

Computer Modeling, Analysis and Visualization of Angkor Wat Style Temples in Cambodia

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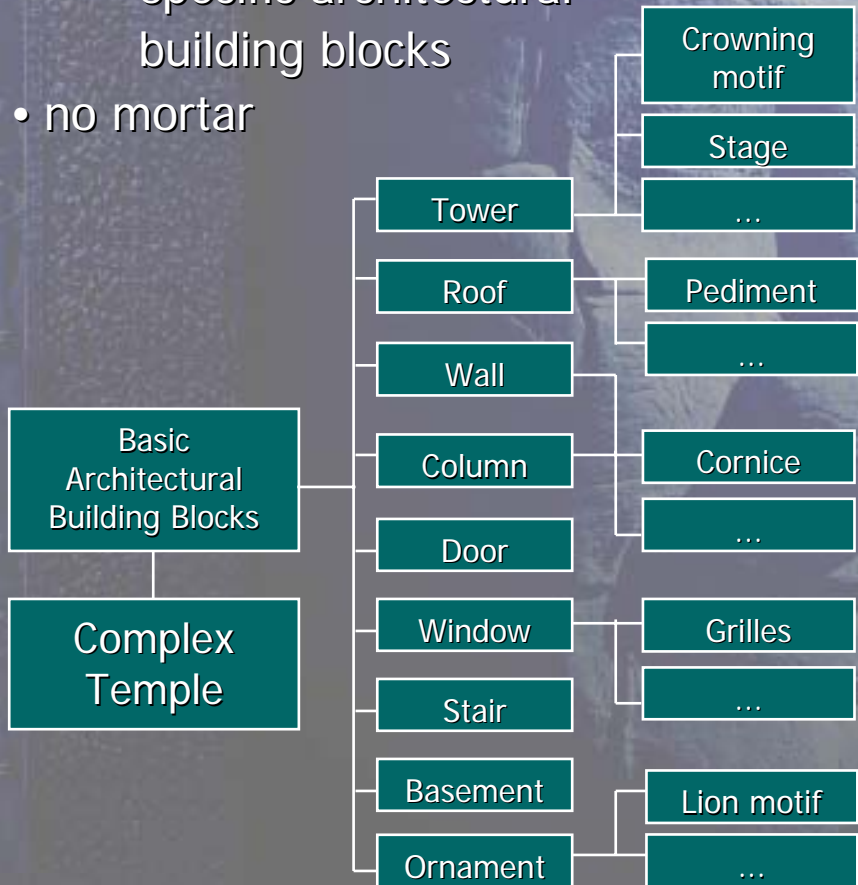


Outline

- introduction to Angkor Wat Style Temples and their specification
- problem statement
- solution
 - goal
 - need
 - method
- goal of my PhD research
 - introduction to new CAD system for Angkor temples modeling
 - relevant AWST characteristic for modeling
 - my approach
- expected results

Angkor Wat Style Temples

- 544 Khmer temples built from 802-1431 A.D.,
- 8 main Angkor Wat Style (1080 - 1177)
 - specific architectural building blocks
- no mortar



Angkor Wat



Thommanon

Problems

- badly damaged and partly destroyed due to soft foundation, war or nature
- several teams of architects, conservationists and laborers involved in conservation or reconstruction
- **computational architecture methods could help in reconstruction, but no support up to now**



Beng Mealea



Reassembling of Stone Blocks



Goal

- development of computational methods and tools to support
 - construction and reconstruction
 - architectural structure analysis
 - 3D visualization

needed:

- interdisciplinary approach, combination of computational architecture, computer science, and applied mathematics

methods:

- image processing, data analysis and model based approximation, object-oriented software development, and 3D computer graphics

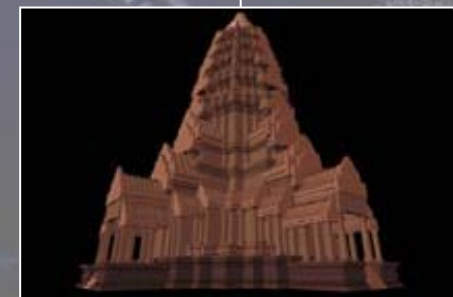
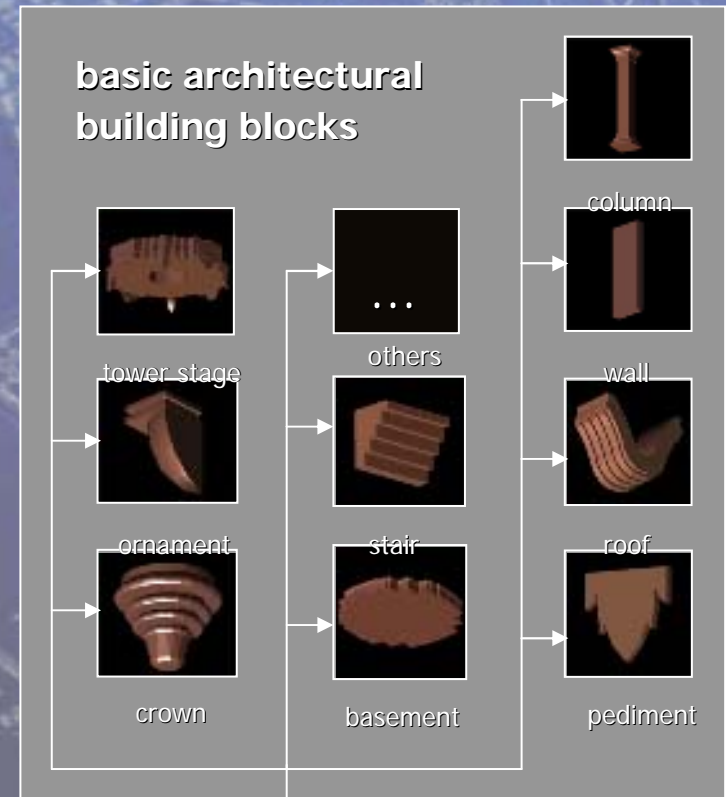
My PhD Project: First Step

Angkor Temple Generator (ATG)

- computer visualization: 3D graphics to support
 - identification of structural elements and properties
 - reconstruction of missing parts
- model calibration: historic data, 2D data, 3D laser scans needs approximation algorithms
- temple modeling
 - development of architectural building blocks
 - object oriented realization to allow for successive refinement down to individual stone blocks

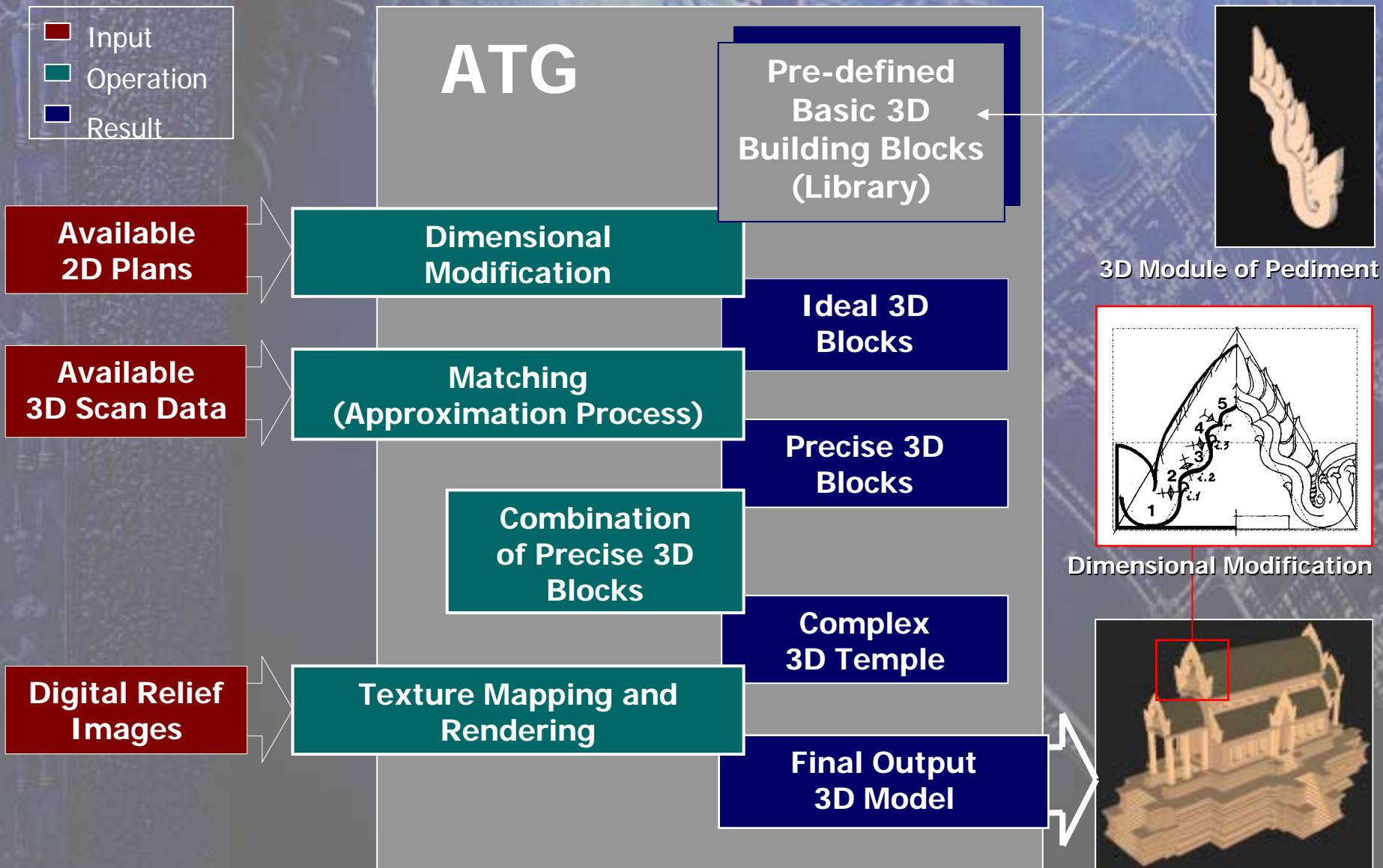
beyond this PhD project:

3D laser scan of rubble - solve 3D combinatorial puzzle



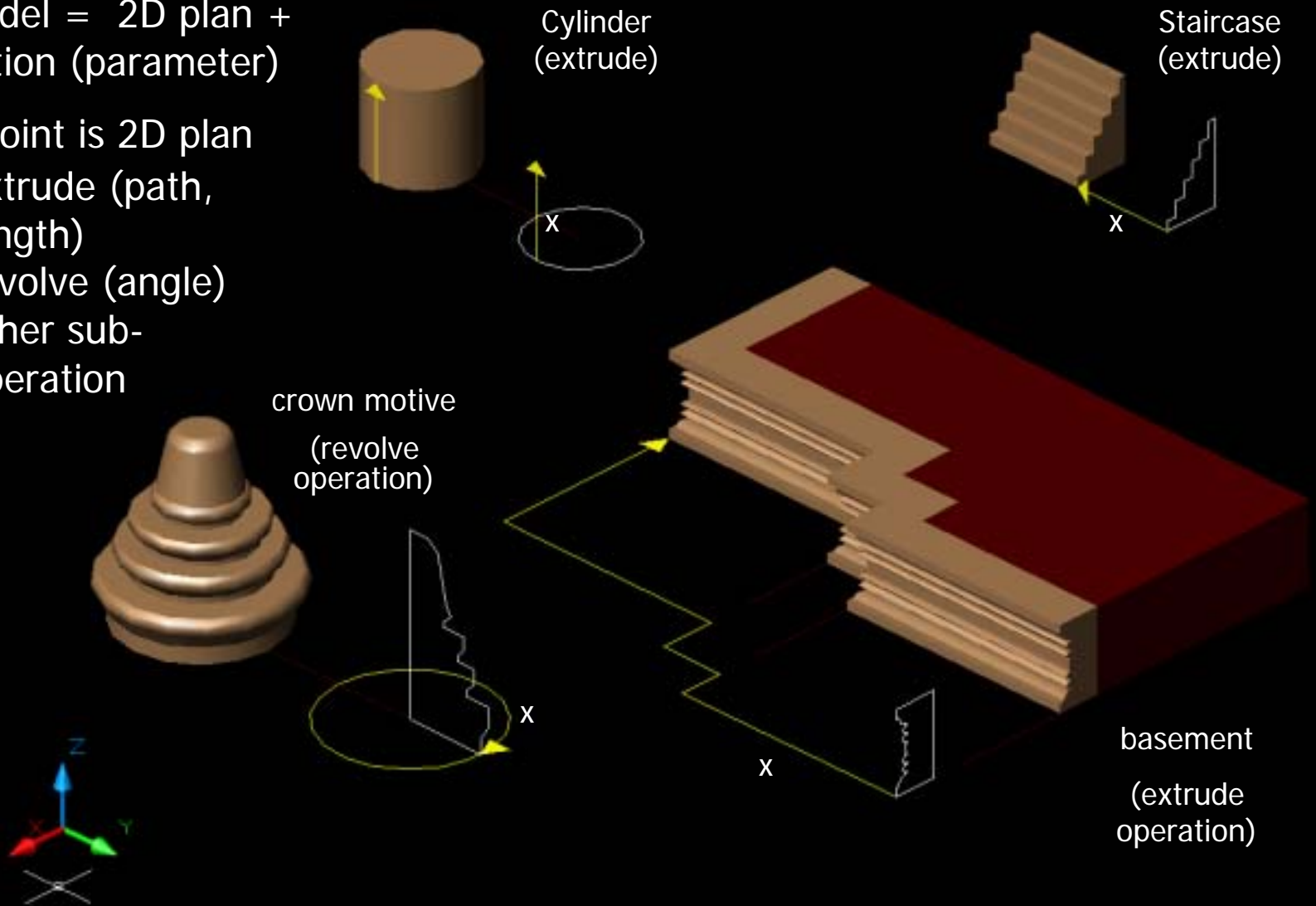
3D module of central tower of Angkor Wat

ATG Pipeline

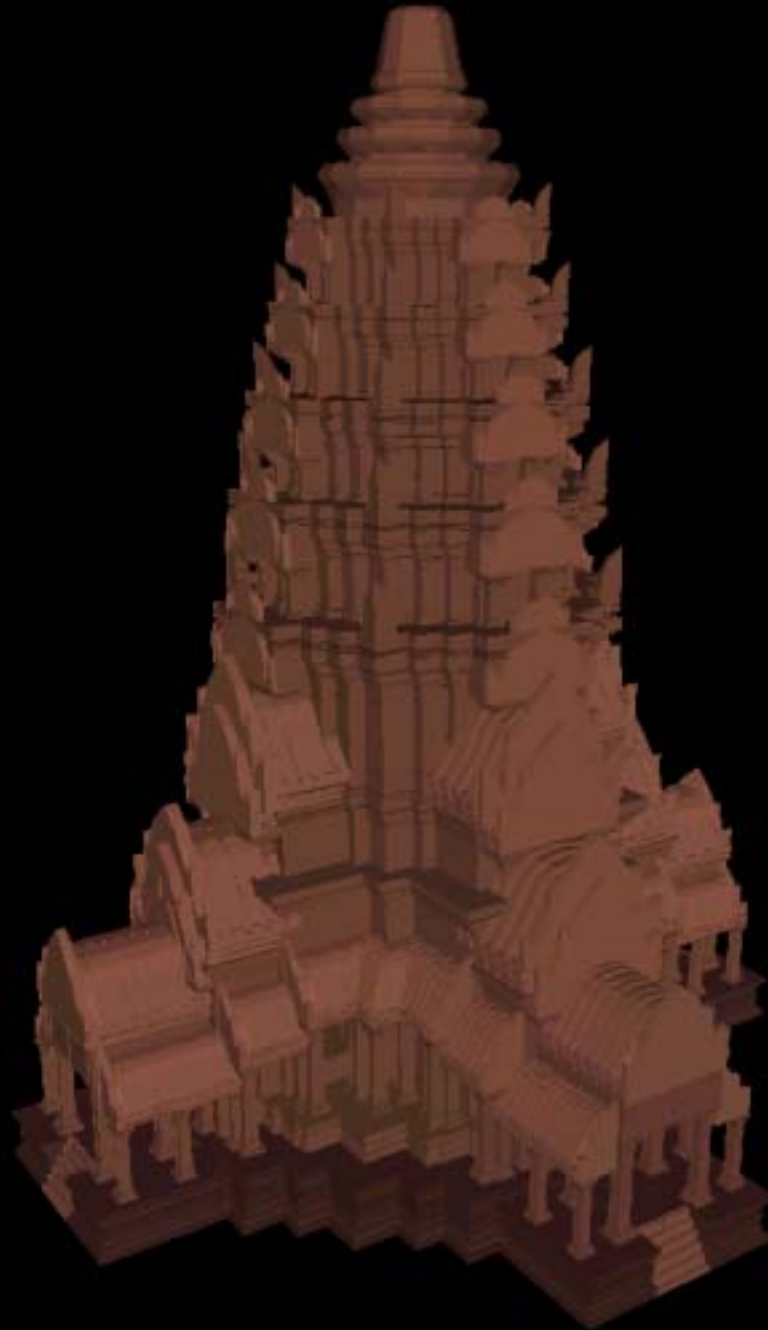


3D Modeling in CAD

- 3D model = 2D plan + 1 operation (parameter)
- focal point is 2D plan
 - extrude (path, length)
 - revolve (angle)
 - other sub-operation



3D model of the central tower of Angkor Wat



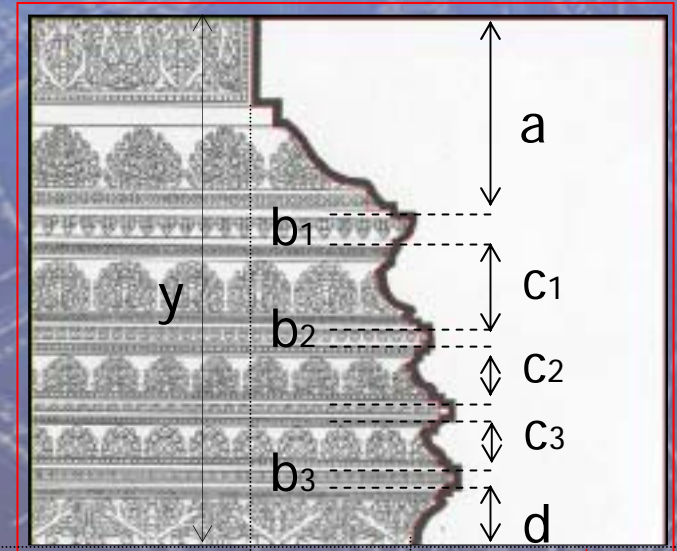
My Approach

simplification:

- distinguish different component
- group them into families
- determine important parameters that characterize the building block

eg. basement (picture 1):

- component: a ; b (b_1, b_2, b_3); c (c_1, c_2, c_3); d
 - parameter set: x and y
- ▶ Input for modeling

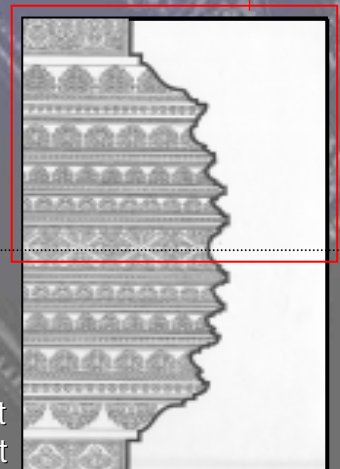


composition of a basement

x

mirror axis

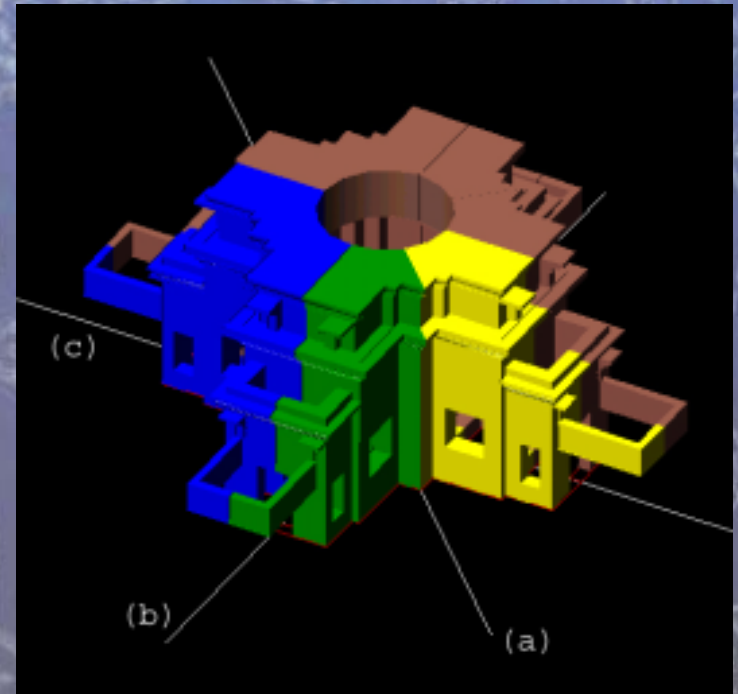
cross section of a basement of Angkor Wat



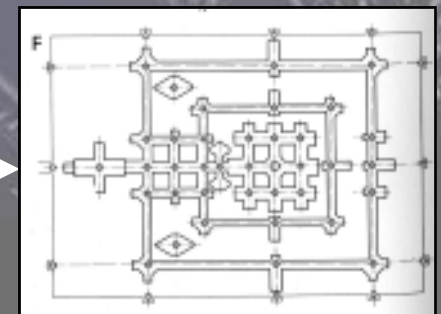
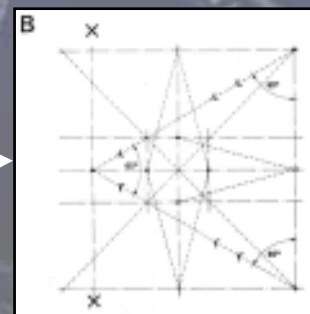
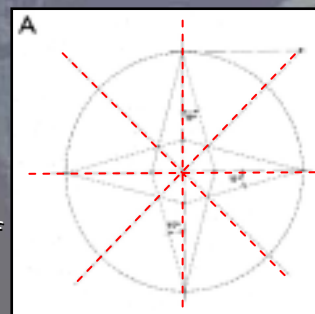
My Approach

- basic concept consist of simple geometric forms implies of up to three axes (mirror)

3D modeling
using three axis



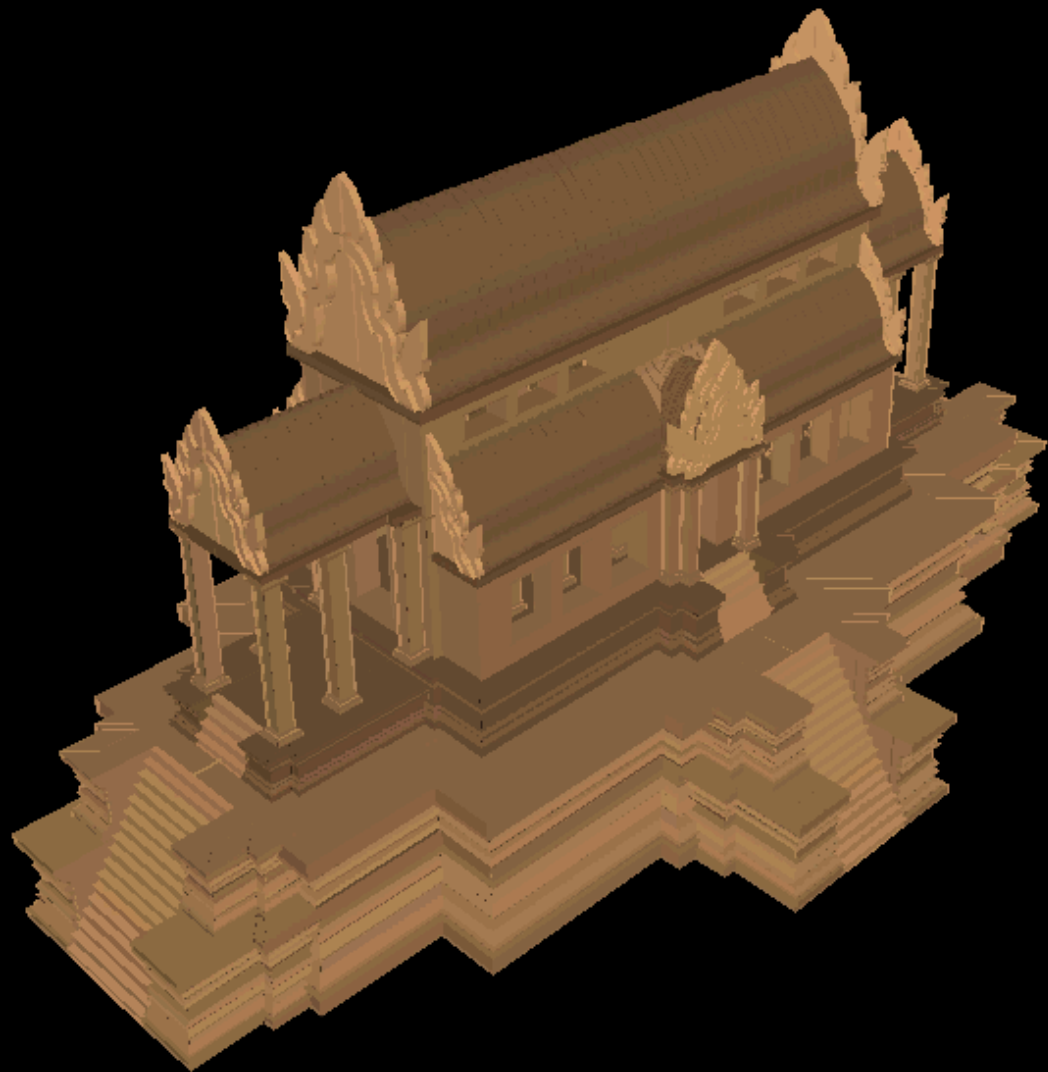
pattern design of
Angkor Wat



Expected Results and Benefits

- versatile software tool for complex temple construction
- generally applicable for Angkor Wat style temples
- 3D animation for temple visualization
- support of :
 - experts for temple analysis and reconstruction
 - architectural students in Cambodia
 - virtual museum via
 - + cyber board
 - + internet





The background is a composite image. On the left side, there is a large, weathered stone face, possibly a Mayan or Aztec sculpture, with a prominent nose and closed eyes. On the right side, there is a complex geometric diagram, likely a Soma cube or a similar mathematical puzzle, rendered in a light blue color. The diagram consists of numerous small, interconnected shapes forming a larger, irregular structure. A vertical line with a '150' label is visible in the upper right quadrant of the diagram. The entire image has a blue tint.

**Thank you
for your Attention!**