

BIM nelle fasi iniziali dei processi d'intervento edilizio

La simulazione computazionale per la redazione del progetto di fattibilità tecnica ed economica.

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UNIVERSITÀ
DEGLI STUDI
FIRENZE

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DIPARTIMENTO
DI ARCHITETTURA



MAILAB.BIZ



The **PERFORMATIVE BIM** & **PROGRAMMA EDILIZIO**



BIM Overview & Model Based Performance Simulation
Dinamic Space Programming & Lay Out Definition



BIM Overview & Model Based Performance Simulation





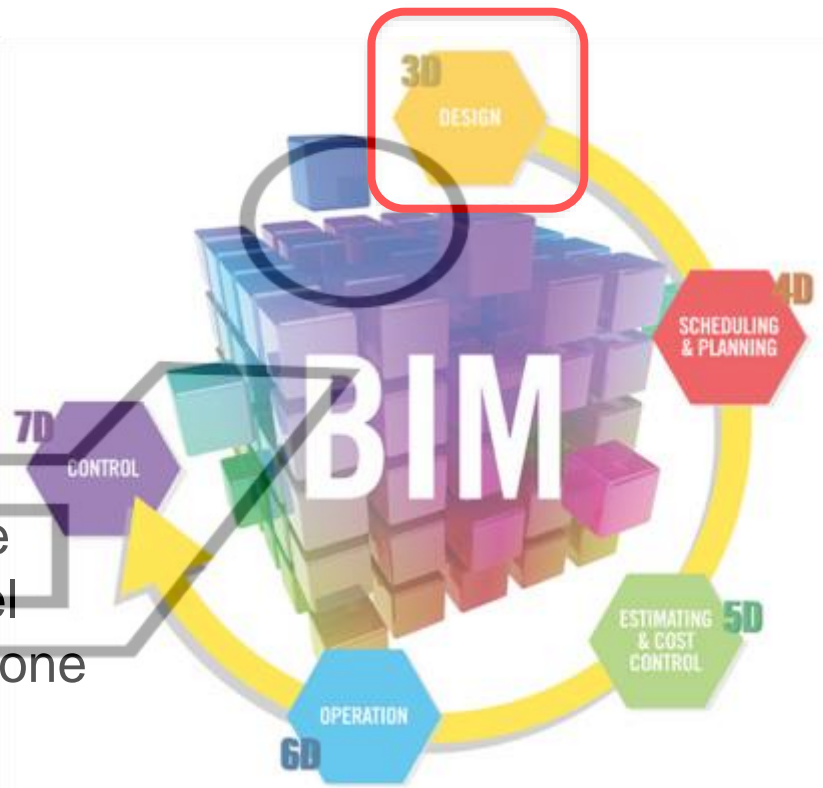


INFORMATIVE BIM VS PERFORMATIVE BIM



INFORMATIVE BIM VS PERFORMATIVE BIM

Ovvero
come la modellazione computazionale
può essere usata per la definizione del
progetto nelle sue fasi iniziali di ideazione



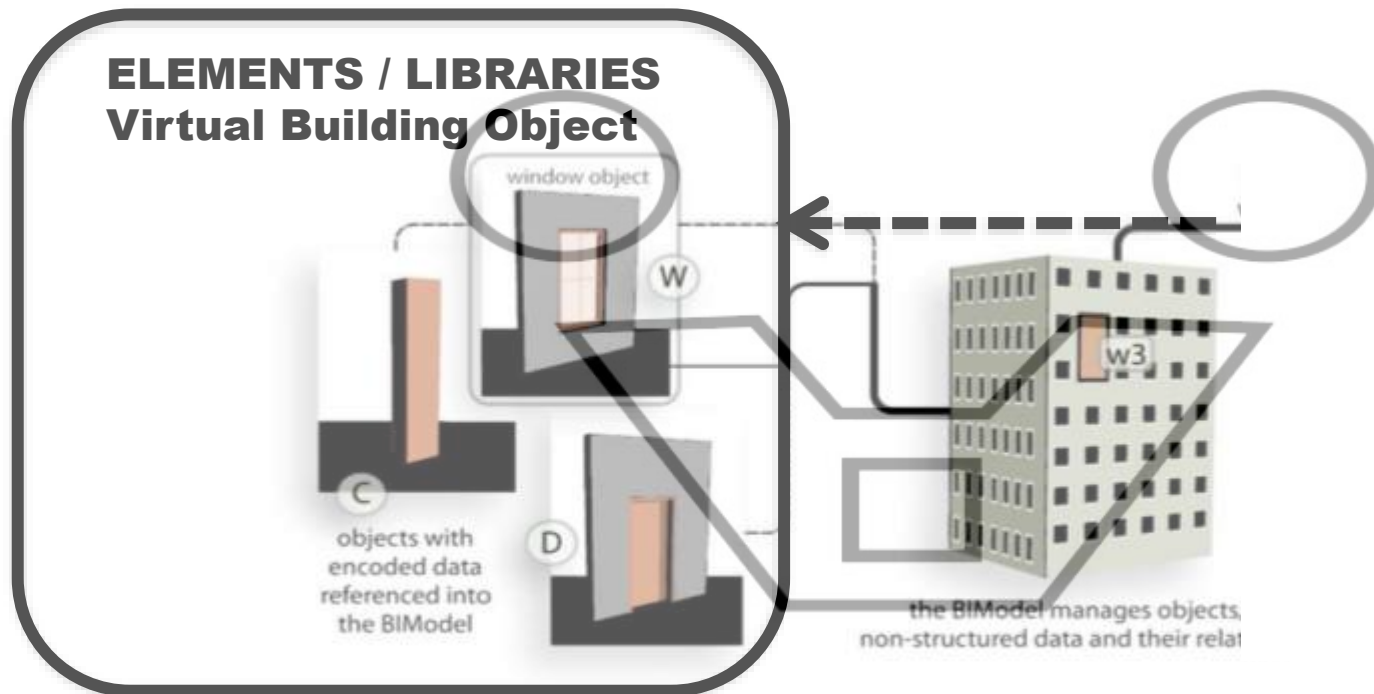
BIM

BUILDING a usually roofed and walled structure assembling materials for permanent/temporary use

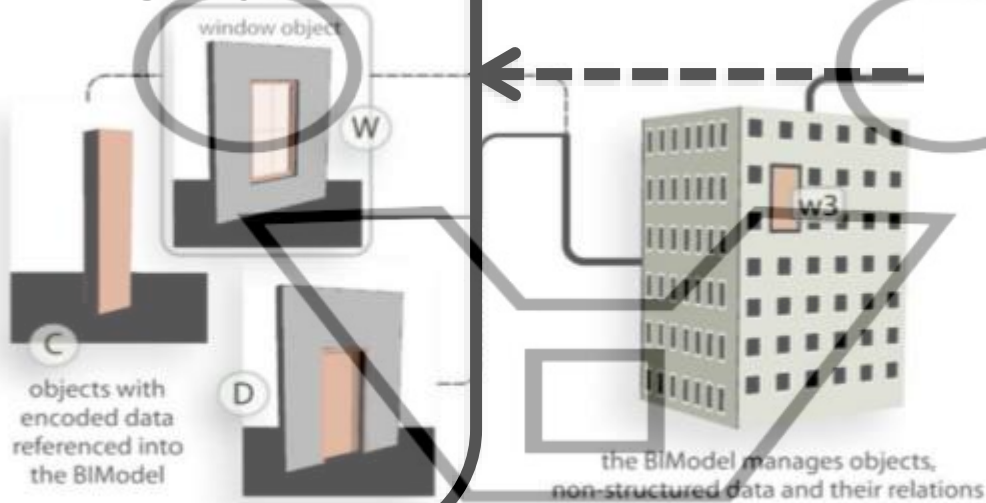
INFORMATION: entity or form that resolves uncertainty related to data and knowledge **as data represents values attributed to parameters**, and knowledge signifies understanding of real or abstract phenomena. Discipline of telecommunication founded on mathematic with application on artificial intelligence, complex system , and cybernetic

MODEL: a simplified representation, a construction with cognitive and operable functions

BIM: A DATABASE



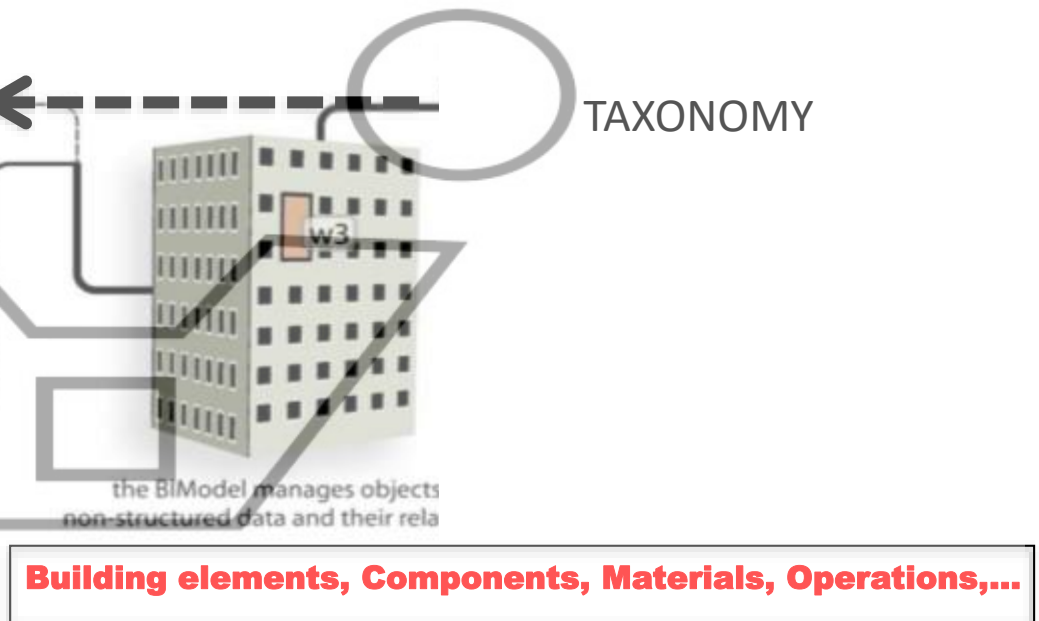
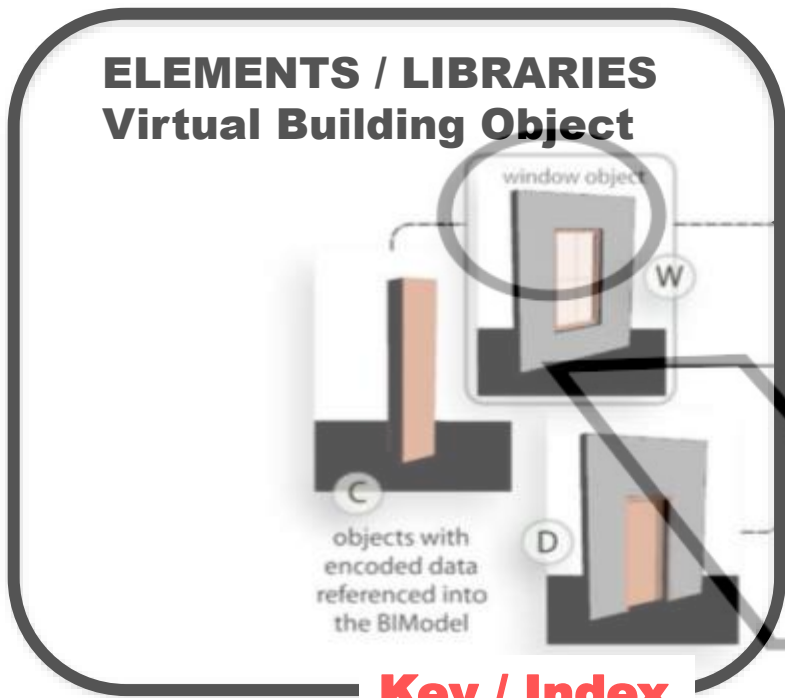
ELEMENTS / LIBRARIES Virtual Building Object



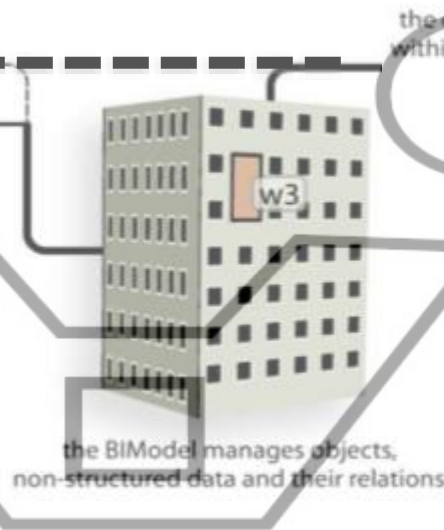
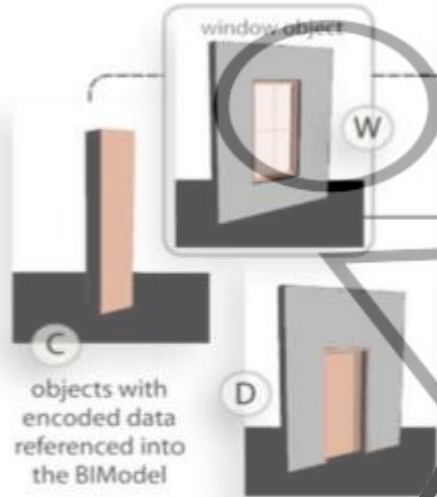
Key / Index

TAXONOMY

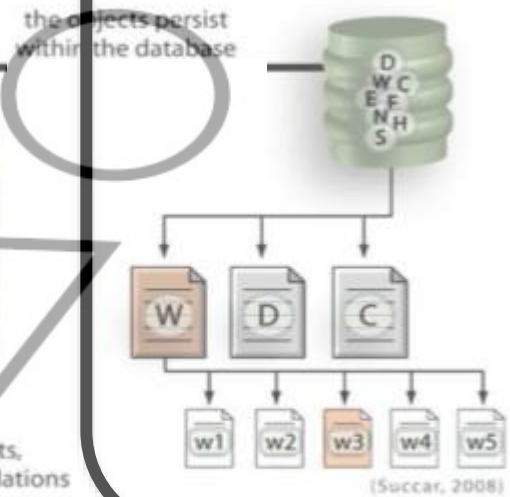
La programmazione orientata agli oggetti applicata alle costruzioni impiega un **codice organizzato per classi** che fornisce un supporto naturale alla modellazione software degli oggetti del mondo reale (o del modello astratto); ne favorisce la modularità e il riuso; permette una più facile gestione e manutenzione di progetti di grandi dimensioni.



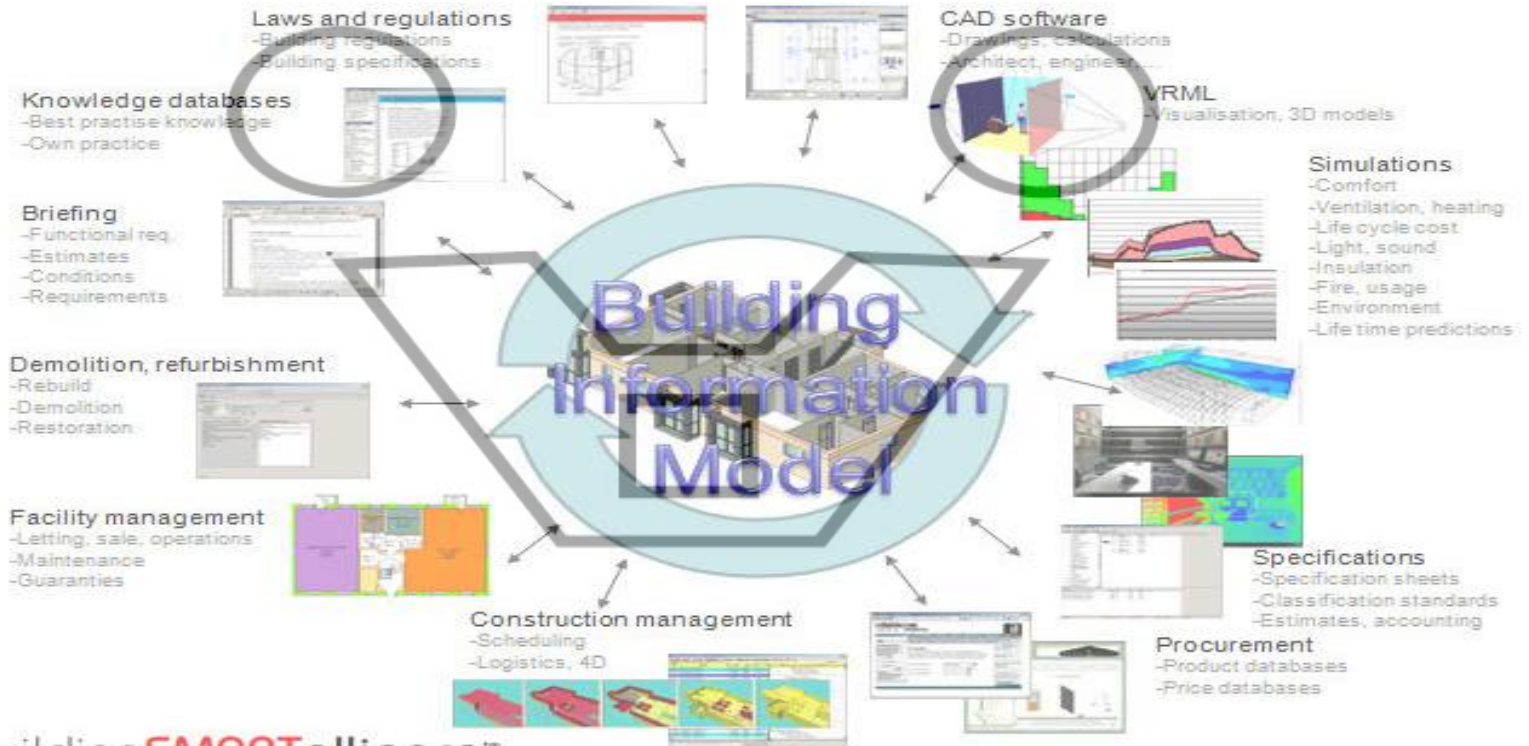
ELEMENTS / LIBRARIES Virtual Building Object



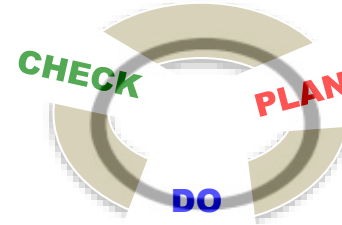
DATASET OF FACTS & PERFORMANCES



APPLICATIONS OF BIM



WHICH KIND OF INTERACTIONS DOES BIM ALLOW?

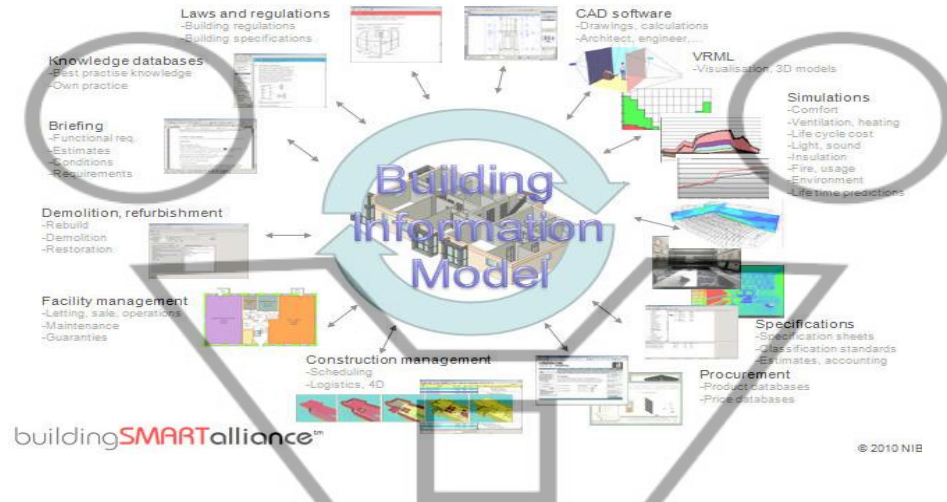


Modelling Information
shaping
forming
presenting,
scoping

Information
an organised
set of data:
meaningful,
actionable

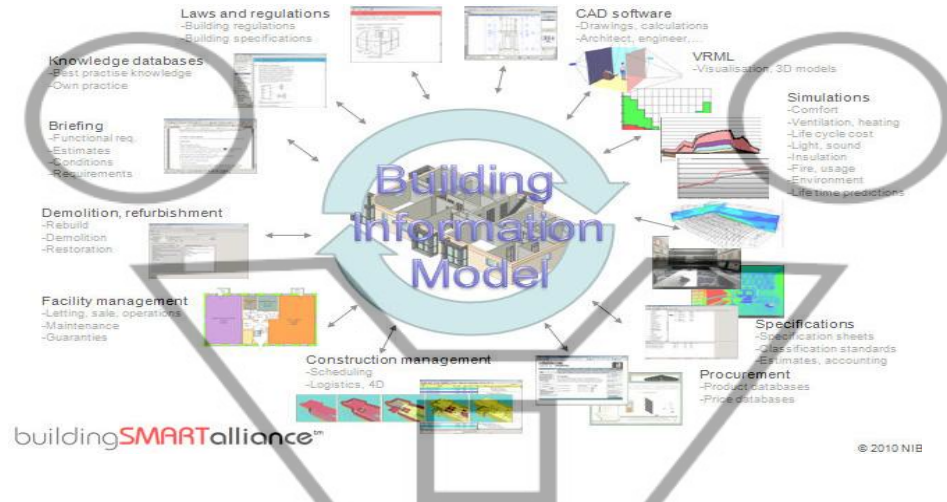
- to virtually construct a
- to extend the analysis of a
- to explore the possibilities of
- to study what-if scenarios for a
- to detect possible collisions within a
- to calculate construction costs of
- to analyse constructability of a
- to plan the deconstruction of a
- to manage and maintain a

Building
a structure, an
enclosed space,
a constructed
environment
(Succi, 2008)



BIM: Operational areas

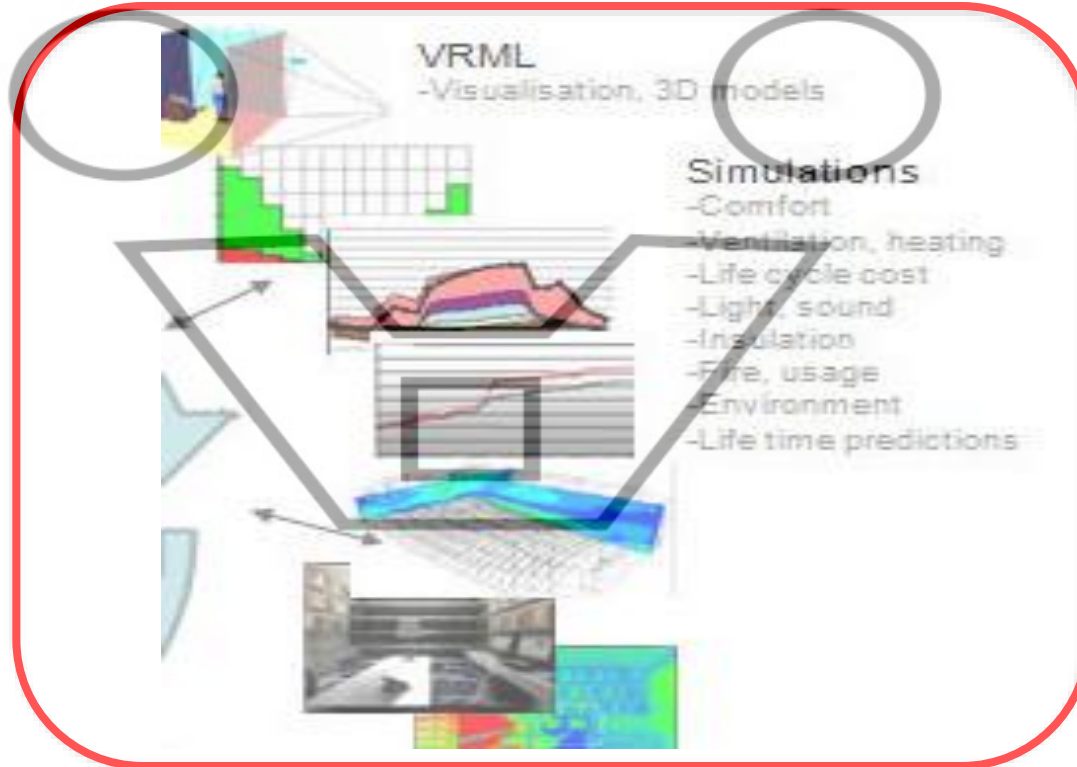
Management ___ Deliverable & Communication ___ Simulation & Design

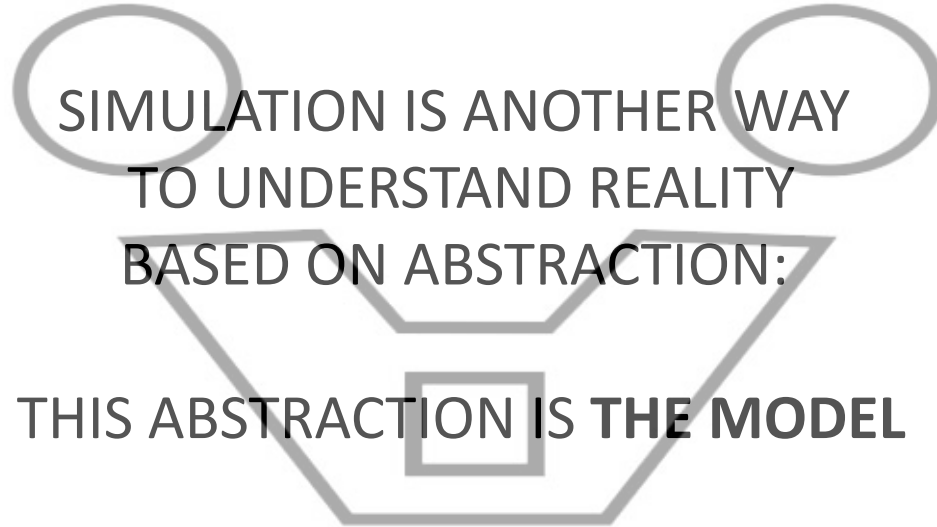


BIM: Operational areas

Management __ Deliverable & Communication __ Simulation & Design

Building Performance Simulation





Building Performance Simulation

programmazione orientata agli oggetti

“... ai moduli tracciati dai compassi, alle misurazioni numeriche e poi alle equazioni matematiche si sostituiscono funzioni parametriche capaci di descrivere possibilità morfologiche e semantiche. (Kolarevic 2000: 2)

La loro formalizzazione evolve dalle strutture sintattiche del *solid modeling* e della modellazione *object-oriented* integrando archivi d'informazioni di varia natura, tipo e dimensione tra loro interattivi e operabili attraverso l'indicizzazione della rappresentazione geometrica dell'edificio

BIM

BUILDING a usually roofed and walled structure assembling materials for permanent/temporary use

INFORMATION: entity or form that resolves uncertainty related to data and knowledge **as data represents values attributed to parameters**, and knowledge signifies understanding of real or abstract phenomena. Discipline of telecommunication founded on mathematic with application on artificial intelligence, complex system , and cybernetic

MODEL: a simplified representation, a construction with cognitive and operable functions

A column really knows that it is a column because it is informed of all the ontological attributes (natural and social); (L. KAHN)

It is no longer a graphic convention that asks to be filled with its meanings and materiality

(Levy 2012: 14).

ISOMORPHIC MODELS

Morfological Model or
“Depictional” representation

*Simulation in order
to understand
how it looks*

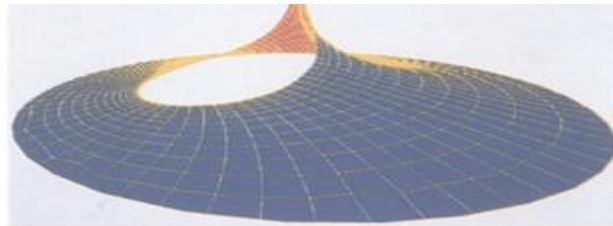
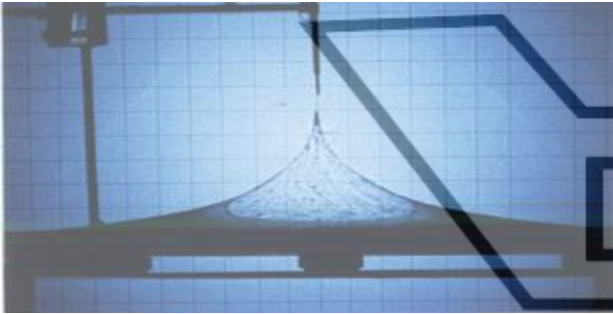
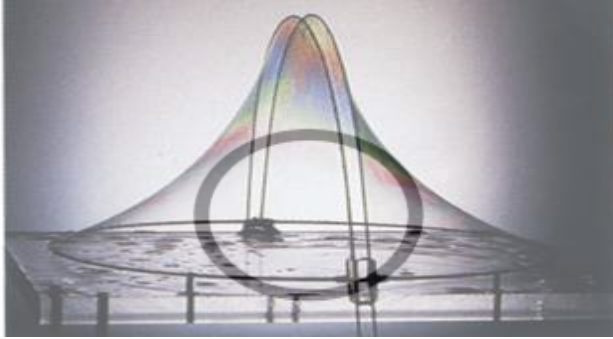


A SCALED MODEL AS AN EXPERIMENTAL SIMULATION to understand how reality behaves



Normally, simulation differentiate itself from experiment where experiment is conducted on reality itself, using the same matter while simulation operates through the interposition of other and different materials.

Traditionally models and simulations are mainly representative, experiments are descriptive.



VISUALIZING MATTER

Functionality and Performance Design

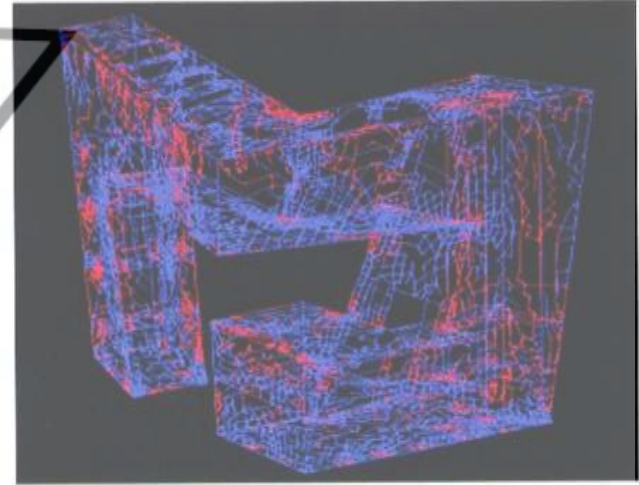
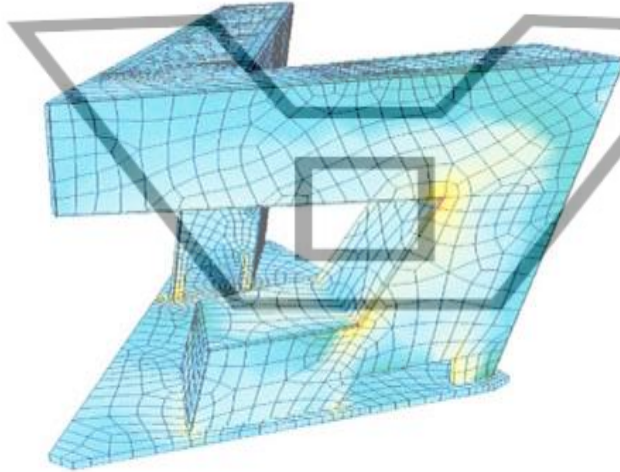
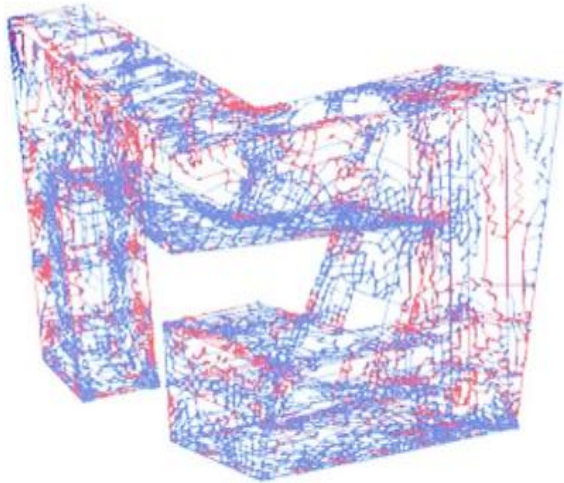
Frey Otto's studies & researches

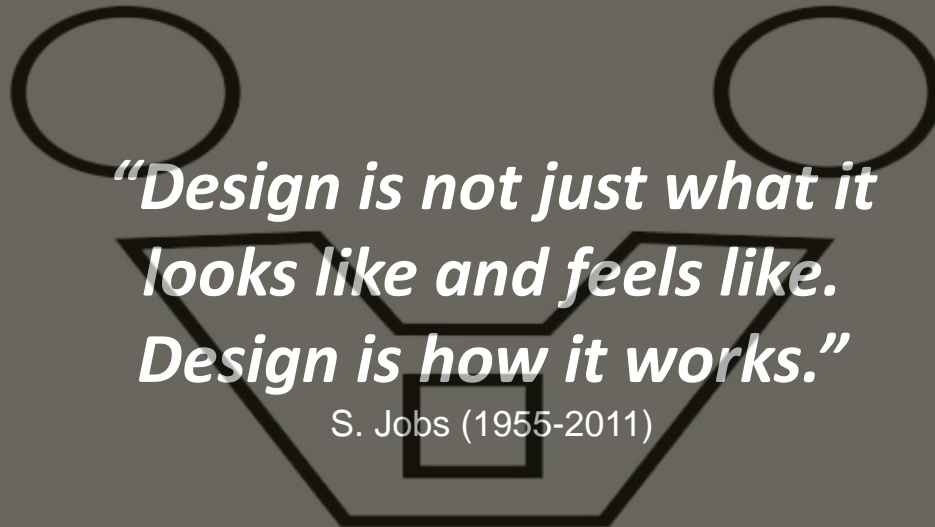
- 1 Soap film model of an arch-supported membrane.
- 2 Soap-film model of a membrane surface with rope loop as its high point.
- 3 Computer simulation of a minimal surface with rope loop.

DIAGRAM: THE ABSTRACT MACHINE

..a map of relations between forces”

Deleuze, A Thousand Plateaus (1988)





S. Jobs (1955-2011)

BUILDING PERFORMANCE SIMULATION – BPS

nasce negli anni '70 come ambito specialistico del *Parametric Modeling* (PM) e del *Performance-Based Design* (PBD)

From *what the building will look like* (Garber 2014:184),

To *What the building will work based on performance specifications* (Kolarevic 2002)

Negli ultimi venti anni la **simulazione parametrica** si è evoluta in diversi ambiti raggiungendo un soddisfacente livello di maturità soprattutto per le attività di verifica/validazione della progettazione esecutiva sino a diventare un irrinunciabile ausilio nell'ingegnerizzazione del progetto e una delle nuove frontiere del BIM come evidenziato dalla corsa delle maggiori software-house a integrare tali funzionalità all'interno dei loro prodotti.

DESIGN BASED ON DIGITAL DATA EVIDENCE

nascita di nuove 'cose'

1979

- Chip Motorola 6800 a 24 bit (in grado di computare blocchi d' informazione da 16 megabyte.)
- Nascita a Tokyo della prima rete commerciale di telefonia cellulare
- Daniel Bricklin e Robert Frankston realizzano VisiCalc

1981-1982

- Silicon Graphics (1981),
- Catia (1982),
- Tron (1982)

1992

- BIM
- the Fish (1989-1992):

1999

- Nvidia GeoForce 256



...dal kernel ...alle interfacce ...cloud computing ...plug-in/add-on

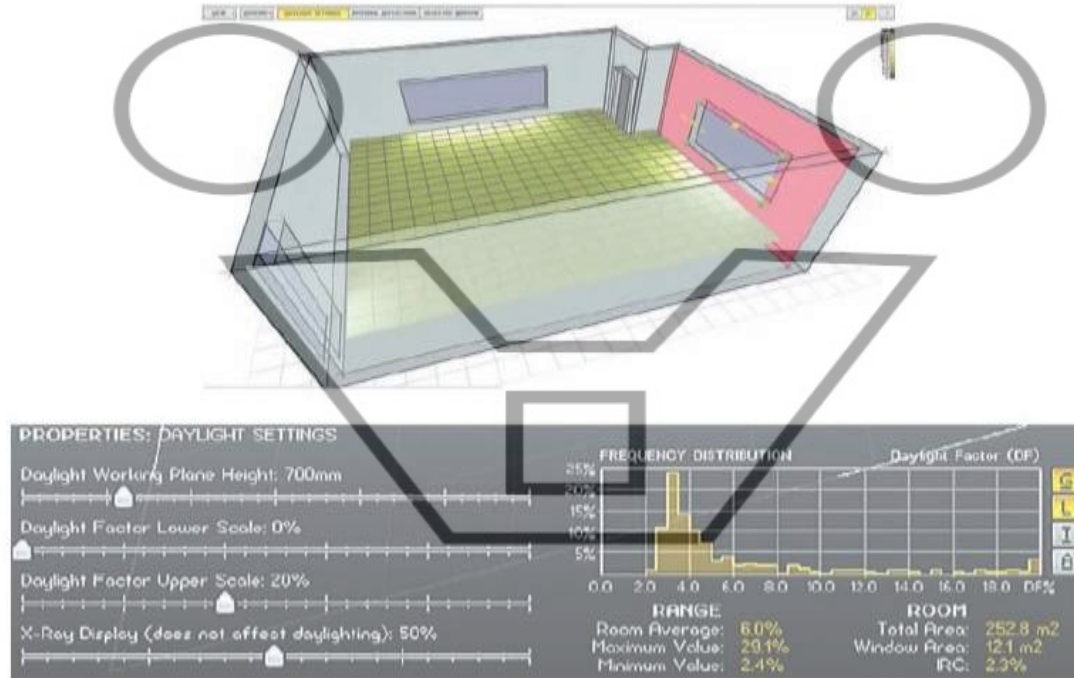
Conclusa una prima fase che si è concentrata sui motori di calcolo (**kernel**), l'attenzione si è spostata **sulle interfacce** con l'obiettivo di semplificare l'operabilità e la leggibilità dei risultati allo scopo di incorporare questi strumenti all'interno dei propri prodotti di modellazione BIM. Questa tendenza convive ed è alimentata dalla parallela diffusione **del cloud-computing** oggi sostenuta da precise logiche commerciali e da infrastrutture e protocolli telematici oggi in rapida evoluzione.

Un'altra area di sviluppo finalizzata all'integrazione si è concentrata sull'**interoperabilità**, sui protocolli d'interscambio dei dati

.... e parallelamente sulla realizzazione di un'innumerabile quantità di **plug-in e add-on dedicati a specifici aspetti della simulazione energetica e ambientale** a dimostrazione che non esiste un software in grado di risolvere tutti gli aspetti della simulazione energetica (Anderson 2014: 172).

Essi includono l'illuminamento e la ventilazione degli ambienti interni; le prestazioni acustiche; la geometria solare e l'ombreggiamento, gli impatti dei venti, ...: una vastità di strumenti che consente di condurre valutazioni di tipo prestazionale in maniera parametricamente interrelata alla geometria, ai modi occupare e usare gli ambienti, ai livelli di benessere attesi, al clima, alle caratteristiche tecnologiche della costruzione. (Mahadavi, 2003:162).

Powerful tools for gamers



2.3 and 2.4

Andrew Marsh, creator of Ecotect, has been experimenting with real-time, on-line daylighting simulation. The room and windows can be adjusted to see real-time daylight factor results.

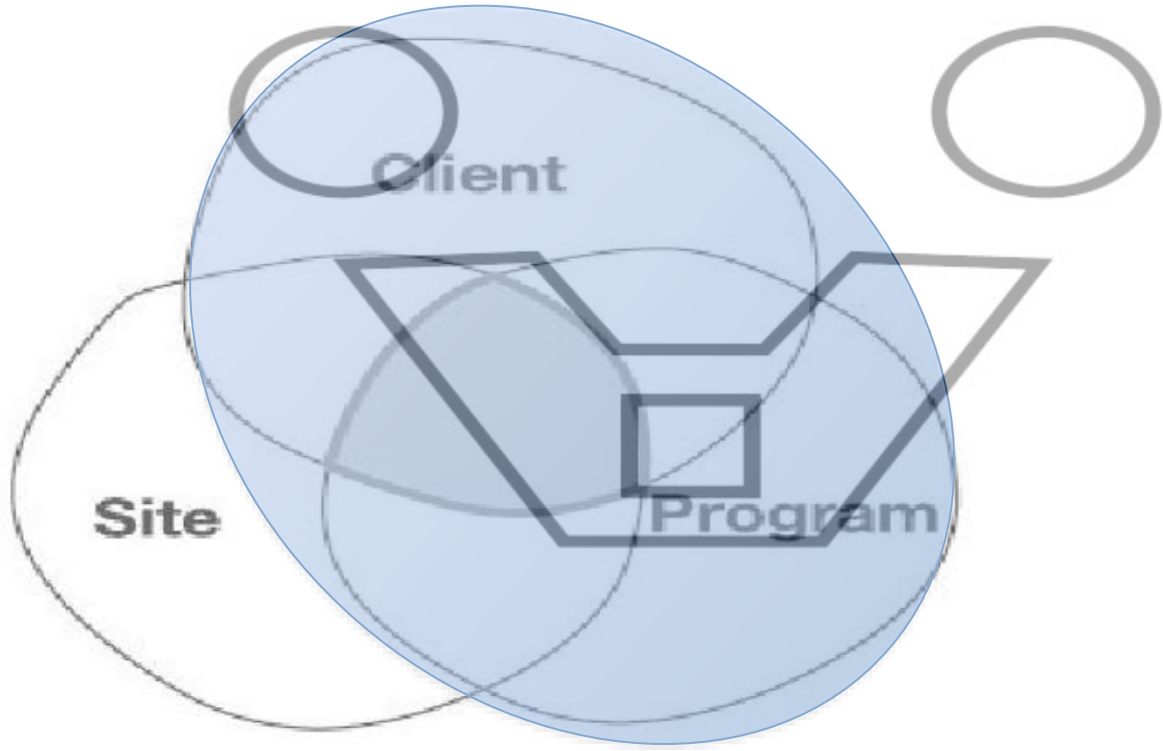
Source: Courtesy of Andrew Marsh.
<http://andrewmarsh.com/blog/2010/04/11/real-time-dynamic-daylighting>.

PLAYING OPTIONS
AND
UNDERSTANDING
CAUSALITY



Dinamic Space Programming & Lay Out Definition





DEFINIRE GLI SPAZI:

1. DIMENSIONAMENTO (programming)
2. ORGANIZZAZIONE (planning)



<http://www.mailab.biz/space-planning-concept/>

1.DIMENSIONAMENTO (programming)

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI

	A	B	C
1	Name	Projected Area	Actual Area
2	Office 1	350	
3	Office 2	250	
4	Conference Room	400	
5	Reception	300	
6			
7			

Worksheet Entry

B5 300

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

TABELLA 6 - STANDARD DI SUPERFICIE: SCUOLA ELEMENTARE

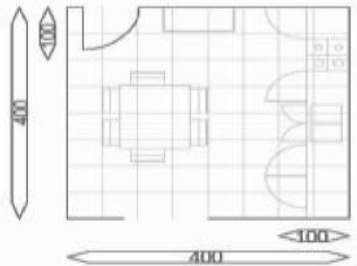
Decreto Ministeriale 18 dicembre 1975

STIMA ANALITICA DA STANDARD

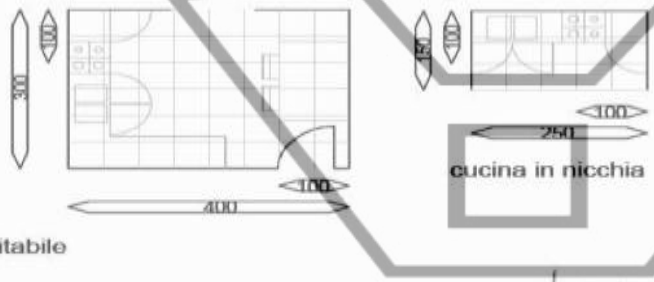
Descrizione attività	<i>m²/alunno</i>
1	
<i>Attività didattiche:</i>	
attività normali	1,80
attività interciclo	0,64
Indice di superficie totale riferito alle attività didattiche	
min.	2,44
max	2,70
2	
<i>Attività collettive:</i>	
- attività integrative e parascolastiche	0,40
- mensa e relativi servizi (1*)	0,70
3	
<i>Attività complementari:</i>	
- biblioteca insegnanti	0,13
Indice di superficie netta globale	5,21
Indice di superficie max. netta globale	5,58
Somma indici parziali	
min.	3,67
max	3,93
Connettivo e servizi igienici (42% della somma presente)	
min.	1,54
max	1,65
4	
<i>Spazi per l'educazione fisica:</i>	
Palestra, servizi palestra, ecc. Tipo A ₁ : 330 m ² (da 10 a 25 classi)	
5	
<i>Alloggio custode (se richiesto): 80 m² netti</i>	
6	
<i>Spazi per la direzione didattica, (se richiesti): 100 m² netti</i>	

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

Unità Ambientale U.A.2	CUCINA		Note: Le U.A. dovranno essere progettate in riferimento al numero di utenza prevista per ogni alloggio.
Area Funzionale	Spazi di Servizio		
Arredi Attrezzature Apparecchiature	- blocco cucina - tavolo	- piani di appoggio - mobili con ripiani e pensili	



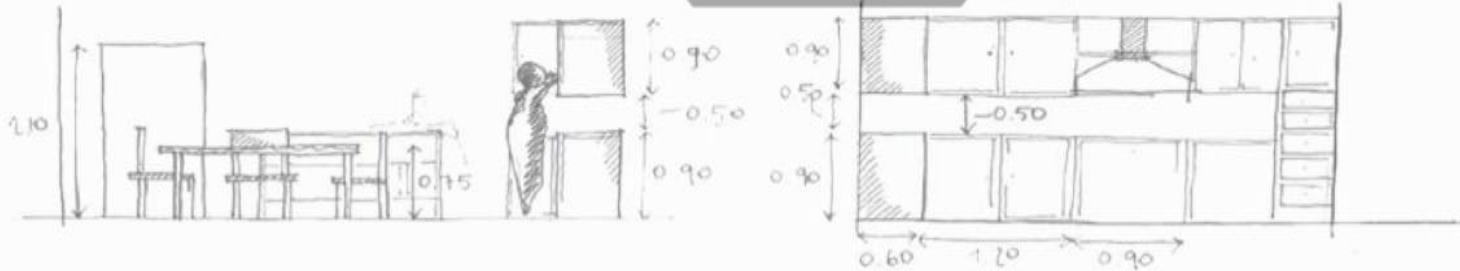
cucina abitabile



cucina in nicchia

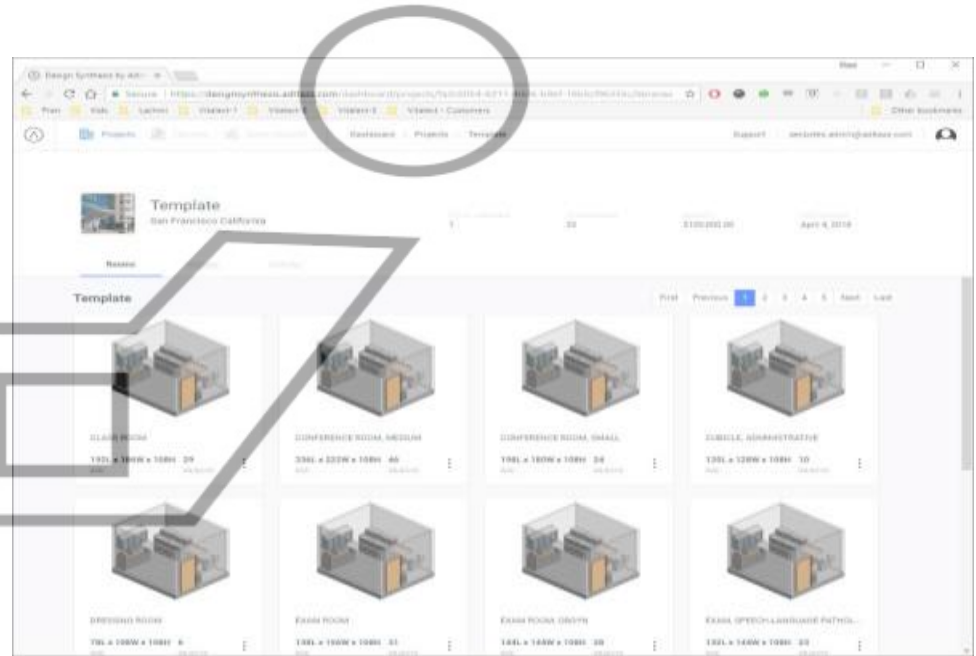
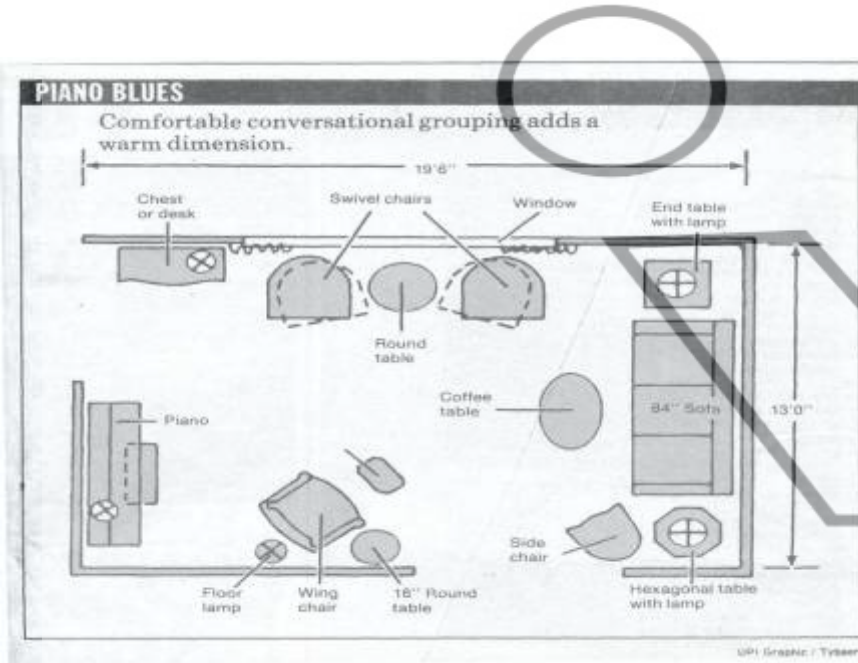


... DA ANALISI ATTIVITA'

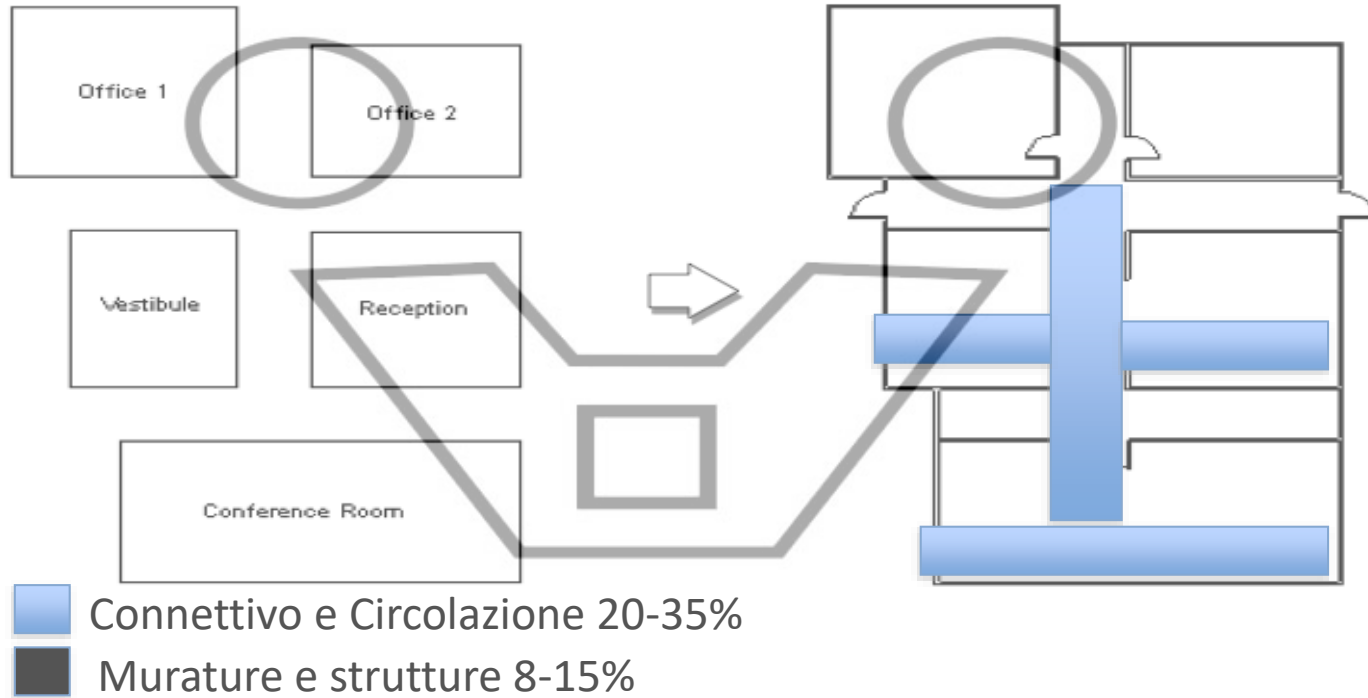


PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

USO DI ABACHI SPAZIALI



PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI



VEDI <http://www.aecbytes.com/review/2016/Archetris.html>

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

Uso di fogli elettronici

	A	B	C
1	Name	Projected Area	Actual Area
2	Office 1	350	
3	Office 2	250	
4	Conference Room	400	
5	Reception	300	
6	Circulation	20%-35%	
7	Walls	8%-15%	

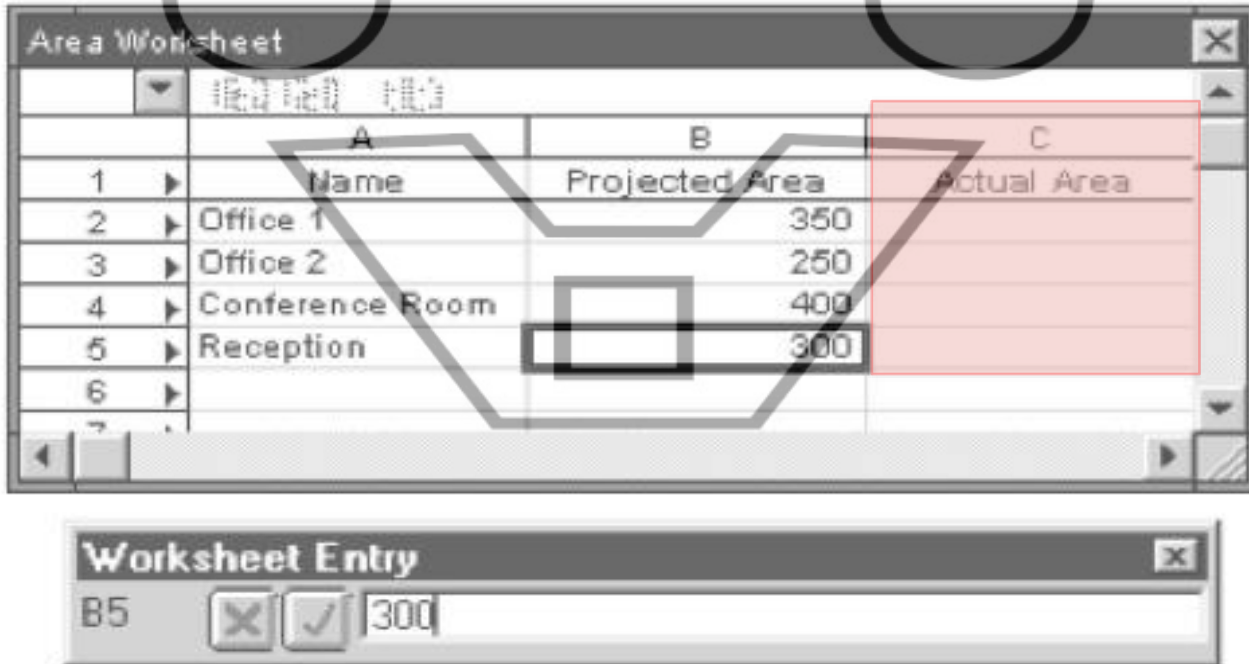
Worksheet Entry

B5 300

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

Uso di fogli elettronici

dynamic evaluation during the design phase



	A	B	C
	Name	Projected Area	Actual Area
1			
2	Office 1	350	
3	Office 2	250	
4	Conference Room	400	
5	Reception	300	
6			
7			

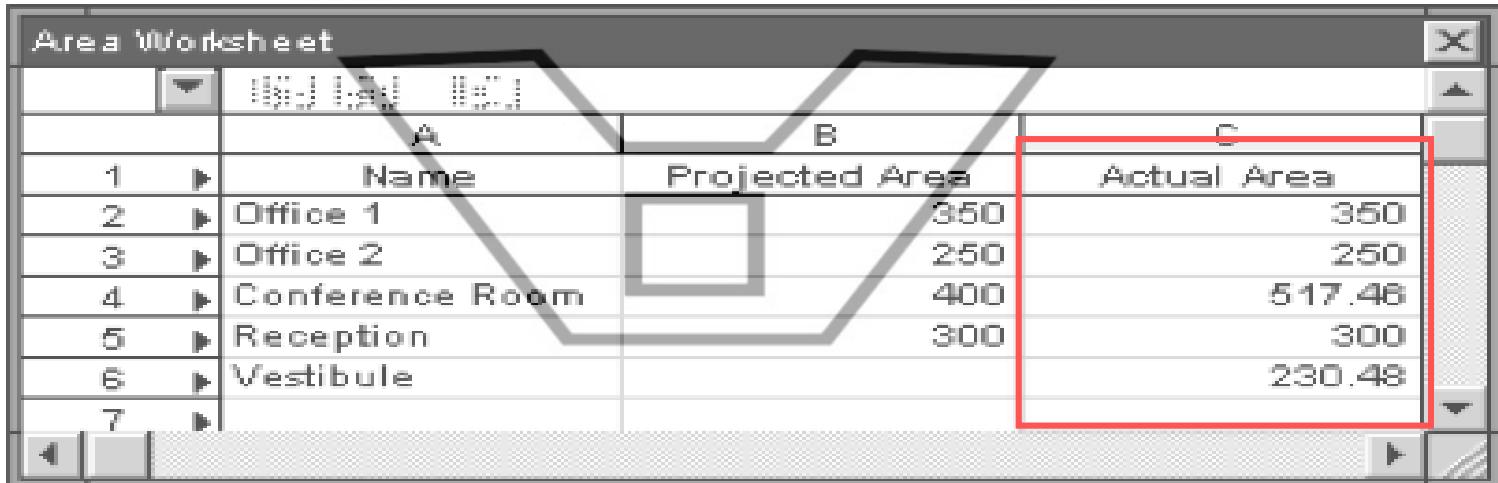
Worksheet Entry

B5 300

PROGRAMMA EDILIZIO: DIMENSIONAMENTO DEGLI SPAZI SPECIFICHE DIMENSIONALI

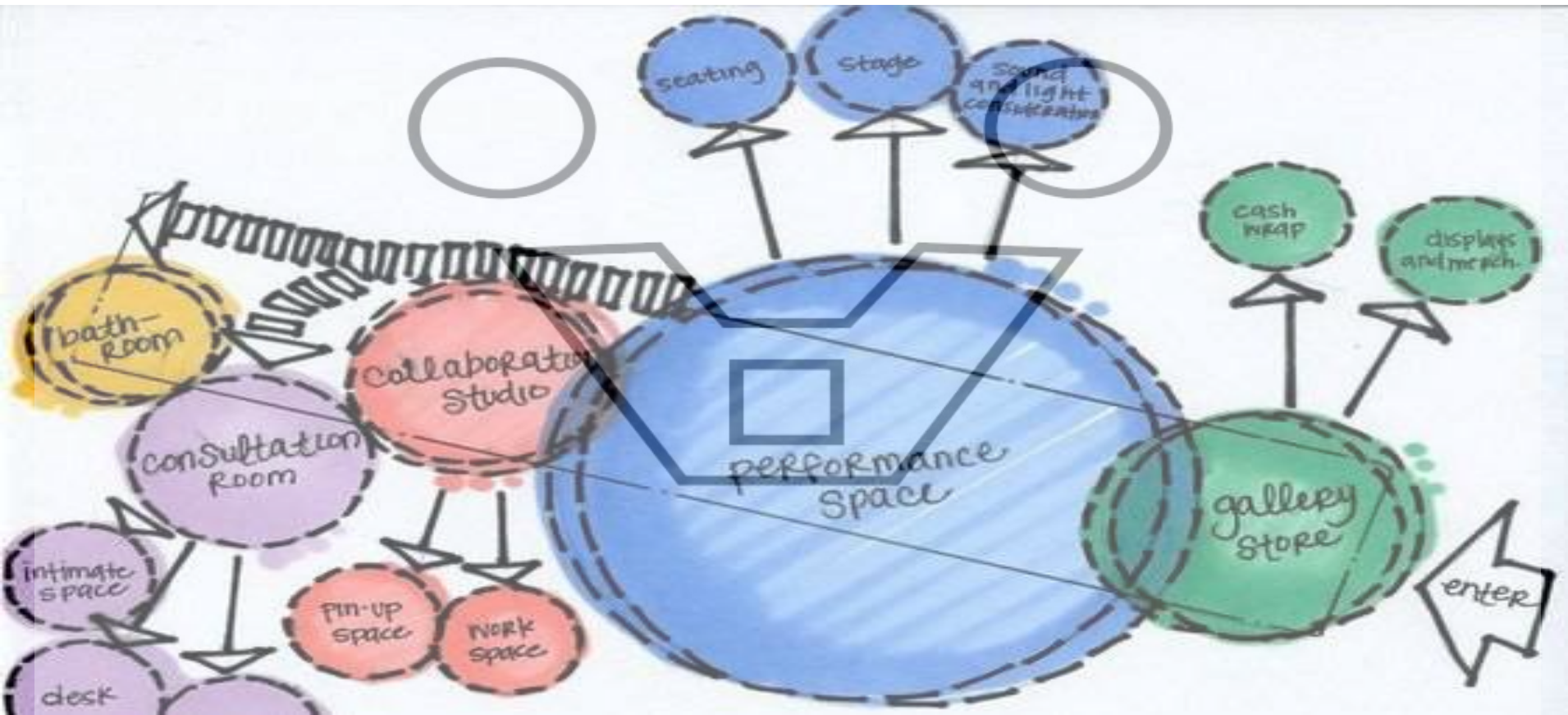
Uso di fogli elettronici

dynamic evaluation during the design phase



	A	B	C
1	Name	Projected Area	Actual Area
2	Office 1	350	350
3	Office 2	250	250
4	Conference Room	400	517.46
5	Reception	300	300
6	Vestibule		230.48
7			

2. ORGANIZZAZIONE (Planning) IL LAYOUT ARCHITETTONICO



DIAGRAMMI FUNZIONALI

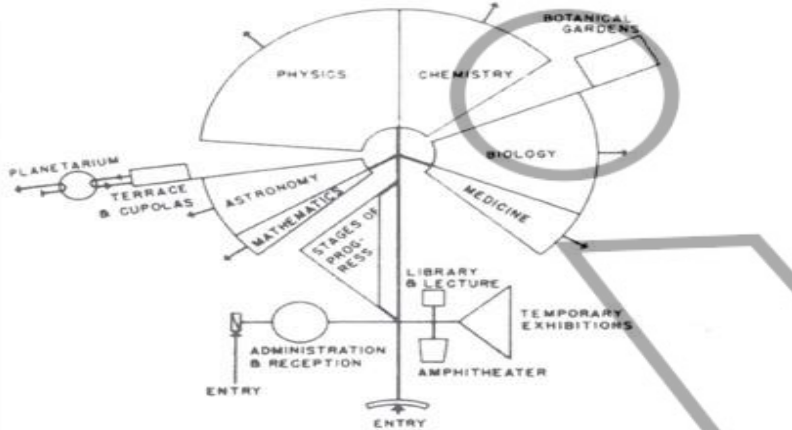
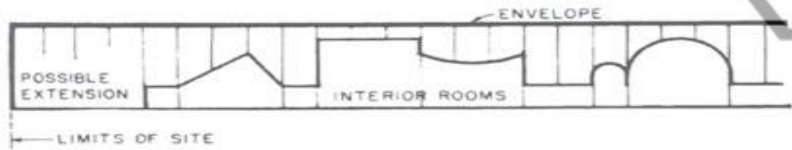
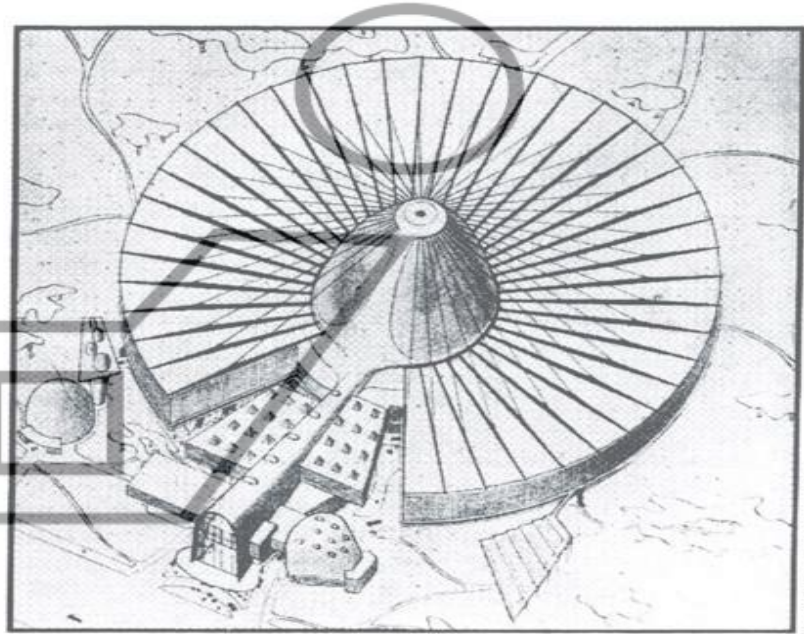


Diagram showing functional relationships of areas



Envelope

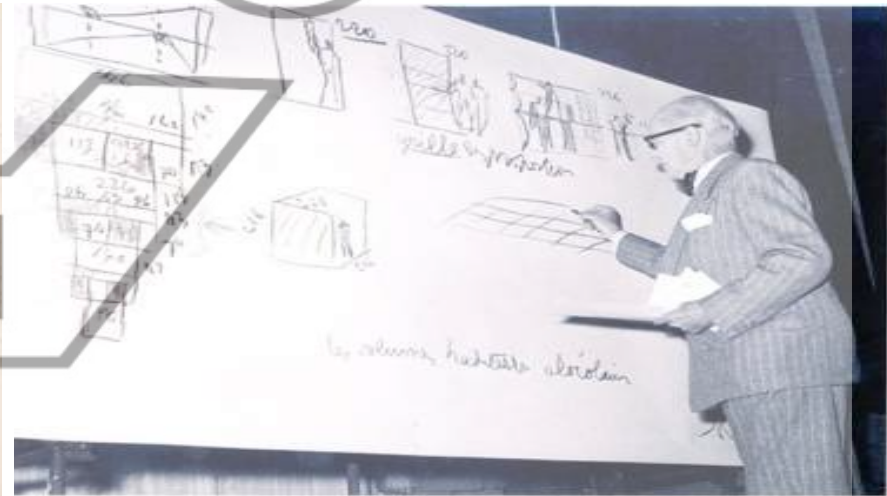
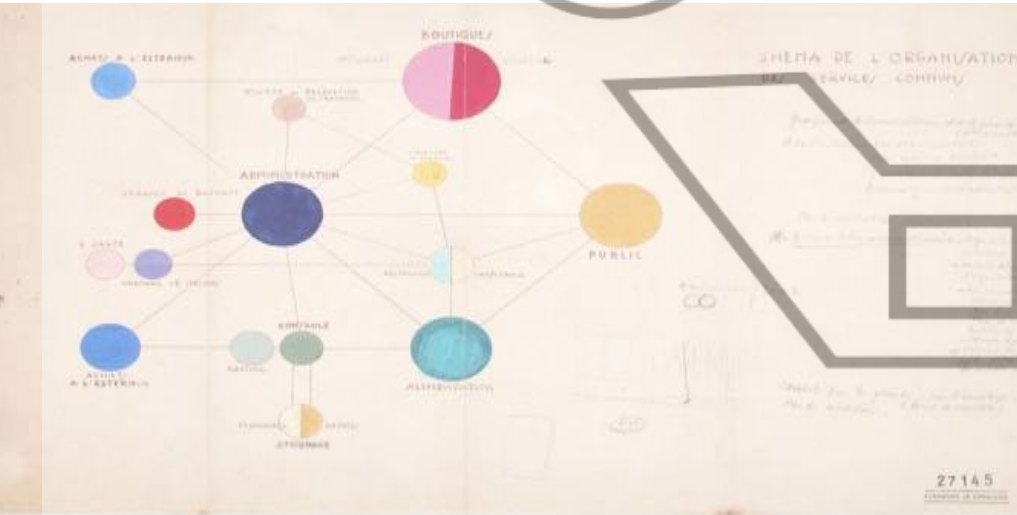


Perspective view from entrance side

R. Piquard, photographer

Figure 8 Paul Nelson, 'Museum of Science' (or Palace of Discovery). From *Architectural Record*, February 1939. Proposed for the 1937 Exposition Internationale, Paris.

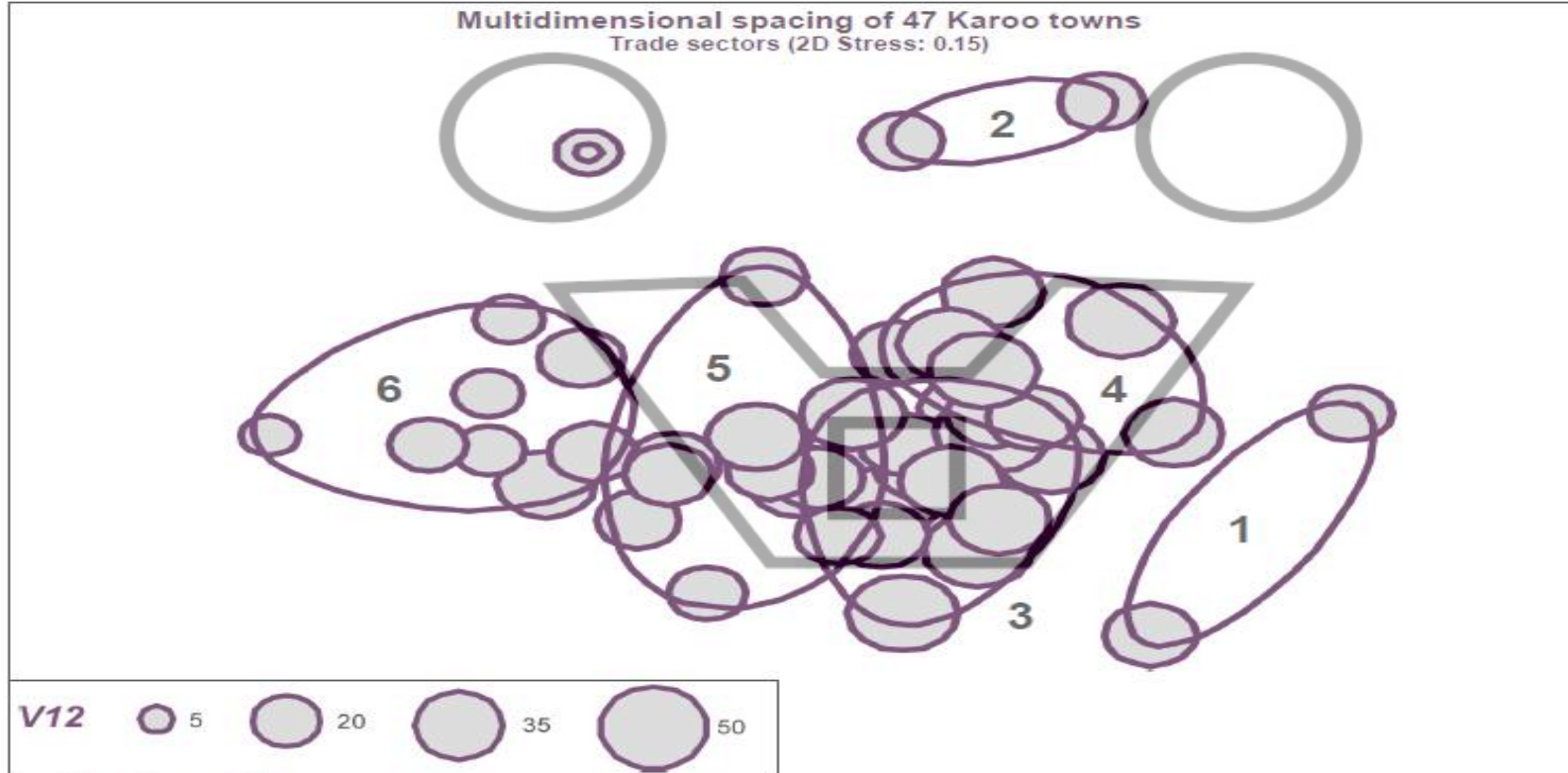
CLUSTER ANALYSIS



Le Corbusier, Marseille: Unité d'habitation, 1945. Bubble diagram of communal services for the building complex. © FLC/ADAGP, Paris and DACS, London 2008.

Le Corbusier making a presentation at the Triennale, Milan, 1951. He often lectured on architecture, using and making diagrams on the spot. © FLC/ADAGP, Paris and DACS, London 2008.

CLUSTER ANALYSIS

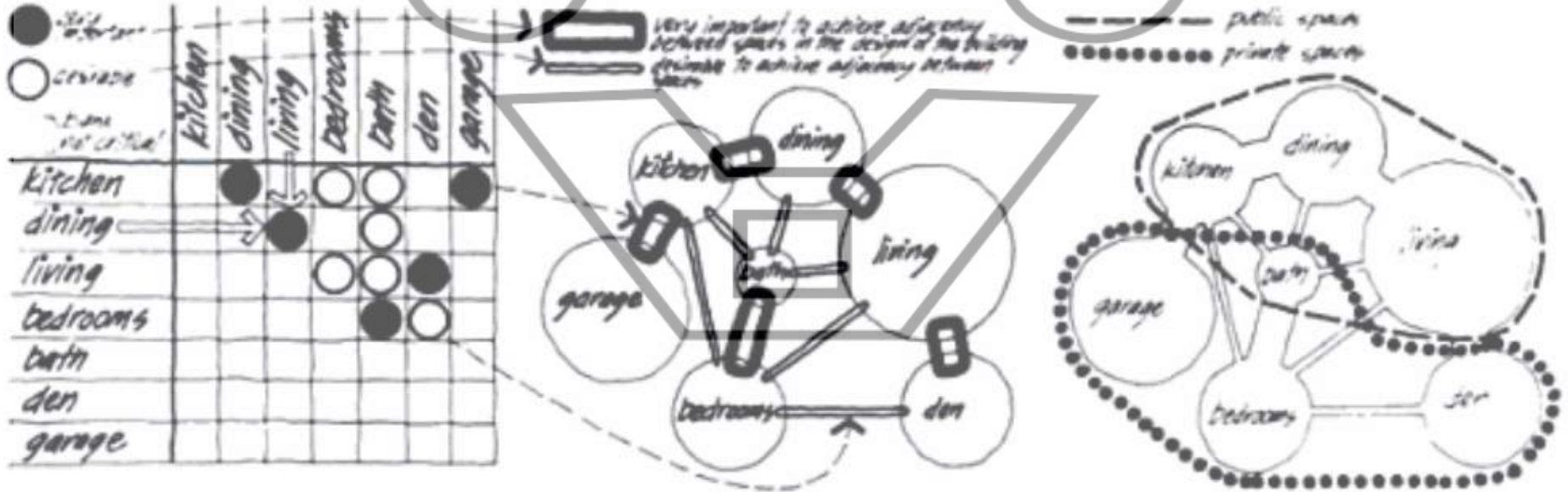


Resemblance: Pearson correlation

FIGURE 6

Multidimensional spacing plot of the trade sectors of the different clusters

CLUSTER ANALYSIS



SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI



SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

<http://www.mailab.biz/space-planning-concept/>

The screenshot shows the Mailab website interface. At the top, there is a navigation menu with links for IDENTITY, PORTFOLIO, IN PROGRESS, RESOURCES, CONTACT US, and LOGIN. Below the menu is a large green banner with the text "Space planning in early conceptual design: Tools & Tutorials". To the left of the banner, there is a date "24 February" and a "Share" button. Below the banner, there are four article entries, each with a title, author, and a brief description. The first entry is "TOOL> TRELLIGENCE AFFINITY: EXTENDING BIM TO SPACE PROGRAMMING AND PLANNING" by Frank Braut. The second is "TUTORIAL> SPACE PLANNING" by Frank Braut. The third is "TUTORIAL> SYNTACTIC DESIGN" by Pirouz Nourian. The fourth is "Guide> EGAN SPACE PLANNING" by Peter Sjarn. At the bottom of the page, there is a navigation bar with tabs for ALL, BIM, Grasshopper, Mass modeling, Modeling, Parametric, Space planning, Trelligence, Tutorials, and Vectorworks.

24
February

Share

TOOL> TRELLIGENCE AFFINITY: EXTENDING BIM TO SPACE PROGRAMMING AND PLANNING
Frank Braut

Trelligence is a research-based software company founded in early 2002 that is focused on enhancing the design process through tools for architectural programming, space planning and early conceptual and schematic design. Affinity is available as a stand-alone application or with plug-ins to the latest versions of Revit Architecture, ArchiCAD, and SketchUp.

TUTORIAL> SPACE PLANNING
Frank Braut

A video part series covering the basic features of the Space Planning suite in Vectorworks 2013.
Part 1 demonstrates creating Spaces with the Space tool, and creating Spaces from polygon objects using the Create Objects from Shapes menu command.
Part 2 demonstrates creating Spaces with Text files using the Import Adjacency Macro command.
Part 3 demonstrates creating design layers to accommodate a space plan that occupied multiple floorable levels.
Part 4 demonstrates creating walls automatically from the completed Space object layout using the Create Walls from Spaces command.

TUTORIAL> SYNTACTIC DESIGN
Pirouz Nourian

Syntactic Design (Designing with Space Syntax for Grasshopper: A plugin for configurative architectural design designed and made by Pirouz Nourian and Samaneh Rezvani).
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License.
* a Grasshopper plugin ([download](#))

Guide> EGAN SPACE PLANNING
Peter Sjarn

The app is intended to help the user work in an intuitive and graphic way during early design: it allows for multiple rapid, lightweight iterations and reduces repetition and sedium in plan development. Helps keep track of program spaces during the design process and provides constant, graphic display of program reconciliation. The app also provides a rudimentary bubble diagram at each step along the way. The app will import a user defined space program in CSV format. Changes to the program can easily be made and re-imported.
* a Revit add-on ([download](#))

ALL BIM Grasshopper Mass modeling Modeling Parametric Space planning Trelligence Tutorials Vectorworks

SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

<http://www.mailab.biz/space-planning-concept/>

The screenshot shows the Mailab website interface. At the top, there is a navigation menu with links: IDENTITY, PORTFOLIO, IN PROGRESS, RESOURCES, CONTACT US, and LOGIN. Below the menu is a large green banner with the text "Space planning in early conceptual design: Tools & Tutorials". To the left of the banner, there is a date "24 February" and a "BLOG" button. Below the banner, there are several tool categories listed in red text: "TRELLIGENCE AFFINITY", "VECTORWORKS SPACE PLANNING", "GRASSHOPPER SYNTACTIC DESIGN", and "REVIT EGAN SPACE PLANNING ADD IN". Each category has a corresponding article snippet with a title and a brief description. At the bottom of the page, there is a horizontal menu with various tool categories: ALL, BIM, Grasshopper, Mass modeling, Modeling, Parametric, Space planning, Trelligence, Tutorials, and Vectorworks.

TRELLIGENCE AFFINITY

VECTORWORKS SPACE PLANNING

GRASSHOPPER SYNTACTIC DESIGN

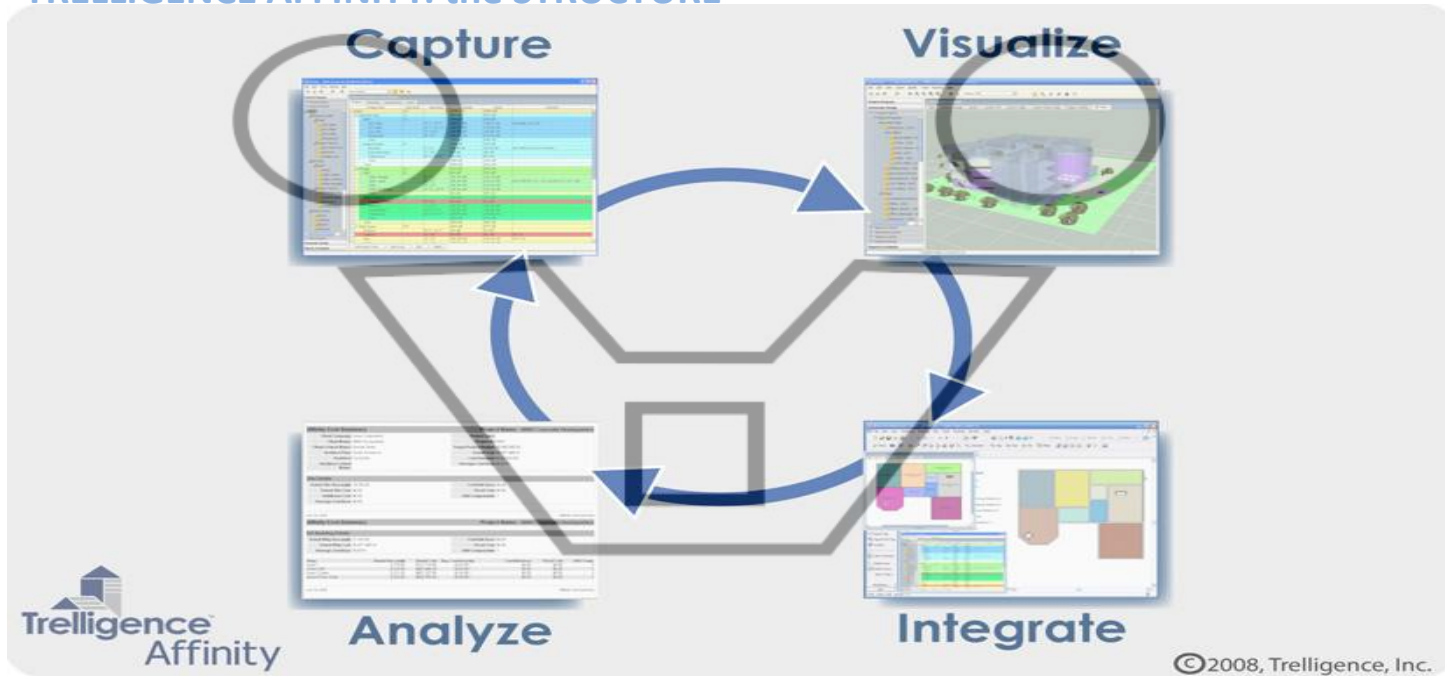
REVIT EGAN SPACE PLANNING ADD IN

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TRELLIGENCE AFFINITY: the STRUCTURE



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TRELLIGENCE AFFINITY: the SPACE LIBRARY

The screenshot displays the Affinity software interface for a BIM project. The main window shows a 3D model of a conference room with a table and chairs. The interface includes a menu bar (File, Edit, View, Insert, Tools, Settings, Help), a toolbar, and a navigation pane on the left. The navigation pane shows a hierarchy: Site > Building > Story 1 > Conference Room. The main view is a 3D perspective of the conference room, showing a table and chairs. The room is highlighted in light blue. The interface also includes a 'Conference Room Details' panel on the right, which displays various properties and requirements for the selected room.

Conference Room Details	
Components Properties	Resources Requirements
Property	Value
Name	Conference Room
Dsg Ref Tag	
Item Type	...rence Room (...)
Locked	<input type="checkbox"/>
Model Ref	
Model Type	
Ofc Pfx	
Program Group	...in Services (...)
Program ID	
Scenario	...
Shape By Bou	<input type="checkbox"/>
Unique ID	72051410
Physical	
Quantity	1.00
Position	0, 54', 0
Rotation	0.0 °
Perimeter	96'
Height	
Width	30'
Depth	18'
Area	540 sqft (...)
Net Area	540 sqft
Weight	0.0 lbs
Area Factor	1.00
Is In Net	<input checked="" type="checkbox"/>
AV / Communic.	
A/V Control P	<input type="checkbox"/>
Audio Amplific	<input checked="" type="checkbox"/>

Conference Room in Administration.Admin Services X = Y = 54', Size = 30' x 18', Area = 540.0

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TRELLIGENCE AFFINITY: the DESIGN MODULE

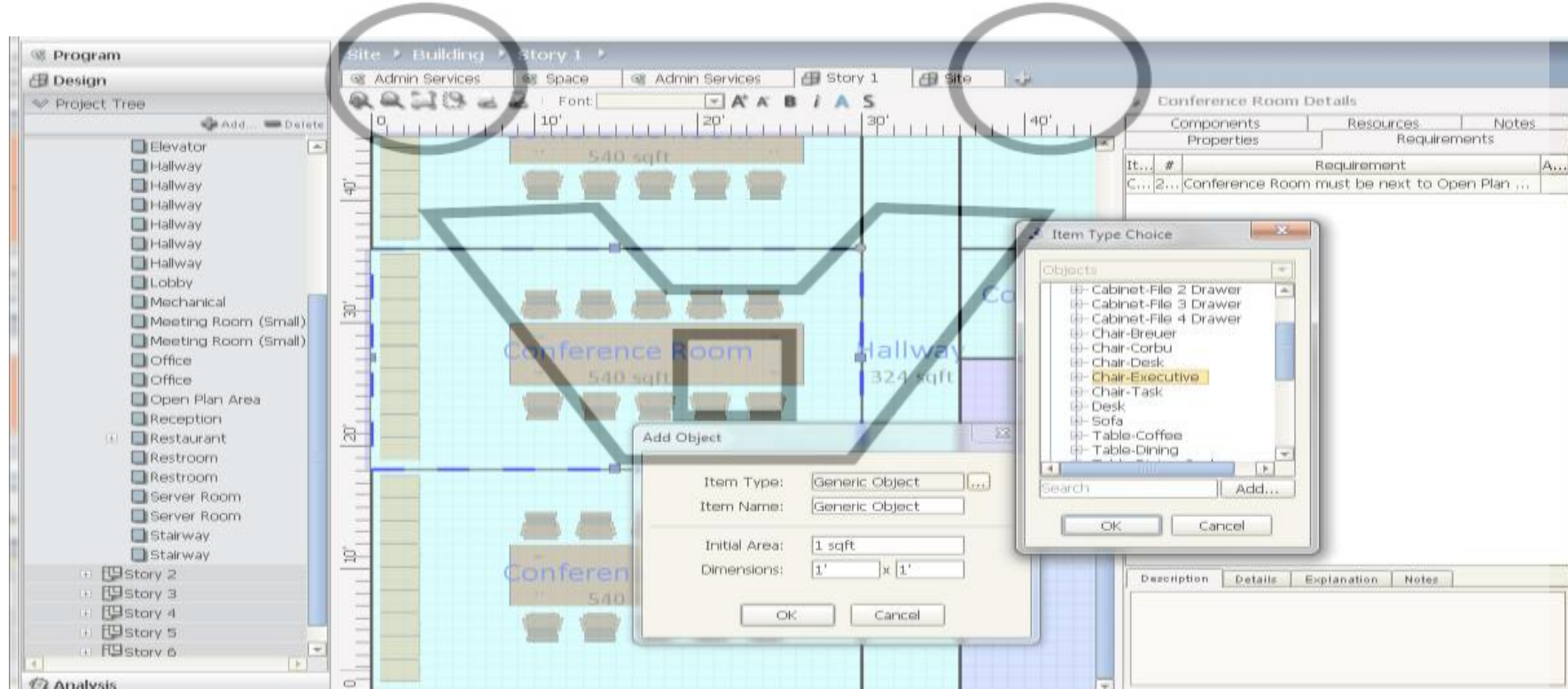
The screenshot displays the Affinity software interface for a space plan diagram. The main window shows a floor plan with various rooms and a green highlighted path. A 'Server Room' is highlighted in blue, with a status bar at the bottom indicating: 'Server Room in Administration.Admin Services X = 51' Y = 18', Size = 24' x 18', Area = 432.0'. The right-hand panel shows the 'Server Room Details' window, which includes a table of requirements.

Components		Resources	Notes
Properties		Requirements	
It...	#	Requirement	A...
SW/2...		Server Room must be next to Meeting Room (L...	

Below the table, there are tabs for 'Description', 'Details', 'Explanation', and 'Notes'. At the bottom of the panel, there are buttons for 'Add Requirement...' and 'Edit Requirement...'.

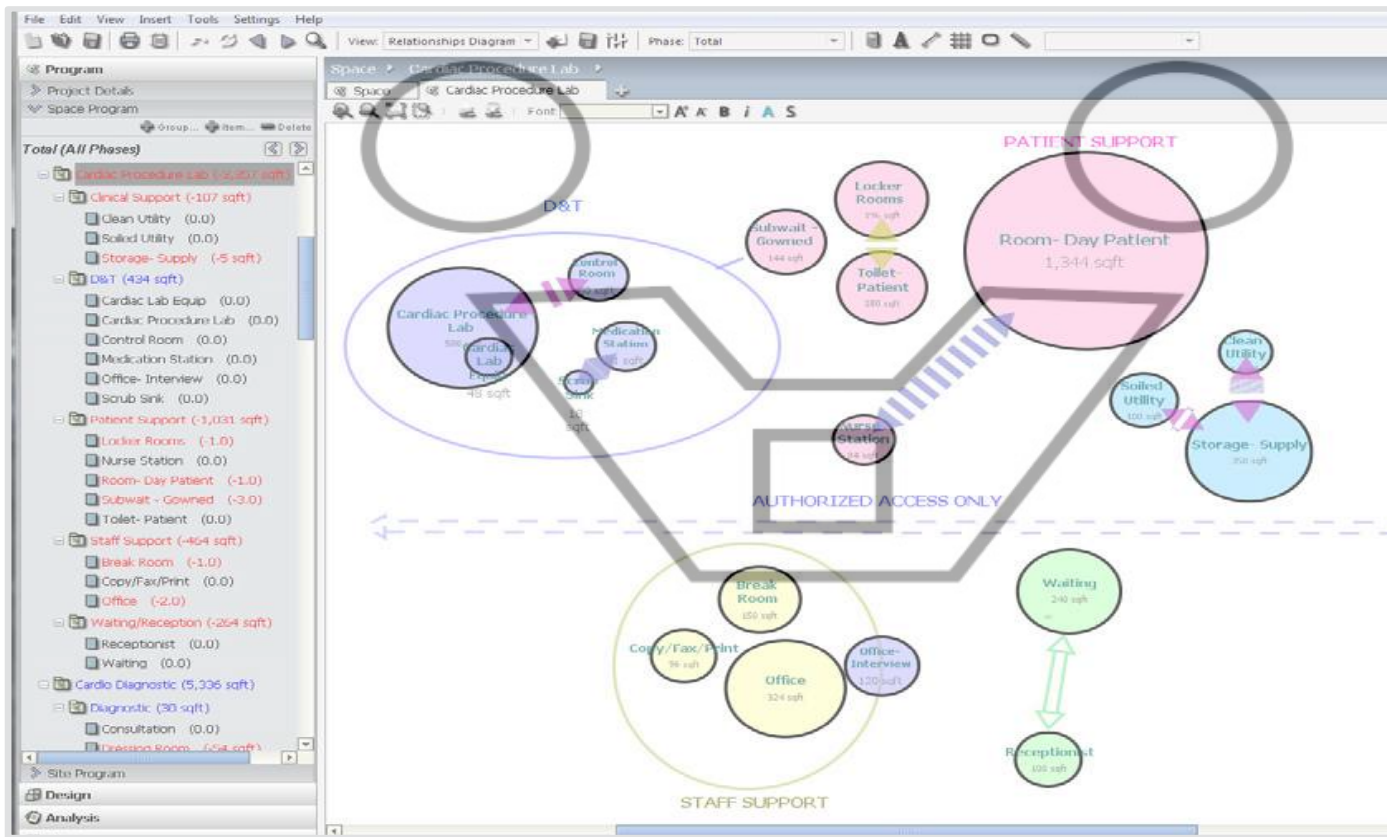
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TRELLIGENCE AFFINITY: the DESIGN MODULE



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TRELLIGENCE AFFINITY: the RELATIONSHIPS DIAGRAM



Relationships / Bubble Diagrams

Relationships diagrams are generated from the program automatically. When the program changes, so do the diagrams, to represent new quantities, areas, and relationships. Functions include:

- Use of color representing program departments / divisions
- User-customizable relationship indicators - arrows, lines, etc.
- User-customizable diagram annotations - text, circles, lines, arrows, etc.
- Ability to save different views of the same data
- Print to scale, with customizable title blocks

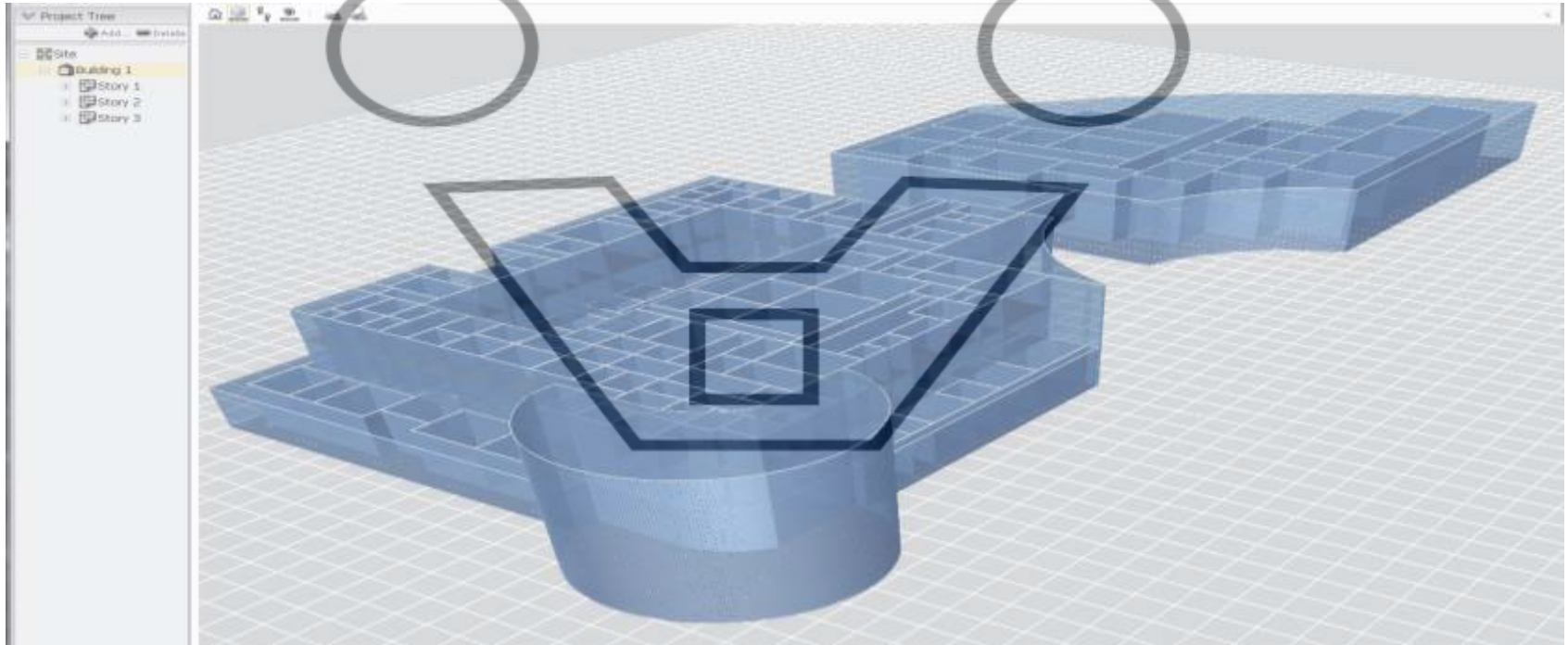
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TRELLIGENCE AFFINITY: the CHECKER

Name	Area	Program Group
Building	43153 sqft	
Story 1	9360 sqft	
Story 2	9360 sqft	
Story 3	5400 sqft	
Story 4	5400 sqft	
Story 5	5400 sqft	
Story 6	5400 sqft	
Board Room	630 sqft	Program.Space.Executive Group.Exec
Break Room	168 sqft	Program.Space.Executive Group.Admin
Copy/Fax	156 sqft	Program.Space.Executive Group.Admin
Electrical	45 sqft	Program.Space.Building Support.MEP
Electrical	45 sqft	Program.Space.Building Support.MEP
Elevator	72 sqft	Program.Space
Elevator	72 sqft	Program.Space
Executive Suite	270 sqft	Program.Space.Executive Group.Exec
Executive Suite	270 sqft	Program.Space.Executive Group.Exec
Executive Suite	270 sqft	Program.Space.Executive Group.Exec
Executive Suite	270 sqft	Program.Space.Executive Group.Exec
File/Storage	84 sqft	Program.Space.Executive Group.Admin
Hallway	135 sqft	Program.Space.Executive Group
Hallway	585 sqft	Program.Space.Executive Group
Hallway	90 sqft	Program.Space.Executive Group
Hallway	78 sqft	Program.Space.Executive Group
Mechanical	144 sqft	Program.Space.Building Support.MEP
Office	112 sqft	Program.Space.Executive Group.Exec
Office	108 sqft	Program.Space.Executive Group.Exec
Office	108 sqft	Program.Space.Executive Group.Exec
Office	108 sqft	Program.Space.Executive Group.Exec
Open Plan Area	180 sqft	Program.Space.Executive Group.Admin
Open Plan Area	374 sqft	Program.Space.Executive Group.Admin

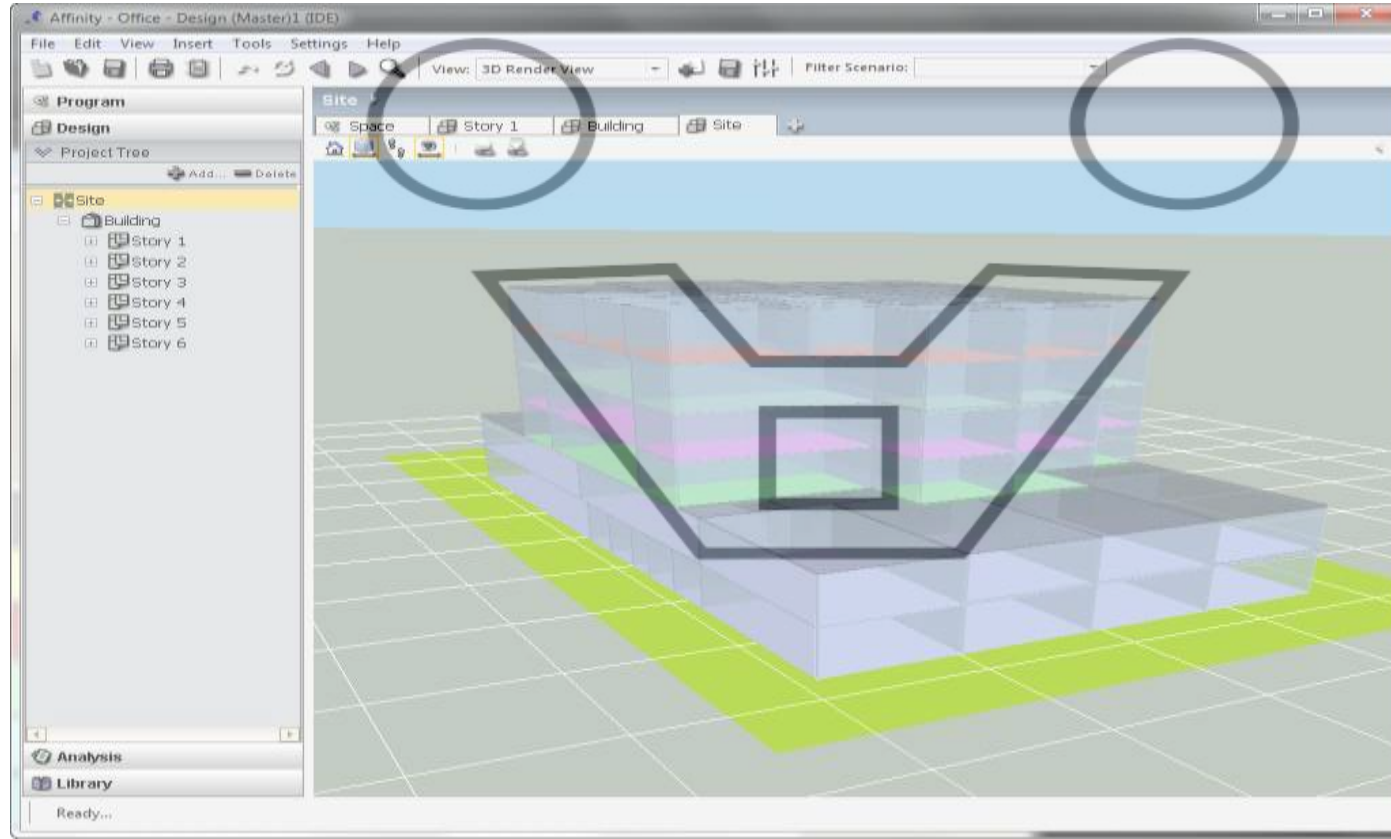
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TRELLIGENCE AFFINITY: the 3d VISUALIZATION



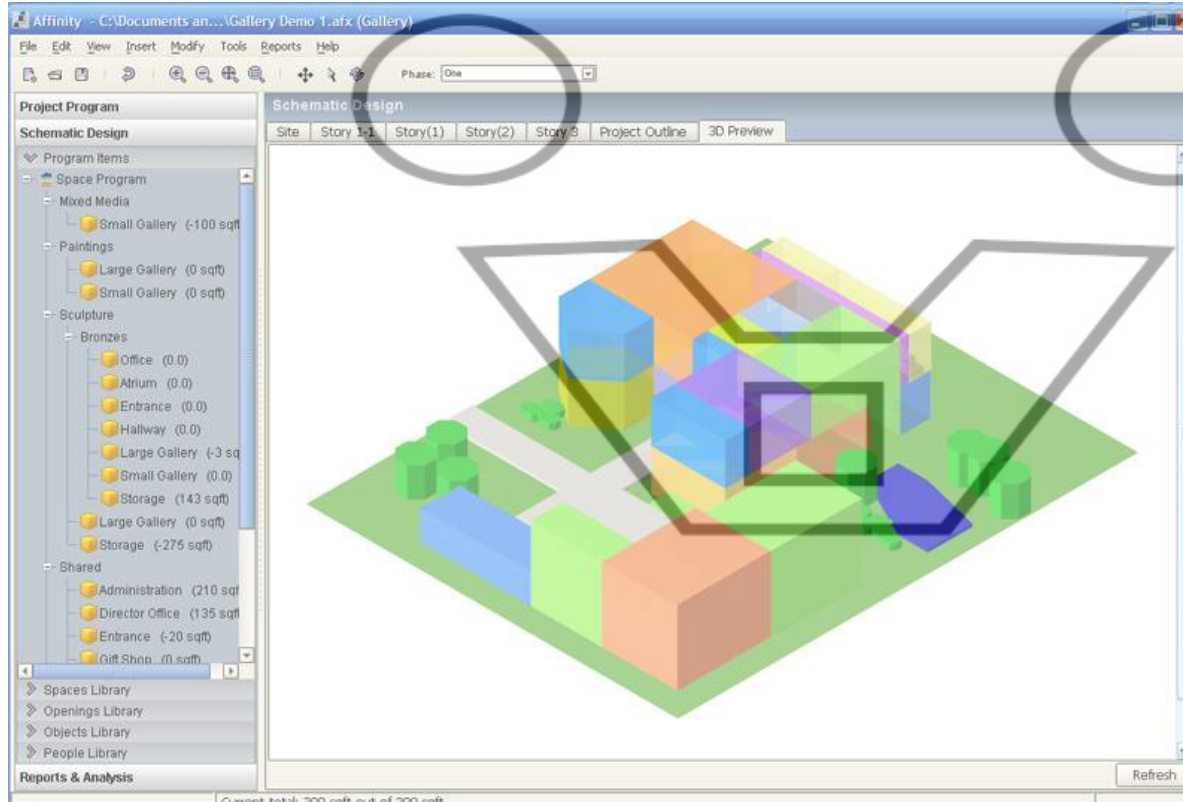
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TRELLIGENCE AFFINITY: the 3d VISUALIZATION



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TRELLIGENCE AFFINITY: the SCHEMATIC DESIGN



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TRELLIGENCE AFFINITY: the SPACE QUANTITY CONTROL

The screenshot displays the 'Space Program' window in Trellis Affinity. The table lists various program items with their respective area factors, unit areas, targets, and dimensions. A blue path highlights a sequence of items: Space, Administration, Admin Services, Meeting Room (Small), Office, Open Plan Area, Server Room, and Subtotal. A square callout highlights the 'Office' row.

Program Item	Area Factor	Unit Area	Target	Dimensions	Comments
Space	1.27		44498 sqft		
Administration	1.0		17420 sqft		
Admin Services	1.0		7764 sqft		
Break Room		180 sqft	5 @ 180 sqft	12' x 15'	
Conference Room		200 sqft	2000 sqft	18' 3" x 10' 11 3/8"	All Conference Rooms in...
Copy/Fax		54 sqft	5 @ 54 sqft	6' x 9'	
Copy/Fax/Mail		108 sqft	1 @ 108 sqft	9' x 12'	Mail for all Depts
Meeting Room (Large)		540 sqft		30' x 18'	
Meeting Room (Small)		108 sqft	2 @ 108 sqft	9' x 12'	
Office		108 sqft	2 @ 108 sqft	9' x 12'	
Open Plan Area		1080 sqft	3190 sqft	45' x 24'	
Server Room		432 sqft	2 @ 432 sqft	18' x 24'	1 dedicated to R&D
Subtotal			7764 sqft		
HR	1.0		4752 sqft		
Library/Reference		504 sqft	1 @ 504 sqft	42' x 12'	
Meeting Room (Small)		108 sqft	4 @ 108 sqft	9' x 12'	
Office		108 sqft	4 @ 108 sqft	9' x 12'	
Open Plan Area		1080 sqft	1000 sqft	45' x 24'	
Training Room		576 sqft	4 @ 576 sqft	24' x 24'	Available for all Dept use
Subtotal			4752 sqft		
Legal & Accounting	1.0		2628 sqft		
File/Storage		108 sqft	1 @ 108 sqft	9' x 12'	Must be coded-lock sec...
Library/Reference		504 sqft	2 @ 504 sqft	42' x 12'	
Meeting Room (Small)		108 sqft	2 @ 108 sqft	9' x 12'	
Office		108 sqft	2 @ 108 sqft	9' x 12'	
Open Plan Area		1080 sqft	1000 sqft	45' x 24'	
Subtotal			2628 sqft		
Public Areas	1.0		2326 sqft		
Lobby		1200 sqft	1200 sqft	18' x 16'	

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TRELLIGENCE AFFINITY: PROGRAM PHASE MANAGEMENT

Program Item	Area Factor	Phase I Qty	Phase I Area	Phase II Qty	Phase II Ar...	Total Qty	Total Area	Space Type	...
Space	1.0	33	30,948 sqft	17	8,674 sqft	50	39,621 sqft		
Gallery	1.2	33	21,148 sqft	17	8,674 sqft	50	29,821 sqft		
Administration	1.31	7	838 sqft	3	409 sqft	10	1,247 sqft		
Hallway								Hallway	
File/Copy Area		1	96 sqft	1	96 sqft	2	192 sqft	Closet	
File/Copy Ar								Closet	
Meeting Room		1	92 sqft			1	92 sqft	Meeting Room	
Meeting Ro								Meeting Room	
Mgr Office		3	324 sqft	2	216 sqft	5	540 sqft	Office	
Mgr Office								Office	
Mgr Office								Office	
Mgr Office								Office	
Mgr Office								Office	
Mgr Office								Office	
Workstation		2	128 sqft			2	128 sqft	Workstation	
Workstatio								Workstation	
Workstatio								Workstation	
Subtotal		7	640 sqft	3	312 sqft	10	952 sqft		
Building Support	1.15	7	2,369 sqft			7	2,369 sqft		
Hallway								Hallway	
Building Service			1,200 sqft				1,200 sqft	Building Services	
Building Ser								Building Services	
Service Access		2	500 sqft			2	500 sqft	Building Services	
Service Acc								Hallway	
Service Acc								Hallway	
Service Elevator		1	100 sqft			1	100 sqft	Elevator	
Service Elev								Elevator	

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TRELLIGENCE AFFINITY: INTEGRATION with REVIT



SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

TRELLIGENCE AFFINITY: INTEGRATION with REVIT

The screenshot shows the Revit software interface with the Affinity7 plugin. The Affinity7 window is open, displaying a table of program items and their corresponding areas. The table includes columns for Program Item, Area Factor, Target, Total Area, and Comments. The background shows a floor plan with a large polygonal area highlighted in blue, representing the space program.

Program Item	Area Factor	Target	Total Area	Comments
Space	1.27	44,488	45,252	
Administration	1.0	17,470	18,064	
Admin Services	1.0	7,754	8,238	
Break Room		5 @ 180	900	
Conference Room		2 @ 1,000	2,000	All Conference Room...
Copy/Fax		3 @ 54	162	
Copy/Fax/Mail		1 @ 108	108	Mail for all Depts
Meeting Room (Large)			540	
Meeting Room (Small)		2 @ 108	216	
Office		2 @ 103	206	
Open Plan Area			3,190	
Service Room		2 @ 432	864	1 dedicated to R&D
HR	1.0	4,252	4,252	
Legal & Accounting	1.0	2,628	2,628	

SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

TRELLIGENCE AFFINITY: DESIGN TOOLS

The screenshot displays the Affinity - Office (Std_Office) software interface. The main window shows a 2D office floor plan with various rooms and a central hallway. The interface includes a menu bar (File, Edit, View, Insert, Tools, Settings, Help), a toolbar, and a Project Tree on the left. The Project Tree shows a hierarchy of elements: Site, Main Office, Story 1, and various room types like Breakroom, Bulfin, Conference, Demonstration, Elec, Entry, Exec Office, Hallway, IT, Janitor, Lobby, Men's RR, and Objects. The main workspace shows a detailed view of the office layout with rooms like Exec Office, Office, IT, Service Rooms, Entry, Lobby, Conference, and Breakroom. A large blue polygon is overlaid on the plan, and a smaller green square is also visible. The right panel shows the 'Story 1 Details' properties for a selected area, including a table of Properties and Requirements, and a table of Cost.

Properties		Requirements	
Property	Value	Requirements	Value
Position	0, 0, 0		
Perimeter	730' 2 6/8"		
Height	10'		
Width	159'		
Depth	69'		
Area	9223 sqft		
Net Area	9223 sqft		
Weight	0.0 lbs		
Story Area Factor	1.00		

Cost	
Area Cost	\$0.00
Component Cost	\$2,306,500.00
Fixed Cost	\$0.00
Total Cost	\$2,306,500.00

Display Properties

Fill Color	
Footprint Image	
Inner Grid Depth	5'
Inner Grid Width	5'
Match Footprint II	<input type="checkbox"/>
Shape Model	
Label	Label X Offset

SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI



SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

EGAN BIM RESOURCES: ROOM AREA TOOLS

The screenshot displays the Revit interface for a project named 'Project1_Rooms.rvt'. The 'Modify | Viewports' ribbon is active, with the 'Modify' panel highlighted. Two circles are drawn around the 'Modify' and 'Viewports' panels. The main view shows a floor plan with eight rooms, each labeled with a number and its area. A large grey arrow points from the 'Room Schedule 2' table below to the rooms. The table provides a comparison between Program Area and Reliable Area for each room.

Name	Number	Program Area	Area	Compare Area	Reliable Area	Compare Reliable Area
Room 1	1	300 SF	290 SF	-10 SF	290 SF	-10 SF
Room 2	2	300 SF	309 SF	9 SF	309 SF	9 SF
Room 3	3	150 SF	148 SF	-2 SF	148 SF	-2 SF
Room 4	4	250 SF	251 SF	1 SF	251 SF	1 SF
Room 5	5	800 SF	609 SF	-191 SF	609 SF	-191 SF
Room 6	6	350 SF	371 SF	21 SF	371 SF	21 SF
Room 7	7	225 SF	241 SF	16 SF	241 SF	16 SF
Room 8	8	400 SF	396 SF	-4 SF	396 SF	-4 SF
		2678 SF	2618 SF	-60 SF	2618 SF	-60 SF

Below the table, two arrows point to the 'Compare OK' button, which is used to compare the Program Area and Reliable Area for the selected rooms.

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EGAN BIM RESOURCES: SHAPE GENERATOR

Autodesk Revit Architecture 2016 - Not For Resale Version - Space Planning Project1.rvt - Floor Plan Level 1

Space Planning

Department	Family Type
Administration	SP_Rectangle - Blue - Dark
Cafeteria/Commons	SP_Rectangle - Blue - Light
Educational House 1	SP_Rectangle - Blue - Medium
Educational House 2	SP_Rectangle - Green - Dark
Educational House 3	SP_Rectangle - Green - Light
Educational House 4	SP_Rectangle - Green - Medium
Educational House 5	SP_Rectangle - Orange - Dark
Educational House 6	SP_Rectangle - Orange - Light

Select Program File To Import:
C:\ProgramData\Autodesk\Revit\Addins\2016\Egan_SpacePlanning_2016\Bundles\Content\Samples\Space Program.rvt

Select Department Mapping File:
C:\ProgramData\Autodesk\Revit\Addins\2016\Egan_SpacePlanning_2016\Bundles\Content\Samples\Family Types Mappings.rvt

Import Program

Assign a family type to each department, or select a department mapping file to import.

When all departments have the desired family type assigned, click "Draw Cubes".

To save the Department Mapping file for later use in this project or a different project, click "Save Mapping".

Close Help

SPACE PROGRAMMING & PLANNING USANDO STRUMENTI COMPUTAZIONALI

EGAN BIM RESOURCES: SHAPE GENERATOR

Space Planning

Import Program | Import Program AC | Draw Walls | Settings | Language | Network

Department	Family Type
Administration	SP_Rectangle - Blue - Dark
Cafeteria/Commons	SP_Rectangle - Blue - Light
Educational House 1	SP_Rectangle - Blue - Medium
Educational House 2	SP_Rectangle - Green - Dark
Educational House 3	SP_Rectangle - Green - Light
Educational House 4	SP_Rectangle - Green - Medium
Educational House 5	SP_Rectangle - Orange - Dark
Educational House 6	SP_Rectangle - Orange - Light
Family and Consumer Sale	SP_Rectangle - Orange - Medium

Select Program File To Import

C:\ProgramData\Autodesk\Revit\Addins\2016\Egan_SpacePlanning_2016.bundle\Contents\Samples\Space Program.csv

Browse

Select Department Mapping File

C:\ProgramData\Autodesk\Revit\Addins\2016\Egan_SpacePlanning_2016.bundle\Contents\Samples\Family Types Mappings.xml

Save Mapping | Browse

Import Program

Browse to select a program CSV file to import.

Import Program

Assign a family type to each department, or select a department mapping file to import.

Draw Cubes

When all departments have the desired family type assigned, click 'Draw Cubes'

Draw Cubes

To save the Department Mapping file for later use in this project or a different project, click 'Save Mapping'

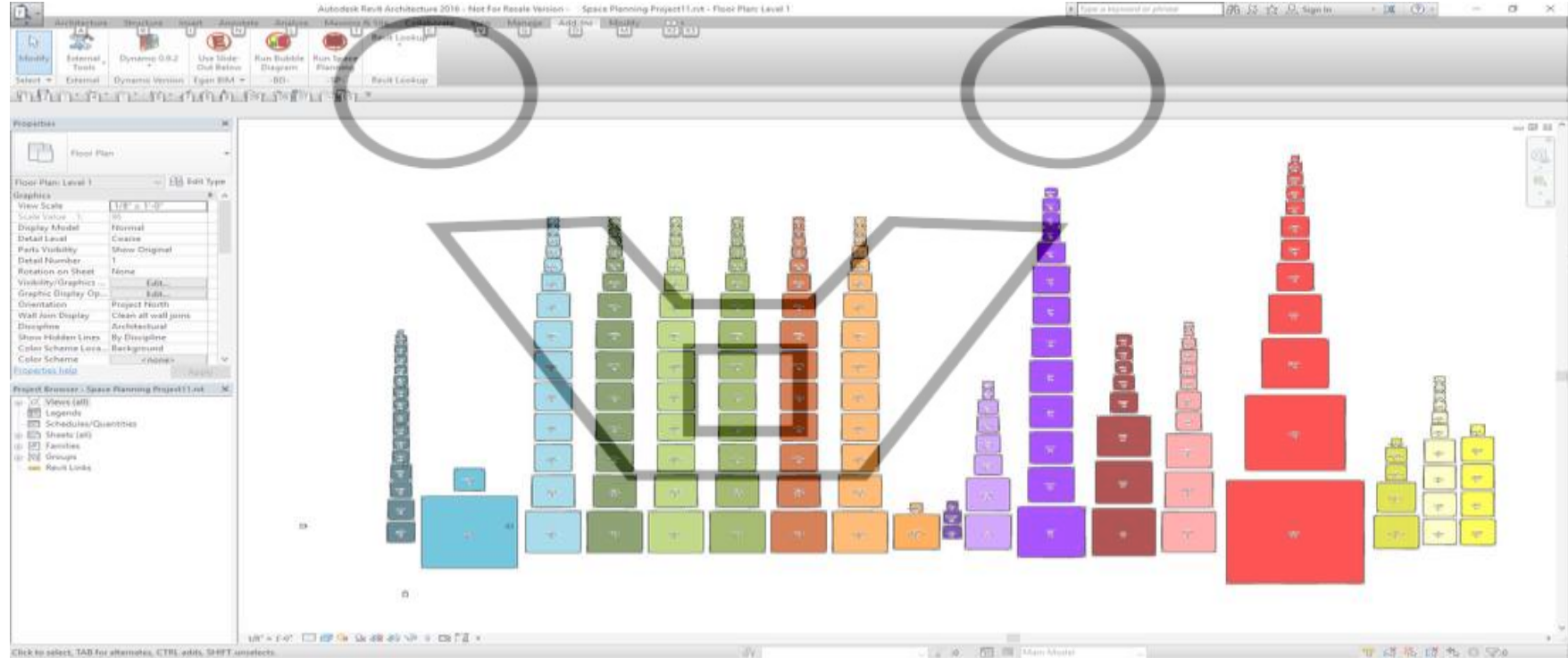
Save Mapping | Draw Cubes

Enable Debug Trace:

Close | Help

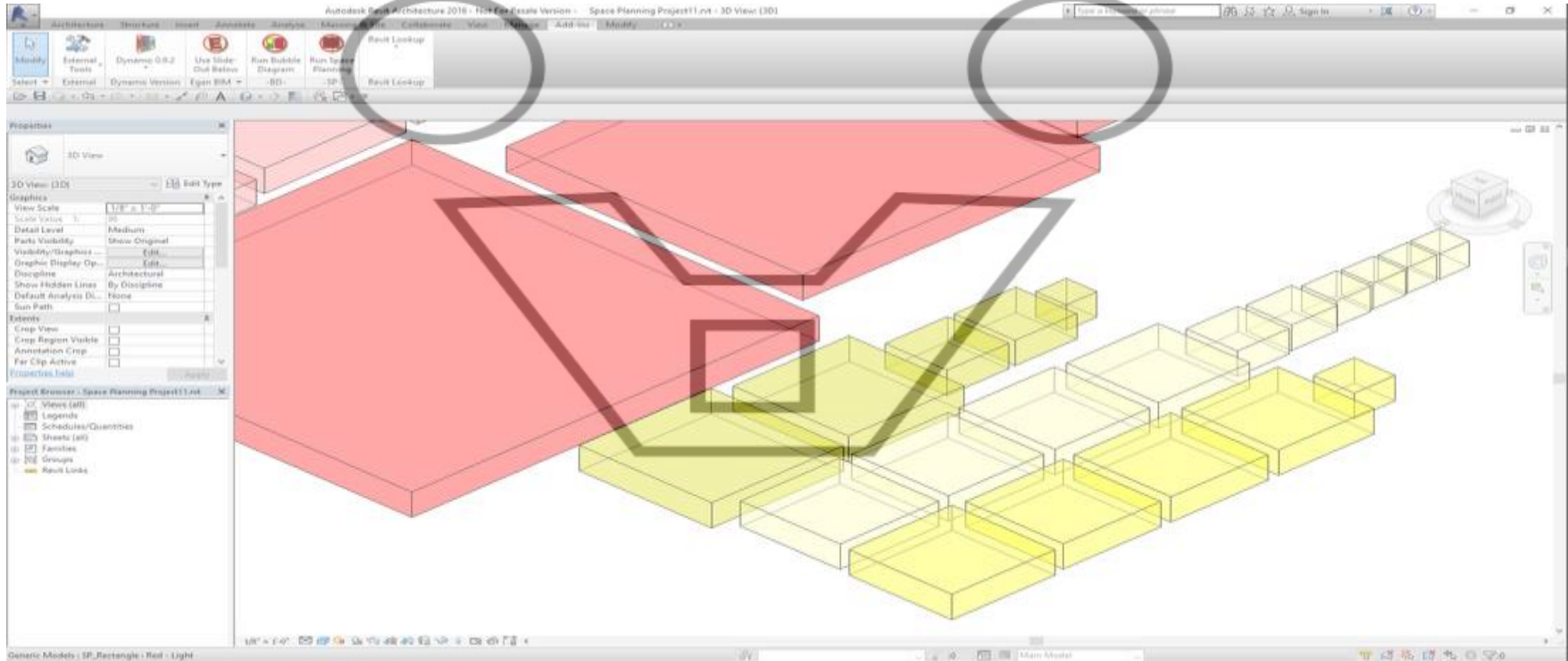
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EGAN BIM RESOURCES: STACK VISUALIZATION



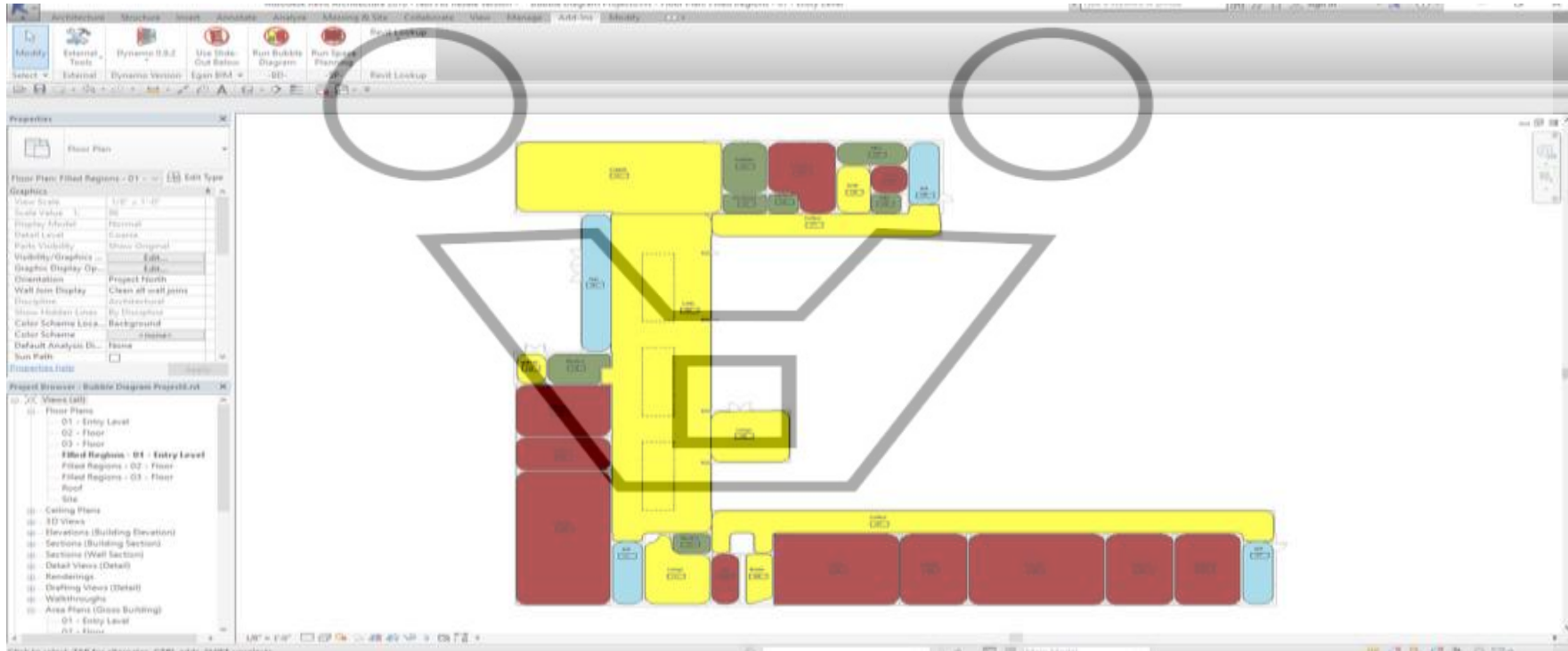
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EGAN BIM RESOURCES: SPACE PLANNING

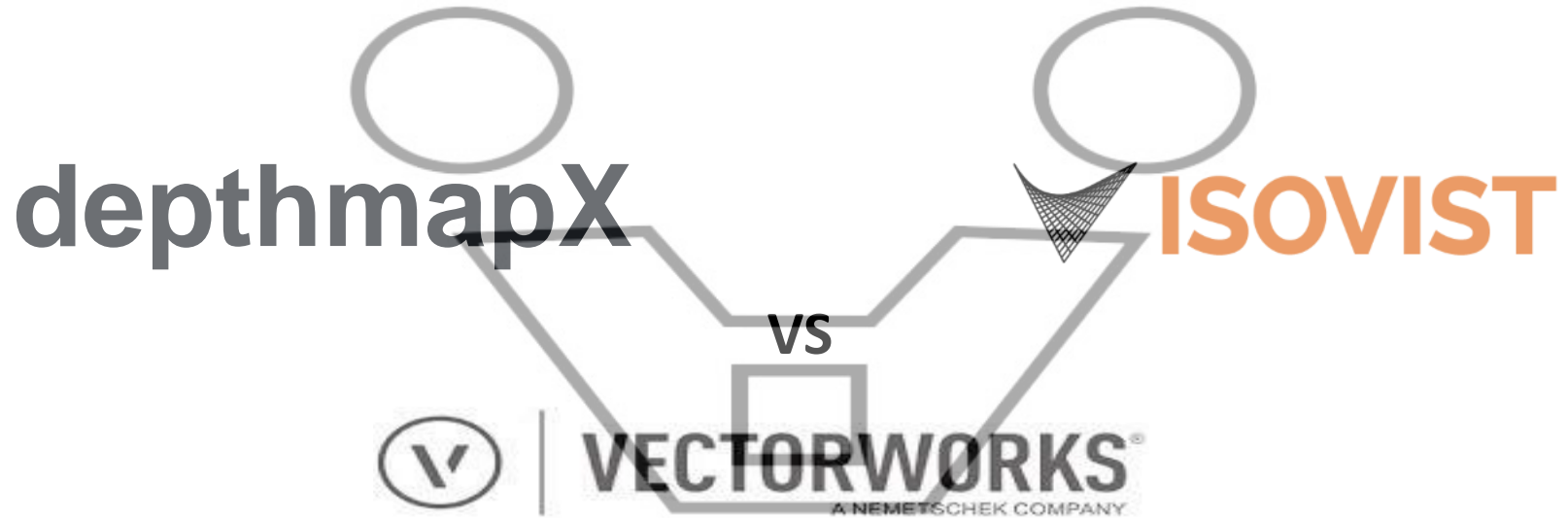


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EGAN BIM RESOURCES: BUBBLE GRAPH

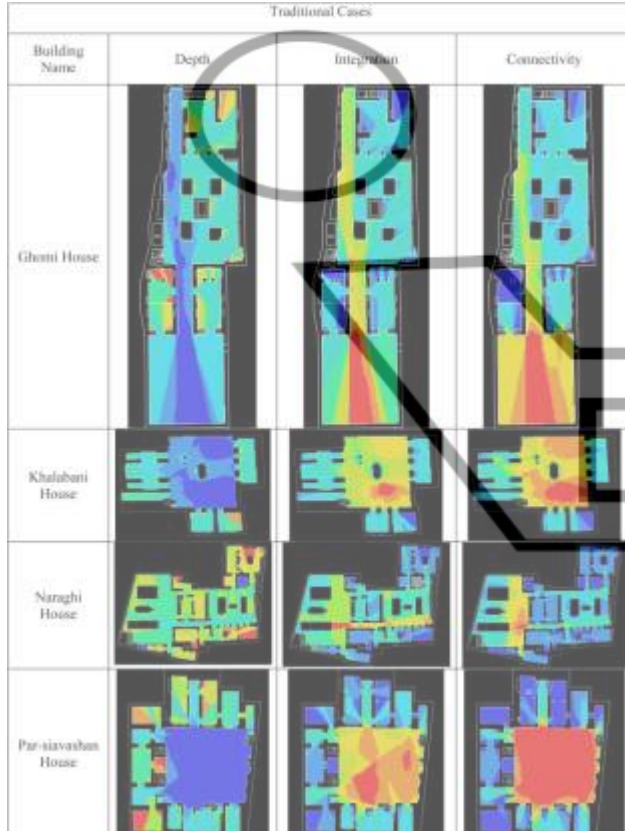
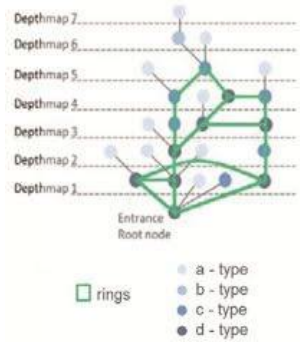


VALUTARE QUALITA' ED EFFICIENZA DEL LAYOUT

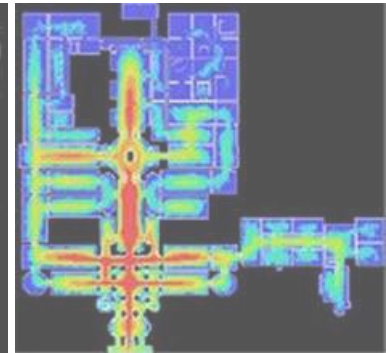
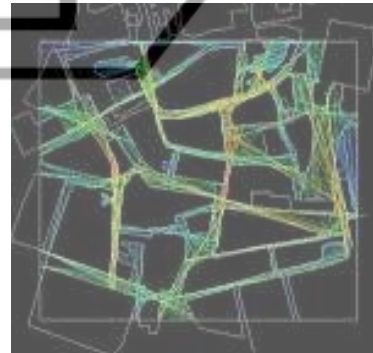
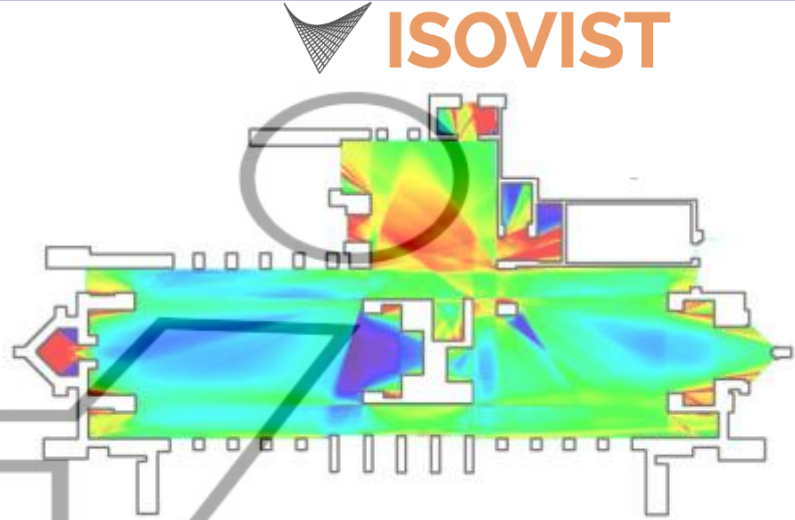


Space/Humans interactions

Space Syntax depthmapX



ISOVIST

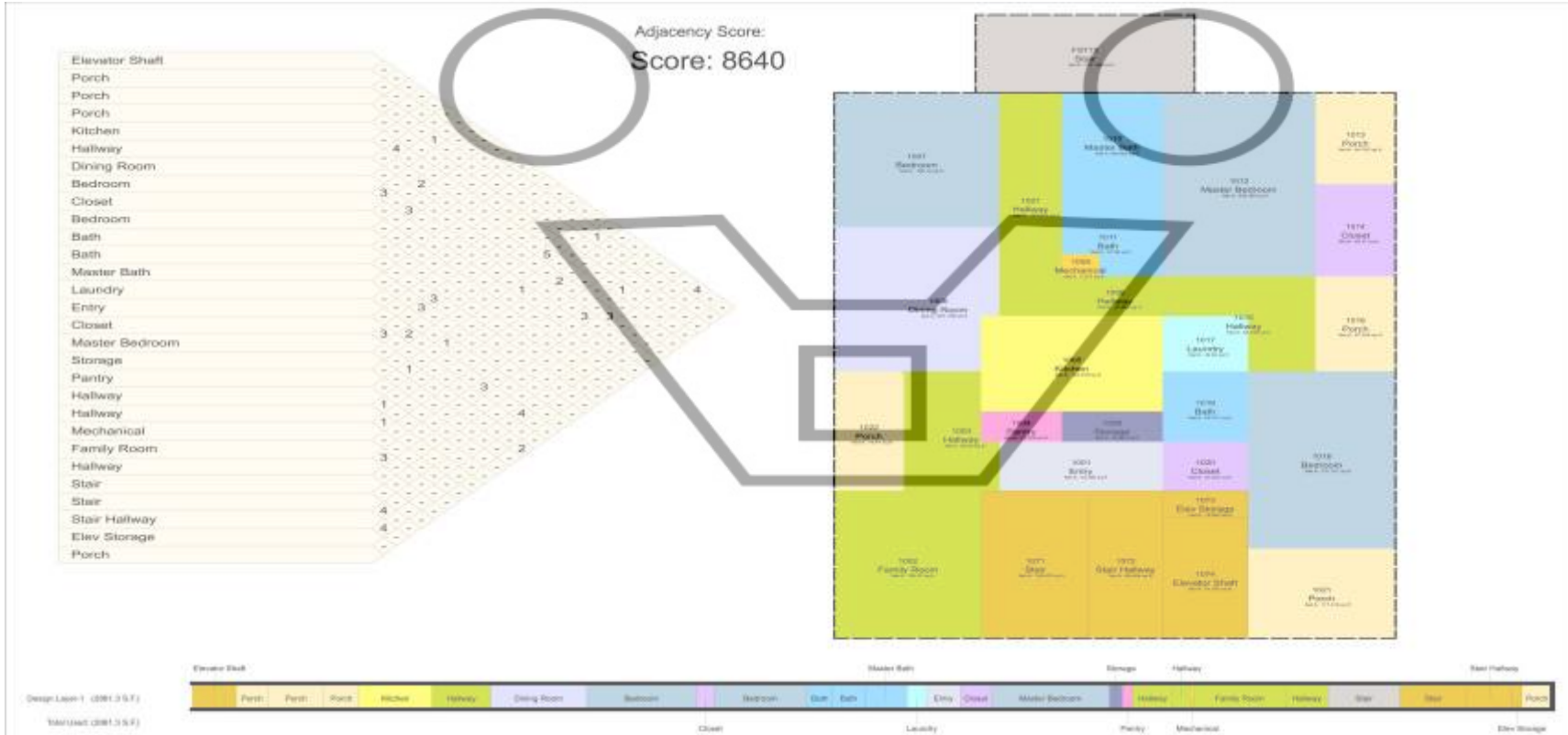




VECTORWORKS
A NEMETSCHEK COMPANY

SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

https://www.youtube.com/watch?v=F6CKvK9otqg&list=PLbOQw_r4cqHvvYNpM9q2SqG3wNg7JNhIr





VECTORWORKS
A NEMETSCHEK COMPANY

SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

1. Definire gli spazi

Vectorworks 2014 - [Untitled1]

Attributes: Solid, Solid, Opacity: 100%

Object Info - Shape: No Selection

Navigation - Classes: Class Option: Show/Snap/Modify Others

Resource Browser: File: Untitled1, Resources: Top Level, Symbols/Plug-In Objects: #10, Net Area: #10, Gr. Area: #10

Room Number	Room Name	Net Area (sq m)	Gr. Area (sq m)
1	Bedroom 1	9,24	9,24
2	Bedroom 2	16,03	16,03
3	Bedroom 3	9,065	9,065
4	Kitchen	12,22	12,22
5	Dining Room	11,994	11,994
6	Living Room	20,512	20,512
7	Bathroom	7,568	7,568
8	Bathroom 2	7,556	7,556
9	Bathroom 3	7,258	7,258
10	Storage Room	2,789	2,789

Score: 0



VECTORWORKS
A NEMETSCHEK COMPANY

SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

2. Stabilire le relazioni spaziali

Vectorworks 2014 - [Untitled1]

Space Link Tool

Attributes

Object Info - Shape

Space Link Object

Class: None

Layer: Design Layer-1

X: 0

Y: 0

Z: 0

Rotation: 0,00°

Strength: 1

Navigation - Classes

Class Option: Show/Snap/Modify Others

Vis...	Class
	Dimension
	None
	Room
	Name
	Number

Resource Browser

Files

Resources

Symbols/Plug-In Objects

Score: 10836

For Help, press F1

Room	Net Area (sq m)	Gr. Area (sq m)
1 Bedroom 1	9,24	9,24
2 Bedroom 2	16,03	16,03
3 Dining Room	11,994	11,994
4 Kitchen	12,22	12,22
5 Bathroom	7,568	7,568
6 Bathroom 2	7,556	7,556
7 Bathroom 3	7,258	7,258
8 Storage Room	2,789	2,789
9 Storage Room	2,789	2,789
10 Storage Room	2,789	2,789



VECTORWORKS
A NEMETSCHEK COMPANY

SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

3. Assegnare le gerarchie delle relazioni

The screenshot shows the Vectorworks software interface with a floor plan layout optimization process. A 'Properties' dialog box for a 'Space Link Object' is open, with the 'Render' tab selected. The dialog box shows the following settings:

- Shape: Data
- Render: (selected)
- Space Link Object
- Class: None
- Layer: Design Layer-1
- X: 0
- Y: 0
- Z: 0
- Rotation: 0.00
- Strength: (slider)

The floor plan shows the following rooms and their areas:

Room	Net Area (sq m)	Gr. Area (sq m)
Bedroom 1	9,24	9,24
Bedroom 2	16,03	16,03
Dining Room	11,994	11,994
Kitchen	12,22	12,22
Bathroom	7,568	7,568
Bathroom 2	7,556	7,556
Bathroom 3	7,258	7,258

The score displayed at the bottom right is 10836.



VECTORWORKS
A NEMETSCHEK COMPANY

SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

6. Valutare l'efficienza del layout (centralità del grafo)

Vectorworks 2014 - [Untitled1]

Modify Model AEC Tools Text Window Help

None Design Layer-1 Screen Plane 171% Top/Plan 0,00'

Selection Tool: Rectangular Marquee Mode

Attributes

Solid Solid Opacity: 100% 0,05

Score: 526969

Room	Net Area (sq m)	Gr. Area (sq m)
Bathroom (7)	7,568	7,568
Bedroom 3 (3)	9,065	9,065
Bedroom 1 (1)	9,24	9,24
Living Room (6)	20,512	20,512
Dining Room (5)	1,994	1,994
Bedroom 2 (2)	16,03	16,03
Bathroom 2 (8)	7,556	7,556
Bathroom 3 (9)	7,258	7,258
Kitchen (4)	12,22	12,22
Storage Room (10)	2,789	2,789



VECTORWORKS
A NEMETSCHEK COMPANY

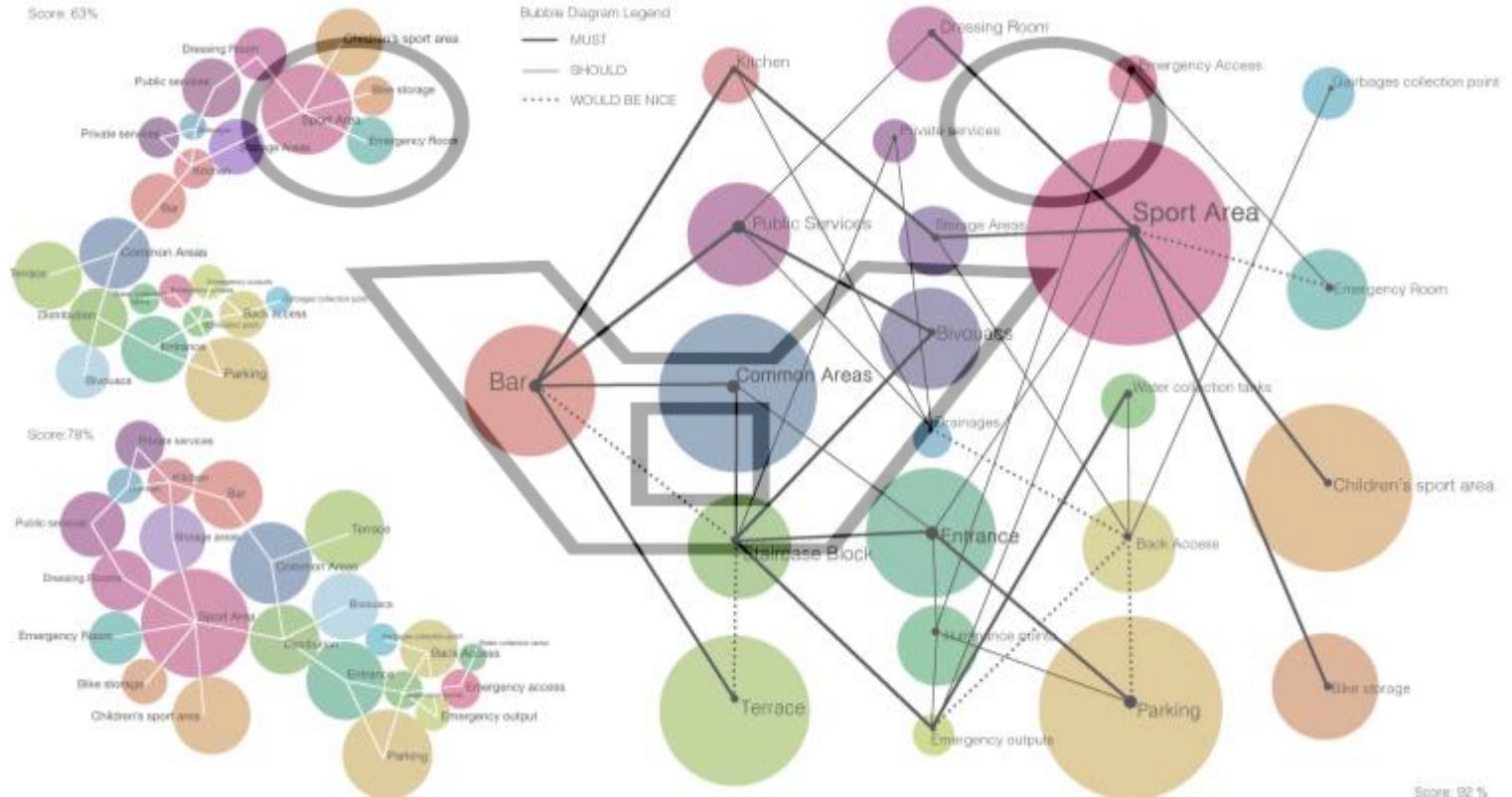
SPACE LAYOUT EFFICIENCY OPTIMIZATION: ALTERNATIVES EVALUATION

7. Modificare e valutare Layout alternativi

The screenshot displays the Vectorworks 2014 interface with a floor plan layout. The layout includes the following rooms and their area calculations:

- 1 Bedroom 1: Net Area: 9,24 sq m, Gr. Area: 9,24 sq m
- 2 Bedroom 2: Net Area: 16,03 sq m, Gr. Area: 16,03 sq m
- 3 Bedroom 3: Net Area: 9,065 sq m, Gr. Area: 9,065 sq m
- 4 Kitchen: Net Area: 12,22 sq m, Gr. Area: 12,22 sq m
- 5 Dining Room: Net Area: 11,994 sq m, Gr. Area: 11,994 sq m
- 6 Living Room: Net Area: 20,512 sq m, Gr. Area: 20,512 sq m
- 7 Bathroom: Net Area: 7,568 sq m, Gr. Area: 7,568 sq m
- 8 Bathroom 2: Net Area: 7,556 sq m, Gr. Area: 7,556 sq m
- 9 Bathroom 3: Net Area: 7,258 sq m, Gr. Area: 7,258 sq m
- 10 Storage Room: Net Area: 2,789 sq m, Gr. Area: 2,789 sq m

The 'Adjacency Score' is highlighted in a red circle and reads: **Score: 464039**

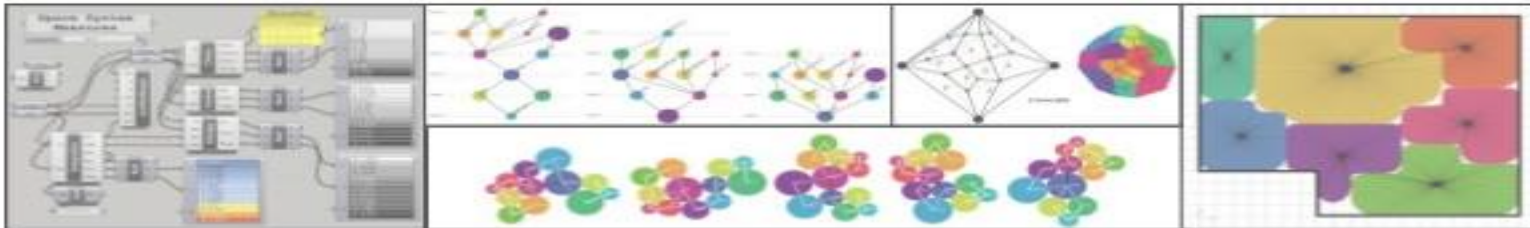
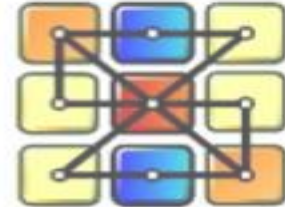


SYNTACTIC: SPACE SYNTAX GRASSHOPPER PATCH

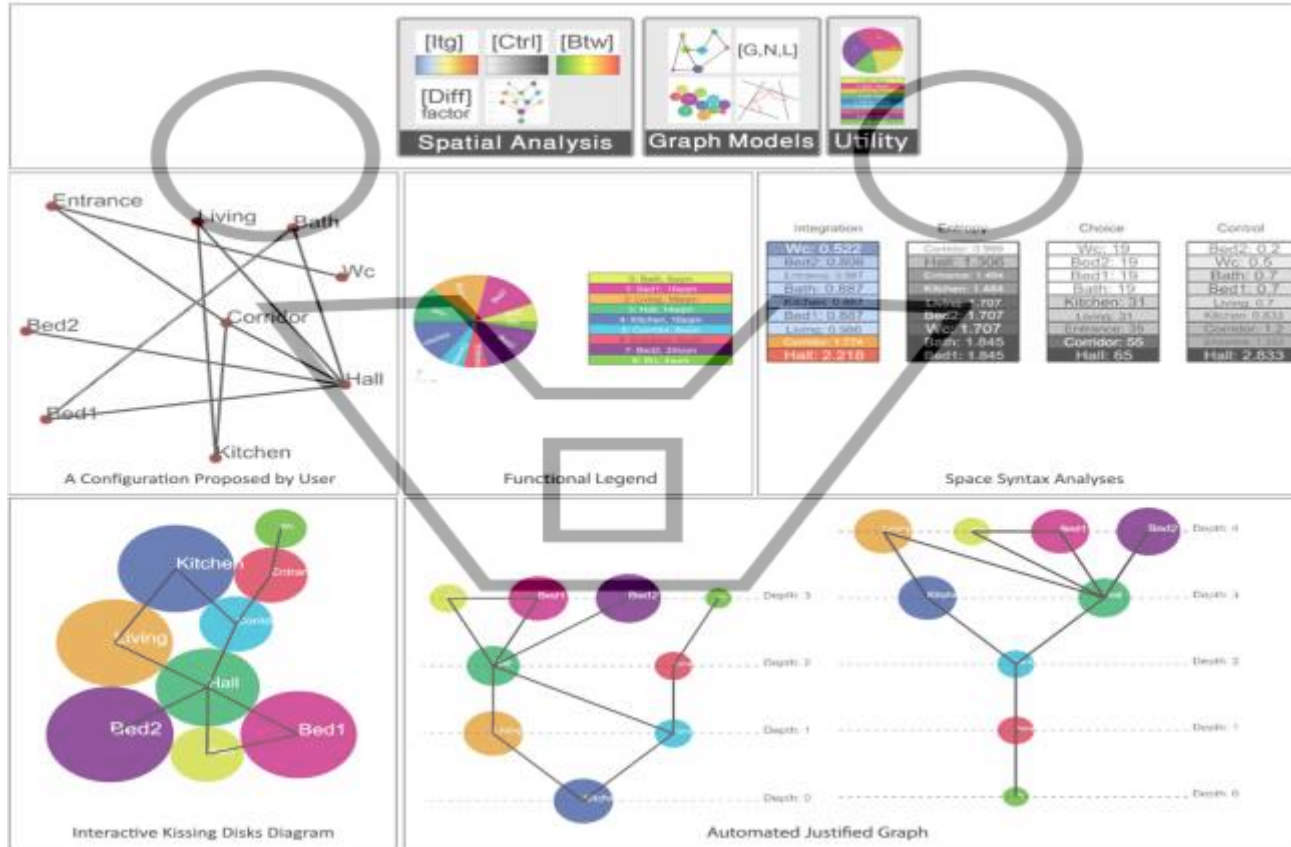
SYNTACTIC

(Space Syntax for Generative Design)

- real-time Space Syntax analyses for parametric design
- interactive bubble diagram
- automated graph drawing algorithms
- enumeration of plan configuration topologies
- measuring the socio-spatial performance



SYNTACTIC: SPACE SYNTAX GRASSHOPPER PATCH

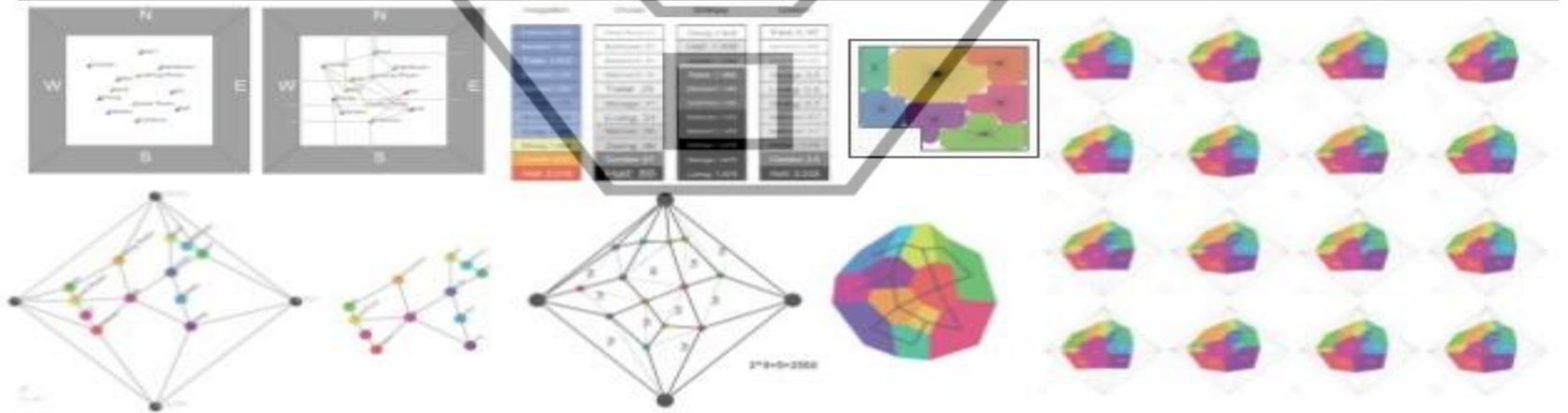


SYNTACTIC: SPACE SYNTAX GRASSHOPPER PATCH

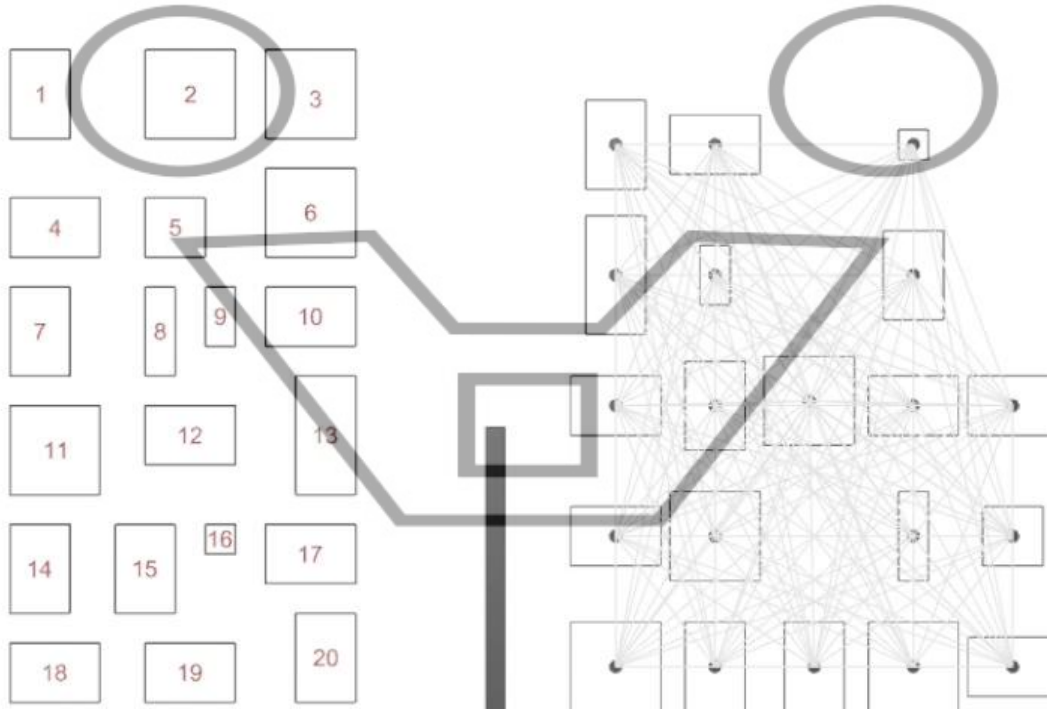
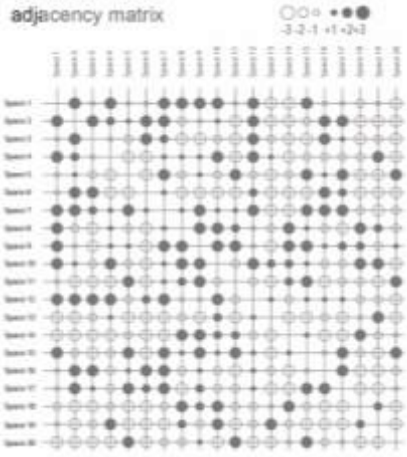
Implementation A: a tool suite for architectural configuration

SYNTACTIC

Space Syntax for Generative Design

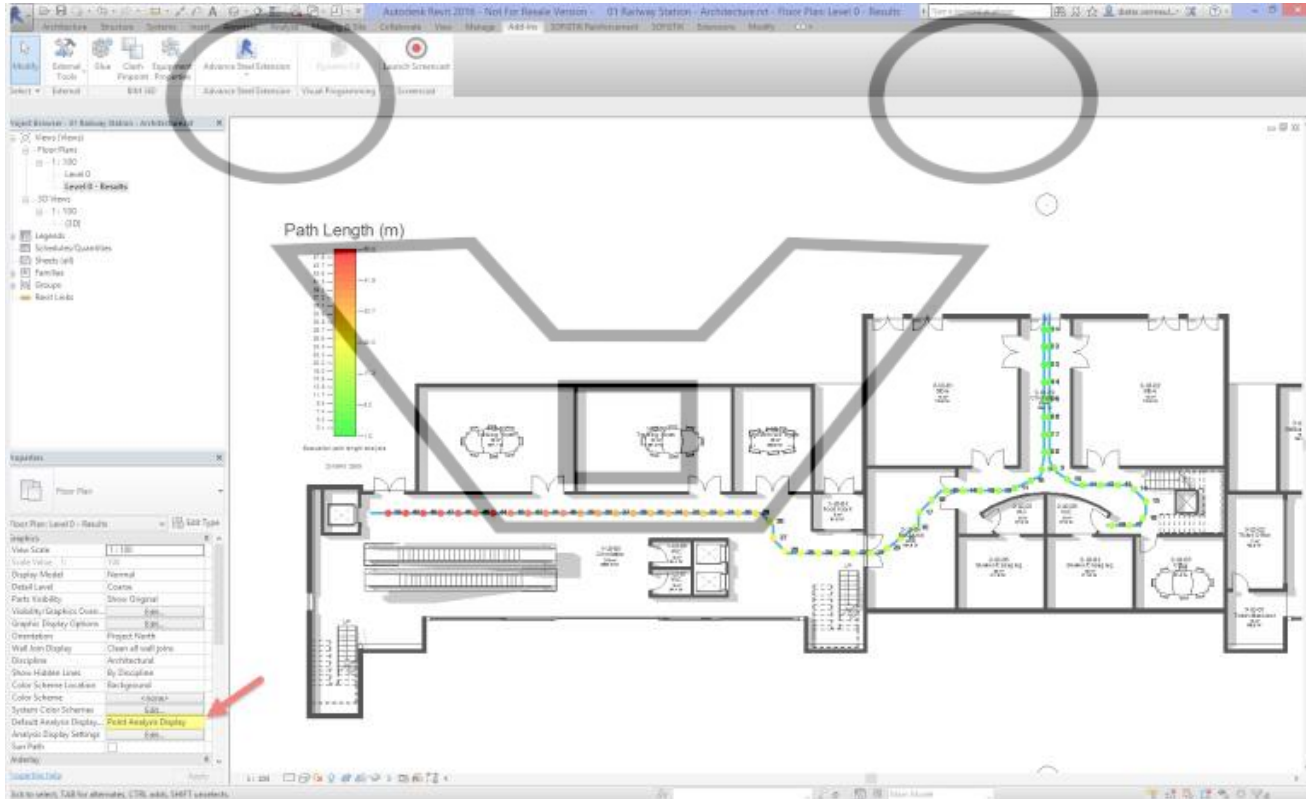


LAYOUT OPTIMIZATION USING EVOLUTIONARY ALGORITHMS



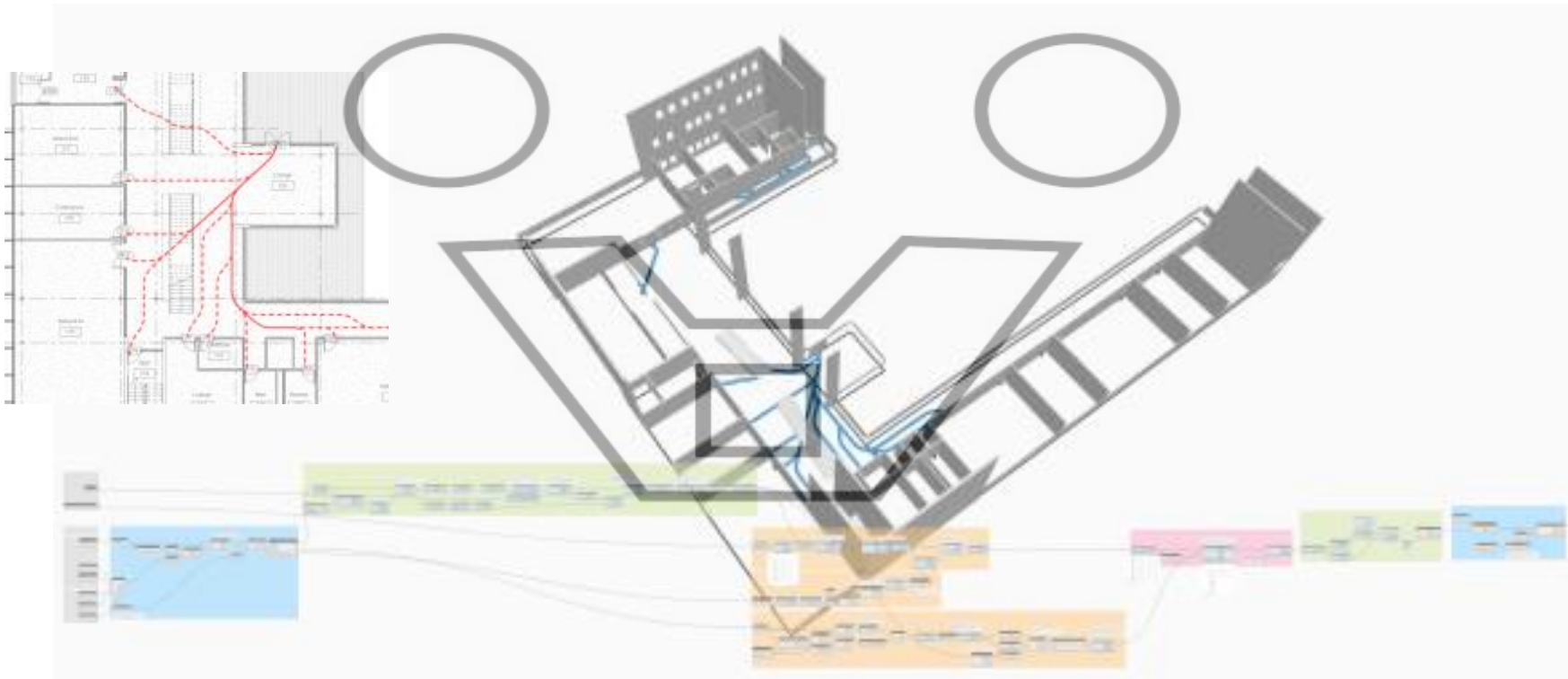
129 122221

Evacuation Planning Tool (EPT) for Emergency on DYNAMO



SPECIALIZED LAYOUT PLUG-IN & SCRIPT FOR REVIT

Fire Exit Risk Assessment in Revit



REAL TIME SIMULATION SOFTWARE USING PARTICLES AGENT-BASE MODELING

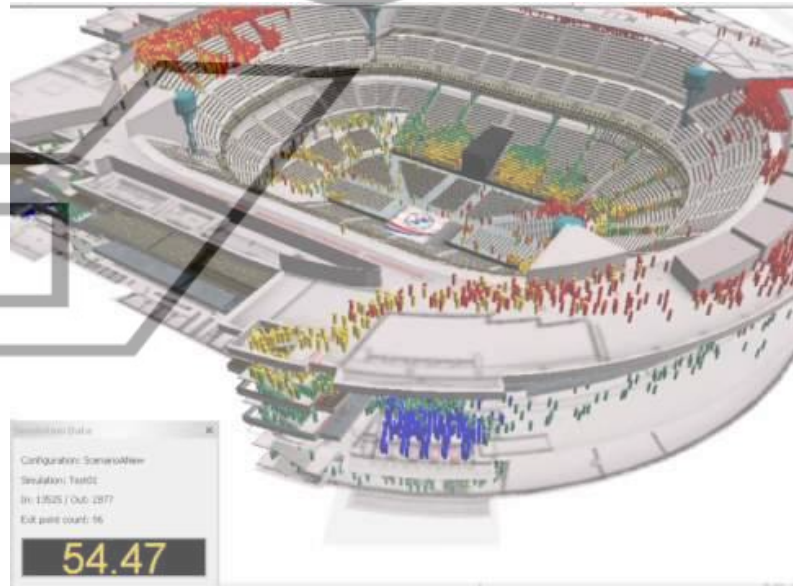
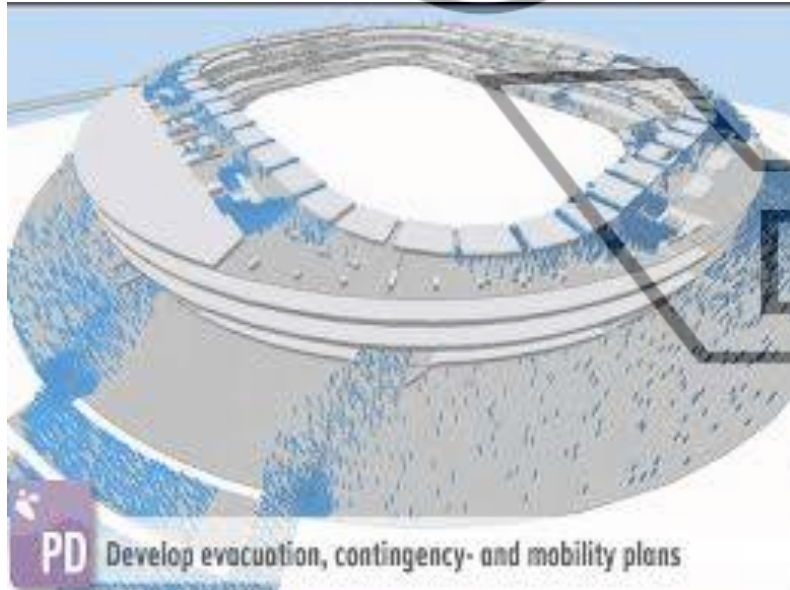
Pathfinder for evacuation simulation

<https://www.thunderheadeng.com/pathfinder/>



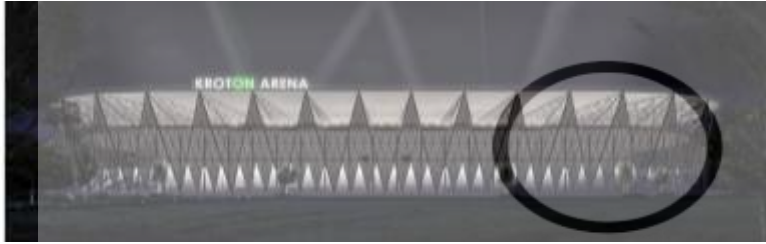
REAL TIME SIMULATION SOFTWARE USING PARTICLES AGENT-BASE MODELING

Evacuation Planning Tool (EPT) for Emergency, Event



OTHER SIMULATION SOFTWARE FOR LAYOUT OPTIMIZATION

Bowl Bulder a Grasshopper Library

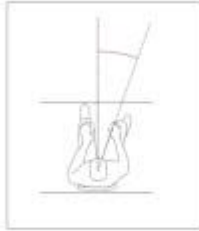


$$C = \frac{D(N+R)}{D+T} - R$$



H ANGLES (inf. 20%)

Calcola l'angolo di visione orizzontale al centro del campo sportivo. Maggiore è l'ampiezza dell'angolo e minore è il movimento che lo spettatore dovrà fare per visualizzare l'intera area di gioco, dunque minore è il numero maggiore è la mobilità dello spettatore. Il numero rappresenta l'angolo rispetto ai graditi e va da un minimo di 0 ad un massimo di 90. L'influenza di questo valore sarà del 20% nel sommersi all' HFOV per la qualità visiva orizzontale. In questa analisi la media degli angoli non supera mai i 23 gradi ed i punti di vista (PVM), con angoli superiori a 45 gradi sono presenti solo alle estremità del sedile lungo.

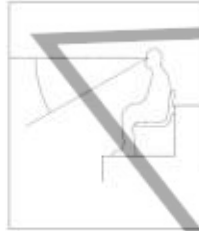


0-15 15-30 30-45 45-60



V ANGLES (inf. 50%)

Calcola l'angolo di visione verticale al centro del campo sportivo. In tal modo viene calcolato il movimento visivo in verticale che lo spettatore deve fare per visualizzare la distanza tra il punto della linea laterale alla linea del centro del terreno di gioco. Anche se gli spalti non sono coperti, una visione superiore un movimento minimo, vengono letti solo in un'operazione di taglio. Per questa analisi vengono utilizzati anche i dati della curva visiva generale, dunque i valori più di attenzione all'analisi di questo punto di vista sono i migliori risultati. Risulta che i punti di vista superiori presentano i migliori risultati visivi.

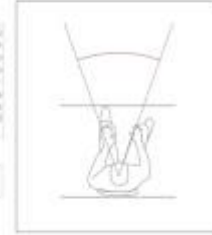


0-1 2-4 5-8 9-12 12-15

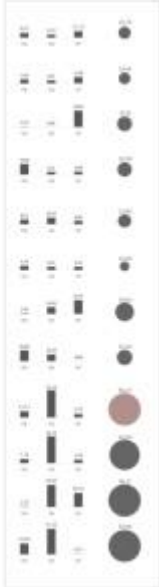


H FOVS (inf. 30%)

Calcola il campo visivo orizzontale in cui si trova il campo sportivo. Più è ampio il campo visivo e maggiore è il campo visivo, dunque maggiore è la comodità dello spettatore. Questo valore è il valore più di basso che sarà maggiore la visuale di essere nel terreno di gioco per lo spettatore. È evidente infatti come la qualità visiva peggiora in prossimità degli angoli e sicché i valori migliori negli angoli sono. La media migliore si presenta infatti nelle zone con forme sinuose. È stato assegnato un'influenza del 30% che somata all' H Angles totalizza il 50% per la qualità visiva orizzontale.



00-60 60-120 120-150 150-180



ESERCITAZIONE #01

A Programma edilizio.

Elaborato rappresentante, in una scala opportuna, le planimetrie con indicazione delle aree omogenee funzionali, corrispondente abaco dei locali da redigere in conformità con il Decreto Ministeriale 18 dicembre 1975, stima parametrica dei costi e scostamenti da valori di programma.

B Calcolo dell'incidenza della murature.

Elaborato da cui evidenziare la quantità di murature in rapporto alla superficie totale e superficie netta.

A Programma edilizio.

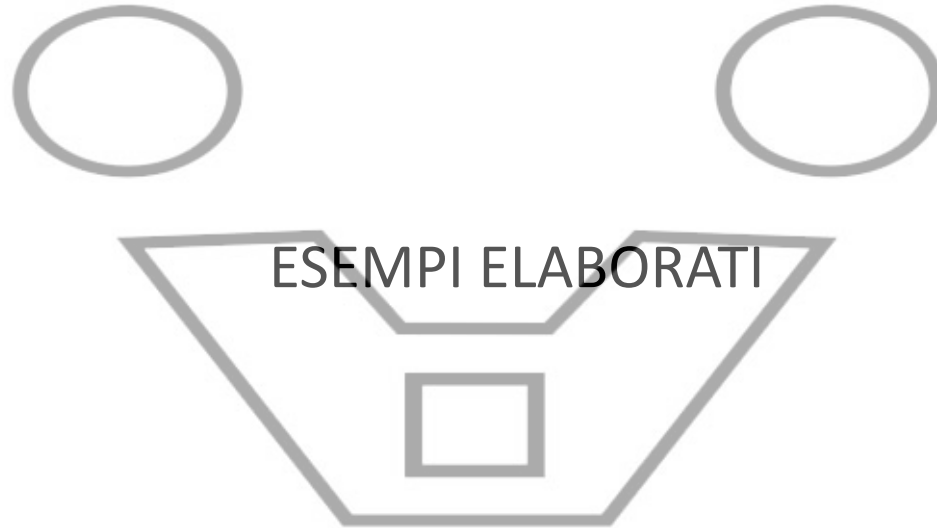
L'abaco dei vani, indicizzato per aree funzionali omogenee (aree comuni, circolazione, attività didattiche normali,...), dovrà contenere e specificare, al minimo, i seguenti campi:

- aree funzionali
- numero di piano
- identificativo del locale
- denominazione del locale
- superficie di progetto (campo con valore estratto in automatico)
- superficie di standard (campo con valore assegnato)
- differenza di superficie (campo con valore calcolato)
- costo standard per superficie diviso in aree di basso-medio-alto valore da definire sulla base delle informazioni ricevute nei moduli didattici relativi alla stima economica (campo con valore assegnato)
- costo di progetto (campo con valore calcolato)
- differenza di costo rispetto all'applicazione delle superfici di normativa (campo con valore calcolato)

B *Calcolo dell'incidenza della murature*

Elaborato da cui evidenziare la quantità di murature in rapporto alla superficie totale e superficie netta. I richiesti valori dovranno essere estratti utilizzando le funzioni automatiche presenti in Revit impiegando, a scelta o in combinazione, l'abaco muri, aree e relativo abaco, delimitatori di aree e/o locali.

Non è quindi ammessa alcuna modalità di tipo manuale.





Area in mq											
Scheda di calcolo											
№	Descrizione	Q	U	U	U	U	U	U	U	U	U
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ATTENZIONE

Il file in rosso non può essere modificato e rappresenta la struttura standard del progetto con verifiche.

Il file in giallo sono i volumi e i quantitativi di accantonamento registrati dal sistema BIM e non possono essere modificati.

Il file in verde sono i quantitativi di accantonamento registrati dal sistema BIM e non possono essere modificati.

PROVA "A"

TAVOLA
 ABACO LOCALI

Autore: Giuseppe Ridolfi - Pdh

Disegnata da: Riccardo Nanni

Completata da: Riccardo Nanni

Scale: 1:100

2

Abaco dei locali

Livello	Reparto	N° locale	Nome	VERIFICA STANDARD DI SUPERFICIE					CALCOLO COSTO PARAMETRICO ED EFFETTIVO			
				Area di standard	Commenti	Superficie del locale	Differenza area	Verifica area	Costo parametrico al mq	Costo locale parametrico	Costo locale effettivo	Differenza
W-AR-B1-II--1,20-Seminterrato	Amministrazione	41	Archivio	0,00 m ²		23,8 m ²	23,8 m ²	SI	800,00€	19.014,24	19.014,24€	0,00€
W-AR-B1-II--1,20-Seminterrato	Amministrazione	36	Ufficio 01	0,00 m ²		23,9 m ²	23,9 m ²	SI	800,00€	19.091,04	19.091,04€	0,00€
W-AR-B1-II--1,20-Seminterrato	Amministrazione	37	Ufficio 02	0,00 m ²		25,9 m ²	25,9 m ²	SI	800,00€	20.691,20	20.691,20€	0,00€
W-AR-B1-II--1,20-Seminterrato	Amministrazione	38	Ufficio 03	0,00 m ²		26,6 m ²	26,6 m ²	SI	800,00€	21.291,68	21.291,68€	0,00€
W-AR-B1-II--1,20-Seminterrato	Amministrazione	39	Ufficio 04	0,00 m ²		26,4 m ²	26,4 m ²	SI	800,00€	21.124,72	21.124,72€	0,00€
W-AR-B1-II--1,20-Seminterrato	Amministrazione	40	Ufficio 05	0,00 m ²		19,1 m ²	19,1 m ²	SI	800,00€	15.296,58	15.296,58€	0,00€
W-AR-B1-P0+2,45-Plano Terra	Amministrazione	42	Aula insegnanti	15,00 m ²	stanza assistente	24,5 m ²	9,5 m ²	SI	800,00€	12.000,00	19.624,32€	7.624,32€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	49	Lavabi e servizi igienici	0,00 m ²		19,6 m ²	19,6 m ²	SI	800,00€	15.664,34	15.664,34€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	52	Lavabi e servizi igienici	0,00 m ²		3,9 m ²	3,9 m ²	SI	800,00€	3.148,52	3.148,52€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	53	Lavabi e servizi igienici	0,00 m ²		3,6 m ²	3,6 m ²	SI	800,00€	2.875,36	2.875,36€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	54	Lavabi e servizi igienici	0,00 m ²		8,4 m ²	8,4 m ²	SI	800,00€	6.746,16	6.746,16€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	55	Lavabi e servizi igienici	0,00 m ²		8,6 m ²	8,6 m ²	SI	800,00€	6.841,20	6.841,20€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	56	Lavabi e servizi igienici	0,00 m ²		2,4 m ²	2,4 m ²	SI	800,00€	1.921,76	1.921,76€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	57	Lavabi e servizi igienici	0,00 m ²		2,5 m ²	2,5 m ²	SI	800,00€	1.963,20	1.963,20€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	58	Lavabi e servizi igienici	0,00 m ²		14,1 m ²	14,1 m ²	SI	800,00€	11.279,99	11.279,99€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	59	Lavabi e servizi igienici	0,00 m ²		3,8 m ²	3,8 m ²	SI	800,00€	3.059,76	3.059,76€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	60	Lavabi e servizi igienici	0,00 m ²		14,1 m ²	14,1 m ²	SI	800,00€	11.279,99	11.279,99€	0,00€
W-AR-B1-II--1,20-Seminterrato	Attività pratiche	79	Lavabi e servizi igienici	0,00 m ²		4,2 m ²	4,2 m ²	SI	800,00€	3.342,53	3.342,53€	0,00€
W-AR-B1-P0+2,45-Plano Terra	Attività pratiche	61	Lavabi e servizi igienici	0,00 m ²		14,0 m ²	14,0 m ²	SI	800,00€	11.207,01	11.207,01€	0,00€
W-AR-B1-P0+2,45-Plano Terra	Attività pratiche	62	Lavabi e servizi igienici	0,00 m ²		3,8 m ²	3,8 m ²	SI	800,00€	3.008,15	3.008,15€	0,00€

