



# Time, Space, and Information Systems for Electronic Commerce

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## ABSTRACT

Information technology and information systems (IT&S) embed the cultural concepts of time and space of their producer. These concepts may not work in other cultures. This lack of fit becomes more salient as the use of IT&S increases around the world with the expansion of electronic commerce (e-commerce). This problem is discussed by contrasting core cultural concepts of time and space embedded in IT&S and resembling the mainstream culture of the main producer, the United States, and equivalent concepts in the culture of Costa Rica.

## INTRODUCTION

As any human creation, information technology and systems (IT&S) carry certain deep-set beliefs or norms that represent a part of culture. Although the relationship between culture and IT&S has been somewhat addressed in the literature (e.g., Ehn, 1988; Feenberg, 1991; Pacey, 1983; Greenbaum & Kyng, 1991), its complexity and importance amplified by the international expansion of e-commerce call for fresh and continuous study. In a nutshell, IT&S apparently carry the language of the producer that is embedded in the user interface. At a deeper level, one may identify the designer's preferable ways of designing IT&S (Ehn, 1988; Greenbaum & Kyng, 1991). These include mental models and cognitive principles, such as those related to measuring system time and organizing space in IT&S. For example, Western system developers operate with concepts of real time, run time, compile time, and organize the computer memory in precisely labeled and measured units, files and directories. Following the assumptions from the literature (Feenberg, 1991; Pacey, 1993), one may search for the identity of these concepts in the culture of the developers. Culture, of course, is a multi-layered phenomenon, including organizational, professional, and larger societal values and practices (Pacey, 1993). In this article, the focus will be on the last layer.

From the international perspective, understanding the cultural background of IT&S may help facilitate effective design and international transfers of IT&S for e-commerce. This article will specifically look into differences between cultural concepts of time and space in the United States, the main producer of IT&S, and the equivalent concepts in Costa Rica, a prosperous Latin American country with a rising information industry. The author spent part of summer 2000 e-commerce in Costa Rica, conducting a study on e-commerce. Much of the discussion will be based on observations and interviews from that trip.

## SYSTEMS SPACE

Many concepts used in the vocabulary of IT&S have to do with organizing space (see Table 1). For instance, the memory space is in the focus of attention of both specialist and end-users. Systems administrators assign accounts to end-users that are the discrete quotas of memory space. The computer code is loaded into the main memory — registers and accumulators each piece of which can be named and precisely addressed. The end-user conceives data in terms of organization units, such as files and directories. Designers of graphical user interfaces operate with space organizing concepts of desktop, file folder, file cabinet, wastebasket, etc. (see Table 1). Similarly, the computer hardware terminology differentiates between primary (main) and secondary memory, cache

memory, and virtual memory. All these concepts of the organization of memory space can be seen as either replicas or similes to concepts used in various domains of the "real world," such as offices, warehouses, firms' structures, or human memory. Often, there is not even a terminological differentiation, and the IT&S term is a simple metaphor (computer "desktop" is the electronic workspace as opposed to the physical workspace of a desktop on a real desk). Sometimes, the IT&S term can be a more complex metaphor ("cache memory" conveys the idea of a readily expendable thing as cache money is). At any rate, the link between the real world or cultural concepts of space and those used in the world of IT&S is extant. These cultural concepts are plausibly shared in the West, but the terms are in English, indicating the country of origin, the United States.

The organization of space is closely related to the issue of space size, as already hinted above. An elaborated metrics has been developed for this purpose, starting with bits, the smallest units of storage, and moving up to bytes, computer words and pages, bytes multiples (kilo-, megabyte), etc. Furthermore, there seems to be a continuous demand for larger memories caused by today's memory-hungry software, as if economizing costs of memory ceased to be an issue whatsoever with the falling price of memory. Moreover, the computer industry has developed the concepts of computer storage that expand beyond the given physical storage space. Examples are distributed storage associated with database management systems, and virtual memory (the extension of main memory through the use of secondary memory).

Both the precise measurement of space and the concept of expanding space have equivalents in the mainstream culture in the United States. In addition, there is a tendency to conceive space in a larger size. This is the first thing that a person from Costa Rica (or any country with a higher population density) can notice. Big is beautiful — appears to be a dictum. Although a smaller organizational size was praised during the downsizing period of the 1980/90s, the cultural value of large size was not really compromised by the vision of "acting as small, while staying big" (the motto of GE's CEO Jack Welch). Furthermore, the cultural conceptualization of space includes expanding spatial limits — a complement to the concepts of distributed storage and virtual memory. The national frontiers were expanding West and Southward in the 19th century; the conquest of the celestial space followed in the 20th century; and the turn of the millennium have been marked by an expansion of electronic frontiers through including remote computer networks into the Internet, another U.S.-born phenomenon.

Control of space is another concept demonstrated in IT&C. The computer accounts, directories and files have their owners,

and so do electronic mail lists, electronic discussion forums and chat rooms. This same concept of private control applies to the machine level as well. For example, an operating system's process controls the memory space it uses to create the (child) processes needed for executing given instructions. Object oriented methodologies assign the same exclusive ownership of memory to an object (or class), which "encapsulates" its constituent data and procedures. Screen space, which in the GUI world is a window controlled by an operating system, is understood in terms of "real estate" – a land-like commodity that can be "rented" by application windows (Rosenfeld & Morville, 1998). And so on. It is plausible, however, that nothing inherent exists in the software that necessitates using the concept of private control of memory spaces as a design principle. The designer's choice builds software on this and not some other concepts. Of course, the designer is coming from a certain cultural context, typically that of the United States. In this country, private control is exclusive to the extent that private property is near sacrosanct and the owner can legitimately guard it by arms. A key model of physical space is individual private "turf," and much of the social dynamism is generated and expended in acquiring, protecting, and managing turfs. In contrast, Sweden, another Western country, cultivates a mix of private and public control. An example is the cultural norm that campers can temporarily reside, pick berries, swim and boat on someone else's property without even asking for the permission; campers are only expected to clean the locale before leaving (Sandell, 1997).

Table 1: Concepts of Space

Space Concept	Definition	In U.S. Culture	In IT&S
Space Organization	Principles & patterns of conceiving and using space	Discrete, addressable	Memory organization in accumulators, registers, files, directories, records
Space Size	Perceptions of the extent and limits of space	Large, expanding limits	Client-server relativizing of system boundaries; cyberspace; distributed storage
Control of Space	Social entity "in charge" of space	Private (exclusive)	Object encapsulation in OO framework; defined ownership over files & communication facilities

In summary, the cultural concepts of space built into IT&S that mainly come from the United States conceive space as discrete and addressable, large, with expanding limits, and subject to exclusive private control.

## SYSTEMS TIME

Time is another interesting and important dimension built into IT&S. Western cultures have been prolific in conceptualizing and measuring time (e.g., Hawking, 1988). The West has made time a key factor in industrial and information revolutions — the timeline was as important for the manufacturing machinery of the steam and electrical age as it is for our time of digital technology, marked by concepts of lead time, just-in-time inventory, time savings, and Internet time. Crucial fundamental research has evolved around concepts of time, providing the basis for developing various technologies (e.g., the theory of general and special relativity, and nuclear and space technology). Social concepts of time have been brought into direct relationship with contemporary IT&S: We live in a culture of global virtuality created via expressions from all local times mixed into the same hypertext, constantly rearranged, and communicated at any time and anywhere; time in this context is instantaneous, created on the fly via computer networks and electronic media, without past and without predictable sequencing — "timeless time" (Castells, 1998: 370).

There exist many cultural concepts of time, such as the path or the shape of time (see Gurvich, 1964, and Table 2). Looking at

IT&S from the perspective of time path, one may easily see that a computer code executes typically in a linear fashion, line by line. System development methodologies also usually follow a linear path (e.g., the "waterfall model" of systems development). There is a similarity of this linear time concept and the conventional periodization of natural and social history in the Western world. The mainstream culture of the United States is a perfect example because it dramatizes the discrepancy of the not-so-distant-rural, anonymous past of the country and its present, marked by the service and information economy and global influence. A linear time path covered by a development or progress is what connects this start and present.

Time focus may be on the past, present, or future. IT&S maintains the present and future focus. For example, an entire class of information systems builds on the concept of the event that starts the system's functioning. A customer order starts the retailer's sales system; the buyer's part order starts the supplier's sales system; an email message received starts the receiver's email system; the click on a hypertext link starts a communication process between a browser and a server and, then, many systems become involved in their exchange. In all these examples, the systems demonstrate the present time focus because it is a present event that initiates them. Systems can also have a future focus. Databases and other organizational memory systems collect and organize data in order to support informed decision making and knowledge transfer in the future. Future scenario-development and testing systems are indispensable in meteorology, the corporate world, finances, securities trading, air traffic control, medicine, research, urban planning and management, etc. Control units of broadband networks continuously monitor network parameters in order to intervene and change emergent, intolerable states of the network.

This present and future time focus in information systems has a cultural equivalent.

As opposed to Latin American cultures where the time focus may be on the past (e.g., Paz, 1985), in the United States conceptions of time bear the present and future focus. Indeed, the past is neglected if not rendered to short term memory. As Postman (1993) explains, the past is unimportant, for there is no time too look back and contemplate what was being lost because the future has always been full of promises. Imposing the future over the past leaves certain room for the present because that is where utility and value are to be consumed and enjoyed. And as Castells (1998) posits above, the timeless time that has only the present rules the cyberworld, which is the fertile environment for e-commerce. Therefore, the cultural norm combines the future and present time focus.

Table 2: Time Concepts

Concept	Definition	In U.S. Culture	In IT&S
Time Path	Shape of "channel" through which time "flows" (linear, circular, spiral)	Linear	"Waterfall" model of systems development; code execution logic
Time Focus	Attention to historical period (past, present, future)	Present and future	System action & time triggered by present event; Memory systems' purpose is making future decisions
Time Speed	Perceptions of speed at which time "flows"	Fast, accelerating	Moore's Law; Dynamism in client-server systems; System development time cuts (Object Orientation)
Time Measurement	How should time be measured	Precise, small units	Processor clock; Code execution in increasingly small time units
Time Value	Social valuation of time	Monetary, commodity	Operations time reduction as main system design objective

Time can also be conceived in terms of speed. Time speed is both an objective and subjective concept. The former refers to calendar time and is measured by the conventional clock. The latter can be sensed and measured by the frequency of events — the more events happen within a unit of calendar time, the faster the time appears to be. The subjective assessments of time speed can greatly

vary, but calendar time is not absolute either (according to the theory of relativity, the clock runs faster on the poles than on the equator). The computer measures both the calendar time and its own run-time. The latter is a function of the processor clock whose pulsations come in increasingly small periods of calendar time (millionth parts of a second). This “slicing” of calendar time is necessary for speeding up the execution of computational operations.

As these become faster, an effect of “lots of things happening” in given units of calendar time, or faster, “compressed” calendar time, is created in the observer. In a similar way, Moore’s Law (certain performance characteristics of computers double every 18 months) makes us believe that time of the computer world runs on a different, faster clock. The fascinating speed at which complex computational structures and processes are constructed and deconstructed in the Internet also reinforces the impression of accelerated time.

These concepts of compressed or accelerated time have a resemblance in the United States culture, which praises speed as one of main cultural norms. Speed is favored over quality and many other values, and has a direct expression in the norm of efficiency that drives work, study, career, catering, entertainment, transportation, and almost every conceivable domain of life.

Measurement is another important aspect of time presented in IT&S. Time measurement in IT&S is elaborate, precise, and captures increasingly small fractions of calendar time. One can find parallels between the measurement of system time and the measurement of business time in United States society. Specifically, the latter operates with very elaborated concepts of time; for example, product development time, lead time, time-to-market-time, and securities maturation time. In addition, business time references are precise (e.g., “tomorrow” means the day stating at one second past 12 PM, and “now” means “as we speak about it”). Moreover, cutting down on time for operations or saving on time-related transactions costs are one of the main drivers for both business change and IT&S development.

Finally, time can have value. Speeding up technology and the execution of system functions are the main targets of design efforts behind the IT&S coming from the United States. Alternative design goals, such as improving quality of work life that is promoted by Scandinavian participatory design, still have no broader acceptance. The system target is directly derived from the organizational push toward time cuts or reducing time-related transaction costs. The background force is the cultural norm equating time with monetary value, that is, treating time as the scarcest and most precious commodity.

In summary, time concepts in the IT&S produced in the United States conceptualize time as linear, fast, and measurable in very precise and increasingly small units, and as having a present-future focus and a high monetary value.

## SPACE AND TIME IN COSTA RICA

This section is partially based on observations from a study trip to Costa Rica in the summer of 2000. The trip was conducted with the purpose of understanding technological, economic, and cultural conditions for developing e-commerce in this Central American country with an Hispanic heritage. Preliminary findings suggest that the cultural conditions may be interesting and important beyond expectations.

Costa Rica is a relatively prosperous country, with a well-developed educational system and strong economic ties with the United States, Mexico and Canada (NAFTA countries). Two characteristics distinguish Costa Rica from other Latin American coun-

tries — a stable democratic tradition since 1949, and a more equal distribution of income. Implications are paramount. Costa Rica was spared dictatorships, civil wars, old oligarchies, and a military capable of seizing power. Also, social services are developed and managed by the government, and poverty is kept to a minimum. (See Biesantz et al., 1999) The economy of Costa Rica has shifted from agriculture to tourism, manufacturing, and information industry. The last is characterized by a strong industry of financial software that has matured in the 1990s and an Intel corporation factory opened in 1997. E-commerce started with the penetration of the Internet in the mid 1990s, and appears to be focused on selling to the foreign, English-speaking customer (Travica et al., 2000).

Although a small nation of four million, Costa Ricans have developed a recognizable culture. The people from Costa Rica are often called “Ticos,” after the way they build diminutive nouns by adding a “tico” suffix rather than “to” as in other Latin American countries. In the same way that the “tico” suffix is more complex and produces a stronger diminutive, Costa Rica’s culture is considered more intricate. This is reflected, for example, in language and some social institutions, such as those of negotiations and conflict management. (Biesantz et al., 1999) The investigation of this author revealed that Costa Rica’s culture also maintains some interesting concepts of time and space that have implications for information systems.

One of interesting space concepts has to do with the addressing of physical buildings, which is conceptually related to organizing space (see the discussion above). Specifically, there are no building numbers in Costa Rica. Street names exist, but buildings cannot be referenced by a precise enumerated location. In systems terminology, this is called absolute addressing. The lack of absolute addresses may not be a significant problem in the downtown of San José, the capital, because it is designed in the traditional Spanish manner as a grid of avenues and streets. A typical address there references a building as being located on a certain avenue between adjacent streets — or the other way around. However, the capital has outgrown its old core long ago, and many settlements do not implement the grid structure.

Instead of absolute addressing, a relative one is used. The location of a sought building is described in relation to a certain landmark. These descriptions are not only given orally, but also appear in official documents, on business cards, and so on. The landmarks can be almost anything — supermarkets, bus stations, monuments, traffic infrastructure objects, and natural objects (e.g., a mango tree). So for example, a business card can contain the name of the company and the description — “300 m East of the Monument of Independence, San Pedro” (a suburb in San José). The foreigner can get this sort of instruction from anyone, including IS professionals, who may not even notice any discrepancy between the unambiguous addressing used in their profession and this fuzzy one.

Table 3: Space and Time Concepts in Costa Rica’s Culture

Concept	Definition	In Costa Rica
Space Organization	Principles & patterns of conceiving and using space	Lack of absolute addressing
Space Size	Perceptions of the extent and limits of space	Limited
Control of Space	Social entity “in charge”	Mix of private and public
Time Focus	Attention to historical period (past, present, future)	Past, Present
Time Speed	Perceptions of speed at which time “flows”	Slower
Time Measurement	How should time be measured	Flexible
Time Value	Social valuation of time	Subjective value for leisure and socializing

A particularly interesting case is when the landmark exists



only in memory, for example, a building of an institution that was moved to another location years ago. In this case, the outsider is supposed to ask the people on the street about the location of the disappeared object. Interestingly, the locals typically know about disappeared objects, either from their direct experience or from stories learned. For children, only the later option indeed is possible. Consequently, the children have to think in past terms in order to function in the present. Here is where the concept of addressing space intersects with cultural concepts of time that will be discussed after space concepts.

What concepts of space size and control can be found in Costa Rica? With regard to the former, space is viewed as small and with tangible limits. Physical conditions are congruent. Although the area of Costa Rica is about one of the smallest U.S. states, it has 2.6 times more inhabitants per square mile than the U.S. A large part of the country is covered by high mountains, leaving only valleys and the Pacific Coast for settlements; also, both houses and estates are smaller in size. Therefore, an understanding of space as small and limited appears to be a natural extension of the physical.

In terms of control of space, private control is mixed with public. A number of respondents in the author's investigation demonstrated strong feelings about maintaining public control over education, health, energy, communication infrastructure, and Internet access. The same surfaced in unusually rampant ways during a failed government's attempt to partially privatize energy and communications in 1999-2000 (see La Nacion, 2000). In perpetuating government control over communications and the Internet — areas directly impacting on e-commerce — Costa Rica is now unique in Latin America. A cultural norm of social equality maintained by a massive middle class is likely to be in the background (Biesantz et al., 1999). On the other hand, the institution of private property has a strong legal and socio-psychological grounding. The private sector covers various industries, and a strong tendency toward privatization can be identified in business circles and among some politicians. For example, one radical proposal concerns "dollarization" of Costa Rica's economy (La Nacion, 2000a).

What are Costa Rica's counterparts regarding the previously discussed cultural concepts of time? First, the example of relative building addresses that have the time reference in the past indicates a past time focus, which is perhaps similar to other Latin American countries (Paz, 1985). The mentioned movement contra privatization may serve as another example: the past is sanctified as a source of stability and prosperity. However, one may find indications of a present time focus in the pro-privatization camp. A younger government employee expressed this strikingly: "What worked yesterday, may not be suitable today." The present focus can also be observed in the thinking of the interviewed business people that are concerned with developing e-commerce. Some respondents seem to be occupied with "overhauling" the traditional management and commerce into the Internet age in a manner that avoids a direct collision with old traditions.

Time is measured in a more flexible way in Costa Rica. For example, just 12% of Web storefronts studied in 1999-2000 provided some indication of the time of the last content update (Travica et al., 2000). Costa Ricans do not spare themselves while making jokes on "Tico time" vs. Western time. The literature corroborates this phenomenon, which that may exist in other Latin American countries as well (Biesantz, et al., 1999). In accordance with this, time is perceived to be running more slowly than in the United States. Moreover, time has a subjectively attributed value as a

resource to be used for leisure and socializing rather than for commercial purposes.

## SEARCHING FOR A FIT

It is obvious from the discussion above that cultural norms of time and space differ in Costa Rica from those built in IT as a reflection of Western/United States cultures. Juxtaposed are the flexible with precise time measurements, past-present and present-future focus of time, slower and faster time, and non-monetary vs. monetary valuation of time. Also, in terms of space juxtaposed are relative and absolute addressing, private-public and private control, and conceptions of large-expanding and small-limited space. The lack of cultural fit may be impeding for e-commerce, particularly regarding

- The transfer of IT&S for E-commerce into Costa Rica;
- Western e-commerce applications targeting Costa Rica's market; and
- Costa Rica's e-commerce applications targeting Western markets.

What solutions are possible? Although conventional wisdom may see yielding to the producer's way as inevitable, this solution can be neither effective nor permanent. IT&S and applications that are not in fit with the user culture may not work well. This works both ways — for imports into Costa Rica as well as for the country's exports. In the past decade or so, Costa Rica has developed a software industry that is now internationally competitive. Banking software leads and now the development of e-commerce applications accelerates, capitalizing on the local pool of well educated developers. This implies that the country reduces dependence on foreign IT&S. On the other hand, Costa Rica inches toward the position of the producer who has to be concerned about consequences of infusing its culture into IT&S e-commerce products. Of course, the main IT&S producer, the U.S., is still to be most concerned in this regard.

It appears, therefore, that some sort of compromise between the producer and the user could be a more desirable solution. Technology can easily accommodate for some cultural differences. For example, object oriented databases can deal with complex address data, and store addresses both as "atomic" values (absolute address) and rich data (relative addresses). Compromising may be more difficult with some other cultural norms, such as time measurement, although not impossible given the wealth of client-server tools and distributed computing. Nevertheless, on the long run both producers and users can gain from compromising, which would advance international e-commerce.

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