TIME-BASED COMPUTER AIDED ARCHITECTURAL RESEARCH FOR MAPPING TECHNIQUES IN MULTICULTURAL SPACE RE-DEFINITIONS

ALEJANDRO ARISMENDY ECHEVERRI
Technical University Delft
The Netherlands.
alegrandote@yahoo.com

Abstract. This paper shall explore the process of research for the development of **time-based** computer aided applications as an alternative for mapping techniques. As part of an ongoing research, it determined the necessity of implementing computer design strategies for time-based mapping due to the complexity and real-time variability of multicultural societies within its chrono-geo-ghraphical constrains for architectural space re-definitions.

1. Introduction

Previously, philosophical discussions raised by Kant and later Deleuze, came about the issue, "time is out if joint". Its contemporary implications in architectural research development are of crucial consideration and imply various levels of analysis and design. For its exploration and further application into architectural re-definition one would need to differentiate the temporalities that may exist and affect daily interactive behaviours, yet incorporating computer-aided architectural design techniques should be used for modelling its real-time implications into architectural and urban design strategies.

For this and within this framework of research this paper shall illustrate an ongoing exploration towards the use of computer-aided architectural design strategies within the limits of time-based mapping, for the creation of an architectural [geometrical] construct as a tool for architectural space modelling.

2. Previous research

Space and time have universal definitions such as the x, y, z vector-coordinates and their reference to universal time (UT). However, these two determinants of a place can also be defined by our private or common understanding of both.

On the relationship between space and time, Parkes and Thrift (1980), take broader meanings than the physical location expressed by co-ordinates and the

clock or calendar time; experiential space is defined through individual and unique perception of the social and physical environment. A mental map would be an illustration of the experiential space around an individual. Experiential time represents the notion of individual sense of time, not regarding the time of duration of activities and events, but the appropriateness or the acceptability of an activity with respect to time.

On the other hand, Lynch in his work developed in the 1970s already had anticipated several time dimensions to be thought a priori to any spatial definition.

He tackled issues such as the density of time, its periodicities or its length, its amplitude or degree of change within a cycle, its rate, its synchronization or changes of temporal phases, its regularity or the stability of such temporalities and finally more precisely its orientation in regards of past, present or future applications.

Lynch also described four methodologies based on temporal approaches for spatial definitions:

Temporal collage: defined by historical data.
Episodic contrast: defined by cyclical present events in place.
Design for motion: present response towards the environment.
Long range change: glacial or long-term temporal modifications.

However Lefebvre (1990), in his work based on "Writing on cities" explains the importance of rhythm analysis as it relates to his interest in everyday life and the extra-everyday behaviours. He then analyses diverse spaces and temporalities—rhythms in the concrete.

Rhythms, Lefebvre says are interesting because *they show the appropriation of spaces in a non-political way,* they show how the citizens resist the state by a particular use of time. A struggle where rhythms play a major role. Therefore, civil time seeks and manages to shield itself from the state, linear, uni-rhythmical measured and measuring time. Thus the public space, space of representation, spontaneously becomes a place of promenades, encounters, intrigues, diplomacy, trade, negotiations, theatrialising itself. Time is hence linked to space and to the rhythms of the people who occupy this space.

For Lefebvre (1990) there are two forms of rhythms and repetition—cyclical and linear—inseparable even if the analyses must first distinguish and separate them and the rejoin them. Mathematicians clearly distinguish two types of movements, rotations and trajectories, and have different measures for these two types.

(a**) Cyclical rhythms** (big and simple intervals, social organisation manifesting itself, or alternating rhythms with short intervals, day and nights, hours and months, seasons and years, tides, solar rhythms and lunar rhythms), generally of cosmic and numbered with duodecimals based on twelve. Each has a determined frequency or period, and also new beginnings.

(b**) Linear rhythms** (succession, routine, perpetual, chance, encounters, predetermined encounters). Defined by consecutiveness and the reproduction of the same phenomena, identical or almost at more or less close regular intervals. The metronome. Generally emanates from human and social activities and particularly from the motions of work. The point of departure of all things mechanical. Linear rhythms have a tendency to oppose themselves to what is becoming. The linear, including lines, trajectories and repetitions is measured on a decimal base (the metric system).

More recently, different research initiatives have tackled the problem of modelling future scenarios and spatial consequences by looking at temporal variables. Time-Map project in Sydney, Australia, have researched the possibility of providing a service through internet modelling for institutions or people interested to animate different scenarios regarding temporal mapping (Johnson, 2004).

The development of the project roots its initiative from the GIS systems used by many disciplines nowadays. Nonetheless they argue that the dimensions covered by GIS systems do not provide further possibilities with accurate results and introducing the time variable could animate possible future scenarios.

However, if we look closer at one and each of the specific approaches towards the implementation of time regarding its use towards architectural/urban space evolution, the balance between space and time for a flexible architectural design is not methodologically specific.

Therefore this research should illustrate the importance of introducing the notions of multiple tempos by different locations and societies, by means of generating an architectural construct based on spatio-temporal events that affect the architectural design process; both at macro and micro levels.

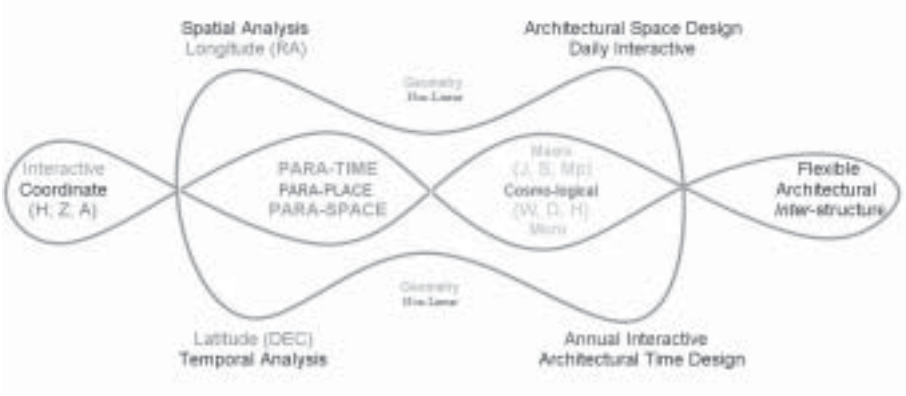

Figure 1. Methodological Model for Architectural definitions.

3. Ongoing research

Due to various and complex temporalities found at different multicultural scenarios and explained by different theories in the previous section, this research has laid out a specific methodology of approach towards the possible render of existent up-to-date units of time as shown in Figure 1. For this a temporal representation layer framework 2D and 3D model has been created mapping six (6) different layers identified for this research. Due to its complexity and variable movement, the platform of departure incorporates different variables constrained to the use, interpretation and adaptability of space and time with regards to the coordinate/ place concerned.

3.1. CHARACTERISTICS OF THE MODEL TO BE DISCOVERED

Once the Spatial analysis and the Temporal analysis of the place in concern have been defined consequently to its correspondence with the Longitude (RA, Right Ascension) and Latitude (DEC, Declination) coordinates, the concept of *paratime* and *paraspace* shall contribute to specify the categories that directly or indirectly affect the architectural design process and decision making.

The ***paratimes*** are understood as phenomenological, structural, and biological studies of time, and are distinguished as follows:

3.1.1. Universe time is the time measured by clocks and calendars in a specific place, by a specific culture and society.

3.1.2. Life-time includes the biological and psychological times, which provide us with a sense of course of events and activities as well as our "sense of time". Its constraint to geographical time, i.e. daily personal schedule/agenda/activities.

3.1.3. Social time represents the collective awareness of the duration, frequency, and sequence of activities with relevance in the community, i.e. daily collective schedule/agenda/events.

Parallel to *paratime*, we find the ***paraspaces,*** which are determined by allowing the space to be defined in terrestrial, economic or social terms:

3.1.4. Terrestrial space, the three dimensions of locational space, x, y, z, as well as political boundaries, geographical accidents, among others that define a specific locational place.

3.1.5. Life space includes the private and public space. Provides us with a sense of course of dimension and function as well as "our sense of space". Its constraint to geographical space, i.e. a house, an office, a restaurant, etc.

3.1.6. Social space represents the collective awareness of the social, economical and political (or more) determinants with relevance to the community, i.e. a plaza, a church, a mosque.

By the use of non-linear geometrical co-relations between the different categories that define the place for architectural evolution, flexible conceptual models can be constructed, building therefore geometrical constructs that permit a constant interaction between different variables along a spatio-temporal framework.

TABLE 1. Up-to-date Unit.

1 DATE UNIT
364/14˜(deg)= 26˜ hrs each date
364/13˜=28˜ parallels
13˜ Mp X 7˜ d = 91˜ Days 7˜ d X 26˜ hrs = 1820 ˜ hrs/w 26˜ hrs X 70˜min = 1820˜ min/d

In order to apply these layers of categories for flexible architectural design evolution, up-to-date units (Table 1) of temporal measurements would need to be revised and adjusted by means of synchronizing six (6) different layers of temporal understanding dictated by different cycles as seen in Table 2.

TABLE 2. Different cycles.

UP TO DATE UNITS	
PERIODICITIES	**UNITS**
Sideral Period	365.256.36 d
Solar Period	365.242.19 d
Lunar Period	28 d
Weekly Period	7 d
Daily Period	24 hrs
Hourly Period	60 min

The following Table 3 explains previous research developed for the inter-relational units within different periodicities and its different "**dis-phases".** When the data was juxtaposed a necessity for a temporal synchronization was revealed. It's important to notice the insertion of the "**1 date unit**" measurement based on the relation between the cycles and geometries between the earth, the moon and the sun, its latitudinal and longitudinal measures.

Moreover, this mathematical calculation aims towards a redefinition of a temporal platform for architectural evolutionary space design. Once this geometrical construct can model the multiple tempos present in our daily life, both at macro and micro levels, an architectural space generation shall evolve as a consequence of an interactive evolutionary design process embracing its constraints of Para-times and Para-spaces with regard to the place concerned.

TABLE 3. Dis-Phase.

DIS-PHASE
Sidereal dis-phase is -3.35¯min shorter day (26hrs)= total 365 ¼
Sideral adjustment: I.e. +1¯ hrs and 18¯ minutes a month
Solar dis-phase is +6.175¯min longer per day (26hrs) total 365 ¼
Solar adjustment: I.e. -8¯hrs 1/8¯ every 13-moon phase
The overall adjustment is –4¯hrs 26.25¯min shorter every 91 dates

Therefore, in order to identify and precisely enable ground for possible spatio-temporal representations in the realm of researching ahead towards this synchronous problematic, six (6) layers will be constructed conveying different rhythmic patterns representative of different temporal implications.

An unfolded [linear-cyclical] strip (per layer) shall loop itself according to its rhythms of correspondence to macro and micro layers of time. The 4D model shall facilitate the multiple readings of correspondence between the layers itself. Once these layers represent the different units of time corresponding to specific places (and cultures) the time mapping would transfer its data to architectural space considerations and decision-making procedures from hourly to annual use/ performance.

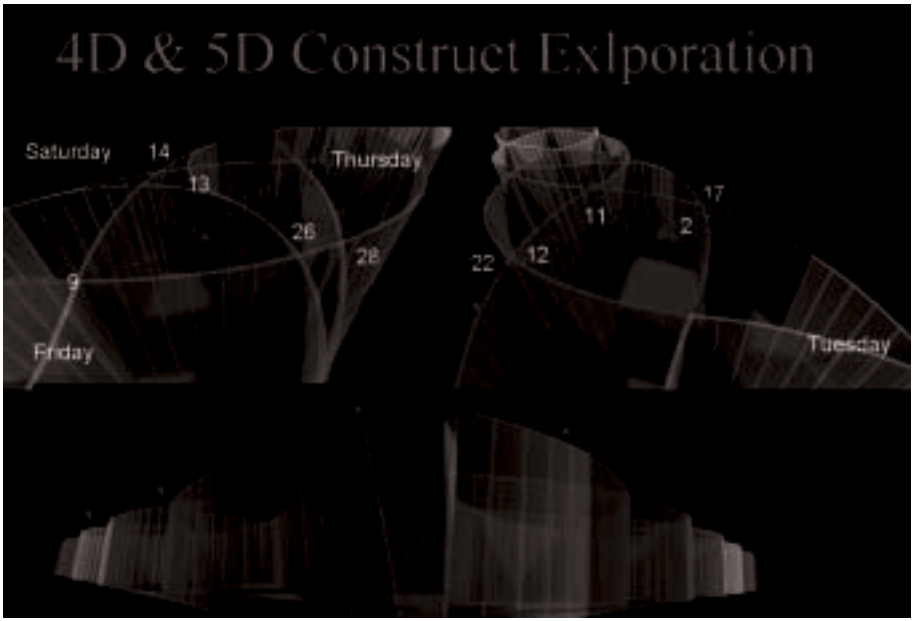

Figure 2. Construction of application.

4. Further research

Along this framework of research computer-aided design has allowed this complex representation of time-based mapping to take place within the architectural environment, facilitating architects and planners the variable of time-use in correspondence to multicultural scenarios. Due to the complexity of time-based mapping and its multiple readings, this research shall concentrate on bridging a precise dialogue between spatial determinations and design approach along with the constant changeable and variable component of time-use under a multicultural umbrella.

Finally this paper is intending to enrich the development and feedback of other interpretations along this frame. For this, the project has been shaped such as it could render flexible inputs and outputs along the multiple requirements of the architect/urban planner. It's a challenge for designers to create appropriate flexible environments permeable to constant and rapid changes. Therefore this research shall constantly be looking for new temporalities in emergence and its applicability to daily and annual execution.

References

Deleuze, G. & Guattari, F. 1986, *Nomadology: The war machine*. Semiotext (e), USA.

Deleuze, G. & Guattari, F. 1987, *A Thousand Plateaux, Capitalism and Squizofrenia*. Pretextos, Valencia, Spain.

Giedion, S. 1949, *Space time and architecture*. Harvard University Press, USA.

Johnson, I, *TimeMap*, GeoInformatics 2004.

Lefebvre, H. 1990, *Writing on Cities*. Blackwell publishing, UK.

Leibniz, Gottfried. 1965, *Monadology and Other philosophical essays*. Macmillan Library Ltd. UK.

Lynch, K. 1972, *What time is this place?* The MIT Press, Cambridge, Mass. USA.

Page, Thornton. 1962, *Star and Galaxies. Birth, ageing and death of the universe*. Spectrum book. USA.

Parkes. D.N. & Thrift, N.J. 1980, *Times, Spaces and Places: A Chronogeographic Persepctive*, UK.

Ridpath, Ian. 1998, *Norton's Satr Atlas*. Longman Limited, UK.