Role of Research in Architectural Design

Jaepil Choi, Ph.D.
Professor of Architecture
Seoul National University
Korea

Search, Re-Search, Research

- Search
  - We are searching for a truth or solution… but fail miserably.
- Re-Search
  - Again, we search for a truth or solution… but fail miserably again!
  - Again, again, and again…
- Research
  - We need **research**, not search and re-search
  - Research is a systematic way of investigation of things to increase our knowledge base.

Research in General

- Creation of a New Theory
- Discovery of a New Fact
- New Interpretation of Known Facts
- Invention of a New Technology or Tool

Creation of a New Theory

- $S = (1/2)gt^2$ → S is a free-fall distance. T is time, g is the acceleration due to gravity.
- $E = mc^2$ → E is the energy. M is the mass. C is the light speed.
- Game Theory
- Environment-Behavior Theories
- New Urbanism
- Space Syntax
- Visual Access and Exposure

Discovery of a New Fact

- DNA/RNA
- The Ancient Nubian Used Antibiotics
- A most Earthlike planet is discovered
- The 20th Century Architecture of Banda Aceh: Researching Identity and Strengthening Colonial Authority
  - The penetration of modernity into Indonesia had the impact on local transformation in the field of architecture. As part of Indies society that had been involved with cultural mix, the colonial government has tried to rethink of architectural production of Aceh within the concept of tropical Netherland that applied throughout the archipelago.

A New Interpretation of Known Facts

- The 20th Century Architecture of Banda Aceh: Researching Identity and Strengthening Colonial Authority
  - The Dutch invented Indies architecture as a medium to calm down the Acehnese people against the foreigners of their colonial presence so that they can protect their colonial interests from possible intervention by the locals. The 'Colonial benevolence' in creating such an architectural concept became part the Dutch colonial's strategy to gain their propitiation toward their colony and secured their authority in Aceh.
- The Holocaust in Occupied Poland. New Findings and New Interpretations

Invention of a New Technology/Tool

- Steam Engine
- Nuclear Bomb
- AutoCAD
- BIM
- OPERA (Office Performance Evaluation Research Application)

Science	Pseudoscience
Willingness to change with new evidence	Fixed ideas
Ruthless peer review	No peer review
Takes account of all new discoveries	Selects only favourable discoveries
Invites criticism	Sees criticism as conspiracy
Verifiable results	Non-repeatable results
Limits claims of usefulness	Claims of widespread usefulness
Accurate measurement	“Ball-park” measurement

What do you need when you design?

- Knowledge & Information
- Intuition
- Experience
- Passion & Dedication

Knowledge & Information

- What is the minimum housing size for a family of four?
- What kind of changes in housing design in Korea do you expect to happen in 10 years?
- How many fire exits do you need in a shopping mall of 20,000m^2?

- Generating Knowledge
- Identifying Information

- These are parts of research.

What do you need when you design?

- Knowledge & Information
- Intuition
- Experience
- Passion & Dedication
- What else?

Tool for Architectural Design

- You need some tools, too
- What are the tools that you need?
  - Drawing Tools
  - Modeling Tools
  - Presentation Tools
  - and much more…..

What do you need when you design?

- Knowledge & Information
- Intuition
- Experience
- Passion & Dedication
- Design Tools
  - Drawing Tools
  - Decision Making Tools

Decision Making in Architectural Design

- Many decision making required during the architectural design process
  - Concept Design
  - Mass Design
  - Plan Design
  - Façade Design
  - Etc.
- Rule of Thumb – is it enough?

Decision Making in Architectural Design

- Many decision making required during the architectural design process
- Rule of Thumb – is it enough?
- What about these?
  - How many elevators do you need to have for 120 story high buildings?
  - I want to put louvers on my façade. What kind of louvers?

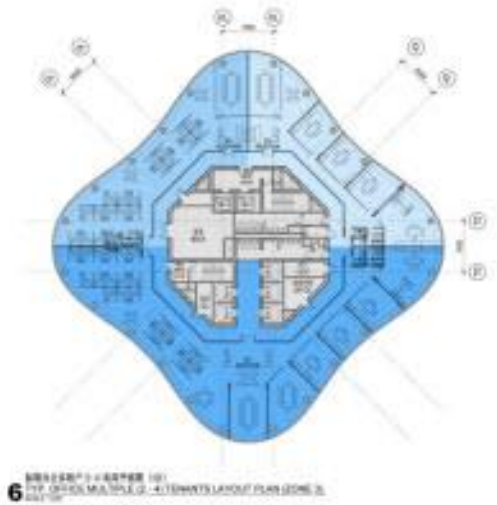
Architectural Design Tools

- A-RIDE (Assistant·Architect – Rough and Instant Design for Elevators)
- PLDS (Parametric Louver Design System)

A-RIDE

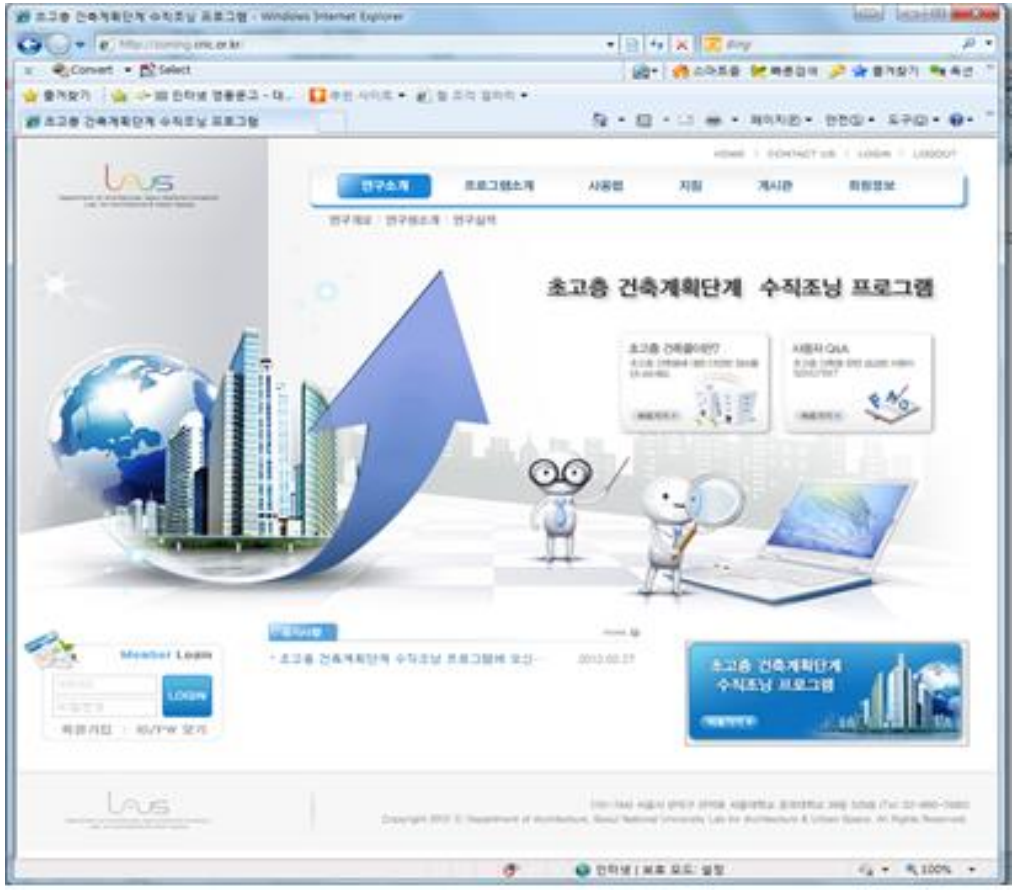
- **Pertamina Energy Tower**

How many and what kinds of elevators do you need?



SOM

A-RIDE: An Expert System




초고층건축 수직조닝 프로그램 - Windows Internet Explorer
http://zoning.cric.or.kr/Program/ZoneStep4.aspx?ID=14
프로그램
초고층 건축 계획단계 수직조닝 프로그램
창닫기
프로젝트 등록
프로젝트등록
프로젝트 목록
진행중인 프로젝트목록
완료한 프로젝트목록
STEP1
STEP2
STEP3
RESULT
결과값 요약
프로젝트명 Parc1,
전용면적 합계 110676 m²
층수 69 층
5분간 수송능력 15 %
거주인구 12 m²/인
구분 조닝수 조닝구성 소요ELV대수 LOCAL SHUTTLE TOTAL 소요ELV면적비(%) LOCAL TOTAL 5분 수송능력 (%) 평균 대기시간 (S) 결과값 상세보기
6대형 6 3+3 36 11 47 8,69 11,78 19,57 18,89 상세보기
6대형 6 2+2+2 36 14 50 7,01 9,63 19,36 19,06 상세보기
6대형 7 4+3 42 10 52 9,66 12,86 24,42 17,73 상세보기
6대형 7 3+2+2 42 13 55 7,74 10,30 23,99 17,95 상세보기
8대형 4 4 32 0 32 13,84 13,84 15,70 15,64 상세보기
8대형 4 2+2 32 11 43 9,36 12,44 14,86 16,58 상세보기
8대형 5 3+2 40 9 49 10,70 13,73 20,18 15,31 상세보기
완료
인터넷 | 보호 모드: 설정
100%

조고층건축 수직조닝 프로그램 - Windows Internet Explorer

http://zoning.cric.or.kr/Program/ZoneStep5.aspx?ID=14&part=1

프로그램 | 초고층 건축 계획단계 수직조닝 프로그램

창담기

STEP1 → STEP2 → STEP3 → RESULT

프로젝트 등록

- 프로젝트등록

프로젝트 목록

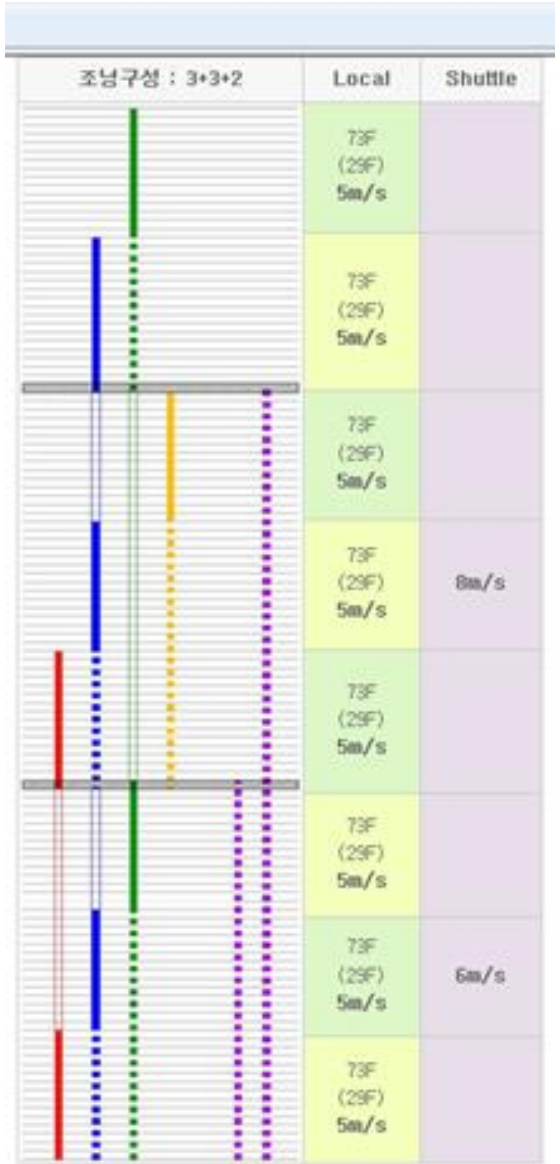
- 진행중인 프로젝트목록
- 완료한 프로젝트목록

결과값 상세

프로젝트명	Parc1,		
전용면적 합계	110676 m²	층수	69 층
5분간 수송능력	15 %	거주인구	12 m²/인

층수		E/V정보			셔틀 E/V정보			거주인구 (m2)	5분수송 (%)	평균대기 시간	E/V면적	TOTAL E/V면적
해당	누적	대수	용량	속도	대수	용량	속도					
12	58 ~ 69	6	24	6.0				1604	20.20	17.57	1026 (5.33%)	1026 (5.33%)
11	47 ~ 57	6	24	4.0				1470	20.82	18.42	1534 (8.69%)	1534 (8.69%)
12	35 ~ 46	6	24	3.0				1604	17.58	19.91	2322 (12.06%)	2322 (12.06%)
11	24 ~ 34	6	24	5.0	11	24	8.0	1471	22.03	17.55	940 (5.33%)	2029 (11.50%)
12	12 ~ 23	6	24	3.5				1604	17.58	19.88	1674 (8.70%)	2862 (14.87%)
11	1 ~ 11	6	24	2.5				1470	19.18	20.01	2128 (12.06%)	3217 (18.23%)

완료 | 인터넷 | 보호 모드: 설정 | 100%



PLDS (Parametric Louver Design System)

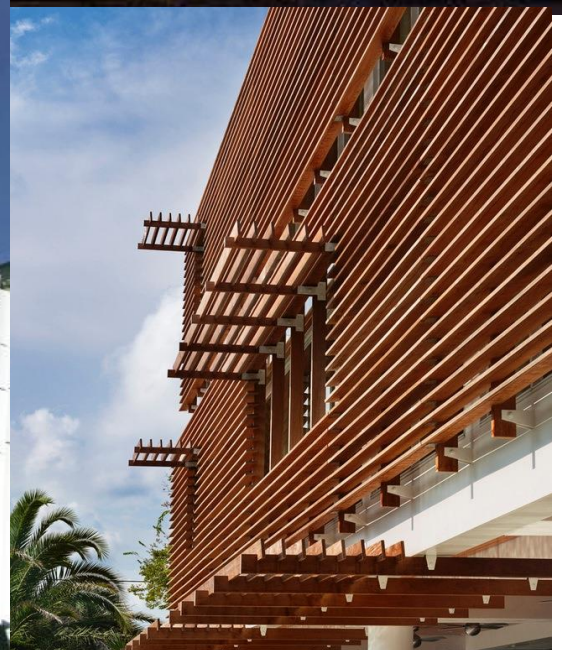
Louvers

for
Sun Blocking
Sun Letting-in
Keeping View

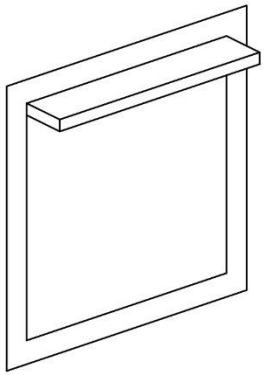
WHAT IS THE BEST LOUVER SYSTEM?

HOW DO WE KNOW?

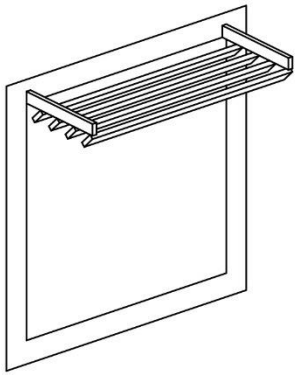
HOW DO WE DESIGN?



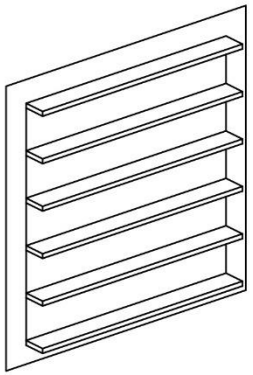
- Research Question: Of the various types of louvers, which one has the best performance?



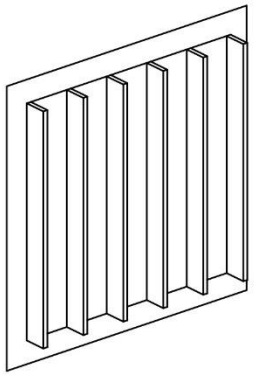
Overhang



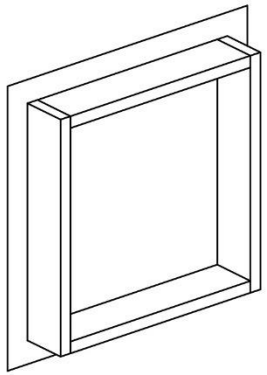
Overhang with blades



Horizontal blades



Vertical fins

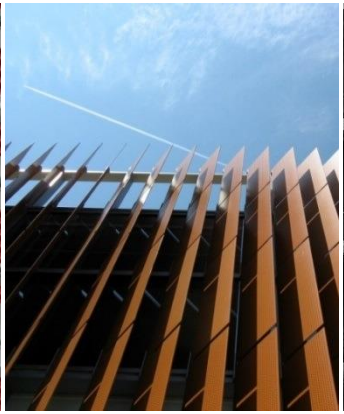


Surrounding

OHSU Center for Health and Healing, 2006, US, GBD Architects

SBL Offices, 2009, Austria, Helmut Schimek

Torre agbar, 2005, Spain, Ateliers Jean Nouvel

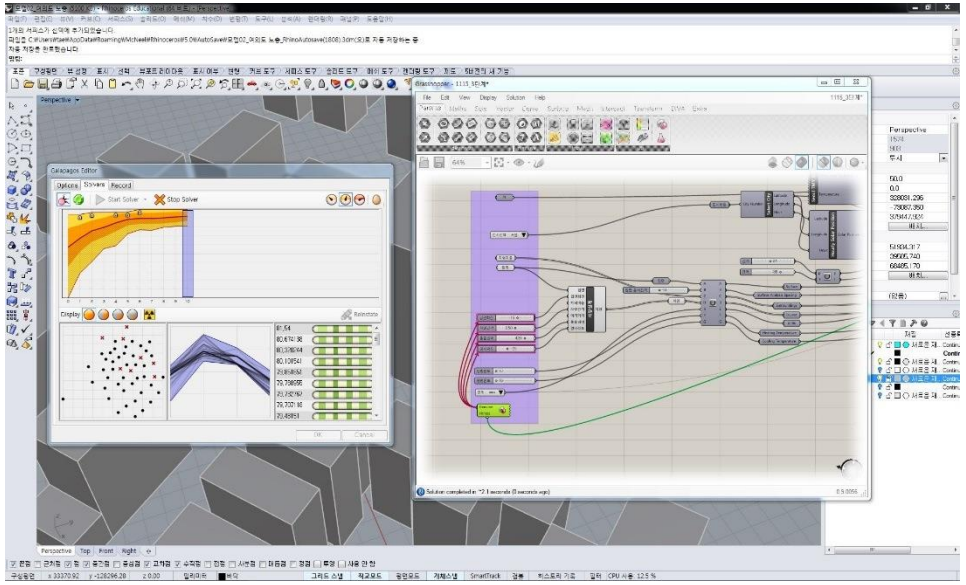


Tenley-Friendship Library, 2011, US, The Freelon Group

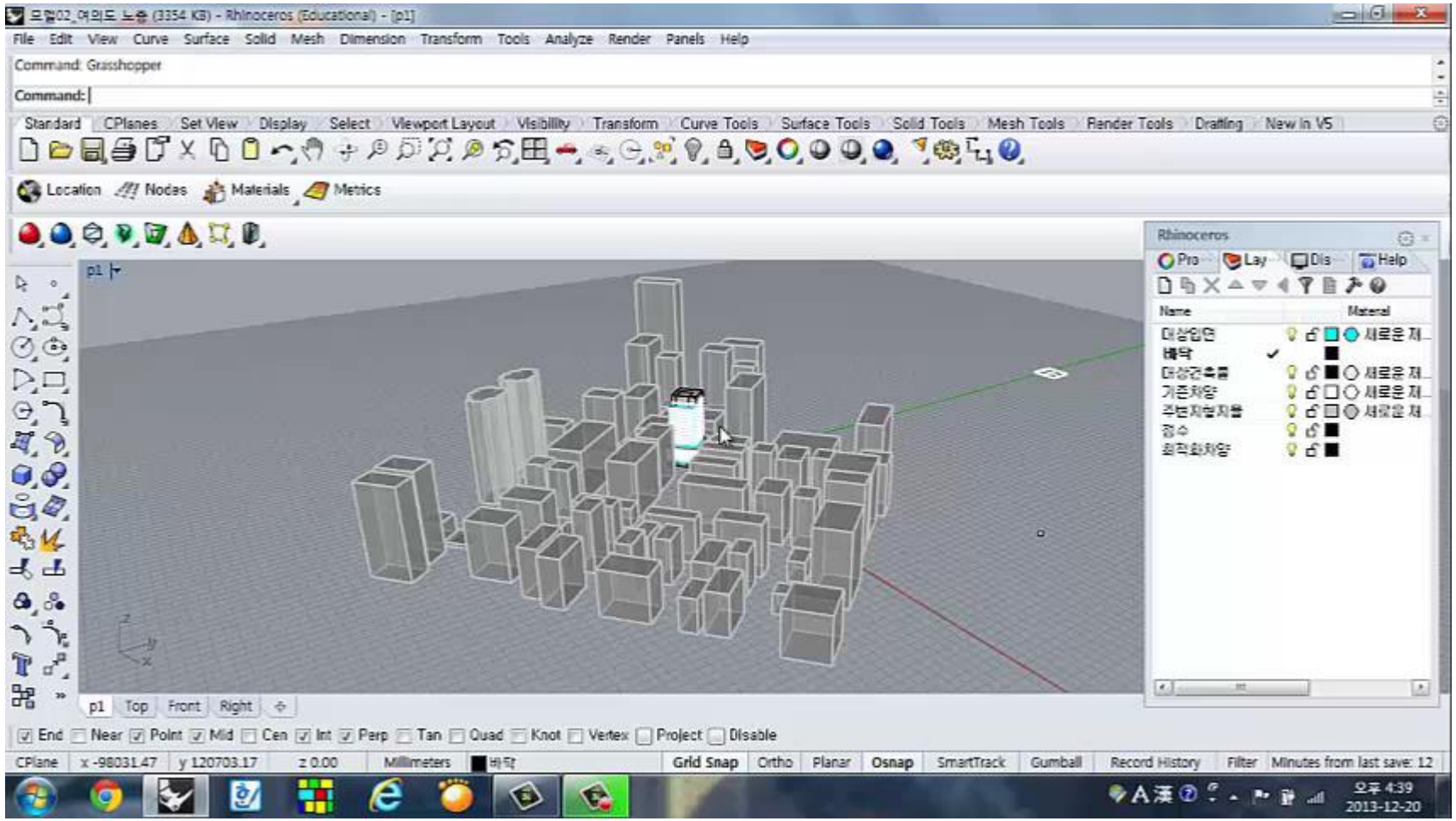
Carpenter center, 1964, US, Le Corbusier

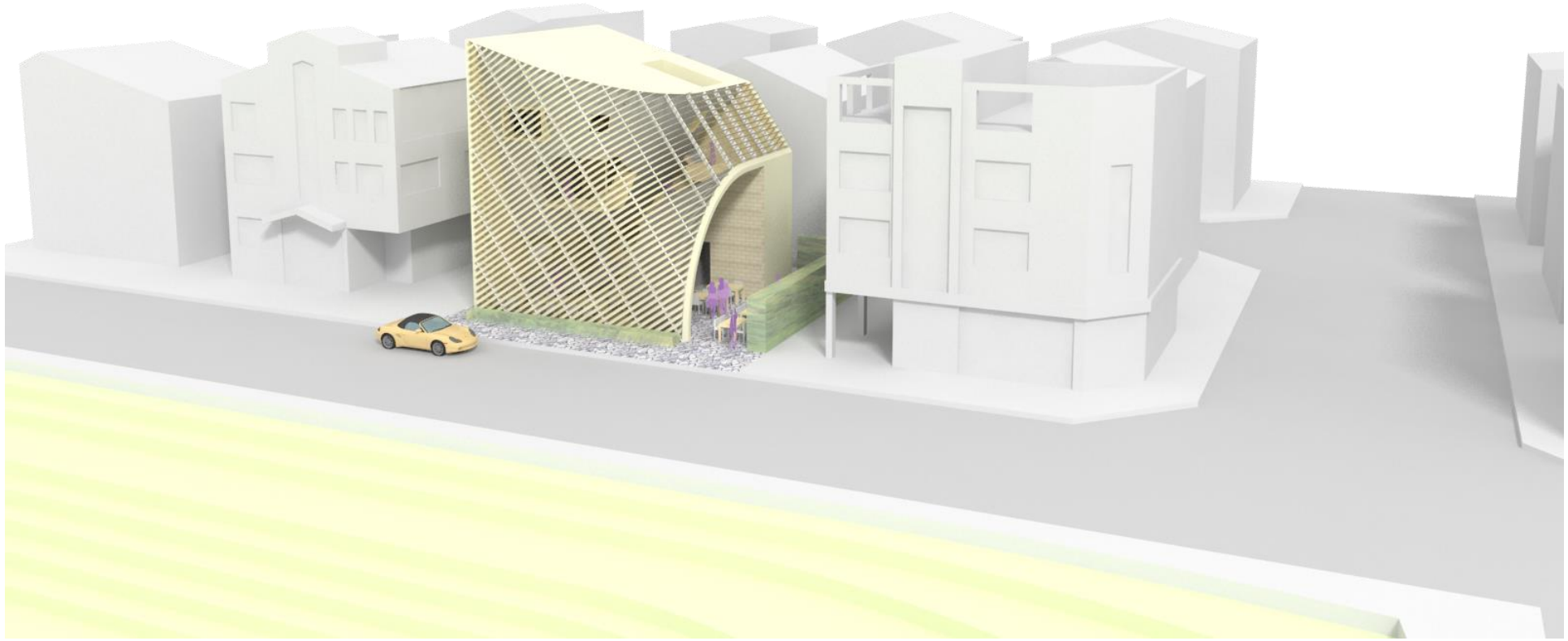
Final Goal: Automated Louver Design System

- Easy-to-use design system, usable especially from the initial stage of design
- Analytic design system, reflecting peripheral building conditions, regional climate, and building orientation
- Optimization design system, suggesting the optimized louver parameters for a given elevation
- Flexible design system, compatible with the existing 3D modeling software



Louver Optimization Algorithm


File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels Help
Command: Grasshopper
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools Render Tools Drafting New in V5
Location Nodes Materials Metrics
Rhinoceros
Pro Lay Dis Help
Name Material
p1 Top Front Right
End Near Point Mid Cen Int Perp Tan Quad Knot Vertex Project Disable
CPlane x -98031.47 y 120703.17 z 0.00 Millimeters 바닥
Grid Snap Ortho Planar Osnap SmartTrack Gumball Record History Filter Minutes from last save: 12
오후 4:39
2013-12-20




tbs HD
음악과 빛, 공간속에 살다
카페 루버윌
空間사람

THE END