

Database Design for Represent Genetic Information and Environment Impression in Architectural Design

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Abstract

One of the way to access many types of design is combination of three types of design in generative design, such as parametric, genetic algorithm and shape grammar in a database with many fields as genes that can related with other database (as chromosomes or environment agents) .The main fields are Primary shapes (two or three dimensional shape),Transformation language field as verbs, nouns, adjectives the architect used [1] can represent with transformation matrix, Spatial relationship field (*bounded polyline shapes* in a groups of shapes or subshapes[2]) so can represent with transformation matrix , a memo field for transformation sequence stores the shape grammar and is a genotype for objects ,that is made in program process ,many fields for many fitness value that compute in program process and finally a total fitness value field that can used with weighting for each fitness value[3].

The phenotype with a script file can represent in CAD or other graphic tools. With mutation in gene or chromosomes as deletion, insertion, duplication, inversion , translocation (of fields) and crossover in one ,two and so point, only with exchange the fields value we can able to generate many shapes and objects. With append one or many fields of database information to another we able to complicate the genetic information of creatures. We can relate databases with key field and change the values of fields with program. This simple programs can able the users to access many records for next use.

1. Introduction

In view of system definition, collection of related elements or things for accessing an aim is propounded, with recognition and analysis of the elements, relationship between them and aims can find another approaches and so can able to change, improve and develop the aims. However possibility of receive to objects will be more if identification of more parameters, coefficients, constants, functions, relationships and finally condition of act is well explained. Just as Frazer was said '....Evolutionary

Architecture is formulate architecture....” , but formulizing don't mean a frame or deterministic function ,because exploring the effective agents ,will open the new aspects and directions for expansion. Thus evaluate and analyze important agents of each entity such as architectural design will evaluate fitness function of it. In this paper we propose linear function to interfere sub function.

Fitness value of an architectural design could studied with evaluate and analyze aspects of aesthetic, behavior in space, climatic design and technical details in performance. These attributes refer to attributes of material, surface and space of solid object .Material property includes appearance and structural properties of solid shape, surface includes main surface and subsurface and last of all shape contains direct or indirect connection of surface. These attribute are columns of total fitness function in a matrix with rows include four aspect of architectural design evaluation.

2. Evaluation of Architectural Design

Four aspect of evaluation are related to solid shape properties include material, surface and space, each of these properties effect on many type of evaluation that is described.

2.1 Evaluation in aspect of Aesthetic

In Sensory Aesthetic the appearance of material property in solid shape is important.

In Formal Aesthetic function appearance and structural properties of material, main surface and subsurface, direct and indirect connection of surfaces are considered.

In Expression and associative Aesthetic function (Symbolic Aesthetic) appearance and structural properties of material, subsurface, direct and indirect connection of surfaces have to concentrate.

2.2 Evaluation in aspect of Behaviors in Space

In evaluation of Main behaviour places properties deals with direct and indirect connection of surfaces and so is true for connective behaviour places.

2.3 Evaluation in aspect of Climatic Design

Natural Light, Natural Ventilation and Natural cooling and heating must be evaluated with refer to main surface, direct and indirect connection of surfaces for all type of this evaluation.

2.4 Evaluation in aspect of Technical details in performance

In this evaluation Material Selection for Different Surfaces are related to structural property of material and Joint & Neighbourhood of Different Surfaces are referred to structural property of material, main surface and direct connection of surfaces properties in solid shape.

Thus we define fitness function in matrix that the rows are fitness function in aspect of aesthetic, behaviour in space , climatic design and technical details in performance

and the columns are properties of solid shape. For example in evaluate the minimum rate of surface to volume for each shape in population within climatic design ,we need minimum of SVR for prevent waste of energy ,so user must define fitness function in this way and sorted the results till selection of individual is occurred. Total fitness function can defined as following :

$$F(x) = \text{Max}(\sum_{i=1}^6 \sum_{j=1}^6 w_{ij} \cdot f(x_{ij})) \quad \text{where} \quad \sum_{i=1}^6 \sum_{j=1}^6 w_{ij} \leq 1 \quad (1)$$

I for four aspect of evaluation in architectural design

J for properties of material , surface and space

w_{ij} for weighting to each fitness function in total fitness function .

3. Database Design

Database table is the physical implementation of an entity with related attributes; this is where the actual data is stored as student, lesson, teacher or whatever. Each table consists of one or more columns .Columns of a table is the physical equivalence to an attribute or field, all important things about an entity describe with attributes / fields. Database design is the process of producing a detailed data model of a database, correct design due to fast access to the correct classified and sorted data. Importance of shapes and materials in solids because of evaluating an architectural design duo to suggest databases with related fields named key fields. Process by acting the fields ,calculate and evaluate values are stored in other fields of another database .

Combination of three types of generative design in database design in following steps of model is described . First must have a value for recognize better or best solutions, this performs with fitness function as field or fields in a solid shape.

Thus fault of parametric design by comparison of fitness value are released in waste time after each changing parameter values, andso have many type of species . shape grammar is rules for construct a shape, therefore must define with a field and perform as genotype.

This field needs is defined by text thus a memo field in database is suitable . Containing text with statements of CAD can express steps of construction , text must be named as script file untile can able to load in CAD . we can display physical property of shape as phenotype in Cad or other graphical tools . some field for perform deformations such as rotate ,move ,mirror and enter deformation matrix as genes of shape deform the primary shapes,therefore can able to change attributes with mutation ,crossover and recombination , also can explain development and growth in this model and are formed a Lindenmayer system with such statement of CAD mcopy ,or first slice and next mcopy ,and then define a path for locating the copy of whole or part of solid object .

In genetic algorithm design we generate with a few data in gene pool and with processing such as mutation ,crossover ,recombination,much more individuals (design) . And then with natural selection, best solution maintain and have

existence chance due to reproduct .In case a gene is deleted from gene pool in any generation but we need it, have to enter the lost gene in artificial synthesis to population .

Existence chance in population due to fitness value and external condition such as environment impression ,therefore a weak gene for existence may maintain in gene pool and has positive effect for existence chance .(e.g.There is malaria disease in mediterranean climate,but individual with talassemia disease gene in this climate have more existence chance because the malaria agent doesn't affect him.) Also there are methods to prevent this effect,but is not coniderated here.

In this paper is proposed sorting the combination of fitness fields or total fitness field in main database and then append the best record to another database ,In this way individuals selection are kept as next generation parents. Bentley do this with introduce two population ,internal population that must evaluate and translate to external population have possibility for reproduction.[5]

Shape grammar in each individual of database as is said before keep in a memo field that explain the construction of shape from primary shape with rules from left to right to deform it.

3.1 Structure of Database

For database design we define many database one for primary shape with unique code for identify each individual ,another database for deform the shape with a unique code ,a database for parameters of shapes , a database for material properties, a database for 2D shape for making spatial relationship in location of individuals to move there, thus a database for deform 2D shapes.

3.2 Programs

Some program for execute mutation, crossover, recombination and selection must prepare as follows:

3.2.1 A program for create new creature with chromosome mutation:

Some Cad statement for create combination of shape (subtract, union, intersect) is used in design ,this program ,with randomly selection of two parents from primary shape and randomly run (subtract ,union, intersect) on them ,due to create a new shape then the result save with unique code for it .Some attributes such as volume, centroid , moments of inertia ,... after displaying in CAD is produced with "massprop" statement and maintain on a text file with .mpr extension , copy this file in a memo field and separate different attribute in text file and replacing with fields in new shape ,the values of fields in new shape is filled and get ready for next evaluating.

3.2.2 A program for create new creature with gene mutation:

Such attribute is suitable to play the role of gene in shape as (3dmove ,3drotate ,3dmirror, scale) statement , with manipulate the sequence and with insertion

,deletion , duplication ,inversion ,translocation of one of the steps, mutation is happened.

3.2.3 A program for crossover :

With exchange the sequence of attribute such as (3dmove,3drotate,3dmirror) in a shape, we have gained new shape ,this event might happened for two or three exchange ,the condition of program for more exchange must not include in first point exchange.

3.2.4 A program for recombination:

This effect similar to the parametric design with a randomly change in the parameters , duo to generate new creature of same species each time .

3.2.5 A program for environment impression:

Some statement in CAD such as (slice ,thicken, also scale ,copy) or with a deformation matrix we can operate shape ,new produced shape is not able to maintain this changes in gene pool .

3.2.6 A program for development and growth:

Some statement in CAD such as (mcopy, scale) can cause the growth and development of shape or part of shape (if slice statement is used) and with definition a path for location the copy objects, we can simulate Lindenmayer system in development.

3.3. Examples

Some example for parametric design with change the parameters of multiple box and spatial relationship as rotation and transition in x ,y ,z direction, are shown, indeed they could simply designed in this way ,but never means this are designed so.



Figure 1: Durham ,Nasher Art Museum , Rafael Viñoly (left)

Figure2 : Cincinnati ,Contemporary Art Center , Zaha Hadid (right)



Figure 3 : Culver City ,Offices and 606 Parking Garage , Eric Owen Moss (left)

Figure 4 : Tokyo ,K-Museum , Makoto Watanabe (right)

Shape_id	Shape_name	Mix_shape	Area	Mass	Volu
0000001	box	Memo	0.0000	10264.5935	10
0000002	sphere	Memo	0.0000	10264.5935	10
0000003	cone	Memo		10264.5935	10
0000004	cylinder	Memo		10264.5935	10
1000200	union				249

Shape .mix_shape	
cylinder -12.01,10.89,7.07 12.59 -5.30	move 0.00,0.00,0.00 d -5.30
union all massprop all y c:\massproperty y cylinder	-12.01,10.89,7.07 12.59 -5.30 move 0.00,0.00,0.00 d -5.30
union all massprop all y c:\massproperty y	

Figure 5 : Memo field contains of shape grammar for construct shape from script file in CAD

References

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Figure and table References

Figure 1 : Explored from arcspace.com

Figure 2 : Explored from arcspace.com

Figure 3 : Explored from [Eric owen moss architects site](http://ericowenmoss.com)

Figure 4 : Explored from makatovatanabe.com

Figure [5 ,6] :Display part of database in programming as prototype.

(1) This formula is my proposition to evaluate architectural design.