An interactive methodology for selecting a suitable window design

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Outline

The aim of the study

Background

What are the significant impacts of windows?

Problem area

Step 1 in developing the interactive framework

Step 2 in developing the interactive framework

Benefits and difficulties

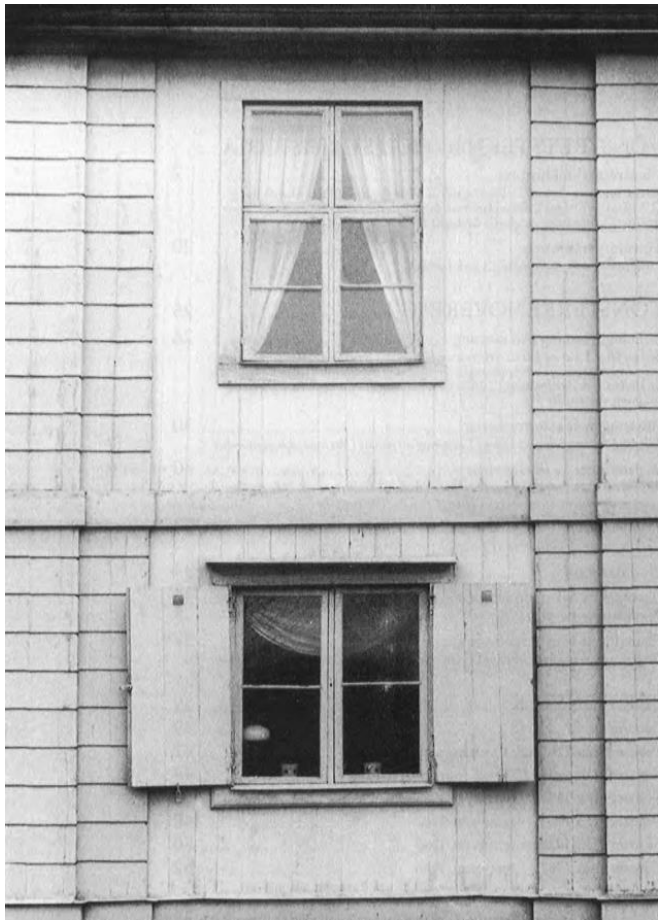
The of this study

Developing an interactive methodology for selecting a suitable window design

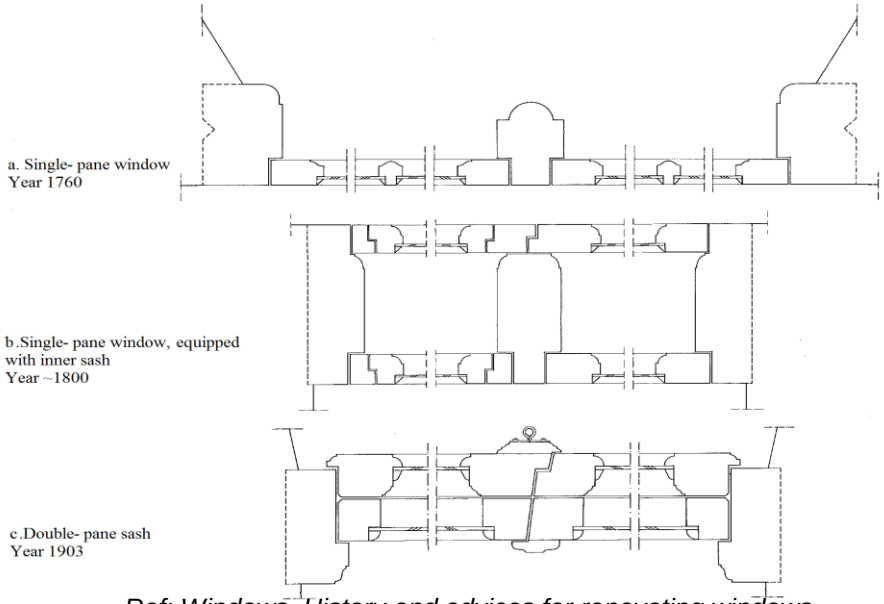
Windows in buildings

- Psychological effects
- Physiological effect

Background



Ref: Windows, History and advices for renovating windows (In Swedish: Fönster, historik och råd vid renovering), 1988



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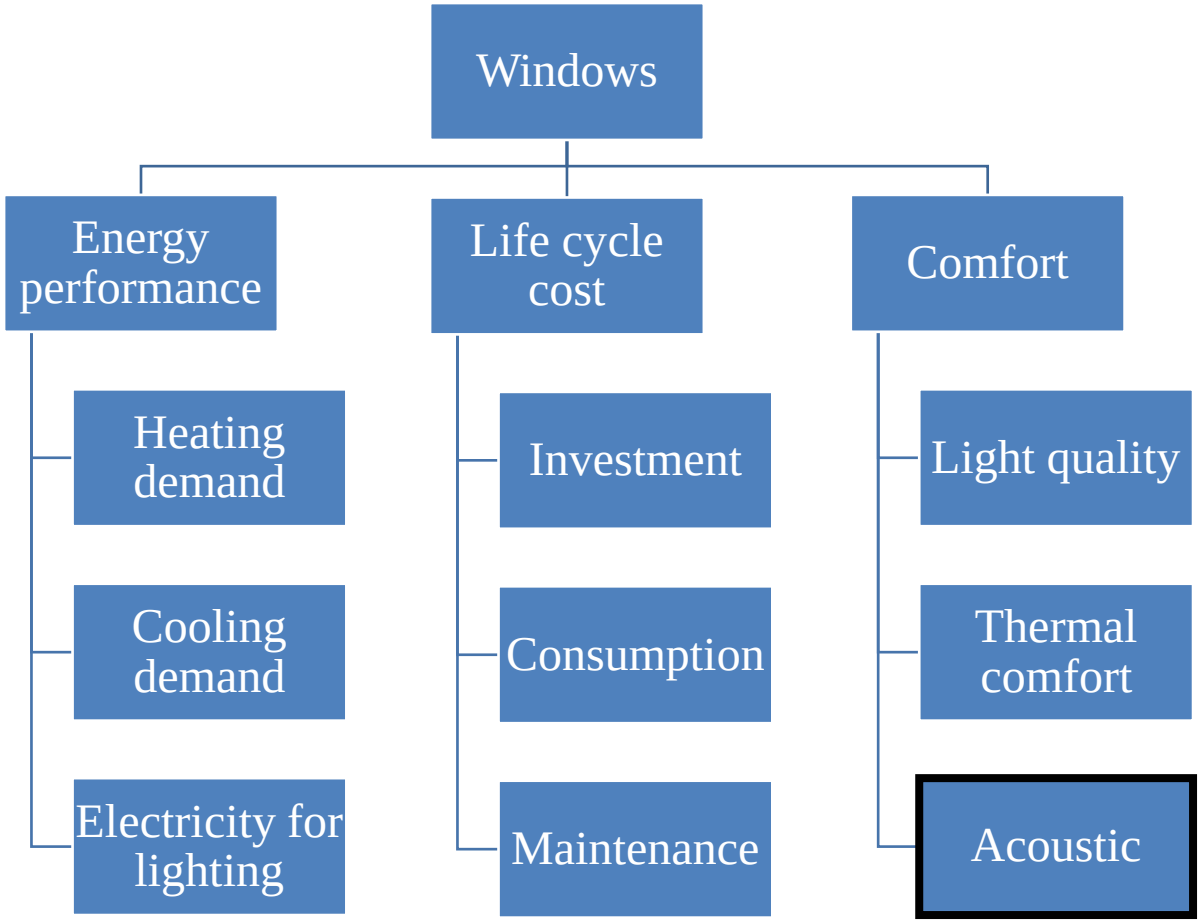
Ref: www.elitfonster.se, 2016 september

Window design impacts



Problem area

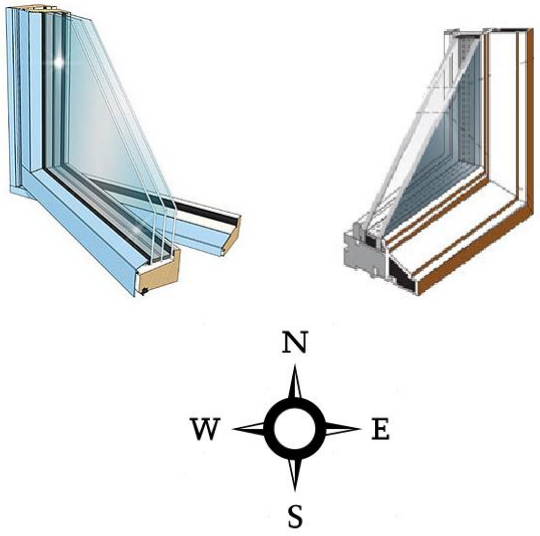
Linear regression model

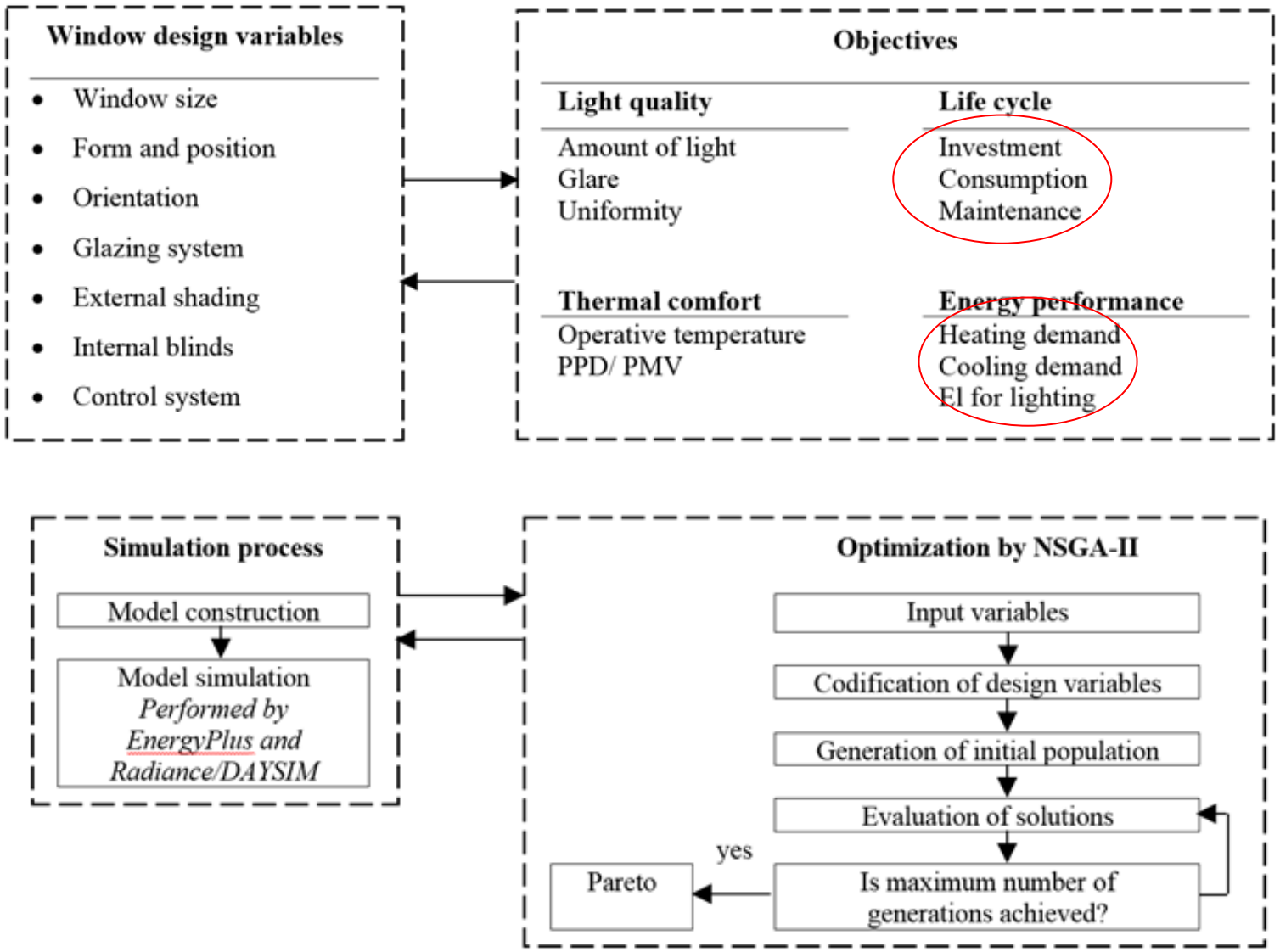
South

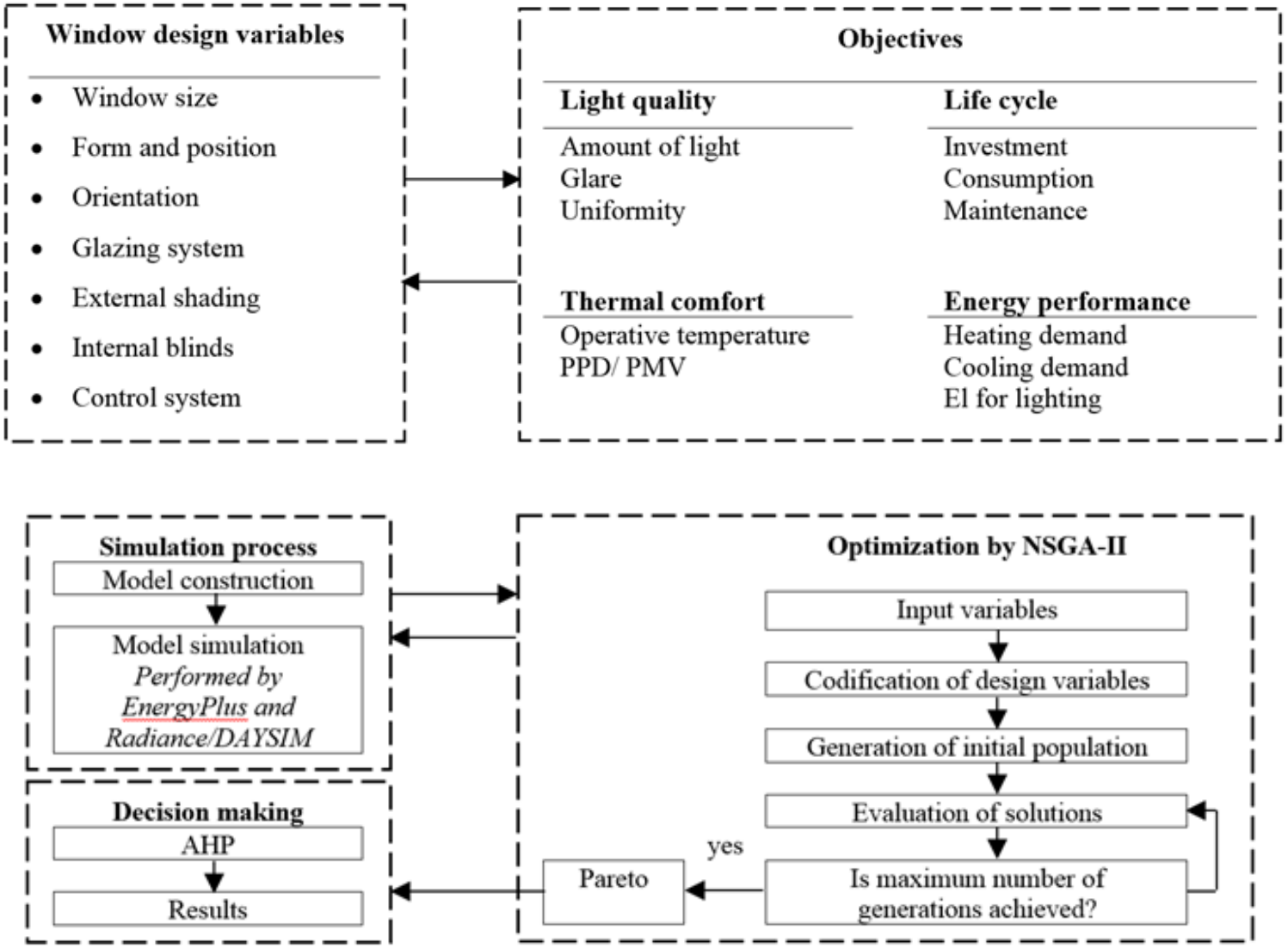
Ln- daylight = 0.011 Window size - 0.096 Glazing system- 0.089 Design model + 0.405 Orientation + 5.632

$Y = \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$

Ln- energy consumption= 0.015 Window size + 0.038 Glazing system - 0.004 Design model – 0.129 Orientation + 2.802




Window design variables
Window size
Form and position
Orientation
Glazing system
External shading
Internal blinds
Control system
Objectives
Light quality
Amount of light
Glare
Uniformity
Life cycle
Investment
Consumption
Maintenance
Thermal comfort
Operative temperature
PPD/ PMV
Energy performance
Heating demand
Cooling demand
El for lighting
Simulation process
Model construction
Model simulation
Performed by
EnergyPlus and
Radiance/DAYSIM
Optimization by NSGA-II
Input variables
Codification of design variables
Generation of initial population
Evaluation of solutions
yes
Pareto
Is maximum number of generations achieved?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Is maximum number of generations achieved?
yes
Pareto
Decision making
AHP
Results

Benefits and difficulties

Benefits

- Considering the all window design impacts
- Analyzing a large number of window design configurations
- Considering occupants preferences
- Finding a trade- off solution

Difficulties

- Time consuming process
- Requires in depth knowledge in optimization and decision making

Thank you