The Theory of the Optimisation of Human Communication

I propose the following theory to account for the forms of communication that individuals and social groups employ within particular cultures:

> *Humans optimise a variety of forms of communication within a culture, and between cultures, to ensure immediate direct personal survival and to maintain their culture as a long-term indirect survival strategy.*

The TOHC has the following corollaries:

1.      On the principle of economy, no culture will evolve a system of communication that is more complex than is required for optimal communication within or between cultures.

2.      Human communication contains *indexical* features as evidenced in nonverbal communication codes (such as gestures, facial expressions, locomotion posture) that are directly grounded in actual instances of communication, and *symbolic* features that, as codes, first relate to one another in complex hierarchical patterns (such as phonemes, or written symbols, that are combined to serve as symbolic labels for conflated concepts in the form of morphemes and lexemes[1], which in turn are combined according to predictable

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[1] The concept CAT is symbolically represented by the English phonemes (distinctive speech sounds) [k][æ][t] or their written letter equivalents *cat*. These combinations of sounds and letters serve as symbolic labels for the conflated concepts {ADULT, FOUR-FOOTED, HAIRY, PREDATORY, FELINE, ANIMAL}. Only in combination can these symbolic features be used to constitute the lexeme 'cat'.

patterns to form sentences that can be used to refer to actual events[2]). Only in semiosis related to other symbolic elements in the human communication codes, can any subset of codes be used to refer to entities in the human environment.

3.      Specific instances of communication can be ordered along a compliance gaining continuum that progresses from *cooperation* to *competition* to *confrontation*.

4.      New forms of communication will from time to time emerge in a culture to give expression to the increasing complexification of that culture.

5.      When new forms of communication emerge in a culture they never supplant existing forms, but instead absorb and relativise[3] them as part of the new more extensive communication processes.

6.      Humans use newly emerged forms of communication as survival strategies to innovate existing domains of knowledge of their culture and to create new domains of knowledge.

7.      As a form of communication matures, it becomes ubiquitous.

8.      Older forms of communication are employed more ubiquitously than newer ones.

9.      Communicators employ ubiquitous forms of communication subconsciously.

10.      Existing forms of communication could be simplified in response to catastrophic stressors that impact a culture.

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[2] The lexeme 'cat' can be used in the role of AGENT along with 'mouse' in a PATIENT role in the sentence *The cat is chasing the mouse* which is built up according to a specific hierarchic pattern, represented by labelled brackets in [Sentence [Subject Noun Phrase, AGENT the cat] [Verb Phrase [Transitive Verb is chasing] [Object Noun Phrase PATIENT the mouse]].

[3] By relativisation of forms of communication, existing forms of communication are assigned new functional roles relative to newly emerged ones.

11.     Basic as well as simplified forms of communication could become more complex under the influence and in the direction of more complex forms of communication during cross-cultural contact if the users of the more basic forms of communication perceive a communication advantage in emulating the forms of communication of the more sophisticated culture.


## The TOHC and other Optimisation Theories

The theory that I am proposing here forms part of a triadic cluster of optimisation theories. The other two theories are a theory of linguistics known as *Optimality Theory* (OT), and the—to my knowledge yet unnamed—framework that focuses on the optimisation of data flow in global electronic data networks. Because many of the researchers in this yet unnamed field readily use the phrase "communication optimisation" to characterise their work I will refer to this approach as the Framework for Optimal Global Electronic Communication (FOGEC).

I would like to point out that OT as well as the FOGEC respectively are theories that focus on the optimisation of communication at the levels of linguistic and electronic *communication codes*. While OT deals with the optimisation of linguistic codes in the domains of phonology and morpho-syntax, the FOGEC deals with the optimisation of hardware data flow architectures and the software algorithms used to generate economical electronic codes for transmission over global information networks.

By contrast with OT and FOGEC, the TOHC that I am proposing, is an overarching integrative theory of all human communication processes, including the code systems used in nonverbal, verbal, written and electronic communication, therefore including OT and the FOGEC.


## Optimality Theory

In 1993, Prince and Smolensky introduced OT in the domain of phonology as an alternate framework of linguistic analysis to the rule-based theory of generative grammar. Within phonology OT has largely supplanted rule-based frameworks (Gibson et al 1994; Itô et al 1995; Boursma 1998; Hale & Rice 1998). It has also been extended to syntax (Bresnan 2000; Bresnan & Aissen 2001) and semantics (Blutner 1998, 2000; Anttila & Fong 2000), but its use is not yet as widely accepted as in phonological analysis.

According to the MIT Encyclopedia of Cognitive Science (2003) optimality is a theory of linguistic universals and universal grammar. This theory posits that the grammars of all human languages share a set of *very general pre-linguistic universal constraints*, denoted by the abbreviation *Con*. These constraints are sufficiently simple and general that they would conflict in many specific contexts if they were all to operate at the same time.

The grammar of any specific language resolves these potential conflicts by ranking the universal constraints of Con into a *constraint hierarchy* in which higher ranking constraints could neutralise lower ranking ones in cases where competing language forms are in conflict. Particular languages have characteristic features because they rank the universal constraints differently from other languages.

It is possible to compute the typology of all possible human languages[4] as the result of all possible rankings of these constraints. An OT analysis explains why some grammatical patterns are possible in a particular language while others are not.

With regard to the process of constraint ranking, Bresnan & Aissen (2001) describe OT as a 'combinatorial engine', a universal language generator[5] of all possible linguistic structures whose output is not in the forms of particular languages, and not even bound to the overall typological space of natural languages[6]. This hypothetical language generator merely provides a common vocabulary for precisely describing all kinds of linguistic structures, natural and synthetic, for any given linguistic content. Which of these generated structures are selected as the outputs of particular grammars is determined by the relative strength of very general but violable hierarchy of constraints external to the universal language generator, but specific to particular languages.

For particular languages, the proponents of OT posit a four-component linguistic system consisting of (1) underlying representations; (2) grammatical rules; (3) competing surface representations; and (4) a hierarchic system of constraints that regulate interpretation violations as basis for selecting particular surface representations. The basic idea of OT is that, as part of natural variation within the language of individual speakers, competing language forms are regulated (optimised) by an array of hierarchic constraints

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[4] This is possible for languages that do not exist anymore, or do not yet exist.

[5] This is abbreviated as GEN in OT literature.

[6] This point of view implies that the algorithmic principles on which optimality is based would also be able to generate non-human communication codes.

that become progressively more general and powerful. This entails that higher level generic constraints can neutralise lower level more specific constraints as part of the optimisation process. For instance, where generative phonology would require a set of autonomous rules to regulate the use of the English plural morpheme –s which is pronounced voiced in some words, but unvoiced in others (e.g. *bags* [bægz] vs *cats* [kæts]) a single higher level optimality constraint allows the plural morpheme –s to be voiced after a voiced stop consonant like [g] and to be unvoiced after a voiceless stop consonant like [t].

## The Framework for Optimal Global Electronic Communication

As I mentioned before I decided to refer to the yet unnamed cluster of approaches that deal with the optimisation of global electronic communication as the Framework for Optimising Global Electronic Communication (FOGEC). De Moor (undated) focuses on the development suites of information tools supporting both individual and group needs as part of a global electronic network to promote sustainable development.

Kennedey and Nevakovic (1994) combine dependence analysis and data-flow analysis for a proposed system of optimising electronic communication codes. Kandemeer et al. (1998) propose an algorithm for optimising global data flows by reducing the number of communications as well as the volume of data flow per communication.

In such forms of electronic communication, optimisation is achieved by a combination of programming routines that minimise the volume of data that need to be transported between users, and the use of the identical chipsets that contain algorithms that strip predictable data from messages at the sender's end and again restore them at the receiver's end.

Having briefly demonstrated that OT as well as the FOGEC are optimisation theories that focus on the optimisation of communication codes, I now proceed to demonstrate that different forms of communication, each with their characteristic code systems, emerged during specific phases of human cultural evolution in response to the increasing levels of complexification that characterised successive ages.

## The Ages of Human Cultural Evolution

Taking Toffler (1978/1991) as point of departure, one can discern four consecu-

tive phases of human cultural evolution, namely the nomadic age, the pastoral age, the industrial age and the information age.

## The Nomadic Age

During this phase, which started at the dawn of modern humans, perhaps a hundred thousand years ago, most of humankind wandered on foot in small bands of hunter-gatherers after their food resources.

Two theories have been proposed to account for the emergence of modern humans as the predominant species on earth, namely the out-of-Africa theory[7] and the multiregional development theory[8]. According to the *out-of-Africa theory*, anatomically modern humans emerged from Africa on foot in successive waves of migration, particularly during ice ages when the accumulation of ice sheets on continents caused sea levels to drop and land bridges to open up between continents. By using these temporary land bridges in pursuit of game humans steadily populated all of the continents of earth over the past 100,000 years, displacing and causing the demise of other humanoid species like Homo Erectus and Neanderthal. An alternative theory proposes that other humanoid species were not eliminated, but instead absorbed into the modern human lineage.

According to the *multiregional theory*, Homo Erectus emerged from Africa as common ancestor species of all humans about two million years ago and populated the globe as bands of nomadic wanderers that independently and in parallel evolved into modern humans. According to this theory the interaction of two forces, a push chain of common genetic traits and a pull chain of adapting to regional conditions, led to the evolution of modern human sub-populations with slightly differing morphological characteristics in multiple regions of the earth by about 30,000 years ago.

I will couch my explanation in terms of the out-of-Africa theory. This theory seems more likely in the light of Mitochondrial X-, as well as Y-chromosome genetic evidence (Goldstein et al 1995; Harris et al 1999; and Noble 2001), in support of the African Adam theory. Researchers based across

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[7] This is also known as the African Eve hypothesis.
[8] See Canby et al (1961); Cann et al (1987); Clark & Willermet (2000); Ingman (2000); Klein (2000); Krings et al (1999); Nitecki & Nitecki (1994); Smith (1984); Stringer (1996); and Tattersall & Schwartz (1999) for reviews of the two theories.

Asia, in the US and the UK, examined the Y-chromosomes[9] of more than 12,000 males from across Asia and found no traces of any ancient non-African influence.
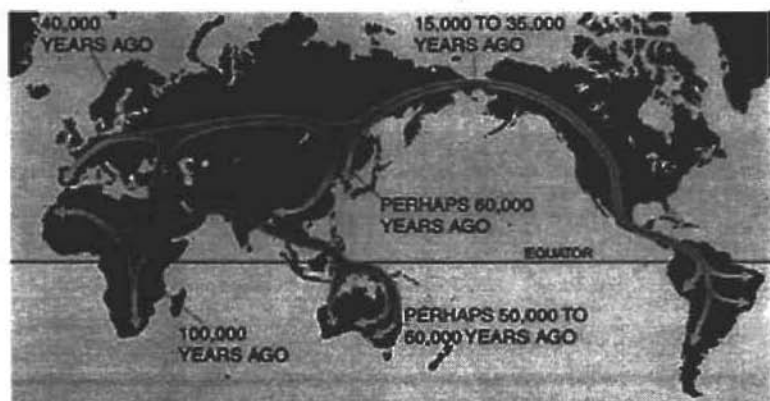


Figure 1: The out-of Africa dispersion routes of modern humans over the past 100, 000 years

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[9] X and Y chromosome genetic evidence supporting the out-of-Africa theory of modern human origins: Over a period of decades, mitochondrial DNA was collected worldwide from discarded placentas after the birth process, analysed and plotted against a specific segment of the human genome, revealing that matrilineal bloodlines worldwide extend back in time to a single mother in Africa who became known as 'African Eve'. More recently an analysis of Y chromosome evidence was analysed because this chromosome is passed on only between fathers and sons along patrilineal bloodlines. Analysis of Y chromosome evidence found a prominent African genetic marker to be present in male populations along the major routes of Asia, specifically along a coastal route between Africa and Australia via India and South East Asia, and via Siberia over the Bering Strait into the Americas. It has been referred to as the 'African Adam' theory.

The African Eve and Adam theories could be seen as complimentary because they both independently confirm that the modern human genome exhibits matrilineal as well as patrilineal African genetic traits.

In figure 1 above I present a global map that traces the migration patterns of anatomically modern humans out of Africa across the globe over the past 100,000 years.



The pre-eminence of verbal and nonverbal gestural communication during the evolution of modern humans is attested by the genetically inherited disproportionate amount of neurological resources dedicated to hand, facial, tongue and laryngeal movement in the human motor cortex, as represented in figure 2:
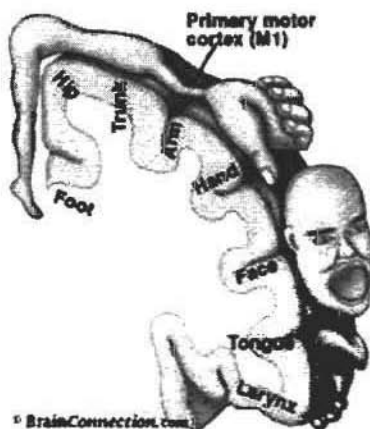
Figure 2: Neurological resources dedicated to verbal and non-verbal muscle movement in the human motor cortex.

## Forms of Communication used by the Nomadic Ancestors

If present-day hunter-gatherer nomadic communities like the San were anything to go by, early modern humans would have depended on direct small group communication consisting of verbal interactions complemented by close visual decoding of one another's facial expressions, gestures, body movement and body stance.

There is evidence that as far back as 30, 000 years ago, rock face paintings, rock face carvings, and statuettes sculpted from stone, ivory and bone, found at European archaeological sites, were forms of symbolic graphical representation.

According to Angeli (1989) Figure 3 below (downloaded from http: //www.aeiou.at/aeiou.encyclop.data.image.v/v136200a.jpg), is thought not to be

a mere representation of the female form, but a symbol of fertility, forming part of the earth mother goddess cult practiced by men who as hunters would have fervently desired that nature should be fertile so that the grazing and the game that they depended on would be abundantly available. Objects that were created according to principles of visual aesthetics such as paintings, engravings and carvings clearly could be seen as precursors of the representations that formed the basis of pictographic writing systems millennia later.

## The Pastoral Age

Over time, most hunter-gatherer nomads settled down along the major river and lake systems that provided year-round sustainable resources for their primary sources of food, game, fruits, grains and tubers. This age is estimated to have begun about 10,000 years ago. In all probability the nomadic clans and tribes however settled down gradually to a pastoral way of life over a much longer time span than 10,000 years ago. During this phase humankind lived in fixed-abode prosumption[10] agrarian communities within small tribal cultures where tribesmen consumed most of their own production, and bartered or traded excess production with neighbouring tribes.



Figure 3: Carved statuette of the fertility goddess, dubbed the Venus of Willendorf

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[10] The term 'prosumption' is a neologistic conflation of the terms 'production' and 'consumption'. It indicates that the same people were the producers and consumers of produce.

During the pastoral age writing and other forms of graphical representation emerged as new forms of communication to give expression to the more complex cultures and technologies that were evolving. Written communication enabled humans to progress to the crucial stage where different domains of knowledge could be recorded, systematised and critically assessed. Writing became the primary form of knowledge generation after Gutenberg invented the printing press in 1452[11]. Before the existence of printed books, almost all transfer of knowledge was by word of mouth and to a lesser extent, by scribes. The only way that one could have learned new ideas, or have gained new skills was by being in direct personal contact with somebody who had created them or who had acquired them from somebody else. The invention of the printing press allowed people to communicate across time and space, and led to the secularisation of knowledge, which until that stage was under the control of the clergy.

## The Industrial Age

This age, that is said to have begun about 300 years ago, is characterised by rapid urbanization in already existing metropoles, and the mass production of goods by mechanical means by individuals that fulfilled specialist duties for remuneration as part of an extensive mutual benefit social contract[12]. The industrial age formed the last phase of the colonial era during which massive amounts of raw materials were extracted from colonies, refined and used in the manufacture of goods for local consumption, and to be exported for sale in other market economies. Towards the end of the colonial era rapidly increasing refinements in technological capacities served as push chains, while the vast distances that had to be traversed between colonies and colonial powers served as pull chains for the development of the first forms of electronic

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[11] According to Brue (1997, accessible at http://communication.ucsd.edu/bjones/Books/printech.html), there is speculation that Gutenberg received credit for an invention that may have been developed simultaneously in Holland and in Prague.

[12] This social contract could be paraphrased as follows: 'I promise to do well for others what I do best, as long as all do well for others what they do best, and all are fairly rewarded for their labours'.

communication, the telegraph and the mass electronic forms of communication, the radio and television.

## The Information Age

Today, some thirty years into the information age[13], prosperous nations increasingly form part of an Internet-based, integrated global knowledge-driven economy, regulated by the flow of data between economies, including the flow of electronic capital that is not substantiated by bullion or hard currency. This enables national economies and cultures to rapidly adjust to trends of increasingly rapid change in order to maintain a competitive edge over economies that remain trapped in pastoral and industrial cultures.

In the information age the knowledge that fuels market economies, increasingly resides in globally integrated information networks that are only accessible to those in command of the requisite electronic communication skills and in possession of the means to access such networks. The digital divide between different cultures—the main presupposition which lead to me developing the FOGEC theory—entails that those without electronic technology and -communication skills, would be shut out from the resources that could give them access to the same global systems serving erstwhile colonial countries.

When I first used the fledgling South African branch of the Internet in the late nineteen eighties I had to place a long distance telephone call from

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[13] In 1969, the year that the first human set foot on the moon, I was asked to address fellow students at a convention that had as theme the impact that technology was expected to have on the future of humankind. After consulting the works of a number of futurologists I spoke on the likelihood that the unbridled use of technology would cause catastrophic worldwide pollution, about future scenarios for space exploration, about the tremendous impact that radio astronomy was expected to have on humankind's understanding of our place in the universe, and about the roles that satellite communications were expected to play in the development of global mass communication transmissions. The one topic that I did not talk about, because neither I nor any of the experts had foreseen it, was the emergence of the personal computer a decade later, and the tremendous role that it would play in the globalisation of human culture and learning, once linked to a global information network that were to become known as the Internet.

Durban to the CSIR in Pretoria, make a furtive satellite-linked search query to a service provider in the US and dial in twelve hours later to download the plain text results of my query. Today we have access to a vast array of services from all over the world at local call rates. By using one of dozens of search engines we can within seconds have at our disposal documents in full colour with sound files embedded, available 24 hours a day on more than five million servers worldwide.

The increasing availability of robust electronic communication networks that integrate all aspects of information age cultures have provided facilities for eBanking, eCommunication, eCommerce, eEntertainment, eGovernance and eLearning. These facilities enable individuals to communicate with relatives on far-flung corners of the globe, pay monthly accounts via online banking facilities, buy and sell products worldwide, play computer games against opponents on other continents, watch movies, access data on government department websites, or obtain certificates and degrees by means of online distance learning—all at the time of their choice from any networked location in the world, including from wireless broadband networks that allow mobile communication from busses and trains.

## A Glimpse into the Digital Future

Unfortunately this section has to be begun on a sober note for South African users of electronic communications. The uneven quality and dead slow[14] Internet access speed provided by Telkom, the South African telecommunications agency, and the high rates that they charge for faster ISDN and ASDL links, all but ensure that ordinary South Africans will end up on the wrong side of the digital divide in comparison with subscribers in the USA, Europe and many other countries of the world where wireless broadband networks are fast becoming the preferred medium for carrying real-time streaming video communications.

Elsewhere in the world, due to the maturation of mobile electronic communication technologies, a range of emerging and converging communication instruments are now putting pressure on the bulky desktop computer that still has to be linked to the Internet by means of copper or fibre optic cables. In many urban centres overseas, people on the move now have

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[14] At many locations users get access to the Internet at a paltry 28k using a 56k modem.

cable-free wideband access to the Internet via wireless broadband networks on notebook computers, tablet PCs[15], mobile phones, and personal digital assistants (PDAs). Due to the impressive growth of the mobile phone[16] market in South Africa, local mobile phone users can also link to the Internet via their mobile phones, or via hand held PDAs[17] that can be linked to the Internet via mobile phones or via mobile radio-frequency modem antennas.

A number of recent innovations in global electronic communications indicate that this form of communication is set to become a ubiquitous part of human existence. A new generation of mobile phone allows users to take a photograph of themselves or of their environment and relay it to other users via mobile phone networks, or to a computer via an Internet service provider. In the Kalahari, SAN game wardens are recording animal movement patterns by means of pictographic icons on PDAs that relay the information via satellite to researchers on other continents. A soon-to-be-released generation of mobile phone will allow real time video communication between users. Satellite-linked global positioning systems (GPS) allow individuals and others to determine their exact location anywhere on earth. Satellite-linked mobile phones allow individuals anywhere on earth to communicate with anyone that is linked to a mobile communication network. Satellite-linked videophones stream video images in real time to recipients, including to TV networks that relay them to cable TV subscribers or satellite TV network subscribers.

An emerging trend, wearable computing and communication clothing, is busy providing new mobile communications technologies to people living in urban centres that are serviced by wireless broadband networks. A mobile web camera embedded in a pair of glasses directly relays what the wearer sees as video and sound images via wireless broadband networks to a base station for

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[15] Notebook computers are fully functional personal computers, about the size of a notebook, every bit as powerful as desktop computers. Tablet PCs are portable computers that have optionally usable cordless infrared keyboards. The use of a touch sensitive on-screen keyboard, handwriting-to-text conversion software or voice-to-text conversion software make the use of a keyboard optional, perhaps even redundant.

[16] I use the international term "mobile phone" rather than the South African term "cell phone."

[17] New generation mobile phones and PDAs come preloaded with e-mail, word-processing and database programs ensuring that a variety of documents can be either faxed directly to someone else, or relayed via the Internet.

capture and storage. The GNU/Linux wristwatch videophone is a full-colour VGA videophone, which consists of a wristwatch camera pointing away from the wearer, a 640 x 480 pixel, 24-bit VGA colour screen built into the wristwatch dial, a body-worn computer that captures the recorded sound and video images, and earpieces. Images received from the Internet are displayed on the wristwatch dial as full-colour VGA video images, with sound being relayed to earpieces. Full colour broadcast quality can also be directly transmitted at six to eight frames per second via a radio transmitter. A future version of the watch is expected to transmit pre-captured sound and video images to a recipient, or to a base station at the rate of thirty frames per second[18].



Figure 4: The GNU/Linux wristwatch videophone at http://www.linuxjournal. com/index.php

According to Vorenberg (2003) the most recent innovation in wearable computing clothing is clothing made from Smart Thread, a plastic-like polymer that feels like nylon fabric, but which conducts electricity like a metal, and which can therefore replace traditional threads in fabric to give cloth computer-like abilities. The inventors of Smart Thread are exploring the possibility of using this material to manufacture wearable computing devices, wearable telecommunications devices, wearable medical and athletic devices,

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[18] The human brain interprets correctly sequenced still photographs, presented to the eye at 20 frames per second, as motion. At 30 frames per second the images from video wristwatch would be perceived as smooth motion.

and wearable fashion accessories that change colour, either automatically, or on demand.

Clothing made with the material would be able to sense conditions around or inside the wearer. A Smart Thread shirt or blouse would have the capacity to monitor ambient temperature and to automatically regulate temperature to make its wearer more comfortable, or it would be able to monitor the pulse and blood pressure of an athlete or a patient.

Telecommunications is seen as a major application of Smart Thread by 2007 or 2008. For an envisaged cell phone shirt all of the components of the cell phone would be integrated into the shirt's fabric. The fashion industry is looking at the potential of using Smart Thread to make shirts that constantly change colour, or change colour based on the wearer's preference for the day.

From these recent innovations it can bee deduced that electronic communications are becoming ubiquitous in communities that have wireless broadband networks.

The innovative electronic technologies that form part of the Smart Weapons used by the USA against Iraq recently during the second Gulf War also deserve mention because they give a glimpse into the role of communication in the rule of future warfare. These Smart Weapons constitute a combination of satellite-generated laser target beams used in conjunction with GPS outfitted ground troop spotters, to direct smart bombs onto their targets once they have been dropped from aeroplanes. One type of smart bomb, the microwave bomb, emits directed microwave pulses at light speed that destroy all electronic circuits in the bomb's path, including vehicle ignitions, radar station control panels and anti aircraft weapon systems. According to the company Tactical Geographies (2002) another part of the electronic arsenal used by the USA is a computer generated virtual 3D rendering of a thirty square kilometre region of Baghdad, including the heart of the city and all of the presidential palaces.

## The Role of Written Communication in the Pre-eminence of Humankind

Early modern humans evolved verbal and nonverbal communication for survival's sake during the nomadic age over a period of 100,000 years while they interacted with one another in their immediate surroundings.

Written and graphical communication emerged about ten thousand

years ago during the pastoral age to help humans cope with the complexification of human culture that resulted from human settlements that eventually developed into cities. Written and graphical communication allowed humans to communicate beyond the limitations of time and space with people living elsewhere, and with people yet unborn.

Because written communication enabled humans to accrue, systematise and critically assess knowledge, it formed the basis for the development of technology over the past two millennia and the establishment of modern science as a branch of learning about 300 years ago. It is science and technology that play a pivotal role in the dominance that humans have attained over other species in the biosphere, and that now allow humans to look beyond earth and our solar system to satisfy the drive to explore, which has been part of our psyche since the dawn of humankind.

## The Integration of Forms of Communication in the Information Age

Electronic communication has enabled humans to integrate verbal, nonverbal and written communication into a single space-time frame. Consequently one can directly hear and see a fellow communicator on the other side of the globe, or one can record communications and access them afterwards at one's leisure. This process of integration of forms of communication has led to a new state of awareness that has become known as *panopticism*[19], the ability to see[20] anything anywhere if one chooses to do so. Examples of panopticism are access via the Internet to video cameras that are used by police to monitor activities in much frequented areas of city centres, live pornographic video shows over the Internet, individuals who have set up webcams throughout their homes so that viewers may observe them for parts of the day or for the full twenty-four hours— accessible to anyone over the Internet—and so called reality TV shows like Big Brother that transmit 24 hours a day scenes of contestants' doings to particular subscription TV channels. To this we may add the ability to access real-time observations of the cosmos by the Hubble telescope over the Internet,

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[19] See the article "The future of Netcams" on the *techtv* website at http://www.techtv.com/techtv/ .

[20] The term "see" here metonymically refers to any way in which one can *observe* and *understand* events.

and even the opportunity to have viewed on the Internet the planet Mars' landscapes as they were transmitted by the Mars Rover a decade ago.

## The Implications of eLearning for South African Higher Education

Despite the poor state of the South African electronic communication backbone that I have referred to before, local institutions of higher education should take note that there is a strong element of panopticism in eLearning, and that this phenomenon could reshape our institutions in the long run once proper wireless broadband communication networks become a reality in South Africa. I say this because eLearning causes the bricks and mortar limitations of local institutions to disappear with the click of a mouse.

Where the industrial age resulted in the *secularisation of knowledge dissemination* the information age by contrast is resulting in the *democratisation of knowledge acquisition* for those on the right side of the digital divide. The democratisation of higher education in the era of eLearning means that where students in a particular discipline were previously limited to the insights of local academic mentors, they now have at their fingertips electronic knowledge generated by dozens upon dozens of experts worldwide.

Knowing the primary printed references in one's local academic library is not good enough anymore. In the information age academics have to remain fellow eLearners who explore the ephemeral flow of electronic information across the globe, firstly to keep their own knowledge current, and secondly to ensure ethical research output of students who have access to a treasure trove of information about any topic under the sun.

## General Conclusions

In this article I proposed a general integrating theory of communication that I have named the Theory of the Optimization of Human Communication, to account for the progressive complexification of human communication in response to the progressive complexification of human culture during successive stages of human cultural evolution, namely the nomadic, pastoral, industrial and information ages. I showed that this theory forms part of a triad of optimization theories, with the other two being a theory of linguistics known as Optimality Theory (OT) and a theory of electronic communication that I, in

the absence of a proper term, call The Framework for Optimal Global Electronic Communication (FOGEC). I also indicated that I intend the TOHC to be a theory that integrate OT and the GOGEC because these two theories in isolation of one another, and in isolation of the TOHC reveal only part of the picture of communication as a complex and uniquely human capacity.

Salient aspects of the TOHC are that humans use forms of communication within and between cultures that ensure personal survival and the maintenance of their culture; that no culture will evolve a system of communication that is more complex than is required for optimal communication within and between cultures; that human communication codes operate at the indexical as well as the symbolic levels; that specific instances of communication can be ordered along a compliance gaining continuum: cooperation—competition—confrontation; that new forms of communication emerge from time to time to accommodate the increasing complexification of cultures; that humans use newly emerged forms of communication to innovate existing domains of knowledge of their culture and to create new domains of knowledge; that newly emerging forms of communication absorb and relativise existing forms rather than supplant them; that mature forms of communication become ubiquitous; that humans use ubiquitous forms of communication subconsciously; that existing forms of communication could be simplified in response to catastrophic stressors that impact a culture; that basic as well as simplified forms of communication could become more complex under the influence and in the direction of more complex forms of communication during cross-cultural communication if the users of the more basic forms of communication perceive a communication advantage in emulating the forms of communication of the more sophisticated culture.

Seen against the TOHC and its corollaries, nonverbal and verbal forms of communication, whose beginnings stretch back to the dawn of humankind, have become ubiquitous subconscious forms of communication. Humans acquire these simply by being socialised among fellow humans.

Written communication, which has been developed over the past ten thousand years, still has to be consciously learnt. In many ways, formal education is a rite of passage dedicated to the acquisition of the reading and writing skills that will allow persons to find economically viable niches for themselves on the extensive social contract that forms the basis of (post-)modern culture.

eCommunication, which became socially significant only about thirty years ago, is in the process of integrating all forms of human communication

and knowledge into a coherent global frame of reference. Two significant outcomes of global electronic communication are the democratisation of knowledge, and the phenomenon of panopticism—the ability to observe and understand anything anywhere due to the increasingly ubiquitous presence of electronic observation devices wherever humans choose to cast their gaze.

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