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ABSTRACT

We apply one of the Salingaros Scaling Coherence Rules, i.e. the small scale is connected to the large scale through a linked hierarchy of intermediate scales with scaling factor approximately equal to e = 2.718 to the front facade of Quezon Hall of the University of the Philippines and see the effects on the form of the buildings. The original and the modified were subjected to a survey of senior Architecture students who rated in terms of aesthetic preference and impression.

Keywords: design, scale, salingaros, quezon hall.

Introduction

Is it possible to quantify architectural elements and their relationship in order to produce a more beautiful and appealing building? In a series of papers [1,2,3] Salingaros postulated on three laws of architectural order which were obtained from basic physical principles and he put forth that these laws may be used to create buildings that would be at par in terms of emotional comfort and beauty as those of the world's great historical buildings. The three laws are: (1) order on the smallest scale is established by paired contrasting elements existing in a balanced visual tension, (2) large-scale order occurs when every element relates to every other element at a distance in a way that reduces entropy, and (3) the small scale is connected to the large scale through a linked hierarchy of intermediate scales with scaling factor approximately equal to the exponential number equal to 2.718 because exponential growth is argued to be a fundamental law of nature. The first two laws govern the two extremes of scale: the very small and the very large while the third law governs the linking of the two scales. We apply the third law in this paper.

The linking of the two scales as one proceeds from the largest to the smallest scale brings about the notion of a scaling coherence that depends on the levels of scale being close enough to relate to each other yet not so close that the difference is indistinct. Ordered growth is possible only if there is a simple scaling so that the basic replication process can be repeated to create structure on different levels. Different structural scales must exist, and they must be related, preferably by only one parameter. Through the different theories in proportion, mathematics gained stronger ground in the field of architecture.

The Salingaros Scaling Coherence Rule takes math as a science of patterns and applies this to architectural elements of a structure and treats the elements to be interrelated. The mind perceives connections and interrelations between concepts and ideas, and then links them together. The ability to create patterns is a consequence of man's neural development in responding to his environment. Mathematical theories explain the relations among patterns that arise within ordered, logical structures. Patterns in the mind mimic patterns in nature as well as man-made patterns. Mankind generates patterns out of some basic inner need: it externalizes connective structures generated in the mind via the process of thinking, which explains the visual patterns in the traditional art and architecture of mankind. The exponential scaling factor fits both natural and man-made structures. Thus with this principle, Salingaros proposes a new way of evaluating a building.

In this study, we take the main front façade of Quezon Hall, one of the key buildings of the University of the Philippines-Diliman campus, and break down the facade into different components and investigate the application of the Salingaros scaling rule to the interrelationship of those components. What we obtain is a new rendering, or a modification, of the façade. We then subject the old and the new renderings of the façade to a survey of senior architecture students to gauge their perception of the aesthetics of the old and the new.

Application of the Salingaros Scaling Coherence Rule

The application of the Salingaros Scaling Coherence Rule (SSCR) may be divided into two processes – evaluation of an existing building, and its modification towards a SSCR-scaled building. However, in order to evaluate and modify, the SSCR had to be translated into working guidelines and equations on which the computation of the components of a building facade will be based on. We first define certain terminologies to be used later. The following is the set of working definitions used:

Architectural Scale. For our purposes, we apply the term scale in terms only of area (A) where(A) is the product of width (X) and height (Y). This would mean an exclusion of the changes solely in height (Y) or width(X). The delimitation is deemed beneficial to the study since differences in area are more defined, and thus easier to determine, than those of height or width alone.

Figure 1. *Architectural Scales*

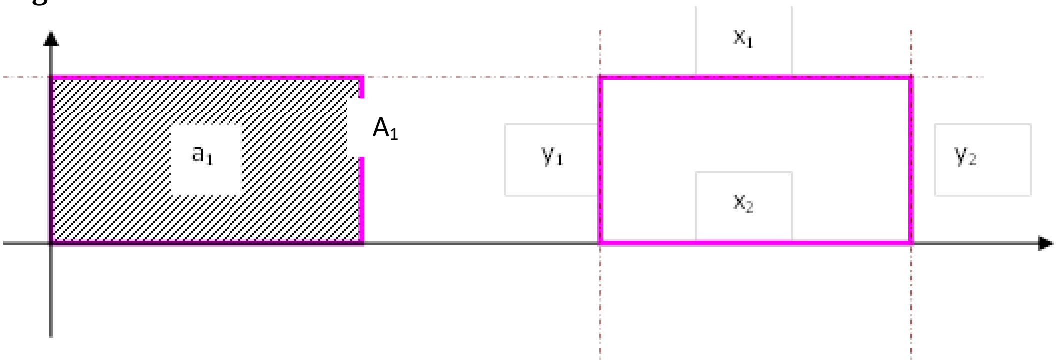


Figure 1 illustrates how one generates one scale (A_1) according to area, and 4scales (X_1, X_2, $Y_1$and Y_2) according to linear dimensions. The subscripts are for delineation of different areas to be studied. The number of scales in a façade varies depending on the architectural design, i.e. ornamentation, proportion and detail. A building with more ornamentation can have architectural scales than that with lesser ornamentation.

Boundary Scale and Bounded Scale. Bigger architectural scales act as boundaries or contain smaller architectural scales. As shown in Figure 2, area$a$ acts as a boundary scale to areas *b* and *c* but area *b* is not a boundary scale to area *c*. Areas *b* and *c* are bounded scales of *a*. We note that Architectural Scales *b* and *c* are not necessarily the same in value.

Figure 2. *Boundary Scale*

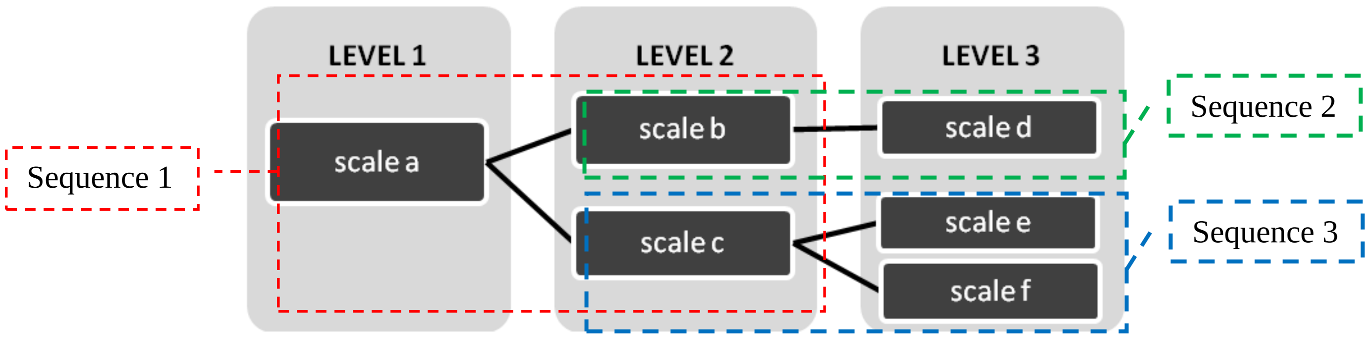
Scale Sequence. A scale sequence is determined by a boundary scales. Note that a bounded scale can become a boundary scale of a smaller architectural scale. Figure 2 above has only one scale sequence which is the sequence emanating from boundary scale *a*. Figure 3 below has three scale sequences, with scales*a*, *b*and *c* acting as boundary scales.

Figure 3. *Scale Sequence*

Scale Levels. Architectural scales are grouped together according to what makes them distinct, i.e. their boundary scales. For ease in reference, we call these groups of scales as 'scale levels'. We note that the aggregate areas within a level may not be equal but their sum should equal their boundary scale.

Scaling Tree. The scales, scale sequences, and scale levels of a building are represented by the 'scaling tree'. Scales of the same level are listed in a single column and same color legend. The first scale level is listed at the leftmost of the scaling tree. Figure 4 below shows the scaling sequence, the scale levels and the scaling tree for Figure 3.

Figure 4. *Scale Sequences, Scale Levels and Scaling Tree Corresponding to Figure 3*



Next, to say that an existing building follows the SSCR, the following steps were followed:

1. Tabulation of Architectural Scales. Given the façade of a structure, areas of the existing architectural scales were identified then labelled and sorted according to size in descending order resulting in a scaling tree. Scale sequences were determined and boundary and bounded scales were identified.
2. Computing for the actual scale relationship (ASR). On a per sequence basis, we start to relate the bigger scale to smaller scales thru their ratios. For a scale sequence containing six (6) architectural scales, say from scales *a* to *f* as in Figure 4 above, the relationships are taken as the ASR between scales *a* and *b*, then assuming that *b* is greater than *c* we take the ASR between scales *b*and *c*. Subsequently we obtain the ASR between *b* and *d*, then the ASR between *c* and *e* and finally ASR between *e* and *f*, assuming that scale *e* is greater than scale *f*.

For Figure 4, there are three (3) scale sequences. Thus the ASR for a sequence is composed of the ASR's of the scales included in the sequence.

Now if the building facade follows SSCR, all of the ratios obtained from the ASR's should be equal to the value of 2.718 or whole multiples of it. If we take the Ideal Scale Relationship or ISR as equal to 2.718 then

$$ASR = \frac{a}{b} = \frac{b}{c} = \frac{c}{d} = \frac{d}{e} = \frac{e}{f} = \cdots = 2.718 = ISR \qquad (1).$$

1. We now compare the ASR and ISR. The value of $k$is then determined to give the relationship between the actual and the ideal scales, and is given by

$$k = \frac{ASR}{ISR} \qquad (2).$$

where ISR is equal to 2.718. In the most ideal of cases, *k* should be equal to 1. However with scale sequencing in mind, *k* should result in a positive integer number.

The sizes of the scales are then altered for the building's ASR to be closer to the ISR resulting in a modified façade. As we compute for the actual k's in the scales sequences, it can have a value having more than decimals. In computing for the modifications the following steps were taken:

1. The value of k is rounded off to three (3) decimal digits. Three decimal digits are chosen because measurements in architectural plans can be in millimetres as practiced. Also, we took the value of e as 2.718.
2. In moving k to be close as possible to a positive integer value, we further rounded k off to two decimal places. This time in rounding off to two decimal places, we chose the value closest to a multiple of 0.25. The value of 0.25 can be arguably arbitrary thus this is viewed as primarily for heuristic purposes. Nonetheless, rounding off to the nearest quarter values can be encountered in common everyday

practices. We also didn't want to 'stray far' from the original measurements of the areas. This new value for k is called k-at-intervals and denoted as k_{int}.

3. $ISR \times k_{int}$. The product $ISR \times k_{int}$ is now used for obtaining a modified area. The ISR is equal to 2.718 and k_{int} maintains its closeness to the original scale sizes. We take this product between two areas within a sequence. We differentiate scales subjected by subscripts denoting the areas where the first subscript refers to the larger area.
4. Computing for the modified area. The area of the boundary scale (biggest scale in the sequence) is retained and used to derive the modified area for the succeeding scales in the sequence. As an illustration, say boundary scale area *a* and succeeding area *b*, the modified area of *b* would be

$$Modified\ Area\ of\ Scale\ b = \frac{Area\ of\ scale\ a(boundary\ scale)}{(ISR \times k_{int})_{ab}} \quad (3).$$

5. Area iteration. The total modified has to be equal to the total original area. Due to the rounding off process this is not the case; as a matter of fact the total modified area is usually less than the total original after the initial run of the of the modification based on the SSCR. Thus the areas were thus subjected to a process of iteration. Broadly speaking, iteration is a repetition of a sequence of instructions characterized by a set of initial conditions, an iterative step, and a terminal condition. Iteration distributes errors based on reality. For the purpose of this particular application, iteration is defined as the repetitive application of the same mathematical formula to an initial condition until it yields the desired terminal condition. The desired terminal condition is zero. The sum of all iterations gives the modified area for a particular scale. In applying the iteration, we repeated the procedure mentioned above but using only the remainder as 'start' value for the boundary scale. The value of $ISR \times k_{int}$ from the initial run was used to determine the corrections to the bounded scales. The iteration process can go on n number of times until the total modified areas of the bounded scales matches the total original area of the boundary scale.
6. Finally, in distributing the modified areas to their respective lengths and widths, direct proportion based on the dimensions of the original areas was implemented.

As an illustration, in Table 1 is a summary of the points mentioned for the evaluation and modification as applied to Figure 4.

	scale relationship			constant		ISR x k$_{int}$	modified area	iteration nx	final modified area
		actual	ideal	k	k$_{int}$ (round k to nearest 2 decimals)	2.718 * k$_{at\ int}$	(before iteration)		
sequence 1									
boundary scale a							actual area a	sum of modified areas $_{(bounded\ scales)}$	actual area a
scale b	sequence ab	scale a/ scale b	2.718	ASR$_{ab}$/ ISR	k$_{int\ ab}$	2.718*k$_{int\ ab}$	modified area b = actual area a/ ek$_{int\ ab}$	sum of modified areas $_{(bounded\ scales)}$/ ek$_{int\ ab}$	final modified area b = modified area b + iteration n
scale c	sequence bc	scale b/ scale c	2.718	ASR$_{bc}$/ ISR	k$_{int\ bc}$	2.718*k$_{int\ bc}$	modified area c = modified area b/ ek$_{int\ bc}$	iteration $_{ab}$/ ek$_{int\ bc}$	final modified area c = modified area c + iteration n
							sum of modified areas	sum of iteration n $_{(bounded\ scales)=0}$	
sequence 2									
boundary scale b							final modified area b	sum of modified areas $_{(bounded\ scales)}$	final modified area b
scale d	sequence bd	scale b/ scale d	2.718	ASR$_{bd}$/ ISR	k$_{int\ bd}$	2.718*k$_{int\ bd}$	modified area d = final modified area b/ ek$_{int\ bd}$	sum of modified areas $_{(bounded\ scales)}$/ ek$_{int\ bd}$	final modified area d = modified area d + iteration n
								sum of iteration n $_{(bounded\ scales)=0}$	
sequence 3									
boundary scale c							final modified area c	sum of modified areas $_{(bounded\ scales)}$	final modified area c
scale e	sequence ce	scale c/ scale e	2.718	ASR$_{ce}$/ ISR	k$_{int\ ce}$	2.718*k$_{int\ ce}$	modified area e = final modified area c/ ek$_{int\ ce}$	sum of modified areas $_{(bounded\ scales)}$/ ek$_{int\ ce}$	final modified area e = modified area e + iteration n
scale f	sequence ef	scale e/ scale f	2.718	ASR$_{ef}$/ ISR	k$_{int\ ef}$	2.718*k$_{int\ ef}$	modified area f = modified area e/ ek$_{int\ ef}$	iteration n$_{ce}$/ ek$_{int\ ef}$	final modified area f = modified area f + iteration n
								sum of iteration n $_{(bounded\ scales)=0}$	

Table 1. Formula Masterlist

Application of the SSCR to Quezon Hall

The University of the Philippines is one of our country's premier learning institutions. The Administration Building of the University of the Philippines in its campus in Diliman, known as the Quezon Hall. It was in 1950 when the construction of the 'stripped' art deco style building was finished. The building's façade can be described comprising of two wings four storeys high linked together by a central high and wide void (see Picture 1).

The wings have anarchitectural feature made up of horizontal bands of concrete under casement windows on all three floors covered by a tiled hip roof. Two wide brick walls flank the central void where four pairs of slender column shafts rise to support an open pavilion at the fourth floor and a second-floor curvilinear open corridor linking the two wings.

Picture 1. *Front View Quezon Hall Facade*

Picture 2. *Left Wing View Quezon Hall Facade*

Picture 3. *Façade Center View of Quezon Hall*

Quezon Hall Scaling Tree

We begin to apply the SSCR to the front façade of Quezon City with a CAD file of the façade using actual and original dimensions as shown in Figure 5a. We proceed with determining the biggest scale of Quezon Hall which is the whole structure itself and consider this as boundary scale (Level 1) of Sequence 1. This is labeled as Façade in Figure 5b. The building is then broken down into the components of the façade, considered as the Bounded Scales (Level 2) of Sequence 1. Higher-level bounded scales where determined until the last identifiable detail of the building.

Figures 5a and 5b show the boundary scale and bounded scales identified in Quezon Hall which translate to its Sequence 1as shown in the Scaling Tree in Figure 6.The complete Scaling Tree for the façade of Quezon Hall is shown in Figure 7a and 7b.

Figure 5a. *Boundary Scale*

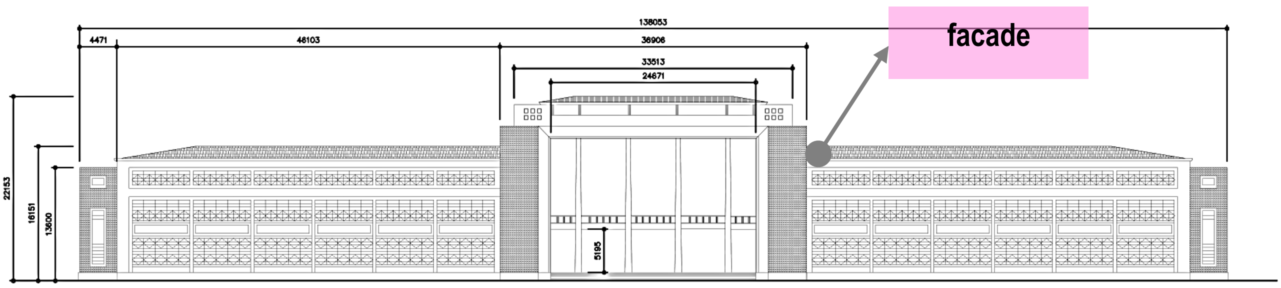


Figure 5b. *Bounded Scale*

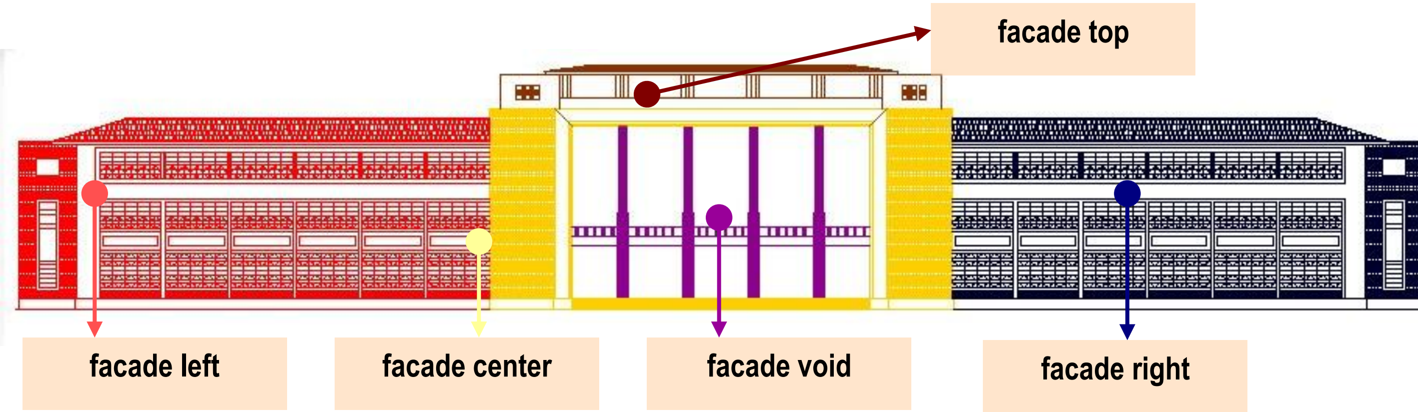
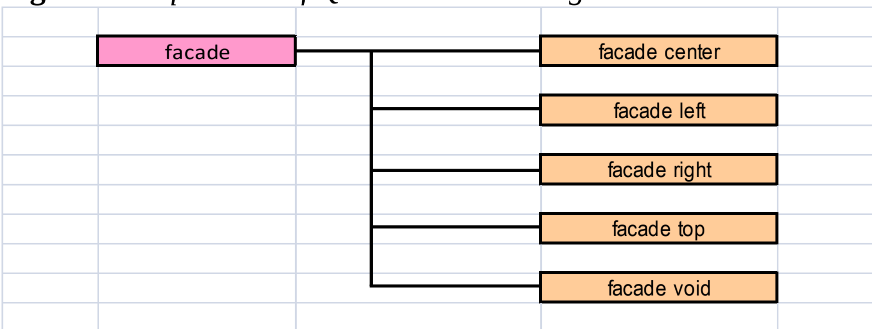
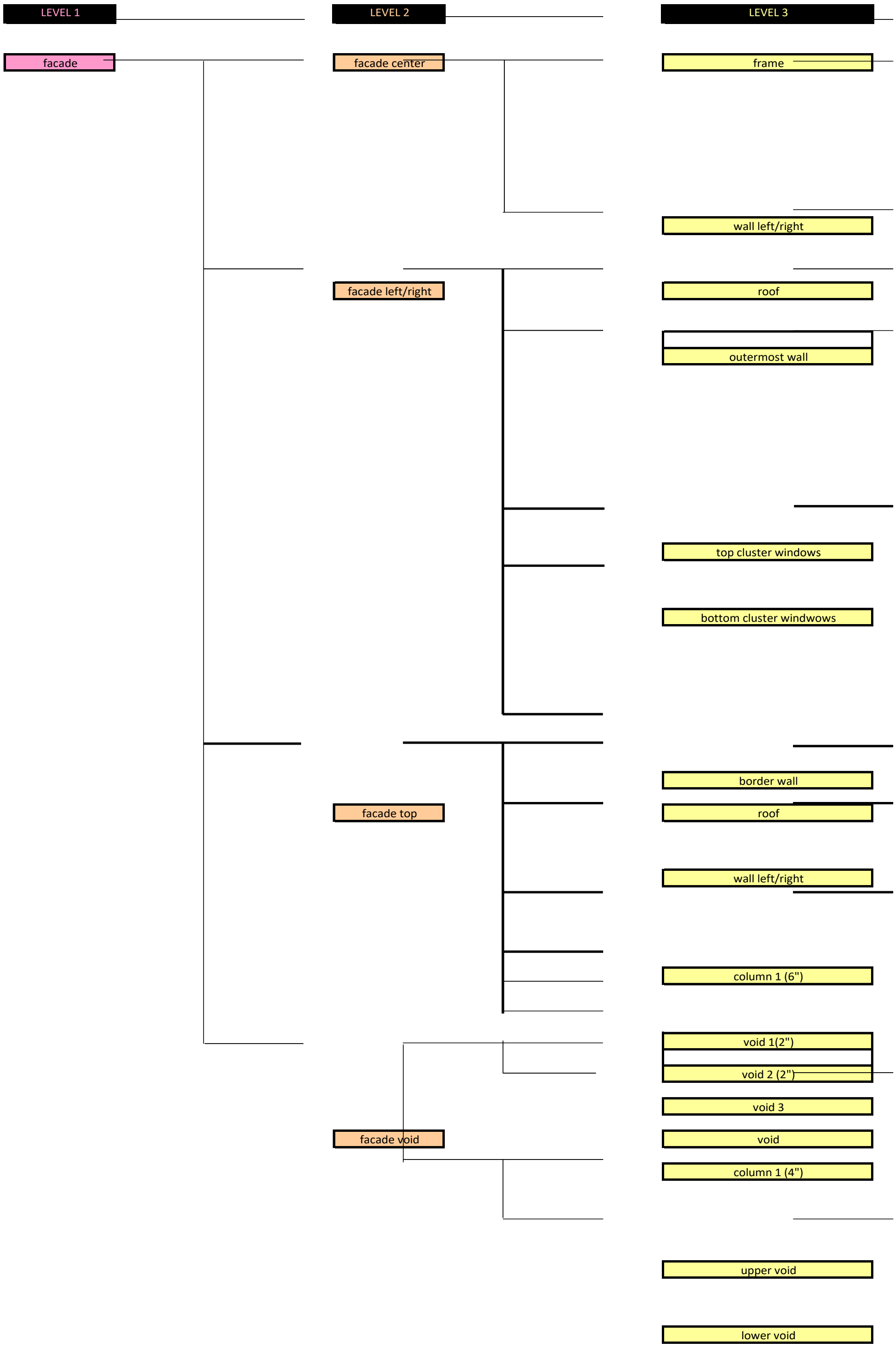


Figure 6. *Sequence 1 of Quezon Hall Scaling Tree*



Elevation Modification

Table 2a and 2b shows the application of the formula master list, i.e. the computations for the values of $ASR, k, k_{int,}, ISR \times k_{int,}$ to Sequences 1 to 7 of Quezon Hall. In addition, Tables 2a and 2b contain iterations applied accordingly. The columns labelled Initial Modified Scales are results before appliting iteration; the columns labelled as Final Modified Scales include ierations. Figure 8 shows how how close the scales of the various elements of the façade approach the original scales after SSCR-modification and the iterations.


LEVEL 1
LEVEL 2
LEVEL 3
facade
facade center
frame
wall left/right
facade left/right
roof
outermost wall
top cluster windows
bottom cluster windwows
border wall
facade top
roof
wall left/right
column 1 (6")
void 1(2")
void 2 (2")
void 3
facade void
void
column 1 (4")
upper void
lower void

re 7a

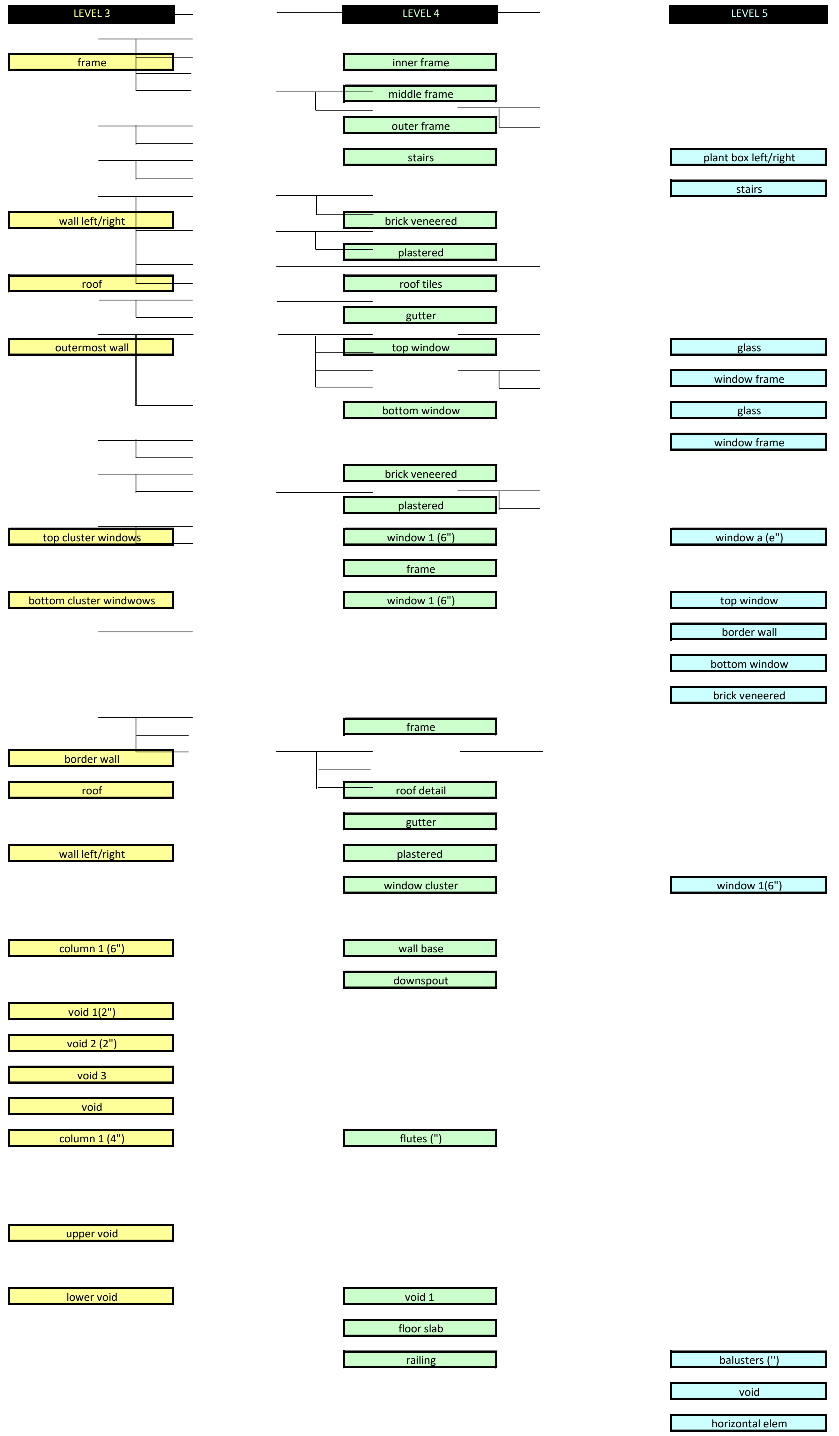

LEVEL 3
LEVEL 4
LEVEL 5
frame
inner frame
middle frame
outer frame
stairs
plant box left/right
stairs
wall left/right
brick veneered
plastered
roof
roof tiles
gutter
outermost wall
top window
glass
window frame
bottom window
glass
window frame
brick veneered
plastered
top cluster windows
window 1 (6")
window a (e")
frame
bottom cluster windwows
window 1 (6")
top window
border wall
bottom window
brick veneered
frame
border wall
roof
roof detail
gutter
wall left/right
plastered
window cluster
window 1(6")
column 1 (6")
wall base
downspout
void 1(2")
void 2 (2")
void 3
void
column 1 (4")
flutes (")
upper void
lower void
void 1
floor slab
railing
balusters (")
void
horizontal elem

Table 2a. *Sequence 1 to 7 Application*

sequence 1	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	structure	2,404,553,332.00						2,404,553,332.00		2404553332.00	2404553332.00	292415953.86	35560488.07	4324484.68
b (2)	massing left/right	738,410,000.00	a-b	3.256	2.718	1.198	1.25	884,677,458.43	3.40	707741966.74	805725670.09	86067977.59	10466663.15	1272843.17
c	massing void	429,760,000.00	b-c	1.718	2.718	0.632	0.75	325,488,395.30	2.04	347187621.65	395254191.85	42221230.12	5134492.60	624401.85
d	massing center	350,435,093.00	c-d	1.226	2.718	0.451	0.50	119,752,904.82	1.36	255472863.62	290841936.61	31067866.16	3778140.25	459456.84
e	massing top	147,538,239.00	d-e	2.375	2.718	0.874	1.00	44,059,199.71	2.72	93992959.39	107005863.36	11430414.34	1390044.24	169042.25
										2112137378.14	2404553332.00	256855465.79	31236003.39	3798587.29
											0.00			

sequence 2	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	massing center	350,435,093.00						290,841,936.61		290841936.61	290841936.61	26358717.31	2388864.50	216500.43
b	frame	129,634,717.00	a-b	2.703	2.718	0.995	1.00	107,005,863.36	2.72	107005863.36	117670197.04	9697835.66	878905.26	79654.32
c (2)	wall left/right	110,400,188.00	b-c	1.174	2.718	0.432	0.50	39,369,338.98	1.36	78738677.97	86585869.79	7136008.58	646729.41	58612.45
										264483219.30	290841936.61	23969852.81	2172364.07	196879.21
											0.00			

sequence 3	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	frame	129,634,717.00						117,670,197.04		117670197.04	117670197.04	-18242287.39	2828082.71	-438434.70
b	outer frame	81,412,871.00	a-b	1.592	2.718	0.586	0.50	43,292,934.89	1.36	86585869.79	74964241.89	-13423316.70	2081002.73	-322615.67
c	stairs	30,398,100.00	b-c	2.678	2.718	0.985	1.00	15,928,232.12	2.72	31856464.23	27580662.95	-4938674.28	765637.50	-118695.98
d	middle frame	11,920,000.00	c-d	2.550	2.718	0.938	1.00	5,860,276.72	2.72	11720553.43	10147410.94	-1817025.12	281691.50	-43670.34
e	inner frame	5,903,746.00	d-e	2.019	2.718	0.743	0.75	2,156,098.87	2.04	5749596.98	4977881.26	-891354.00	138185.68	-21422.78
										135912484.43	117670197.04	-21070370.09	3266517.40	-506404.77
											0.00			

sequence 4	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	wall left/right	110,400,188.00			2.718			86,585,869.79		86585869.79	86585869.79	19266617.19	4287102.95	953942.85
b	brick veneered	104,400,376.00	a-b	1.057	2.718	0.389	0.50	31,856,464.23	1.36	63712928.47	81968418.85	14177054.59	3154601.14	701944.70
c	plastered	5,999,812.00	b-c	17.401	2.718	6.402	6.50	11,720,553.43	17.67	3606324.13	4617450.93	802459.65	178558.96	17548.62
										67319252.60		14979514.24	3333160.10	719493.32

sequence 5	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	stairs	30,398,100.00						27,580,662.95		27580662.95	27580662.94	4896458.05	869279.38	154325.15
b	stairs	27,204,148.00	a-b	1.117	2.718	0.411	0.50	10,147,410.94	1.36	20294821.89	24675523.99	3602986.06	639646.34	113557.87
c	plant box left/right	1,596,976.00	b-c	17.035	2.718	6.267	6.25	3,733,410.94	16.99	1194691.50	1452569.48	212096.31	37653.94	6684.79
										22684204.89		4027178.68	714954.22	126927.46

sequence 6	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	
			rel	actual	ideal	k	$k_{at\ int}$							
a	brick veneered	104,400,376.00						81,968,418.84		81968418.84	81928208.68	20105.08	4.93	
b	brick	51,200.00	a-b	2039.070	2.718	750.210	750.00	30,157,622.83	2038.50	40210.16	40200.30	9.86	0.00	40200.30
										81948313.76		20100.15	4.93	81928208.68
													0.00	

sequence 7	scales	actual area	scale relationship			constants		area$_2$	ek	modified area 1	modified area	iteration 1	iteration 2	iteration 3
			rel	actual	ideal	k	$k_{at\ int}$							
a	stairs	27,204,148.00						24,675,523.99		24675523.99	24675523.99	466032.71	8801.70	166.23
b	step 1 (10")	2,720,414.80	a-b	10.000	2.718	3.679	3.75	9,078,559.23	10.19	2420949.13	2467552.40	45723.10	863.55	16.31
										24209491.29		457231.01	8635.46	163.09

Table 2b. *Continuation of Sequence 1-6 Application*

iteration 4	iteration 5	iteration 6	iteration 7	iteration 8	iteration 9	iteration 10	iteration 11	iteration 12	iteration 13	
525897.39	63953.99	7777.40	945.80	115.02	13.99	1.70	0.21	0.03	0.01	
154789.52	18823.84	2289.15	278.38	33.85	4.12	0.50	0.06	0.01	0.00	805725670.09
75933.05	9234.16	1122.96	136.56	16.61	2.02	0.25	0.03	0.00	0.00	395254191.85
55874.21	6794.82	826.31	100.49	12.22	1.49	0.18	0.02	0.00	0.00	290841936.61
20557.10	2499.93	304.02	36.97	4.50	0.55	0.07	0.01	0.00	0.00	107005863.36
461943.39	56176.59	6831.59	830.79	101.03	12.29	1.49	0.18	0.02	0.00	2404553332.00
									0.00	

iteration 4	iteration 5	iteration 6	iteration 7	iteration 8	iteration 9	iteration 10	iteration 11	
19621.22	1778.25	161.16	14.61	1.32	0.12	0.01	0.01	
7218.99	654.25	59.29	5.37	0.49	0.04	0.00	0.00	117670197.04
5311.99	481.42	43.63	3.95	0.36	0.03	0.00	0.00	86585869.79
17842.97	1617.09	146.56	13.28	1.20	0.11	0.00	0.00	290841936.61
							0.00	

iteration 4	iteration 5	iteration 6	iteration 7	iteration 8	iteration 9	iteration 10	iteration 11	iteration 12	
67970.07	-10537.33	1633.59	-253.25	39.26	-6.09	0.94	-0.15	0.02	
50014.77	-7753.74	1202.05	-186.35	28.89	-4.48	0.69	-0.11	0.02	74964241.89
18401.31	-2852.74	442.26	-68.56	10.63	-1.65	0.26	-0.04	0.01	27580662.95
6770.17	-1049.57	162.71	-25.23	3.91	-0.61	0.09	-0.01	0.00	10147410.94
3321.15	-514.87	79.82	-12.37	1.92	-0.30	0.05	-0.01	0.00	4977881.26
78507.40	-12170.92	1886.85	-292.52	45.35	-7.03	1.09	-0.17	0.03	117670197.04
								0.00	

iteration 4	iteration 5	iteration 6	iteration 7	iteration 8	iteration 9	iteration 10	iteration 11	iteration 12	iteration 13	iteration 14	iteration 15	
234449.53	52168.44	11608.24	2583.00	574.76	127.89	28.46	6.33	1.41	0.31	0.07	0.02	
172516.21	38387.37	8541.75	1900.66	422.93	94.11	20.94	4.66	1.04	0.23	0.05	0.01	81968418.85
9764.88	2172.83	483.49	107.58	23.94	5.33	1.19	0.26	0.06	0.01	0.00	0.00	4617450.93
182281.10	40560.20	9025.23	2008.25	446.86	99.43	22.13	4.92	1.10	0.24	0.05	0.01	86585869.78
											0.00	

iteration 4	iteration 5	iteration 6	iteration 7	iteration 8	iteration 9	iteration 10	iteration 11	iteration 12	
27397.70	4863.98	863.51	153.30	27.22	4.83	0.86	0.15	0.03	
20160.19	3579.08	635.40	112.80	20.03	3.56	0.63	0.11	0.02	24675523.99
1186.77	210.69	37.40	6.64	1.18	0.21	0.04	0.01	0.00	1452569.48
22533.72	4000.46	710.21	126.09	22.38	3.97	0.71	0.13	0.02	27580662.94
								0.00	

iteration 4	iteration 5	
3.14	0.06	
0.31	0.01	2467552.40
3.08	0.06	24675523.99
	0.00	

Figure 8a. *Iteration of Areas for Sequence 1*

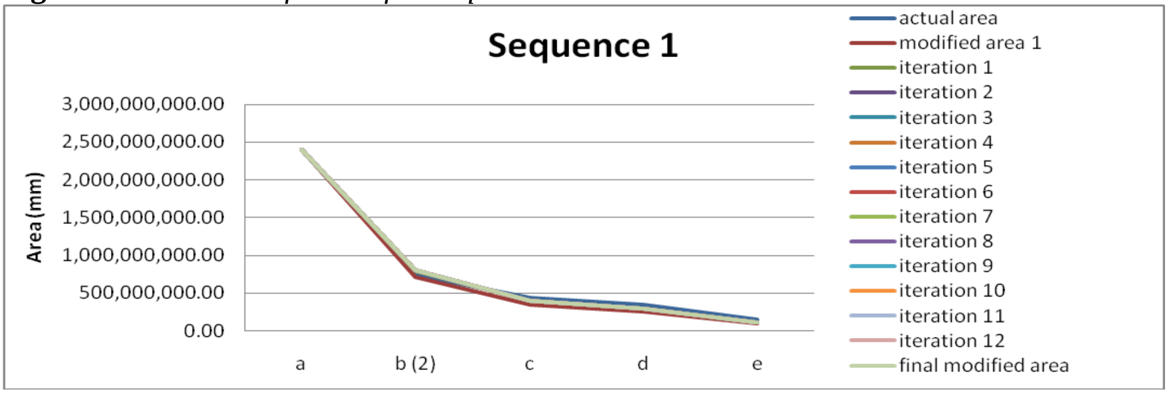


Figure 8b. *Iteration of Areas for Sequence 2*

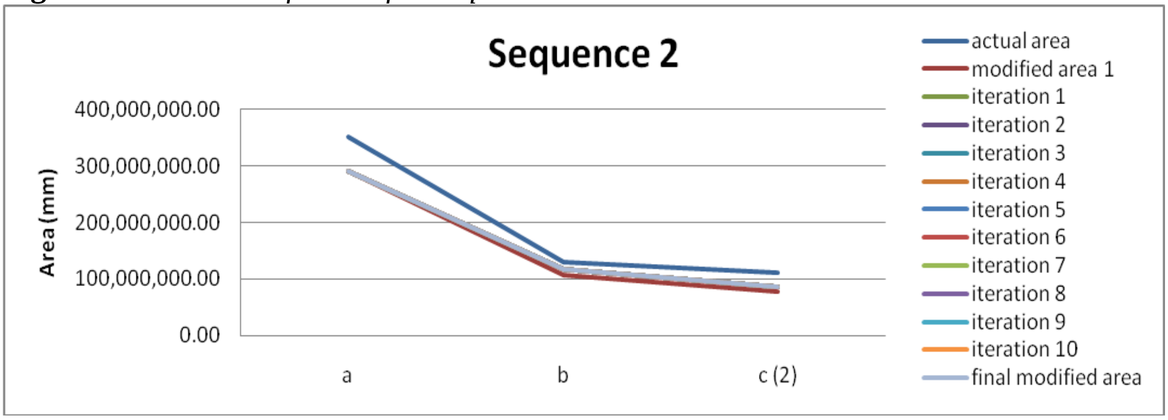


Figure 8c. *Iteration of Areas for Sequence 3*

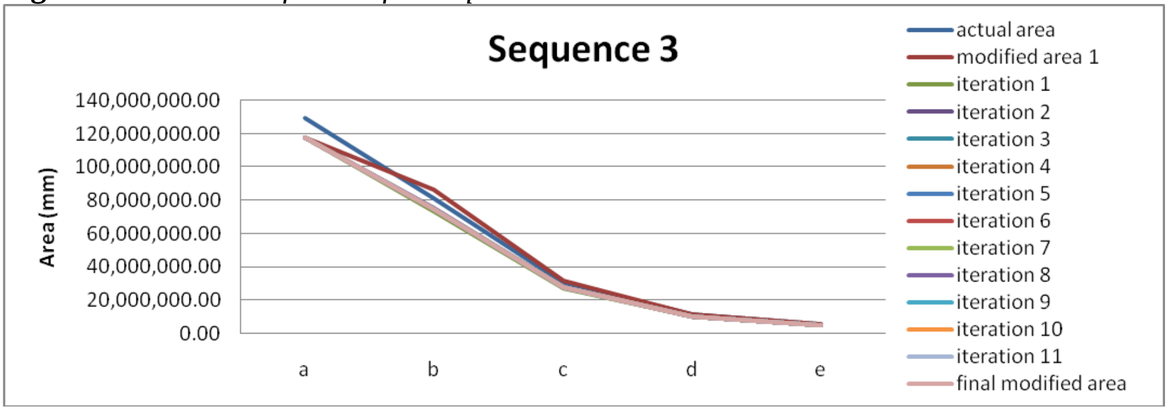


Figure 8d. *Iteration of Areas for Sequence 4*

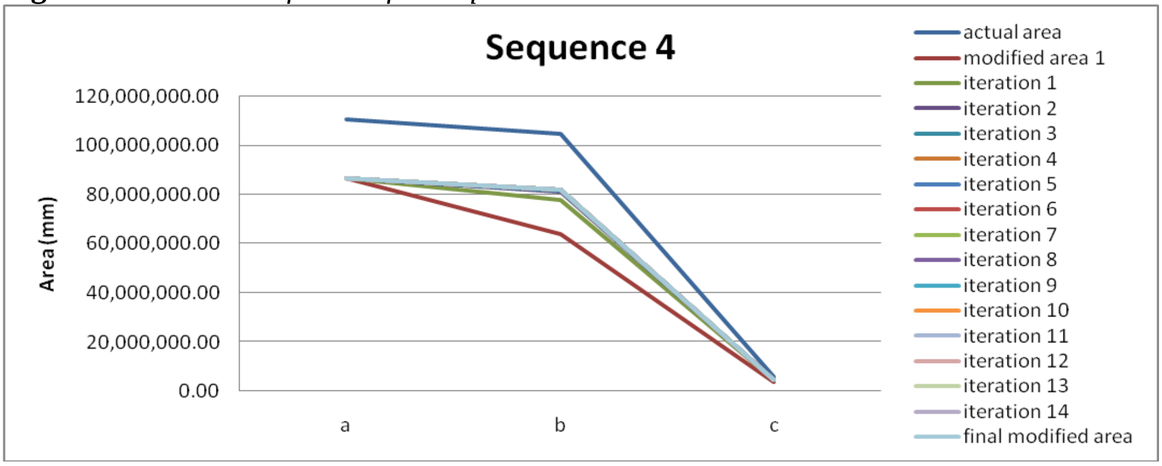


Figure 8e. *Iteration of Areas for Sequence 5*

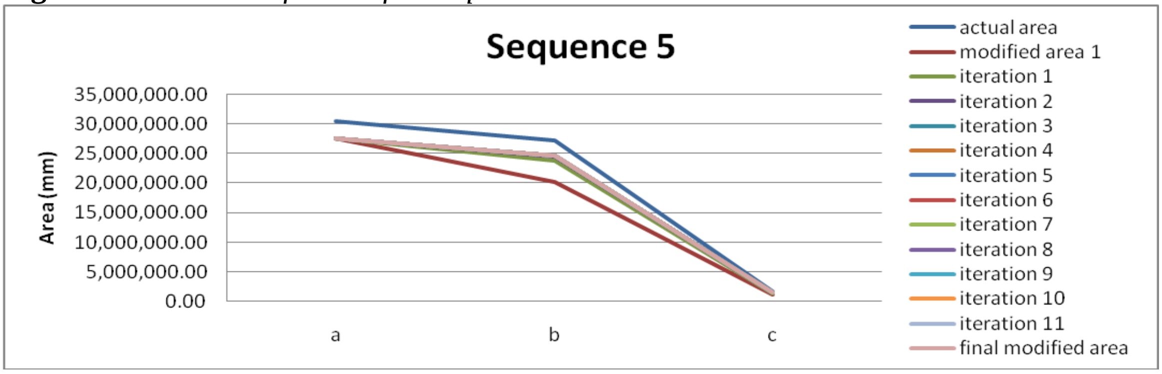


Figure 8f. *Iteration of Areas for Sequence 6*

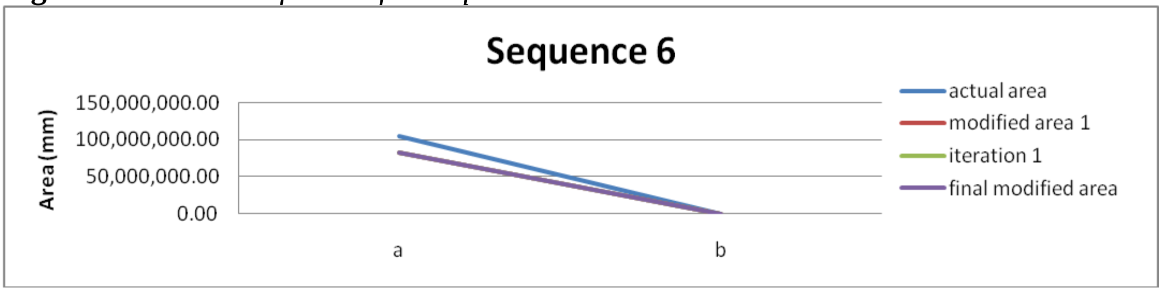


Figure 8g. *Graph of Areas for Sequence 7*

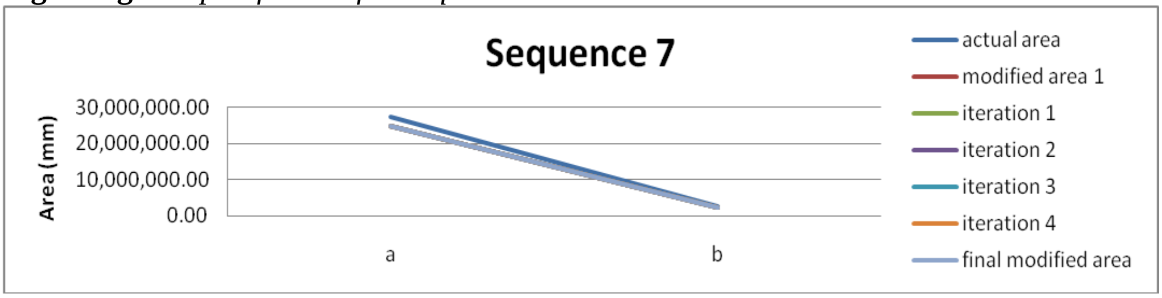


Figure 9 shows the actual and modified elevation of Quezon Hall following the methods and procedures presented. The height of the balcony was retained for functionality purposes. Figures 9 and 10 show the line and rendered drawings of both the modified and existing elevation, with the following observations:

1. The modified elevation pronounces the building's height more than its width. Note that the façade length has changed but the total area of the façade, and its individual elements, have not changed.
2. The modified elevation has a narrower lobby.
3. Columns appear to be slimmer in the modified elevation than those of the existing elevation.
4. Openings and architectural elements were hierarchically-defined as opposed to the consistent sizes of openings in the existing elevation.

Figure 9. *Quezon Hall Actual and Modified Line* Drawings

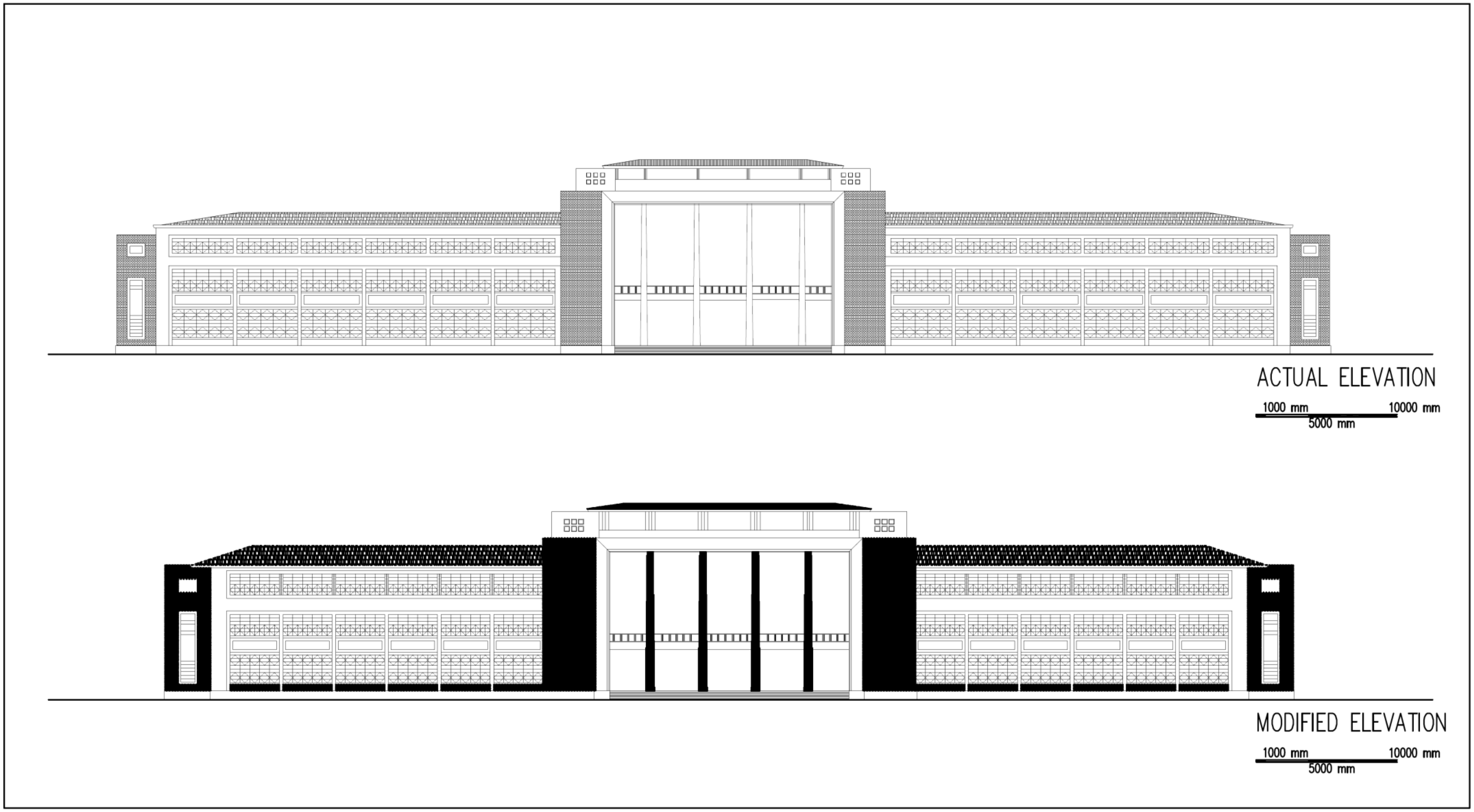


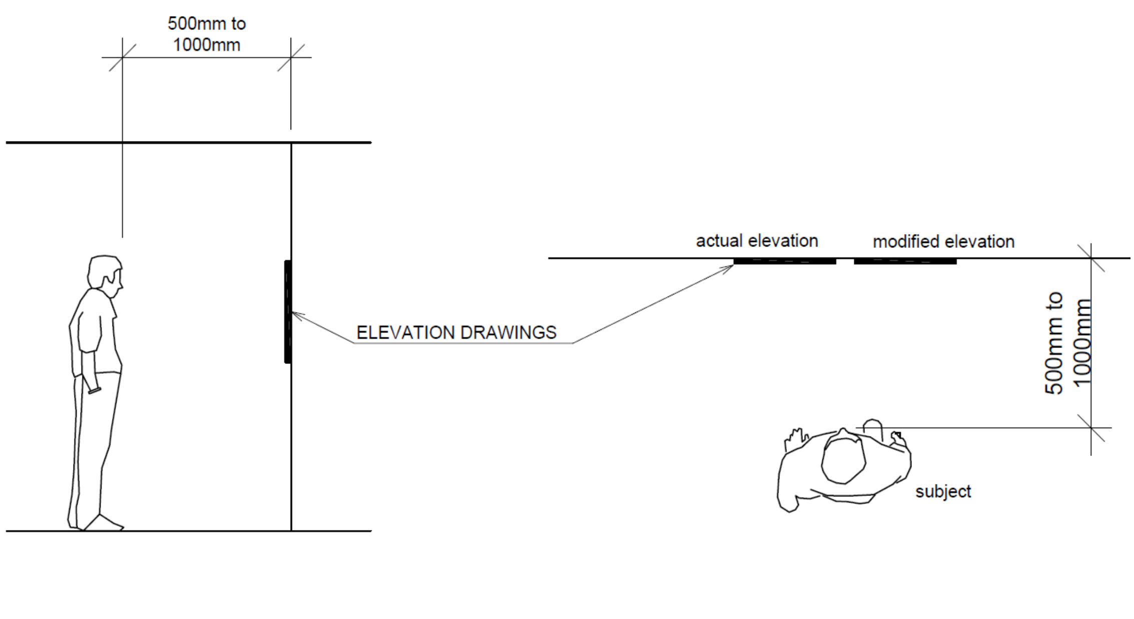
Figure 10. *Quezon Hall Actual and Modified Rendered Drawings*

Experimental Results and Analysis

The researches were curious to see the reaction to, or perception of, the modified Quezon hall façade elevation so the existing and modified elevation drawings were subjected to a simple experiment. A survey was taken among senior Architecture students of the university and from non-students of the university. The goal was get initial findings on which, between the existing elevation and SSCR-modified elevation, is more aesthetically pleasing. The reason for including architecture students who were not from the university was to control the familiarity with the university's prominent edfices. Senior student and their peers were chosen not only due to ease conducting the survey but also because these students would be aware of architectural design at the stage of their education. Including the students of the University of the Philippines, the survey group was composed of a total of 90 students chosen from the Far Eastern University (FEU) and the Technological Institute of the Philippines (TIP). The difference between FEU and TIP is that the former is a school located in Manila while TIP is located in Quezon City also

The drawings in Figs. 4.7 to 4.10 of appropriate size were presented to the students. The students were asked to view simultaneously the existing and modified elevation drawing at eye level a meter away. The drawings were placed beside the other such that the drawings are along the same line of sight. The subjects were asked to remain in a room during the experiment and survey and were monitored throughout the proceeding. Discussions with peers were not allowed. Figure 11 shows this arrangement.

Figure 11. *Presentation of the of Quezon Hall during the Survey*



While viewing subjects were asked to reply to a questionnaire with questions designed to determine the subject's preferred building (aesthetic preference) and their criteria for judgement. The questions were simple and done only for this survey. The results of the survey are shown in Tables 1 and 2. The questions are given in the first column of the tables.

Table 1. *Results of Survey for Line Drawing of Quezon Hall*

Line Drawing of Quezon Hall	Group 1		Group 2		Group 3	
	UP Diliman		TIP Quezon City		FEU Manila	
	actual elevation	modified elevation	actual elevation	modified elevation	actual elevation	modified elevation
Question 1:						
As a whole, which elevation do you prefer?	8	22	15	15	19	11
	26.677%	73.33%	50%	50%	63%	37%
Question 2:						
Which of the two elevation drawings appeal to you best with regards to:						
a. Size	13	17	20	10	20	10
	43.33%	56.67%	66.67%	33.33%	66.67%	33.33%
b. Shape	14	16	12	18	20	10
	46.67%	53.33%	40%	60%	66.67%	33.33%
c. Composition	10	20	16	14	21	9
	33.33%	66.67%	53.33%	46.67%	70%	30%
d. Proportion	12	18	19	11	19	11
	40%	60%	63.33%	36.67%	63.33%	36.67%
e. Detailing	10	20	16	14	19	11
	33.33%	66.67%	53.33%	46.67%	63.33%	36.67%

Table 2. *Results of Survey for Rendered Drawing of Quezon Hall*

Rendered Drawing of Quezon Hall	Experimental 1		Experimental 2		Control 1	
	UP Diliman		TIP Quezon City		FEU	
	actual elevation	modified elevation	actual elevation	modified elevation	actual elevation	modified elevation
Question 1:						
As a whole, which elevation do you prefer?	19	11	14	16	11	19
	63.33%	36.67%	46.67%	53.33%	36.67%	63.33%
Question 2:						
Which of the two elevation drawings appeal to you best with regards to:						
a. Size	22	8	13	17	17	13
	73.33%	26.67%	43.33%	56.67%	56.67%	43.33%
b. Shape	16	14	12	18	16	14
	53.33%	46.67%	40%	60%	53.33%	46.67%
c. Composition	19	11	19	11	13	17
	63.33%	36.67%	63.33%	36.67%	43.33%	56.67%
d. Proportion	19	11	13	17	11	19
	63.33%	36.67%	43.33%	56.67%	36.67%	63.33%
e. Detailing	13	17	16	14	13	17
	43.33%	56.67%	53.33%	46.67%	43.33%	56.67%

Conclusions and Recommendations

It is interesting to see in Table 1 that the reply of the students from the UP Diliman itself to Question 1 indicate preference to the line drawing of the modified facade than that of the actual façade. As seen in Question 2, the reasons for the preference are related more in terms of composition, proportion and detailing. TIP Quezon City students were split between the actual and modified facades, while the FEU Manila students showed preference to the actual elevation. For the FEU Manila students, there is preference for the line drawing of the actual elevation also in terms of composition, proportion and detailing.

Except for the TIP Quezon City students, the data is reversed when the students are presented with the rendered colored drawings of the actual and the modified elevations. In Table2, the UP Diliman students prefer the actual façade for reasons related to size, composition and proportion. The FEU Manila students preferred the rendered drawing of the modified elevation in terms of size, composition, proportion and detailing.

One can say that based on these initial surveys there is no consistent evidence to support the Salingaros Scaling Coherence Rule, but there is also no evidence to disprove it. Architectural aesthetics may be of a more personal preference. Nonetheless, a mathematical method to develop and explore architectural forms should be available to aid architectural designers in their study of form, and these can be built-in or translated in a computer design programs. The Salingaros Scaling Coherence Rule (SSCR) is an example of as a proportioning system can be applied in architectural evaluation and design thinking effectively. Through it, architectural elements and their relationships can be quantified that can still result in a beautiful and appealing building.

In closing we note that based on Tables 1 and 2, the rendering of an architectural design affects the aesthetic appeal of architectural form. These can be seen in the reversal of data between the line and the rendered facades. There is also indication that familiarity with a building has not much significant influence on architectural aesthetics. If it were so then the proximity of Quezon Hall for UP Diliman students may have shown consistent marks for the actual façade either in both line or rendered drawings but this is was not so. We reiterate the fact that these are initial surveys results and further studies related to these are thus recommended.

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[3] N. Salingaros, Hierarchical Cooperation in Architecture and the Mathematical Necessity for Ornament, J. Arch. Planning Res., 17(2000), 221-235.