



DESN3002

Proposal

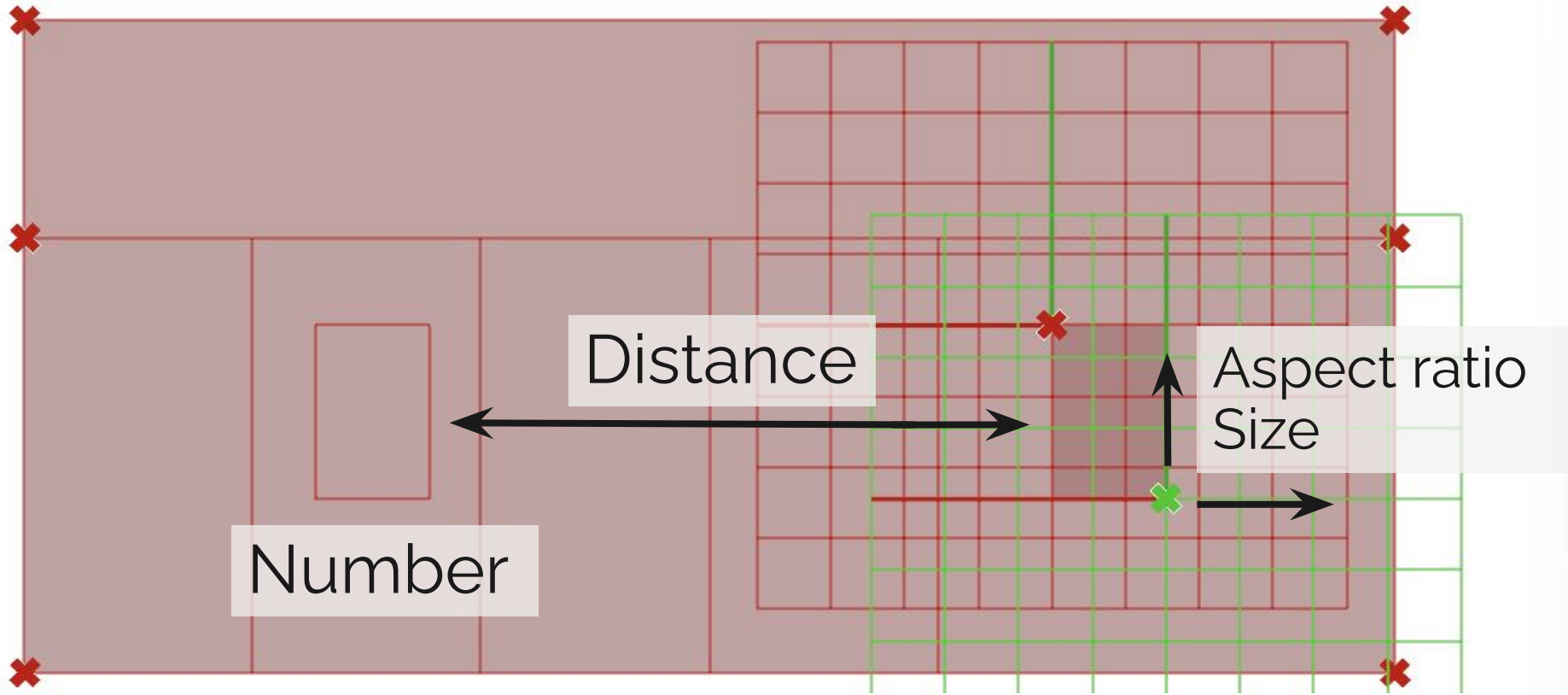
La'O, Bernadette 3035957329

Better Shelter

Relief Housing Unit



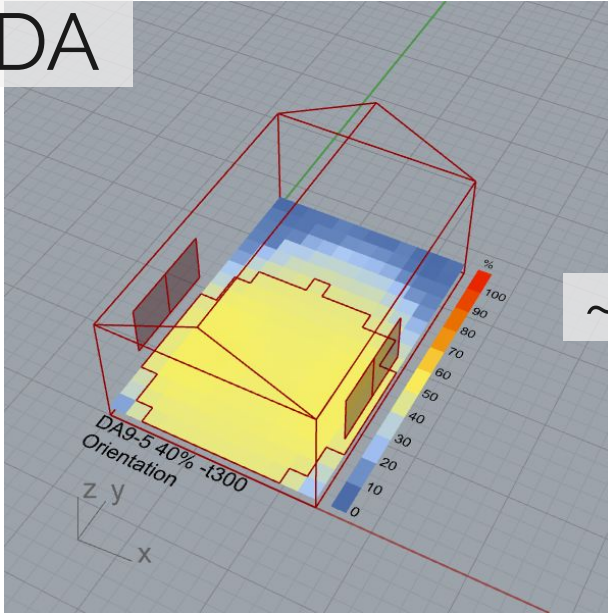
Process



- Arbitrary, unspecific, relative, inconsistent metrics, buggy, bad isolation of variables
- Failed to observe relationships between variables
- Made hard assumptions and conclusions off of preliminary findings

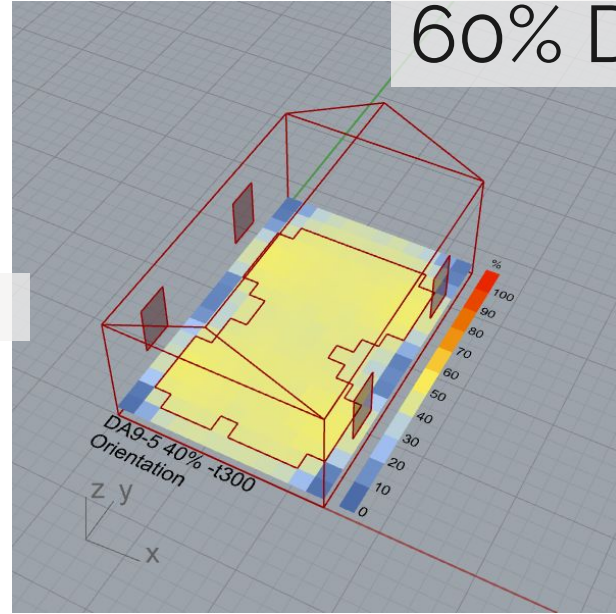
Distance vs Size

Two 3:3
59% DA



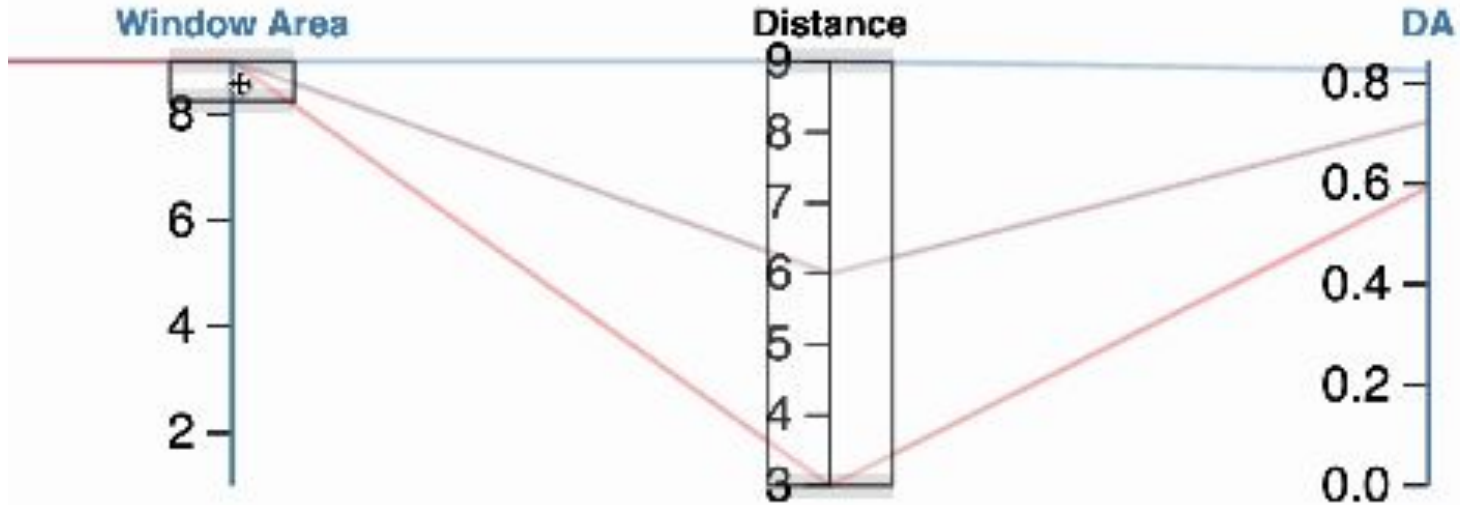
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Two 2:3
60% DA



Distance can make up for size...

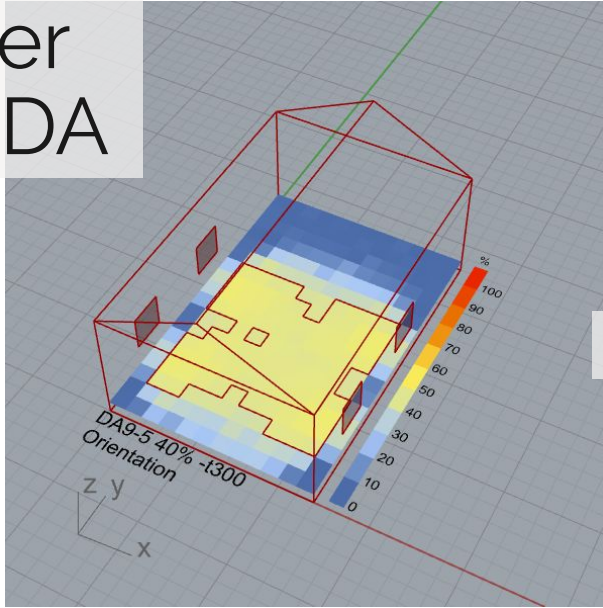
Distance vs Size



...but according to their proportional relationship

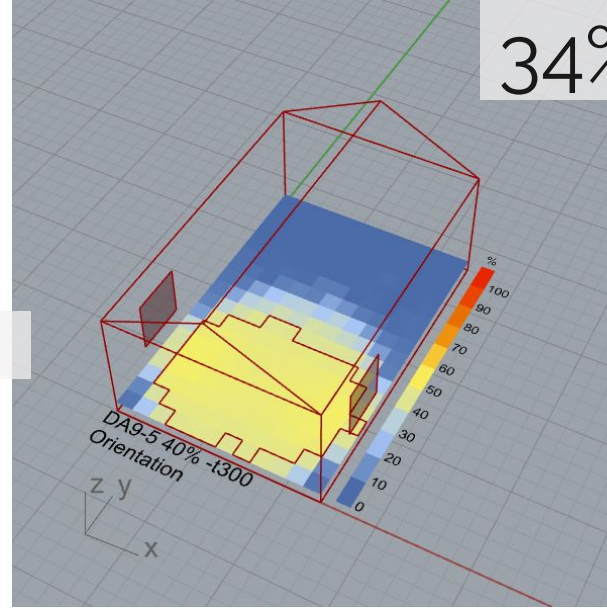
Number vs Size

Two 2:2
Closer
39% DA



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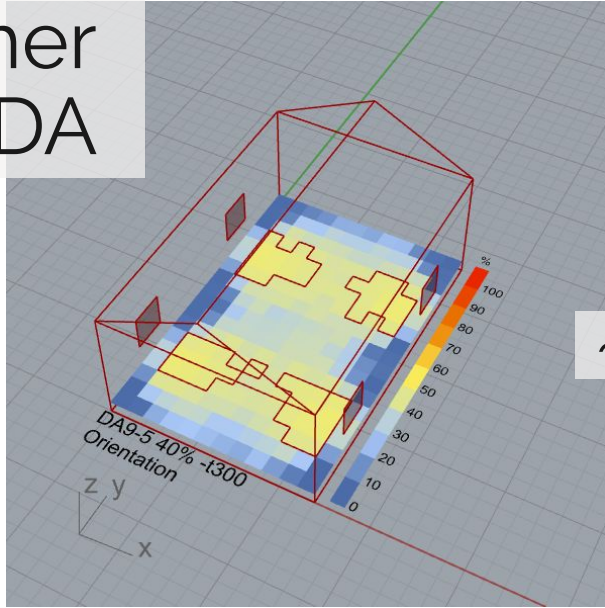
One 3:3
34% DA



Number can make up for size...

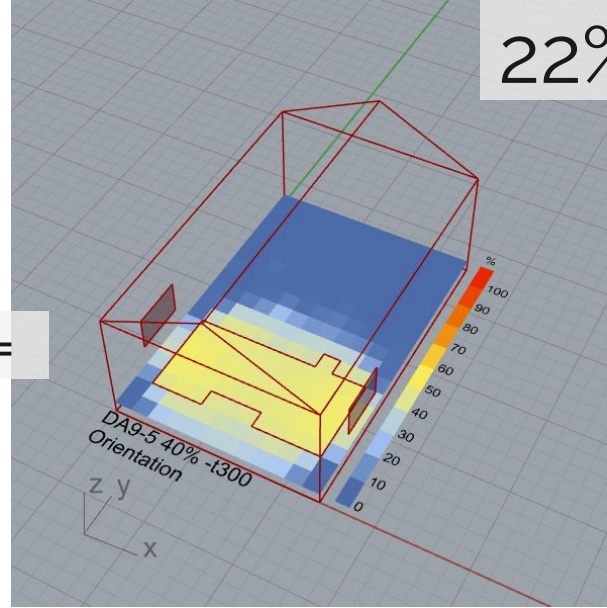
Number vs Size

Two 2:2
Farther
21% DA



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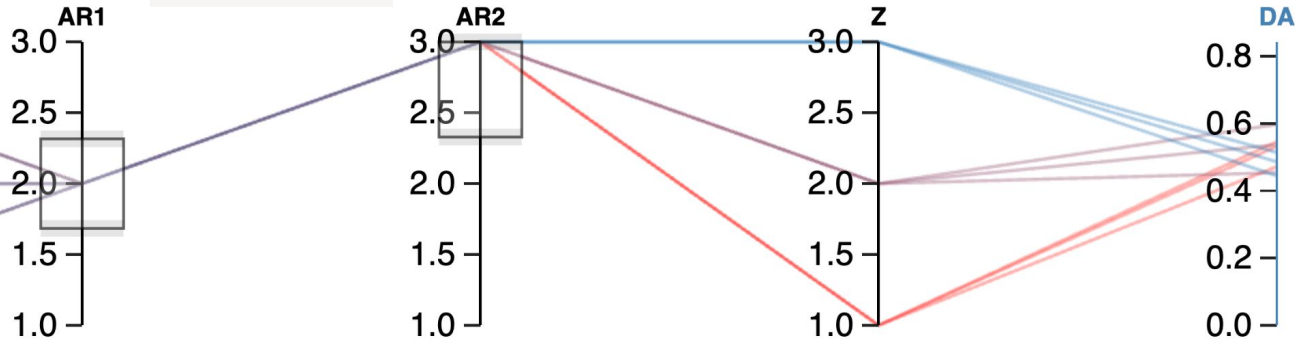
One 3:2
22% DA



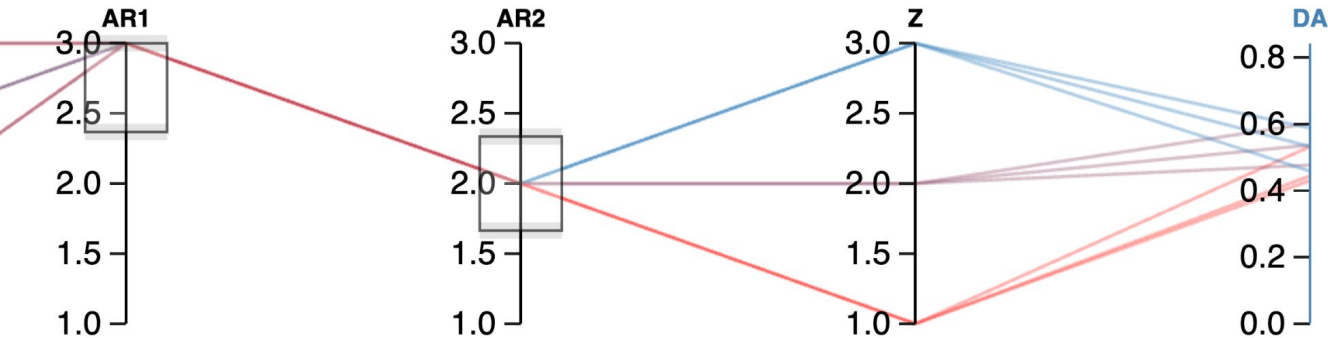
...but performance heavily relies on distance as well

Aspect Ratio vs Height

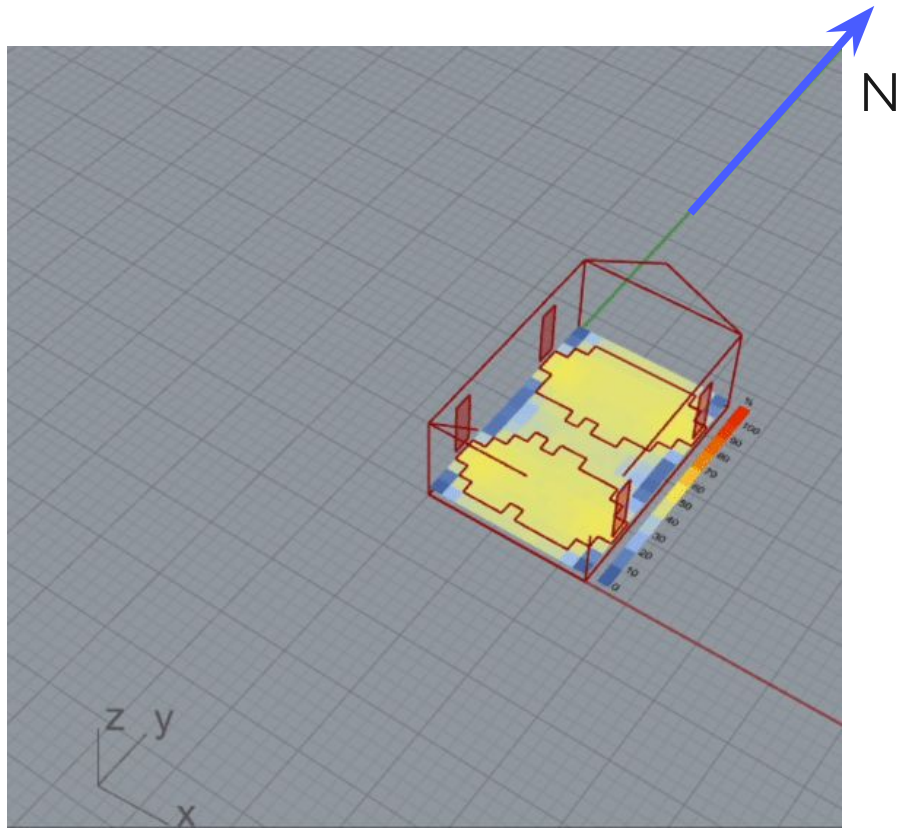
Vertical



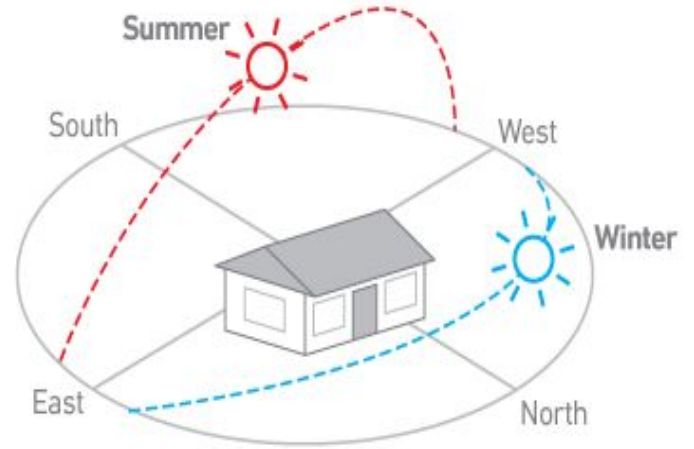
Horizontal



Minimal effect
on their own
and to each
other



Orientation



SUMMMER vs WINTER SUN

East-west windows receive direct sunlight more consistently

Key Insights

- Size and distance have a proportional relationship
- Number and size has less intuitive interchangeability with volatile dependence on distance
- Aspect ratio effect is not as important as size
- Greatest annual daylight uses east-west windows
- **Limitations:** 2D measurement disregards evenness, simulation time, small scale limits effects

Modularity



Access to local resources and **insulation**

Rwanda – straw mats on roof
Afghanistan – wood panels
India – mud and bamboo
Iraq – concrete slabs on floor



If not?

Revised Problem:

Poor Insulation with Shade Net and Panel Material



- Aluminum fabric prone to fast corrosion
- Shade net fastening threatens ventilation
- Defeats intention of semi-opaque panels
- Polyolefin R-value = 0.77 per inch (5x less than alternative insulative materials)
- Ranges 5-40°C indoors

Revised Evaluation

Daylight analysis with realistic window configurations

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Heat/structural analysis with materials

Focus on **light** and **thermal comfort** modularity,
especially for countries *without* immediate access to local
materials that are better-suited for the weather

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Visualize optimal window placements and insulative
materials classified by climate zones

Importance

Additional focus areas

- Safety and dignity
- Thermal comfort
- Modularity
- Versatility
- Cost
- Optimize for production
- Ease of assembly

Annual report 2022

- **Less dependence** on solar panel use, maintenance, and production
- **Avoid disuse**, waste, and reverting back to tents
- Ensure **health, safety, and productivity** of inhabitants
- **Streamline** design process
- Provide **user-friendly information**
- **Save costs** for scalability
- Provide **better alternative** in emergency situations
- Increase **adaptability** for global use
- Broad **applicability**

Variables

- **Windows**
- **Location weather**
 - Representatives from grouped climate zones
- **Panel material**
 - R-values and UV resistance
 - Misc. durability properties

Objective

- **Daylight**
- **Indoor heat and insulation**
 - Match performance of local materials
- **Structure**
 - Mass (min. thickness <5mm)
 - Match existing weather performances (snow/rain load, wind resistance)

Next Steps

- Further literature review
- Narrow down ideas and parameterize everything
- Diversify material database and figure out key property navigation
- Run structural analysis
- Construct heat analysis script
- Test windows with different climate zones
- Incorporate machine learning
- Brainstorm final design space and filtering

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