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Discovered the visual qualities of cultural and heritage waterfront influences by impression of place

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Abstract

Waterfront is the place of birth of human culture and heritage. In many waterfront developments, particularly in the Heritage & cultural waterfront, the most of development be abandoned and recede about the impression of place. The visual qualities of heritage & cultural has in the past being used as a means of town structuring where consideration of a few component that influences all development. Adopting a case study at Heritage and Cultural waterfront, these paper intentions to discover the visual qualities of cultural and heritage waterfront that influences by impression of place. This evaluation will analyzed and study on literature review from journal, books and other resources about the visual qualities that create the impression of place of heritage and cultural waterfront development. As a result this paper will come out with the theoretical framework about the characteristic of heritage and cultural waterfront development in way to understanding about heritage and cultural characteristic development.

Keywords: Visual qualities, impression of place, abandoned

1. Introduction

Virtually culture is the necessities of people life constantly practiced by community since the past, in present and toward future (Orbasli, 2000, Yunos *et al*., 2015).In accordance to the UNESCO Intangible Heritage Glossary, cultural or heritage space delineated as "a physical or symbolic space for people meet to enact, share, or exchange social practices or idea"(zanten,2002:4). So that, visual quality of impression of places can be a sum in a insufficient component namely as physical, social and perception, excluding sense of place, memory, orientation, perception and cogitation and identification and image. Moreover if those, component if consistently applies on the Heritage and cultural waterfront development will enhance another's identity and image to the needs of the area and draw more visitors and tourists toward this place. This revision will discover the approach to conducting a townscapes appraisal which is useful tool in outlining the component of impression of place that personalities the culture and heritage waterfront. The various aspect that need to be considered and way in which the visual qualities of the townscape also been outlined. Hence, the aim of this paper is to discover the visual qualities of culture and heritage waterfront that influence by impression of place. In this revision qualitative method are fit to the issue and objective. The evident was originated from many different sources: such as, observation, noted, user opinion, personal journal and news clips from many source namely internet, books and media social sources. These consequences can be supportive for the developer, policy makers and master planner to facilitate in documenting the cultural and heritage tourism strategies for a successful cultural and heritage waterfront development.

2. Literature review

2.1 Heritage as a part of cultural value

Heritage is a part of the cultural tradition of any society (Nuryanti, 1996, p. 249). In this study, heritage is taken to include architectural and historical values, in addition to people whose heritage is encapsulated in daily routines (Howard and Pinder,2003, p. 58) r investigation [8,9].According to (Lynch, 1960)cultural heritage is, comprising both archaeological sites and archaeo-landscapes, is included by many recent European policies, laws and national reports on the state of the environment.

2.2 Cultural and the role of cultural spaces

The literature review with begin to discuss the meaning of the culture and cultural spaces. In general, culture is the most complex word in the English Language conveyed by William (1983) (cited in Richards, 2001). The definition of culture meant what people think, to perform and also composed of a process related to people way of life in the form of buildings, artifacts, art, customs, atmosphere and cultural (Littrell, 1997 and Richards, 2001). Montgomery (2003) describes culture is predominantly an imperative aspect to create urban public realm seeing like: spaces, streets, and squares in creating a city's identity. Concisely, Ferdous and Nilufar (2008) stated that cultural space referent to an urban spatial associated with people activities, behavior (or perception), space prototypes and the surrounding characteristics (illustrated in Fig. 1) However in this case, they also emphasize cultural space has a strong implication tied to people's way of life. Cultural space is the collective of the phenomenon and a communal space to Lee Yoke Lai et al. (2013) conduct a variety of activities. A cultural space also interpreted as allied to people behavioral and psychological spaces (Rapoport, 1977:14 cited in Ferdous and Nilufar, 2008).

2.3 Components of heritage and cultural character

2.3.1 Physical, social, and perceptual

The pivotal components of a cultural space amalgamated the social and perceptual aspect and these compositions are interconnected without fragmented (Ferdaous and Nilufar, 2008). The Authors review the morphological space implied as a physical character whilst perceptual described as qualitative or intangible entities (Ibid.). According to Lewelyn (2000), the feeling and perception disclosed to a place could be expressed through genus loci. He emphasized that people comprehended the physical character through an identity, historical morphology, natural features, socioeconomic profile, and buildings of a place or the adjacent area. At the same point of view Lynch (1960) consensuses the discernible layout and transparency of townscapes can increase the place legibility that assimilated to the physical or tangible form (cited in Norsidah, 2010). In succinctly, Ferdaous and Nilufar (2008) summaries the indispensable physical attributes in the cultural space defined by the urban fabrics, notable physical setting, street pattern as well as the structure of open space. According to Mohd. Amirul .H(2015), the sensation and perception disclosed to a dwelling could be communicated through genus loci. He emphasized that people comprehended the physical character through an identity, historical morphology, natural features, socioeconomic profile, and buildings of a place or the adjacent area. At the same point of view Lynch (1960) consensuses the discernible layout and transparency of townscapes can increase the place legibility that assimilated to the physical or tangible form (cited in Norsidah, 2010). In succinctly, Ferdaous and Nilufar (2008) summaries the indispensable physical attributes in the cultural space defined by the urban fabrics, notable physical setting, street pattern as well as the structure of open space. The perceptual components related to historical substance and people's feelings on their activity space. Additionally, human perception influenced to the cultural space implication base on differences cultural and physical settings in the city's urban spaces (Ferdous and Nilufar, 2008). Users would continue to stay at the public space if the genuine place meanings and activity belonged to the physical setting (Appleyard, 1979; Rapoport, 1982 in Carr, 1992). Therefore, the emotional elements to perceive cultural space's meanings or a place identity encompasses the familiarity; memory; orientation; perception and cognition; identification and image ability (Lynch, 1960; Carr et al, 1992; Mowla, 2006, Nilufar & Ferdaous, 2008).

Table 1: Summary of cultural spaces component and research attributes

Components	Attributes	Elements
Physical	Site background Spatial attributes Visual legibility and accessibility Architecture form and historical structure	Historical morphology and land use Physical setting, cultural space location and layout Landmark, view, orientation, accessibility layout Architectural values, image ability and building use
Social	Sociocultural activities	Cultural activity, people way of life, socio economic influence, event, festival, special occasion, past event.)
Perceptual	Viewpoint	Perception on favorite cultural spaces, preferred sociocultural activity, memory and identity.

2.4 Components of visual qualities influence by impression of place

2.4.1 Sense of place

Relph (1976) explains a sense of place means the ability to familiarise diverse places and different identities of a place. Generating a sense of place is through the collectives of past memory, event and features (Zeldin, 1885 and Mowla, 2006). The important components like orientation and sense of continuity aided to improve the identity of a place (Harvey Cox, 1968 & Relph, 1976). Conversely, Steele (1981) elucidated the sense of place shaped by the physical and social settings where people associated with such place (Ferdous and Nilufar, 2008). There are three main attributes to configure a sense of place which are the physical setting, social (activity), meaning or image (psychology factor) (Steele, 1981 in Ferdous and Nilufar, 2008; Jon Punter, 1991 cited from Carmona, et al., 2003; Montgomery, 1998). Nonetheless, Lang (2005) clarifies the sense of place interrelated with sociological and other psychological.

2.4.2 Memory

Memory means a process to evoke realities and experiences by taking the benefits to remember(recalling), images and identify a space through the sense of familiarity to form a sense of place (Mowla,2006). Ferdous and Nilufar (2008) stated that the collective of memories related to time in creating the sense of place and a component to form a cultural space that portrayed a place's history. Likewise,Carr etal. (1992) explained people expressed the special meanings of a space evolving the meaningful memories.Even Rossi (1982) has mentioned a city assembles people's memories because memories attached with the objects and places (cited in Ferdous and Nilufar, 2008). In sum, memory is the primary element in place making because the more activities occurred in place meant the potential to build more memories from such place (Lynch, 1960).

2.4.3 Orientation

Schulz (2000) depicted that the memory exemplify as information or presumption of the orientation (refer to in Ferdous and Nilufar, 2008). Orientation indicator in a city presented by the "landmarks, buildings and spaces" (Mowla 2002 & 2006:2). Schulz (2000) specified memory was the identification of orientation. Apparently, a place orientation integrated with memory performed as an imperative element in notifying individual physical location (Ferdous and Nilufar, 2008). The visual interpretative and other senses used to identify a space orientation via visioning for the observer to see and seek (Porteous, 1996 and Carmon et al., 2003).

2.4.4 Perception and cognition

Rapoport (1977:178) elucidated that perception is the key process to connect people within the surrounding environment related to man and environment (quoted in Ferdous and Nilufar, 2008). Similarly, perception in the urban setting strained on how people perceived the milieu and experience of a place (Carmon et al., 2003, Mesyam *et al.* (2015). Whereas, cognitive defined and measured by nature and level of "people values, feelings, beliefs, and perceptions about locations, district, and regions". It has classified as portions of perception that emphasised by Ittelson (1978) and Bell et al. (1990) (cited in Carmon et al., 2003). In short, people perceive a cultural space through by seeing or intellections of the information from the urban environment while cognition required of thinking, planning and keeping information (Carmon et al., 2003).

2.4.5 Identification and imageability

In identifying the urban setting; memory is to record or indicate the actual circumstances. Schulz (2000) exemplified that the necessary to understand a place is through knowing a place identity (Ferdous and Nilufar, 2008). Lawson (2001) states a place identity or place character often perceived via visual senses and feeling to that space. As well as the legibility induced to read the image; the path, edges, districts, nodes and landmarks guided as direction of a district (Lynch, 1960). In other words, the imageability is the quality of a physical object whilst the spatial connections possibility to evoke the strong image for movement and legibility in a city (Lynch, 1960 and Carmona et al., 2003; Ismail and Nor Zalina, 2010). The implications of the physical (tangible), social attribute (intangible) and perceptual contributed to making the roles of cultural spaces in characterising an identity of the historic town. In consequence, the determinants attributes identified as i) site background ii) social cultural activities, iii) spatial attributes,iv) visual legibility and accessibility, v) architecture form and historical structure (refer to Table 1). This study also discusses on users opinions on cultural spaces when they practice as their routine activities. In sum, people experience on cultural spaces in the historic town are through the emotional feeling, reminiscent from memory, the sense of place and social activities that existence in the cultural spaces.

3. Methodology

The focus of revision is to discover the visual quality of culture and heritage waterfront influence by impression of place. This revision will analyzed and study on literature review from journal, books and other resources about the visual quality that influence the impression of place at culture and heritage waterfront. From this contents analysis, researchers have come out with the theoretical framework for characteristic of heritage and cultural waterfront development in role to understanding about the function of impression of place in creates a good townscape.

4. Analysis and discussion

This section discovered the visual quality of cultural and heritage waterfront that influences by impression of place contributes to the cultural and heritage waterfront character of the cultural & heritage waterfront in Amsterdam area. Stunning riverside vistas, colorful pastel houses along the riverfront, and a buzzing port district are a few of the things you'll find in Amsterdam waterfront. Visitors can explore the city's cobbled streets by foot, and climb winding sets of steps to reach the town's best vantage points. Ride an ancient canal gondola to Royal palace of Amsterdam to view the ancient ramparts of Joods Historic Museum, or head to downtown of Amsterdam to explore the bustling city squares. The old port district of Amsterdam rivers is the perfect place to relax by the river, while Belém includes some of Dutch historical & culture are the best museums and monuments. Families will enjoy *Basillica of St Nicholas*, Amsterdam largest museum. Never less more, are perfect shade from ancient tree make Amsterdam waterfront more workable and cozy to visitor treasure the dazzling place.

Through the literature finding and observation survey, the visual quality that influences by impression of place comprised of waterfront, marketplace, and pocket spaces in between the building, open space and scenic promenade along the canal. Hence the local cultural activities in Amsterdam are relative to workplace of economic revenues and outdoors recreational. The summary of visual quality that influences by impression of place and its activities illustrated in table below. On the other hand, physical development of Amsterdam waterfront is gradually

facing declining besides facing the competitive development from new town nearby. Due to this reasons the initiative to conserve and maintain Amsterdam waterfront are the must to be protect the local cultural and heritage especially for visual quality that influence the sense of place.

Table 2: Analysis of visual quality that influences by impression of place

Components of impression of place	Categories visual quality place	Character of cultural & heritage place	Types of activities
1.Sense of place	 Waterfront	The waterfront is located along the Amsterdam canal, as a social and outdoor recreational place. Whilst, the water transportation was busiest cultural space for trading, loading and unloading work. Besides a peaceful landscape environment to encourage outdoor recreational and social cultural among the local community and tourist	Leisure activities, photography, people watching, pedestrian walking, sitting, cycling, resting, special carnival and transportation hubs.
2. Memory (Sense of memories)	 Open space at Rijksmuseum of Amsterdam (Source from: donwillms.wordpress.com)	The museum known as Heritage square utilized for formal event celebration, physical activities, and for certain event.	Special event use such as carnival, special performance show and national day celebration
3.Orientation	 Scenic promenade at Amsterdam canal (Source from: donwillms.wordpress.com)	The scenic promenade and sidewalk at Amsterdam canal for family gathering, leisure and recreational purpose. The canal is full with water activities.	Outdoor recreational, sightseeing, people walking, strolling, hang out, relaxing, cycling, and play ground

4. Perception and cognition	 Central square, Oude Kerk, Amsterdam. (Source from: donwillms.wordpress.com)	The interior and exterior of central squares utilized for human activities setting, a significant place for local people meeting, and do some activities.	Merchandise sold, special utensil groceries and handicraft, food vendor activities and socialization
5. Identification and Imageability	 Pockets spaces in between old shop houses (Source from: donwillms.wordpress.com)	There are only several mercantile activities operated at old shop houses due to dilapidation and incompatible building used.	Commercial activities. Shopping, community, socialization and etc.

5. Conclusion

As we remarked waterfront pursue to be used as the world face cities present to the global lines, in between the challenges of balancing world class amenities with local identity that must be carefully standardized. What sets them to be unique from the newer centers and the other waterfront townscapes is also the sense of vivacity through the graphic qualities that influence by impression of place that took place on the street and the relationship between the buildings and the outdoor spaces fronting the street. An art of relationship between the buildings and their juxtaposition with the street is observed in historic townscapes where the visual become important focal point that characterize the view one can enjoy in the cultural & historic waterfront townscapes. The sense of variety within uniformity is one of its strong features that make the cultural & heritage waterfront townscapes are difference than its counterpart and having a stronger sense of place. So then, to complete this research study, researchers will test this content analysis in Malaysia cultural & heritage waterfront to see how far thus component of landscape element are really validity to support the successful waterfront development.

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Seismic Signals Equation of Motion

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Abstract

This is an analysis of seismic signals transmission in bounded media. The result is a simple seismic signals equation of motion, and some deductions on the electrical characteristics of the transmission line.

Keywords - Seismic signals, Equation of motion, Geophone, Bounded media.

I. Introduction

Electronically, a signal may be described as a wave generated naturally or artificially into a steady electromagnetic field, which sets it into vibration. The vibrational energy manifest in the electromagnetic system as a variation of voltage, such that amplitude and or frequency of its variation corresponds to information about the physical attributes of the signal that originate the vibration. In seismic exploration, the seismometer – a transducer – really induces a sinusoidal emf in its coil, which is set into motion relative to its magnets, due to the seismic energy it experienced. The emf varies periodically with time in magnitude and direction. The damping of the seismometer is constructed such that its response is approximately uniform over the range of frequencies of interest – generally about extremely low frequency range (ELF).

Seismic transmission lines are bounded media means of communicating the signals from the seismometers to the recording equipment using cables. Miller [1] explains 'this normally occurs in the form of parallel transmission lines, and the types of parallel transmission line include: two-wire open line, twisted pair, shielded pair, and coaxial cables. And since no dielectric is perfect and efficiency improve through the above listed order; electrons will still maneuver their way from one conductor to the other in the pair, through the dielectric.

Apart from the seismometer(s) being an active component, their exist batteries in the seismic transmission line circuit, thus there is a terminal potential difference V volt(s) and current I ampere(s) driven through the transmission line.

Generally: $I \propto V$

and:

$$I = SV \qquad (1)$$

Where, S is the conductance of the lines material.

The proportionality constants S and R in the two forms of ohm's law equations depend on the size and shape of the line. It is useful therefore, to define the quantity which depends only on the material of the line. Equation (1) implies:

$$S = \frac{1}{R}$$

and

$$S = \frac{\sigma A}{L} \qquad (2)$$

Where σ is conductivity of the material; A, the cross sectional area of the conductor; and L is the Length of the conductor. Combining equations (1) & (2), above:

$$I = \sigma AV \div L \qquad (3)$$

i.e.:

$$J = \sigma \frac{V}{L} \qquad (4)$$

Where J is the current density.

If we view the two – wire transmission lines as a long capacitor, and consider experience of a test charge (q_t) in its uniform electric field, as that between two oppositely charged plates of common surface area A, and length L. The work done on the charge when it experiences displacement ds is given by:

$$dw = F_t \,.\, ds$$
$$= q_t E \,.ds \qquad (5)$$

From the potential energy relation:

$$du = -dw \qquad (6)$$

Thus: $$du = -q_t E.ds$$

$$\frac{du}{q_t} = -E.ds$$

Where the RHS defines the electric potential (V), hence:

$$dv = -E.ds \qquad (7)$$

Integrating equation (7) we have:

$$V = -\int E.ds$$

$$= -\int E.ds\, Cos\, \theta$$

But E and ds are everywhere anti-parallel between the plates, hence:

$$V = -E\int_0^L ds$$

$$V = EL \qquad (8)$$

Equation (8) gives the magnitude of the electric field anywhere in the uniform wires. Substituting (8) into (4), we have:

$$J = \sigma E \qquad (9)$$

Thus the current density at any location within the transmission line (assumed Ohmic) is directly proportional to the magnitude of the electric field at that location. Equation (9) thus expresses the Ohmic behavior of the transmission line as being dependent only on its material properties rather than shape or size. When a voltage is applied to its terminals, a finite amount of current would flow, and thus the characteristic impedance (Z_o) of the infinite line could be calculated, through the ohm's law. The characteristic impedance (Z_o) of the line is the same at any point on the line. Miller [1] showed that:

$$Z_o = \sqrt{L/C} \qquad (10)$$

Implying that, transmission line characteristic impedance only depends on its distributed inductance and capacitance. It is thus independent of length. This ordinarily implies seismic lines may be as long as possible, provided the characteristic impedance of the wire is low enough to support good communication of the seismic signal.

Furthermore, increase in the separation of the parallel wires increases the inductance and decrease the capacitance, since the effective inductance, is proportional to the flux that may be established between the two wires. As the two current carrying wires (in opposite directions) are further separated, more magnetic flux is included between them. They cannot cancel their magnetic effect as completely as if the wires were closer together. Thus the distributed inductance increases, and hence increasing the transmission wire's spacing increases the characteristic impedance Z_o. Also, decreasing the size of the plates of the capacitor is equivalent to decreasing the size of the transmission wire, therefore reduction in the diameter of the wire increases Z_o.

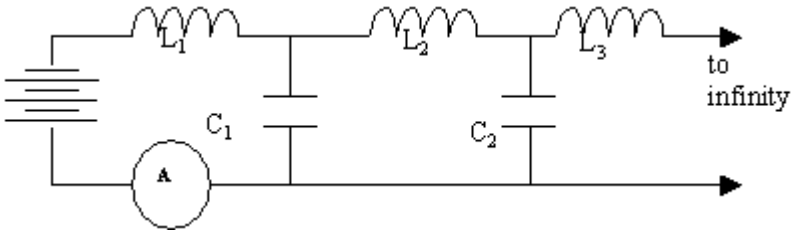

Figure 1: An illustration of seismic signals Transmission mechanism

When a current is moving down the line (Fig.1), its associated electric and magnetic fields are propagated down the line, and the time for a field to be propagated from one point on a line to another may be computed and the velocity of propagation determined, Miller [1]. Thus propagation velocity is a unique property of a conducting material, since it varies from one material transmission line to another but remain constant in vacuum or space. The voltage and current waves are called traveling waves and move in phase with one another from the source to the load through a transmission line. Reflected signals generally are highly undesirable, and it occurs in lines not terminated in its characteristic impedance. The type and amounts of reflected waves are dependent on the type and amount of mismatch. When a mismatch occurs there is an interaction between the incident and reflected waves.

Energy losses in transmission lines cannot be ignored, and the three major losses that occur in transmission lines are: copper losses, dielectric losses and radiation or induction losses. The radiation loss in parallel wire transmission lines is caused by the electrostatic and electromagnetic fields that surround conductor. This result from the action of electrostatic field in charging neighboring objects and in the case of accompanying magnetic field as it induces an electromotive force in nearby conductors. Dielectric losses are proportional to the voltage across the dielectric. Lowest losses occur, when air dielectric lines are used. Dielectric losses are lower with direct currents than alternating current, and hence D.C preference in underground cables transmission, and in equipment as seismographs where energy conservation is of extreme importance. Since the resistance of any conductor is never zero, the greater the Voltage the smaller is the loss. A reduction in resistance will minimize the power loss in the line.

Also, the use of a wire with large cross - sectional area reduces the loss, though result in cost increases. Losses due to resistance and dielectric are proportional to length and they are usually lumped together and expressed in decibels of loss per meter.

II. Analysis of a Geophone Equation Of Motion

Geophones are motion sensitive transducers that convert mechanical energy of ground vibration due to seismic energy source to an electrical signal whose amplitude is proportional to the velocity of the motion. As seismic wave passes in the ground into which the geophone has been firmly pegged- down, the ring-magnet attached to the case moves with the ground, while the suspended coil mass (M) moves relatively with the magnet - hence a sinusoidal emf (ε) is induced.

Geophone coils are divided into two parts that are wound in opposite directions and so wired that signals due to motion add; while those that are noise in the coil cancel. Geophone's spurious resonance due to modes of the fundamental motion is resolved by its seismic pass band, since they occur at higher frequencies than the pass band. It is assumed that the geophone follow exactly the motion of the ground, hence the jug hustling need to ensure rigid ground coupling for each of the geophones in use. Sheriff and Geldart [2] states three forces mainly act upon a geophone coil in motion: the restoring force of the spring, the force of friction, and the force resulting from the interaction of the permanent magnet’s field with the magnetic field of the current.

Consider a vertical surface displacement Z_s accompanied by a *geophone* coil displacement Z_c relative to its permanent magnet. Given mass (M) of the geophone's coil, having n, number of turns each of a radius r. Based on the 2nd law of motion, the magnitude of the net force is algebraic sum of spring force ($\mathbf{F}_s$), damping force ($\mathbf{F}_d$) and force on coil due to current. Since the first two are retarding forces, the equation of motion of a geophone can be written as follows:

$$SZ_c - \tau \frac{dZ_c}{dt} + T_{ic} = M\left(\frac{d^2Z_s}{dt^2} + \frac{d^2Z_c}{dt^2}\right) \qquad (11a)$$

where **S** is spring constant, τ is mechanical damping factor and $\mathbf{T}_{ic}$ is the force on the coil due to current. In general, if the coil of length L_o, is carrying current **I** in a uniform magnetic field **B**, then:

$$\mathbf{T}_{ic} = L_o\,(\mathbf{I} \times \mathbf{B})$$

$$i.e.: \qquad T_{ic} = BiLosin\alpha$$

where α is the angle between **I** and **B**.

Now, the voltage output of the seismometer as geophone is proportional to the vertical displacement component and the plane of the coil turns is perpendicular to the magnetic field of the ring magnet. Then:

$\alpha = 90^o$ and hence : $T_{ic} = BiL_o$

Let $C = BL_o$, then:

$$T_{ic} = iC \qquad (11b)$$

Also, the induced emf (ε) is directly proportional to the rate of change of flux (Ø) cutting i.e.:

$$\varepsilon \propto \frac{d}{dt}(n\phi)$$

$$Thus: \qquad \varepsilon = K\frac{d}{dt}(n\phi) \qquad (12)$$

Where, $K = n = 1$, for unit Weber

Using Lenz's law, the Faraday's law becomes:

$$\varepsilon(_{coil}) = -\frac{d\phi}{dt} \qquad (13)$$

Equation (13) could be written as:

$$\varepsilon_{(coil)} = -\frac{d\phi}{dZ_c}\frac{dZ_c}{dt} \quad (14)$$

Now, by mutual inductance when a current flows through a single solenoid, each turn makes a contribution to the total magnetic flux and the flux contribution of a turn links it with some of the neighboring turns.

Robert and Lawrence [3] explain 'in a long solenoid or a toroid, the magnetic flux contribution of each turn links essentially all other turns. For geophone coil having n turns of radius r each, and permanent magnet of strength H, the constant factor (k) is 2πrnH. Hence:

$$\varepsilon_{(coil)} = -2\pi rnH\frac{dZ_c}{dt} = -K\frac{dZ_c}{dt} \quad (15)$$

Relative motion between the magnet and coil produce induced current (i), which is a consequence of an e.m.f (ε) induced in the coil. The value of the induced current (1) by ohms law, depends on the resistance of the circuit and the induced e.m.f (ε):

$$\varepsilon = Ri \quad (16)$$

Thus when a geophones receive a seismic wave through the ground that is set into vibration - creating relative motion between the magnet and the coil to have equation (11a); the current flow through the solenoid also increased with the vibration, implying increase in the amount of flux linking each turn to other turns. Thus by Faraday's law the induced and a back emf (V_b) which opposes the growth of current are related as follows:

$$V_b = -L\frac{dI}{dt} \quad (17)$$

Where L = Self inductance

Every binary conductor, including the coil has a self-inductance, though it may be small. Now for an increasing current to be driven through an inductor, work must be done against the back emf V_b. The work is stored as potential energy in the magnetic field.

The net induced e.m.f in coil is thus:

$$\varepsilon = RI - \left(- L \frac{dI}{dt} \right) = RI + L \frac{dI}{dt} \tag{18}$$

Equating (15) & (18):

$$- K \frac{dZ_c}{dt} = RI + L \frac{dI}{dt}$$

$$\frac{dZ_c}{dt} = - \frac{1}{k} \left(RI + L \frac{dI}{dt} \right) \tag{19}$$

Now, differentiating both sides of equation (11a) we have:

$$\frac{SdZ_c}{dt} - \tau \frac{d^2 Z_c}{dt^2} + C \frac{di}{dt} - M \left(\frac{d^3 Z_s}{dt^3} + \frac{d^3 Z_c}{dt^3} \right) = 0$$

$$- M \frac{d^3 Z_c}{dt^3} - M \frac{d^3 Z_s}{dt^3} - \tau \frac{d^2 Z_c}{dt^2} + S \frac{dZ_c}{dt} + C \frac{di}{dt} = 0$$

$$- M \frac{d^2}{dt^2} \left(\frac{dZ_c}{dt} \right) - M \frac{d^3 Z_s}{dt^3} - \tau \frac{d}{dt} \left(\frac{dZ_c}{dt} \right) + S \left(\frac{dZ_c}{dt} \right) + C \frac{di}{dt} = 0 \tag{20}$$

Substituting for $\left(\frac{dZ_c}{dt} \right)$ from equation (19) into (20) we have

$$- M \frac{d^2}{dt^2} \left(\frac{1}{K} \left(Ri + L \frac{di}{dt} \right) \right) - M \frac{d^3 Z_s}{dt^3} - \tau \frac{d}{dt} \left(\frac{1}{K} \left(Ri + L \frac{di}{dt} \right) \right) + S \left(\frac{1}{K} \left(Ri + L \frac{di}{dt} \right) \right) + C \left(\frac{di}{dt} \right) = 0 \tag{21}$$

Since a single pulse is being considered, its impact is essentially that of a spike - a single maximum amplitude, hence Z_s may be considered a constant greater than zero, hence:

$$M \frac{d^3 Z_s}{dt^3} = 0$$

Also $$\tau \frac{d}{dt}\left(\frac{1}{K}\left(Ri + L\frac{di}{dt}\right)\right) = \frac{\tau}{K}\left(\left(R\frac{di}{dt} + L\frac{d^2i}{dt^2}\right)\right) \quad (22)$$

and $$S\left(\frac{1}{K}\left(Ri + L\frac{di}{dt}\right)\right) = \frac{S}{K}\left(\left(Ri + L\frac{di}{dt}\right)\right) \quad (23)$$

Thus equation (21) becomes:

$$-\frac{M}{K}\left(R\frac{d^2i}{dt^2} + L\frac{d^3i}{dt^3}\right) - \frac{\tau}{K}\left(R\frac{di}{dt} + L\frac{d^2i}{dt^2}\right) + \frac{S}{K}\left(Ri + L\frac{di}{dt}\right) + C\left(\frac{di}{dt}\right) = 0 \quad (24)$$

Simplifying,

$$\left(\quad\right) - \frac{M}{K}\left(L\frac{d^3i}{dt^3} - \frac{M}{K}R\right) + \frac{\tau}{K}\left(L\frac{d^2i}{dt^2} - \frac{\tau}{K}R - \frac{S}{K}L - C\frac{di}{dt} + \frac{S}{K}Ri = 0\right) \quad (25)$$

Multiplying Equation (25) through by K, we have:

$$-ML\frac{d^3i}{dt^3} - (MR + \tau L)\frac{d^2i}{dt^2} - (\tau R - SL - CK)\frac{di}{dt} + SRi = 0 \quad (26)$$

Now, if a constant current (i) flow for a time (t) across any given point A, on the transmission line, then the charge(s) that flow across the point is given by:

$$q = it$$

i.e.: $$i = qt^{-1}$$

then: $$\frac{di}{dt} = \frac{d\left(qt^{-1}\right)}{dt} = -iqt^{-2}$$

also: $$\frac{d^2i}{dt^2} = \frac{d}{dt}\left(\frac{di}{dt}\right) = \frac{d}{dt}\left(-qt^{-2}\right) = +2qt^{-3}$$

and: $$\frac{d^3i}{dt^3} = \frac{d}{dt}\left(\frac{d^2i}{dt^2}\right) = \frac{d}{dt}\left(2qt^{-3}\right) = -6qt^{-4}$$

Thus equation (26) becomes:

$$-ML(-6qt^{-4}) - (MR+\tau L)(2qt^{-3}) - (\tau R-SL-CK)(-qt^{-2}) + SR\,\dot{i} = 0$$

i.e.: $$6MLqt^{-4} - 2(MR+\tau L)qt^{-3} + (tR-SL-CK)qt^{-2} + SR\,\dot{i} = 0$$

- making the signal-current the function subject, and rearranging the constants, we have:

$$SR\,\dot{i} = -6MLqt^{-4} + 2q(MR+\tau L)t^{-3} - (\tau R-SL-CK)qt^{-2} \quad (27)$$

Let : $SR = C_r$; $6MLq = C_0$; $C_1 = 2q(MR+\tau L)$, and $C_2 = q(\tau R-SL-CK)$ (28)

Now, considering the frequency of oscillation of the coil's charge body which corresponds to a particular current (i) in response to each of the series of impacts of the ground's mechanical vibration on the geophone's coil, then:

$$\{t^{-4}, t^{-3}, t^{-2}\} \equiv \{f_0, f_1, f_2\} \quad (29)$$

Finally, substituting equations (28) and (29) into equation (27), we have:

$$\mathbf{C_r i = -\,C_0 f_o + C_1 f_1 - C_2 f_2 + \ldots\ldots \mp C_n f_n} \quad (30)$$

Equation (30) relates the current **i(t)** produced in the geophone to the frequency(f) of the seismic signal it carries. The voltage **V (t)** variation waveform is represented by the left hand side of the equation. The equation thus represents the seismic signals as they move through bounded media, and considering the Leslie Balmer[4] explanation, "it is this voltage and the manner in which it varies that carries information about the content…"

The equation implicitly expresses the seismic signals velocities **(v_n)** with respect to their corresponding wavelengths, which could be shown by rewriting equation (30) as follows:

$$\mathbf{V\,(t) = -\,C_0\frac{V_0}{\lambda_0} + C_1\frac{V_1}{\lambda_1} - C_2\frac{V_2}{\lambda_2} + \ldots\ldots \mp C_n\frac{V_n}{\lambda_n}} \quad (31)$$

The equation (31) describes a geophone's seismic signal wavelength distribution that can be observed in a seismograph's monitor. However in a society of exploration geophysicist review [5], the mathematical definition of a pulse is a signal of infinite amplitude, extending over an infinitely short period of time. For practical purposes it is possible to approximate a pulse with as much precision as the ability to measure it.

The limit of mathematical precision required for digital processing is usually pre-ordained by the constraints of the field parameters and equipment. Moreover, seismic sources really produce a much more complex situation. The simplest time variation that a wave can have is harmonic (sinusoidal). In general, the waves are more complex than this, though the methods of Fourier analysis allow us to represent almost any complex wave as a superposition of harmonic waves. Seismic waves experienced by the ground, thus correspond to charge wave in the transmission cable(s).

III. Conclusion

Whenever the electromagnetic field of a geophone is disturbed, it generates bits of information about the source of disturbance. Communication of the seismic data would be near perfect, if in addition to having the data digitized at the seismometer, they were transmitted through a wireless media at a licensed frequency. The cost of this, for economic reason may keep the explorers to bounded media means of getting the signals from the seismometers to the recording unit of the seismograph. The bounded media means occur in the form of parallel transmission cables. If the two wire transmission line is considered as a long capacitor, then the current density at any location within the transmission line is directly proportional to the magnitude of the electric field at that location.

The seismometer contribution to the field is alternating as indicated by the derived equation (30) of signal motion in bounded media and equation (31) describes a geophone's seismic signal wavelength distribution, as its change of capacitive reactance will manifest as applied frequency change.

Consequent values of inductance and capacitance will also depend on some other physical factors. The transmission line impedance only depends on its distributed inductance and capacitance, but independent on its length. Thus seismic lines may be as long as required, provided the characteristic impedance of the lines material is low enough to support good transmission of the seismic signals. Increase in the transmission wires spacing or reduction in the diameter of the wires increases their characteristic impedance. Also large cross-sectional area of the transmission line wires reduces the energy losses though this translates to cost increase.

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Structures of Uncertainty: Kinetic Constructions of A-live Space

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Abstract

Today's structural symbolic – abstract sense of matrix thinking based on the integration of structure and architecture referred to biological analogues (plant, animal, coral, historical analogues) and material configurations. These structural models of uncertainty reject the architectural design process focused on a set of questions concerning stability and strength of frozen and perfect space organisations. They specifically explore kinetic post-humanist architecture which is also related to new, innovative, flexible space concepts. New architectural design principles create performative constructions beyond geometries, which are soft / abstract geometries, where the object resolves into movement. Those changeable, but techtonic structures are open for a process of appropriation through a user, come into interaction / reaction with their environment and enable a constant alteration of bodies and a-live spaces of 21. Century. In this case this century will be the time for poetics of "new" architectural space based on endless spatial modifications / facilities described by uncertain structures on an endless playground of compatible physical conditions in many variations.

Keywords: a-live space, kinetic construction, structures of uncertainty, post-humanist architecture, spatial dialectic

1. Introductıon: Space as frozen Structure

"Technology which is essentially instrumental in nature is dissociated from the original meaning implied in the Greek word 'techne' which is related to the notion of poesies; its essence is not technological"

Martin Heidegger (Lim, 2010)

"Beauty is no longer traditionally defined in reference to an object but in reference to the dynamic processes of construction. In the engineering context, viability is valued as a form of beauty attained through "aesthetics of process" instead of the traditional "aesthetics of object".

Joseph Lim (2010)

21. century human being who stucked in between the "koinos kosmos (common world) and idios kosmos (internal world) is also in a very special consecutiveness shaped in the swirl of blurry future while she / he is completely engaged in the present time / exclusive moment (in German: Augenblick) which is named 'schizoid hexagram'. As a schizophrenic character she/he rejects the approved reality but lives in an over - perception based on an endless oscillation between daydreams and phobias (Dick, 2015). She / he perceives each event / space or spatial transformations (physical and psychological changes) in unique chaotic synchronization (logos) created by a very confidential relationship between her / him and physical conditions. This is a performance of open consciousness / an elaborate analysis of multi-faced spatial mutations as endless configurations.

Traditional architectural methodologies and modern design approaches were about stability, solidity or foundation. The classical and (early) modern concepts designated the (frozen) size, location, shape, form, and proportion of the mathematical and esthetical perfect architectural space which has been described by Vitruvian triology "venustas,firmitas,utilitas" means attractive appearance, structural stability and appropriate spatial accommodation. This architectural construction was the result of geometrical vocabulary which came from reproduction, combination and furthermore manipulation of basic spatial configurations.

Traditional and also early modern architecture, which would serve power in place, avoid the previous dissociation between the particular fragmented social space and the general logico-mathematical or mental singular physical delineated spaces. Its foundation was about solidity, considering the political framework. That was the pleasure of geometry, by extension, the pleasure of order; that is, the pleasure of concepts named typical statements on architecture (Clark, Pause, 1996). The concepts of symmetry and balance have accordingly been in use since the beginning of architecture. As a fundamental issue of composition, balance in architecture occured through the use of spatial of formal components. Balance was the state of perceptual, conceptual equilibrium (Clark, Pause, 1996).

Architecture was first the art of stable obligated measure as 3D organisations of absolut proportions of certained power and beauty. It once allowed civilizations to measure time and space (Tschumi, 1996). According to Clark and Pause (1996), symmetry, balance, radial or spiral, grid, cluster or patternative organizations, nested, concentric, hierarchic, repetative or transformative configurations have been the general geometric organizations in the development of architecture of frozen perfect space. Later theories defined space as homogeneous and they were based on Euclidean geometry which also described classical order of structure.

2. Contemporary Space Concepts

The idea that Euclidean geometry gives a faithful representation of physical space collapsed with the creation of non-Euclidean geometries in the nineteenth century and with the theory of relativity (Tschumi, 1996). According Tschumi (1996) it is obvious to assert that in the twentieth century it seemed to be distinguished between five different main space concepts: The pragmatic space of physical action, the perceptual space of immediate orientation, the existential space which forms man's stable image of his environment, the cognitive space of the physical world and the abstract space integrates man with his natural, "organic" environment.

Since the beginning of the last quarter of 20th century, architecture keeps trying to construct new conceptions of geometries based on the perceptions, requirements, program – scenario. Events give form to space physically and architecture becomes an organisation of the combinations of the abstract geometries representing the blurry new orders of movements, events and scenario, which determine new form of space or spatial. In this sense, space is transforming from a physical, limited, static, certain geometric form as a completed, frozen modern monument into an unlimited, dynamic, changeable, non-geometrical conditions / variations or geometry of unlimited possibilities, perceptual montage of the user's knowledge as a chain of personal or common kinetic experiences. The edges of the geometry of common space becomes blurry, but the contemporaray space of individual perception and commentry gets sharpen. In this case space can be evaluated as spatial or nonspace in the 21. century.

New architecture as a system / set of variables requires more research and pursues the a-live space as a new form of freedom / liberty to experiment. It does also creates a self regulating whole which is a construction (a structure not as a frozen music but an orchestral piece unfolding in infinite time) constituted of frames of probabilities (Buchanan, 2005). In other words post – humanist architecture (architecture of violence) (Tschumi, 1996) of 21. century is about abstraction of absolute truth and conceptualizes structure and chaos. Geometry in architecture and construction / structure had become abstract, changeable and unlimited. Spaces and their geometries are particularly evoluted to the multifunctional-multipurposed, perceptual, unlimited scenes of a repetitive movie (Clark, Pause, 1996). In this case it is completely difficult to comprehend the coincidence of construction's centre of gravity and its geometric centre because of the chaotic index of uncertain structural (com)positions which look like mobile and tend to fall down easily.

In this context contemporary architectural attitude is a prelude of vitalized set of geometries where the structure acts like mobile ornamentations and romantic mathematics. It is a flamboyant architecture which represents the "crystals of life" like redundancy (the availability of an enormous but not infinite number of ribs), changefulness (every figure is variable), flexible rigidity (all free movement of figures settles into configurational patterns, rigidity of structural and

ornamental modalities, naturalism, savageness (heterogeneous breaks in fields of variation, breeding box, general movement of the figures) (Spuybroek, 2009) and spirituality. It does create performative constructs beyond geometries, which are soft geometries, does enable situations beyond geometry, where the object resolves into movement and a state of blurring boundaries, performative spatial organizations. Those changeable, but techtonic structures are open for a process of appropriation through a user, come into interaction / reaction with their environment and enable a constant alteration of bodies and spaces. They provide a future prospect towards a new, widened concept of architecture (Agkathidis, Schillig, 2010).

3. Bio - structural Analogues in a-live Space

> *"One was to start with the geometry of an unit element and then to generate this into spatial (and structural) patterns by joining identical elements together.*
>
> *A second approach was to modify and adapt known structural types into flexible hybrids...*
>
> *A third approach sought to develop structure as a scaffold of elements, distortion of the overall geometry.*
>
> *A fourth approach began with an unstable form followed by successive iterations of stabilizing and deformation resisting measures to non-orthogonal, asymmetric or discontinuous forms..."*
>
> Joseph Lim, 2009

Today's structural symbolic – abstract sense of matrix thinking after the experiments of Felix Candela, P.L. Nervi, Eduardo Torroja, Frei Otto who were enabled the integration of structure and architecture based on biological analogues and material configurations. These were obvious structures as the main spine possess capabilities of adaptability and controlled dynamics in the contemporary process oriented design concepts in new performative geometric layouts (kinetic configurations).

These structural models reject the architectural design process focused on a set of questions concerning stability and strength. They specifically explore abstract geometries relating kinetic architectural form to the characteristics of living species in a provisional way as a certain connection between pattern and structural action (Lim, 2009).

According to the discovery of new relationships between structure and algorithmic, parametric and generative architectural products related to the contemporary DNA of heterogeneous, open-ended, innovative kinetic space, structural components in geometric variations compose the main construction. They are interrelated through interlacing patterns of variable figures, which exist successfully / impressively in Cecil Balmond's structural surveys. His projects represent structures / constructions of uncertainty described by Rem Koolhaas (Lim, 2009) as being no longer heroic or confident, they embrace unreason and weakness – at their most rational. These structures look unbelievable, they are often a double image that conveys in a single almost-oscillating perception both triumph and its disaster, it does not reassure. Belmond's structures seem often inexplicable; they are innocent and nihilistic (Lim, 2009).

Figure 1: Collaborative ideas for more liveable cities, Cecil Belmond

Figure 2: Carabott beatbox, structures of uncertainty, Cecil Belmond

New structural organisations can express doubt, arbitrariness, mystery in forms which can engage with the uncertainty of the current moment. These generic architectural structures based on the specific relationship between flexible geometric patterns (that can adapt to and physical / climatic changes in the environment or to the changing requirements of the user) as highly effective forms / morphologies referred to bio – structural analogues of complex natural systems (bio-mimetic). According Lim (2009) there are four different analogues which create flexible – kinetic, generic architecture of bio-structural a-live space. These are as follows:

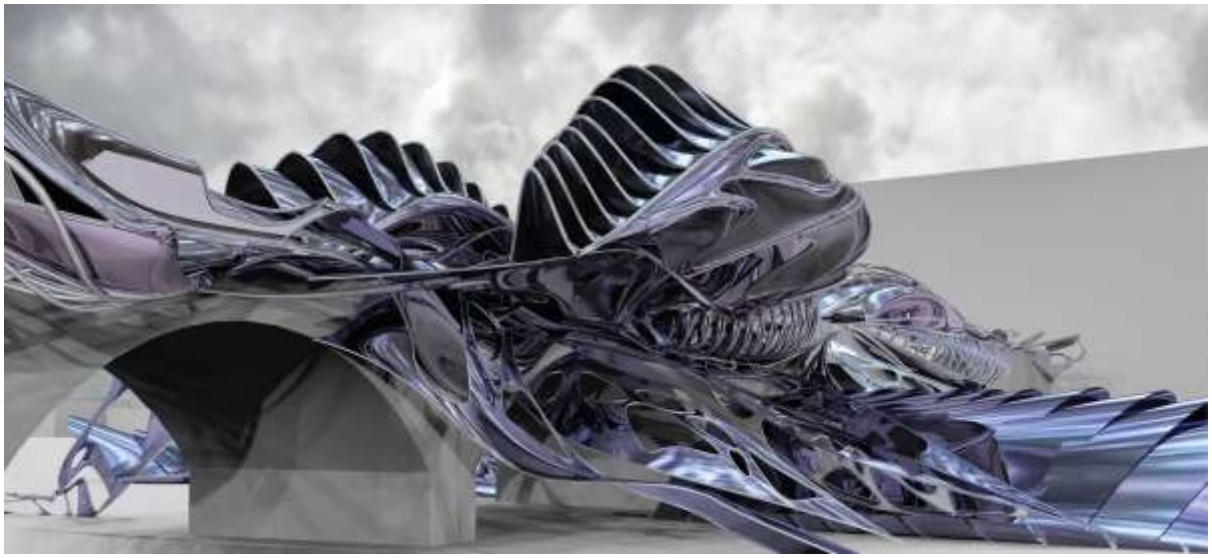
PLANT ANALOGUES: based on flexibility and kinetic movement with a potential to accommodate a range of architectural programmes. These were necessary to contextualise further design development of the structural idea

ANIMAL ANALOGUES: based on self propelling, self-protection, self-fuelling, self-healing. These bio-structural analogues allow the development and generations of alternative solutions to shelter and space – changing enclosures. The skeletal system of the animal / plant and their structural action in enabling movement is applied to a space modifying prototype

CORAL ANALOGUES: based on growing space and sedimentation

HISTORICAL ANALOGUES: based on a generic morphology in assuming different forms of existence. There are bio-formed modular units with space frame action. Their structural morphology is likened to the Gothic / Baroque bridging structural theory with form making (Lim, 2009).

Figure 3: Structure of uncertainty, Chinese golden fish - animal analogy, liquid architecture, Zeng, H.



These bio – formed organizations / analogues – mechanisms which do not demarcate a rigid boundary but do open an interval, a frame of probabilities, describe the new irrational structures as non-Euclidean forms of uncertainty of unstable architectural constructions. Their concepts based on a logic where the whole is not given but (is) always open to variation, as new things are added or new relations made, creating new continuities out of intervals or disparities (Buchanan, Lampert, 2005).

Contemporary a-live space subjected to change with non-hierarchal natures surrounded responsive surfaces which constitute the innovative unusual shape. In this case facade of the construction does not demarcate a rigid boundary but proceeds consolidation from exterior to interior.

Contemporary integrated design appoaches based on analogues which might be able to dissolve the constructional and functional differentiations between structure and building. They are furthermore able to suggest alternative structural types and able to re-shape new architectural space / spatial concepts. They also enable relation of material elements with social and physical environments through a process of material operations involving culture, climate and energy contextual to the sustainability (Lim, 2009).

Today's innovative constructions are originating living species morphologies as developmental models for structural and mechanical action. Contemporary architectural design approaches are involving the dialectic use of structure (engaged in the poetics of structure) - structural material in the conception of flexible multi-functional space. In this context elasticity of space (shrinking / enlarging capacity and evolvability) comes from material variability according to the physical (topology, climate, light, pressure etc.) or social (user's profile and requirements) conditionally changes. Regarding this contemporary structure is much more subjective, irrational but valid and more related to architecture. In other words this mentioned architecture does include a group of framework of movements (Tschumi, 1996) a combination of kinetic structures (dis-structuring) without centre. It is constituted of combination of system of lines, surfaces, points a spread compact but complex masterly construction, as an artistic gesture (Lim, 2009). In the contemporary concepts structure becomes architecture. In this case today's (hyper)-architecture also as an engineering knowledge and performance is being asked for the actualization the conventional structure / construction dialectics.

4. Conclusion: Space - Structure Dialectics

> *"Regulation was not at the centre anymore. Today we have entered the age of deregulation."*
>
> Bernard Tschumi (1996)

Contextually today's architecture of "new" space represents a complex design attitude without resorting to traditional rules of composition, hierarchy, power, historic contextual beauty and order. Contemporary architecture is accepted as constantly unstable, and on the verge of changes of flexible spaces with open narratives (Tschumi, 1996). It does reject the traditional

opposition or relation between program and design but extends spatial questions of superimpositions, variations, permutations according to the synchronizations with the designated experimental space and requirements / perceptions of the user. Today's architecture is a replacement of geometrical space concepts and user's experience of space (reversed relation between program and its architecture) concepts.

Stated in other words contemporary architecture as set of variation is also the architecture of patterns, is a new approach to from as an environment, and produces transformative space of digital avant-garde in the performative geometries according to the physical and social conditionally changes or requirements. New architecture of contaminated patterns generates as an endless repertoire of motives which perpetually expand variations taking precedence over progress. They can only appear under circumstances of dynamic instability and also perform / produce the continuity between mind and (artificial) nature / environment (Andersen, Salomon, 2010).

In this case contemporary designer becomes the choreographer of adaptive translation and specification of inner and outer sustainable environments, creator of form as environment. Perception and experience are classifications of the new space of elastic precision under linguistic and hylomorphic material variability, emergence of variability, progressive differentiation of and specialization, which could be embryological, biological, physical, chemical, or meteorological. In this case, the relationship between form / space of variation on a performative geometry and behavior is much more dialectic, capricious, dynamic and synchronized.

Today's architecture should also be the art of introducing intervals and should construct frames of probability. This is the architecture of contingency of a perpetual, balanced and distributed environment. The contemporary new metabolic architecture looks for a new adaptation between body and space, rethinks the body in its interactive environment creates metabolic interactions from which living functions might arise in the matrix (Andersen, Salomon, 2010).

21. century's (time of de-, dis-, ex-: ex-centric, dis-integration, dis-location, dis-junction, deconstruction, dismantling, disassociation, discontinuous, deregulation) constructional approach include structural understanding dialectically, integration of structural thinking with architecture in general in terms of creating innovative space concepts.

More detailed contemporary hyper-architecture is engaged in the innovative, flexible, half-translucent structure of uncertainity as the main blurry vertebra of new extroverted space which gives liberty of experience. Today's design attitude is based not on a specific form and material, but related to sensuality and tactility (Beesley, 2010). It is a hybrid approach (architectural and engineering) which creates endless spatial modifications / facilities hence the uncertain structural variations describe the endless playground of compatible physical conditions as the poetics of "new" architecture which means "humanisation of space" in contrary Le Corbusier (2014), who evaluated space and event (accordng him even these events are measurable and framed in flexible standardization of frozen "Modulor" as a kind of texturic and visual acustic (spatial) phenomenon – ruler or architectural mould) separatly from each other and described "humanisation of space" as a poetry of perfect "right angle" fundamental geometric space in golden proportion which does create / include their plastic without events in a frozen 3D shape as perfect sculpture.

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Social Context of Prevention and Management of Infertility in Nigeria

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Abstract

The incidence of infertility in Nigeria has assumed an alarming proportion and is a major public health problem. Although some studies have looked into the problem of infertility, current knowledge of the factors contributing to infertility is limited. And given that these studies are mainly conducted by medical experts, they present just a partial view of the situation without necessarily locating the problem of infertility within the social context in which it occurs. This paper examines infertility in Nigeria especially as it relates to its social and behavioural aspects. In carrying out this research, the author relied mainly on secondary data. It is observed that there is no adequate health policy and services that tackle infertility in Nigeria. Again, inability to comprehensively understand socio-cultural dimensions of infertility has largely resulted in the failures of family and reproductive health interventions and population policies in many Sub-Saharan African countries. The author concludes, with rare instances, that interventions at resolving the problem of infertility should be focused at prevention rather than treatment.

Key words: Infertility, Nigeria, Social context, Reproductive health interventions, Public health problem.

Introduction

Infertility constitutes a grave emotional and social problem in societies where great importance is attached to having children (Caldwell and Caldwell, 2000; 1978). The contradictory scenario however, is that Sub-Saharan Africa, characterized by high fertility also represents areas of highest prevalence of infertility. Estimates suggest that about 20-30 percentage of couples in Africa experience primary and secondary infertility (Okonofua, 1999). The most affected areas lie within the central African region referred to as the "infertility belt" of Africa (Okonofua, 1999; Romaniuk; 1969). Although Nigeria does not fall within the infertility belt, there are indications of high and rising prevalence levels (CDC, 2000). In spite of the high prevalence of infertility, significant efforts have not been made at tackling the problem.

Even though the population policy of Nigeria (section 4.1B of 2004) affirms the need for family planning clinics to assist infertile couples desiring to give birth to children, infertility is yet to be addressed as a public health issue (Okonofua *et al.*, 1997). This low level of response negates the Action Plan of the International Conference on Population and Development held in Cairo in 1994, which echoed the importance of guaranteeing reproductive health rights to every individual. The lack of adequate focus by policy makers on the problem of infertility has often resulted in its further intensification. For instance, having multiple sexual partners and abortion, which are parts of the coping mechanisms among infertile persons. This predisposes them to sexually transmitted diseases (STDs) and reproductive tract infections (RTIs) that could result in infertility. According to the analysis of the World Fertility Survey (WFS, 1972 and 1978) and the Demographic Health Survey (DHS, 1990), the prevalence rate of infertility among various regions in Nigeria is between 6 and 19 percent (Araoye, 2003). In the same vain, data also show that about 70 percent of gynecological cases reported at the hospitals in Nigeria are of infertility (Okonofua, 1999). This makes it imperative to understand the social and behavioral concerns with respect to infertility in Nigeria.

Indeed the problem of infertility has been subjugated for perceived urgent concerns of high population growth through fertility and increasing incidence of unplanned pregnancy, unsafe abortion, sexually transmitted diseases and lately HIV/AIDS (Boerma and Mgalla, 2001; Widge, 2001; Okonofua *et al*., 1997; Romaniuk, 1969). Family planning services that treat infertility are not adequate and widespread. They are most not affordable to the majority that is socio-economically impoverished. Given that these studies are mainly conducted by medical experts, they present just a partial view of the situation without necessarily locating the problem of infertility within the social context in which it occurs. In fact, studies on infertility have been neglected in the social sciences, and abandoned at the slab of medical science (Greil, 1997). Although there were demographic studies on infertility in the past, these were largely confined to the infertility belt. The implication is that there is paucity of data that could lead to a comprehensive understanding of this complex phenomenon.

While some researches have addressed fertility issues in Sub-Saharan Africa, studies related to the social context of infertility in the region on the other hand are not extensive (Larsen, 2003; Caldwell and Caldwell, 2000; Boerma and Mgalla, 2001; Okonofua, 1999; Okonofua et al., 1997; Greil, 1997). The few that exist have espoused female aspects of infertility alone while creating the impression that infertility is not equally a problem experienced by males. Isiugo-Abanihe (2003) recently stressed the crucial role of the male factor in fertility and family health issues. Indeed, inability to comprehensively understand socio-cultural dimensions of infertility has

largely resulted in the failures of a number of family and reproductive health interventions and population policies in many Sub-Saharan African communities; as a major public health problem in Nigeria, infertility has contributed to inappropriate contraceptive behavior and poor sexual and reproductive health of women.

Evidently, there is no adequate public health policy and services that tackle infertility in Nigeria in-spite of the International Conference on Population Development (ICPD) Plan of Action, which states that reproductive health services should include the prevention and appropriate treatment of infertility. This paper therefore examines infertility in Nigeria especially as it relates to its social and behavioral aspects as well as prevention and management.

Conceptual Clarifications

There are various conceptions of infertility, which depends on context it is being used. The medical conception refers to infertility as the inability of a couple to achieve pregnancy within 12 months of regular unprotected sexual intercourse (Leke, 2003), while demographers often define infertility as the proportion of (married) women between ages 40 to 45 who are childless. Another demographic definition refers to infertility as the absence of live born children or the presence of few children, or, primary and secondary infertility respectively (Frank, 2003). Demographers use the term infertility to refer to all forms of unsatisfied fertility including sterility, fetal loss whether as a result of spontaneous or induced abortion or stillbirths. Thus infertility refers to shortfalls in live born children whether or not pregnancy (ies) has occurred. This paper therefore takes into account these varied conceptions of infertility owing to various socio-cultural, individual circumstance and experiences as well as structural and institutional meanings. For instance, the medical science definition, which views infertility only as when a couple or an individual is not able to conceive, is not sufficient for other institutions. For example within the socio-cultural context it is not sufficient enough for a woman to prove her fertility without her having live birth. Similarly, an inability to give birth to the desired number of children is perceived as infertility.

These pluralistic understanding of infertility further emphasize the importance of understanding the social contexts of infertility. Therefore for the purpose of this study, infertility refers to the inability of a man, woman or couple to achieve desired pregnancy or natural fertility in terms of preferred number, sex and time. There are two levels of infertility that is, primary and secondary infertility. **Primary infertility** refers to a situation where a woman has not achieved pregnancy or a live birth in her lifetime, or a man not being able to fertilize an ovum to achieve pregnancy or a live birth. The World Health Organization (WHO) defined primary infertility as when the couple has never conceived despite regular unprotected intercourse for the past 12 months (Rutstein and Iqbal, 2004; Larsen, 2000). **Secondary infertility** refers to the inability of a woman to achieve a desired pregnancy or live birth following previous achievements, or the inability of a man's spermatozoa to fertilize an ovum for pregnancy or live birth following previous achievement. WHO defines secondary infertility as when the couple has previously conceived but is subsequently unable to conceive after 12 months of regular unprotected intercourse (Rutstein and Iqbal, 2004; Larsen, 2000). **Infertility Behavior** therefore refers to all biological and behavioral perceptions, attitudes, actions and reactions engaged in by both fertile and infertile persons in relation to infertility. It involves constellation of perceptions, attitude and actions and reactions towards infertility including its causes, consequences, treatment and prevention of infertility.

Prevalence of Infertility in Nigeria

The incidence of infertility in Nigeria has assumed an alarming proportion. Araoye (2003) asserts that difficulty in achieving desired childbirth accounts for more than half of the cases seen in gynecological clinics in the developing world particularly Sub-Saharan Africa. Nasah (1984) equally reports that 30-40 percent of consultations at family planning or gynecologic clinics relate to complaints of infertility. Findings in Nigeria also show a corresponding pattern as about 60-70% of all gynecological cases were for infertility (The Punch, September, 2003; Okonofua et al., 1997; Megafu, 2003).

According to Leke (2003), despite the increase in world population, 10-20% of couples in the world suffer from infertility. Brady (2003) estimates that 8-12% of couples experience some infertility problem during their reproductive lives. Leke (2003) puts the estimate at 25% of couples that experience some difficulty in achieving desired pregnancy at some stage in their lives. Gerias and Rushman (1992) reported that an estimated 580 million people (approximately 5-8% of couples) around the world, experience infertility at some point in their reproductive lives. Of these, nearly 372 million persons (about 186 million couples) reside in low-and middle-income countries, with the exclusion of China (Rutstein and Iqbal, 2004). Frank (1987) estimates these proportions to be 3 percent based on the proportion of women who have reached the end of their childbearing years childless. Rates of primary infertility are between 3 percent in developed world and 10 percent in developing countries. The unavailability of data however makes the measurement of secondary infertility difficult. According to the United States, Office of Technical Assistance (OTA), almost three times as many women who suffer primary infertility suffer from secondary infertility.

The geography of infecundity in Africa shows different zones of low fertility with a large zone of hypo-fecundity extending through most parts of west and central Africa from Senegal, Mali, Burkina Faso and Niger through Cameroon, to Sudan, DRC (Zaire), Uganda, Kenya and Tanzania, Gabon (Leke, 2003). This region is referred to as the "infertility belt" in Africa (Okonofua, 1999; Romaniuk, 1969). Similarly, Sub-Saharan Africa is characterized by about 15-30% prevalence rate of infertility compared with reported rates of 5-10% in developed countries. In Nigeria, the increasing prevalence of infertility has been observed in several places. Udjo (1987) noted the incidence of low fertility attributable to pathological sterility among the Kanuri in Northern Nigeria. Okonofua (1999) asserts that about 800,000 couples experience infertility. A recent survey by the Obstetrics and Gynecological unit of the Lagos State University Teaching Hospital, Ikeja, reveals an increase in the number of infertility cases in Nigeria over the past ten years (that is, 1992 to 2002), to range from 1,347 to 2,861, while weekly cases increased from 26 to 55.

Some experts have drawn some implications from this high prevalence of infertility in Africa and established a relationship with the high prevalence of fertility. Frank (1987) for instance; found that variations in levels of infertility alone accounts for 60% of the variation in fertility levels. Adjei and Adansi-Pipim (1989) and Frank (1983) equally assert that the inability of women to satisfy their fertility desires explains their unwillingness to use contraceptives. This points out the need to review population policy and programmes to accommodate for the needs for regions of high infertility (Obono, 2003; Nkounkou, 1989).

Social Context of Infertility

The more important children are to the fabric of a given culture, the more important it is for couples to be fertile and the worse the consequences if a couple is infertile (CDC, 2000). Isuigo-Abanihe (1993) affirms that cultural dictates shape behaviors and one's environment affect reproductive efforts, outcomes, perceptions and motivations. Thus, infertility and perceptions towards it are hinged within some socio-cultural beliefs and practices. According to Greil (1997), infertility is not specifically a physiological state but also a social status. However, economic, socio-cultural or psychological factors such as educational level, socio-economic role of women, migration patterns, income level and distribution, agricultural production, land tenure practices, perceived value and cost of children, customs regarding marriage and sexual behavior have not been studied among causes of infertility. For instance, Nasah (1984) reports that socio-cultural and family pressures often make couples perceive themselves as infertile after less than one year of marriage. Savage (1992) and Widge (2001) noted that when a woman is defined by her infertility, she internalizes the role of motherhood, which makes her feel worthless, and considers herself truly infertile. Many scholars shared the opinion that infertility is socio-culturally perceived as a punishment for wrongdoing. Witchcraft, promiscuity, infidelity, immorality, abortion are also notable perceived socio-cultural causes of infertility (Koster-Oyekan, 1999; Okonofua et al., 1997 Leke and Nasah, 1979). It is observable from the foregoing that socio-cultural perceptions of the causes of infertility tend to assume that infertility is often caused by the female factors. This is largely due to the patriarchal nature of the African societies, which tend to assume reproductive issues as a sole burden of women.

Although various studies have looked into the problem of infertility, current knowledge of the factors contributing to infertility is limited. In Africa, empirical analyses of infertility are complicated since data on factors contributing to infertility are not available. For instance, Sundby (1997) in a study in Gambia observed that half of the infertile couples failed to seek modern healthcare although they sought traditional care healers and spiritual leaders.

Nasah (1984) asserts that factors contributing to infertility may either operate singly or in combination. They are related to the physical environment in conjunction with the actual physical or psychological factors. For instance, while most infertility cases in Africa and the rest of the developing world are due to poor physical environment, inadequate basic health services and infection, predominant causes of infertility in the developed world are as a result of hormonal, psychological and development factors.

The contribution of gender to infertility remains controversial. While most studies have investigated the prevalence of female infertility, very few have studied male infertility. However, it has been suggested that males and females contribute equally to infertility (Chukudebelu et al., 1997). Nevertheless, reports from parts of Nigeria have reached different conclusions. While some showed an equal contribution of male and female partners to infertility (Alemnji and Thomas, 1997; Olatunji and Sule-Odu, 2003), others showed a disproportionate contribution of male and female partners (Esima et al., 2002; WHO, 1987). For instance, in a study among 10,000 couples by the WHO in 1987, the male factor was responsible in 33 percent of the cases, female causes account for 25 percent, couples –related reasons form 20% while no cases of infertility was found in 15 percent of the couple. However, it is difficult to accurately determine the contribution of males and females to infertility, as fertility is relative and may manifest differently in different

couples. For example, Leke and Nasah (1979) found infertility to be highly prevalence among women that marry at late ages.

According to Nigeria Demographic and Health Survey (NDHS, 1990), 4 percent of women aged 30 and above in Nigeria have never born a child while about 14 percent have secondary infertility. Similarly the NDHS (1999) reveals that about 4.2 percent of women aged 25-49 have no child and in southwest Nigeria, prevalence rate of infertility is 2.5 percent (NDHS, 1999). There are no corresponding figures for infertility among males.

Female Factors

There are varying statistics on the contribution of female and male factors to infertility. Sherries and Fox (1983) for instance, state that female factors account for between 50 to 70 percent of all infertility cases. More recent studies (for example Brady, 2003) tend to suggest an equal contribution of male and female factors to infertility. A major cause of infertility in women in Africa is acquired sterility due to pathological conditions, that is, Pelvic Inflammatory Diseases (PID). The most likely origin of PID is sexually transmitted diseases (STDS). In most cases of STDS and infertility, neisseria gonorrhea and Chlamydia trachoma have been identified as precipitating factors (Larsen, 1989; Nasah, 1984; Leke and Nasah 1979). There is an intricate relationship that has been established between infertility and HIV/AIDS (Brady, 2003; Samudine et al., 1999a; Favot et al., 1997). Studies have documented that sub-fertile and infertile women have higher rates of HIV infection compared to fertile controls (Samudine et al., 1999; Favot et al., 1997).

Another major cause of pathological infection, which results in infertility, is infection from previous childbirth, pregnancy wastage and abortion carried out under unhygienic conditions (Larsen, 1989; Cisse, 1990; Leke and Nasah, 1979). Female circumcision, otherwise known as female genital mutilation, has also been identified to result in pelvic infection which causes infertility (Owumi, 1996; Koso Thomas, 1989).

Some types of contraceptives have also been reported to contribute to pelvic infection and subsequent infertility in women. For example, some intrauterine contraceptive devices (IUDs) have been reported to aggravate the incidence of PID. Studies show that there exist misconceptions and fears among African women that the use of contraceptive results in infertility (O'Reilly, 1986; Chiwuzie and Dariah, 1986). Studies indicate that abortion is generally preferred to contraceptive use as a means of prevention of pregnancy (Chiwuzie and Dariah, 1986; Renne, 1996; Adediran in the Punch News paper, 2003). Permanent infertility may however result from contraceptive sterilization (that is, tubal ligation or vasectomy) if surgery is not properly carried out, thus meaning later undesired infertility for those who wish to reverse the process. Poor nutrition or malnutrition is another contributory factor to infertility (Romaniuk, 1969). Stress and illnesses such as malaria, and tubal tuberculosis are also identified as other possible factors for female infertility.

Male Factors

Studies on infertility have for long addressed female factors as being responsible for childlessness. However, more empirical findings have begun to prove otherwise. Okonofua et al (1997) for instance, in their study noted with interest that focus group participants did not mention

the male partner as a contributory factor to infertility. They found among participants in the study that having an erection and being able to engage in sex was sign that a man was fertile.

According to Nasah (1984) 40 to 50 percent of infertility in Africa is due to male factors. However many causes of male infertility are yet to be known. The major known reasons for male infertility are blockage of sperm ducts, or disorders in sperm production resulting in poor semen quality, that is, too few sperm or abnormal sperm. Other contributory factors of male infertility are regarded as unknown or unexplained infertility. Leke and Nasah (1979) attribute these unknown factors to the lack of sophisticated investigatory procedures in Africa as in the developed countries.

Implications for Prevention and Management of Infertility in Nigeria

Interventions at resolving the problem of infertility should be focused at prevention (Okonofua, 2003). This is because most attempts aimed at the surgical treatment of infertility have achieved limited success (Nasah 1984). Conventional methods of treatment are poorly developed in many African countries, with treatment effectiveness not exceeding 10% of infertile couples (Okonofua 2003; Nasah, 1984). Part of reasons for this poor effectiveness is that many cases of infertility are presented in hospitals late when they have simply gone beyond the scope of the available treatment (Okonofua, 2003). Also, the cost for assisted Reproductive Techniques (ARTs) is still very high and beyond the reach of many even though they offer a breakthrough for major infertile cases. This is especially so for most parts of Africa. As Okonofua (2003) noted, in spite of high prevalence of infertility in Africa and the severe negative consequences for the reproductive health of women, very little resources presently exist for the treatment of infertile couples.

The new reproductive technologies (ARTS) and their accessories however, offer a major breakthrough for infertile cases especially those that have previously defiled solution (Okonofua, 2003) especially with regard to the treatment of male infertility. Ajayi et al. (2003) report high success rates in the use of intra-cytoplasmic sperm injection (ICSI) for the treatment of severe male infertility in Nigeria. However the huge cost involved in the use of ARTs and the worsening reproductive health situation in Africa make its adoption inappropriate by government for the treatment of infertility (Okonofua 2003).

Several factors that posed challenges to acceptance and popularity of ARTs have been identified. This include the poor state of social infrastructures which makes provision of services expensive, poor economic situation, low level of formal education, as well as religious and cultural values. Many people still find it embarrassing to seek ART and therefore those who do so do it with a great deal of secrecy. It is noted that religion has a stronghold on people, as most infertile couples believe that God will eventually cause them to achieve a pregnancy (Ajayi www,wadn.org/ARTinWestAfrica1.pdf;Widge, 2001; Savage, 1992). The prevalence of HIV is also a potential challenge to the adoption of ARTs. Ajayi et al. (2003) stated that experience from other parts of the world show that HIV zero positivity is not a contra-indication to ART especially when couples are zero-discordant.

Conclusion and Recommendations

Since genital tract infections have been identified as causes of male and female infertility in Nigeria, risk factor analyses are particularly important to determine the predisposing factors to genital tract infections that lead to fertility (Okonofua, 2005). Socio-demographic and behavioural risk factors such as patterns of marriage, timing of sexual debut, sexual frequency and numbers of sexual partners, past use of contraception and health-seeking behavior for genital tract infections are critical sexual and reproductive health issues in Nigeria, for which their association with infertility in later life is critically needed. As Okonofua (2005) rightly noted, such data are needed to support and planned efforts to develop programs for the prevention of infertility in Nigeria.

Nasah (1984) has highlighted some practical preventive measures for infertility which are worth recommending. These include sex education, public health and hygiene, control of sexual transmitted diseases, correction of nutritional deficiencies, early treatment of abnormal conditions, prevention of damage from trauma, heat, chemical and X-ray exposure, early investigation. When marriages are childless, improvement of obstetric practice and provision of accessible health services, avoidance of unnecessary operations or procedure and proper contraceptive counseling are also important measures.

However, when desired fertility is at the end not achieved, individuals, couples and their significant others devise measures to cope with the problem of infertility. These can be positive or negative reactions and may either palliate or aggravate the situation (SSRHN, 1999; Wretmark, 1999). Coping strategies towards infertility are varied in terms of their unique socio-cultural, socio-economic and individual experiences. They include religious activities, projection of anger, re-marriage, and extramarital affairs, helping and caring for others especially children, rearing pets, writing and child fostering.

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