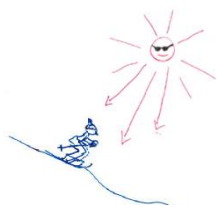**RADIATION IN THERMAL COMFORT SIMULATIONS**

METTE HAVGAARD VORRE, PHD. CANDIDATE
RASMUS LUND JENSEN & JEROME LE DRÉAU
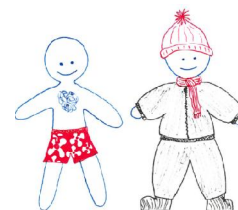
DANISH BUILDING RESEARCH INSTITUTE
AALBORG UNIVERSITY COPENHAGEN

Thermal comfort

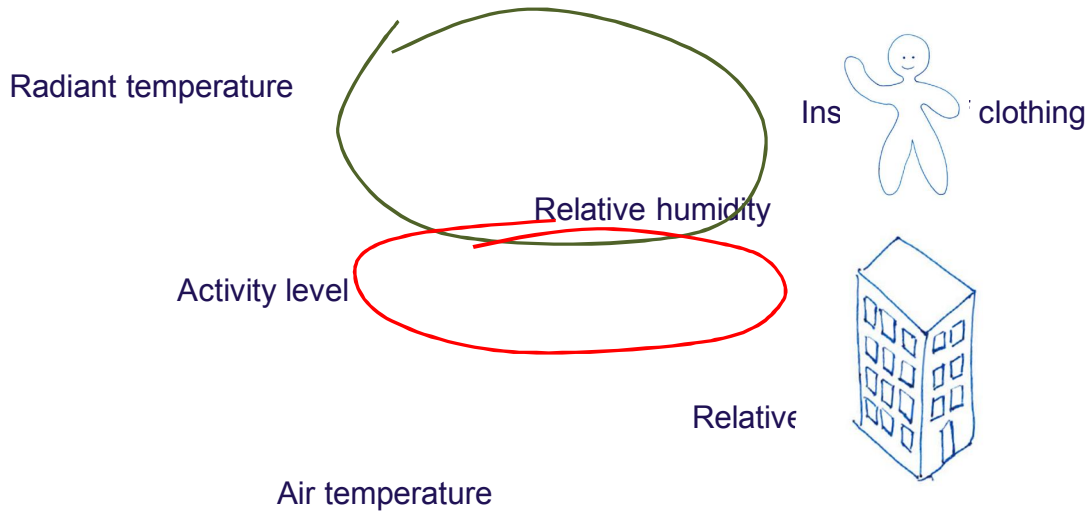Radiant temperature

Insulation of clothing

Relative humidity

Activity level

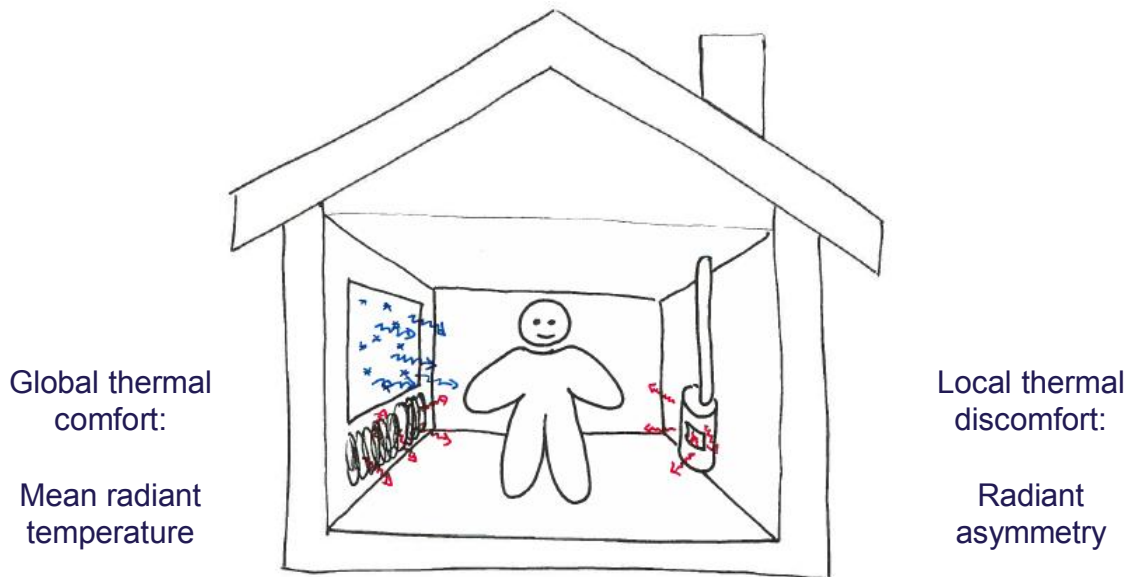Air temperature

Relative air velocity

2

Thermal comfort

Radiant temperature

Ins   clothing

Relative humidity

Activity level

Relative

Air temperature

3

Radiant temperature

Global thermal comfort:

Mean radiant temperature

Local thermal discomfort:

Radiant asymmetry
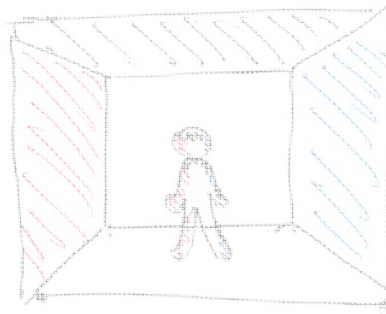
4

Overview

Projected area factor

View factor

5

Projected Area Factor

6

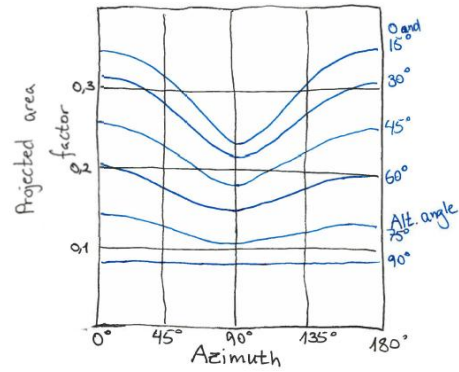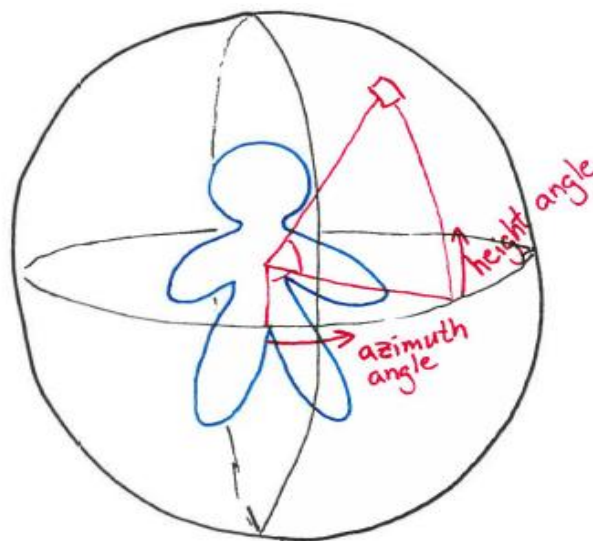# Projected Area Factor

Taylor
1956

Underwood
and Ward
1966

Fanger
1970

Rizzo et al
1992

7

How are they compared?
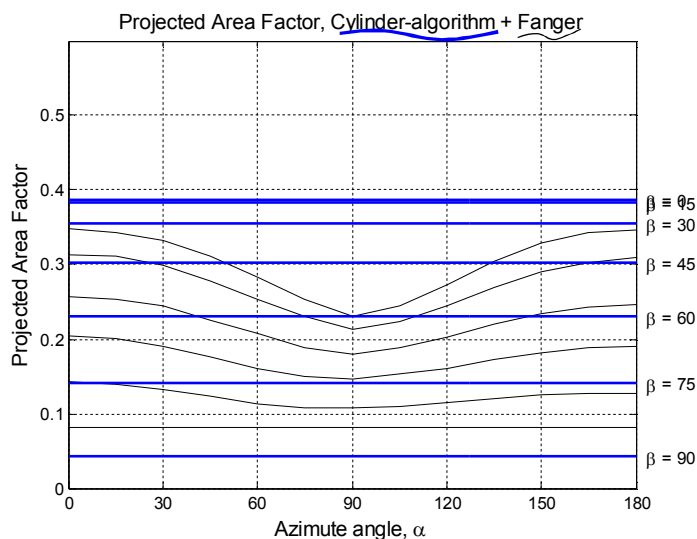
8

Cylinder

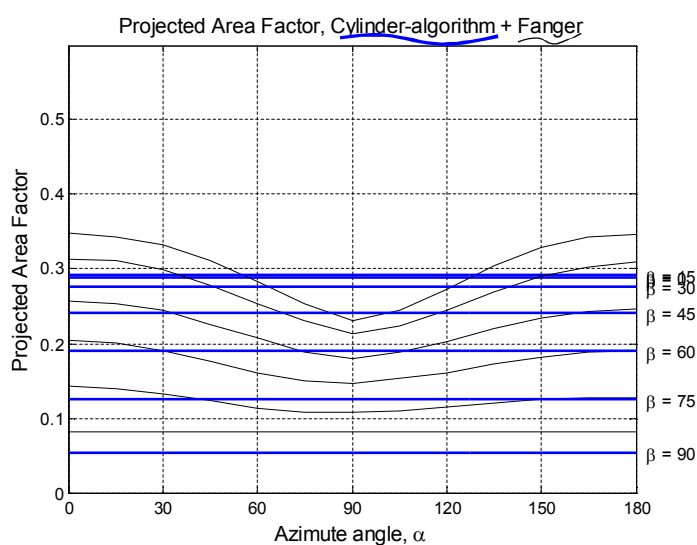Projected Area Factor, Cylinder-algorithm + Fanger

0,23 m

1,65 m

9

Cylinder, optimized to Fanger

Projected Area Factor, Cylinder-algorithm + Fanger

0,26 m

0,23 m

1,65 m 1,11 m
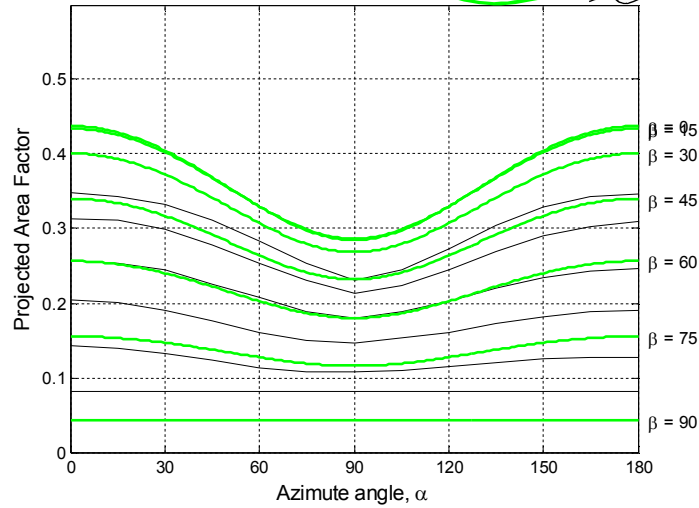
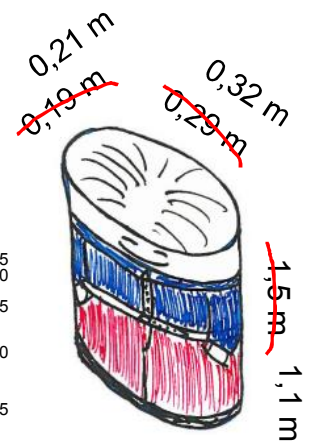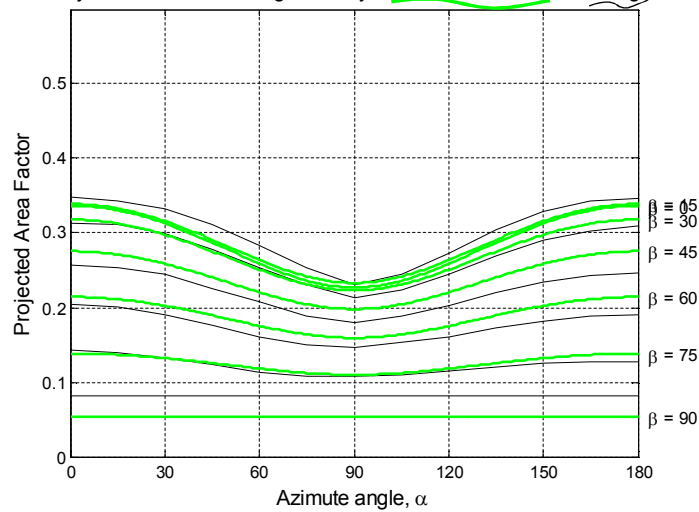10

Comparison of algorithms

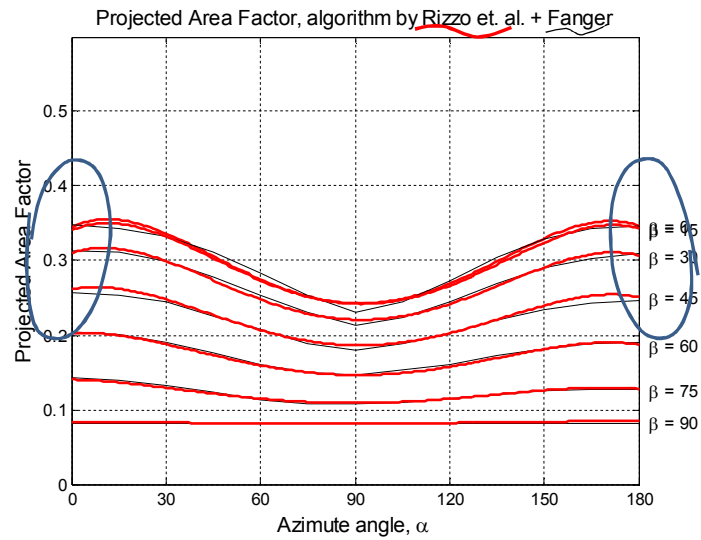Projected Area Factor, algorithm by Underwood and Ward + Fanger
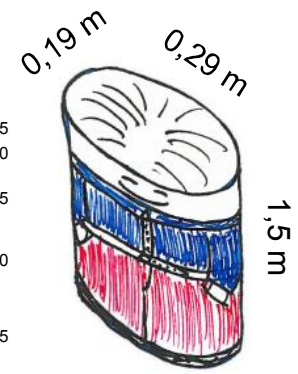
11

Oval cylinder, optimized to Fanger

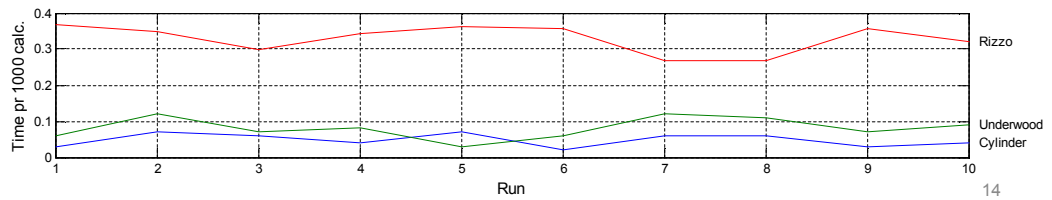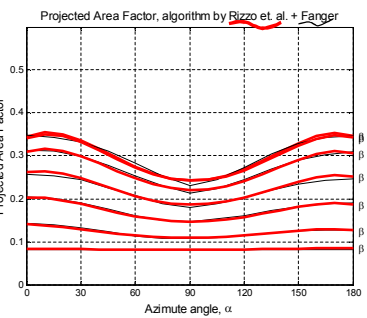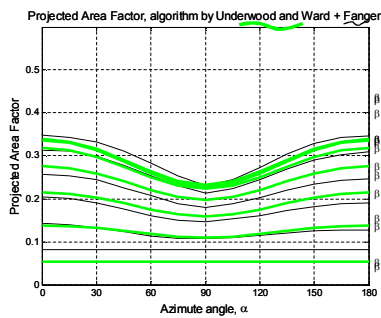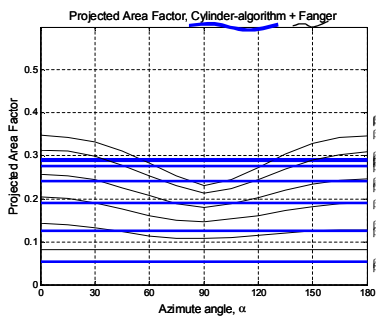Projected Area Factor, algorithm by Underwood and Ward + Fanger
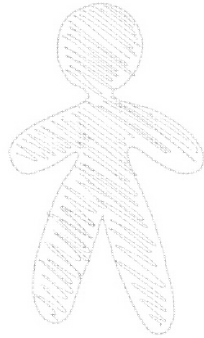

12
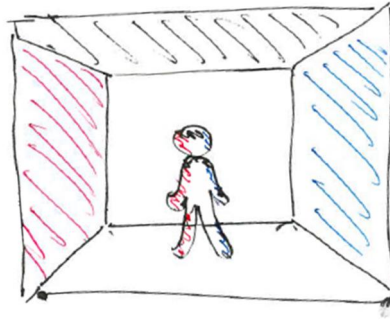
Comparison of algorithms

13

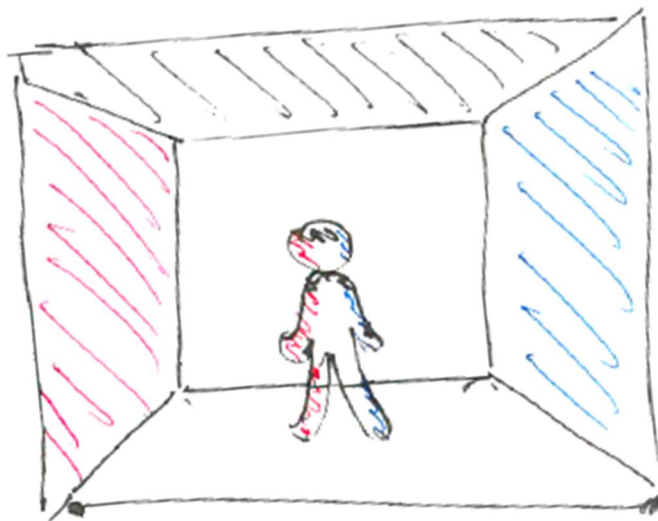# Comparison of algorithms

14

Overview
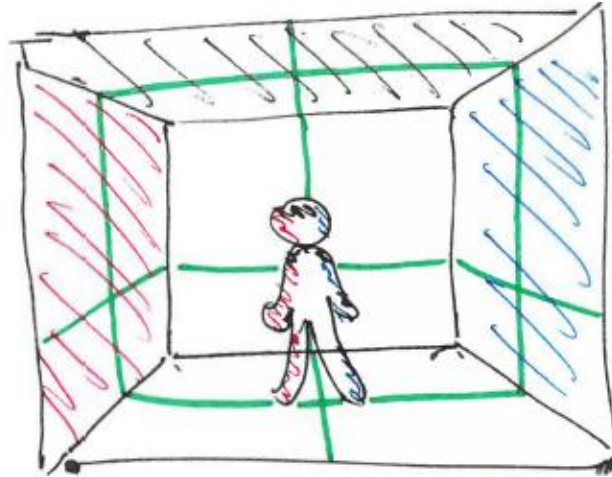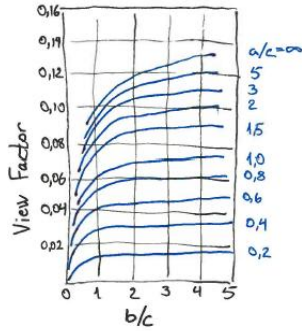

Projected area factor

View factor

15

View Factor

16

Comparison of View Factor

Fanger

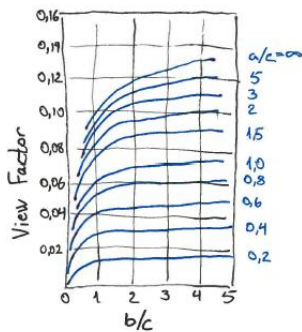$$f\left(\frac{a}{c}, \frac{b}{c}\right) = F_{sat,max}\left(1 - \exp(-\%_c/_L)\right)\ldots$$

Cannistraro

17

Comparison of View Factor

Fanger   Sphere   Rizzo

$$f\left(\frac{a}{c}, \frac{b}{c}\right) = F_{sat,max}\left(1 - \exp(-\%_c/_L)\right)\ldots$$
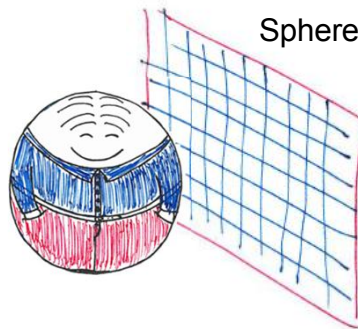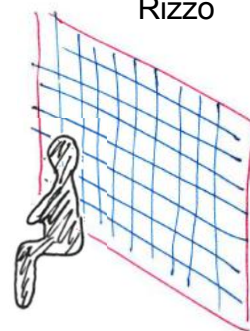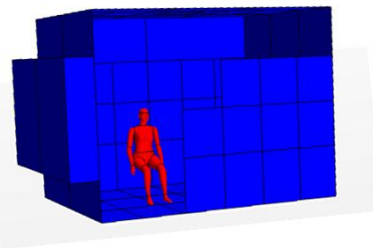
Ray
tracing

18

Comparison of View Factor

South

North

East
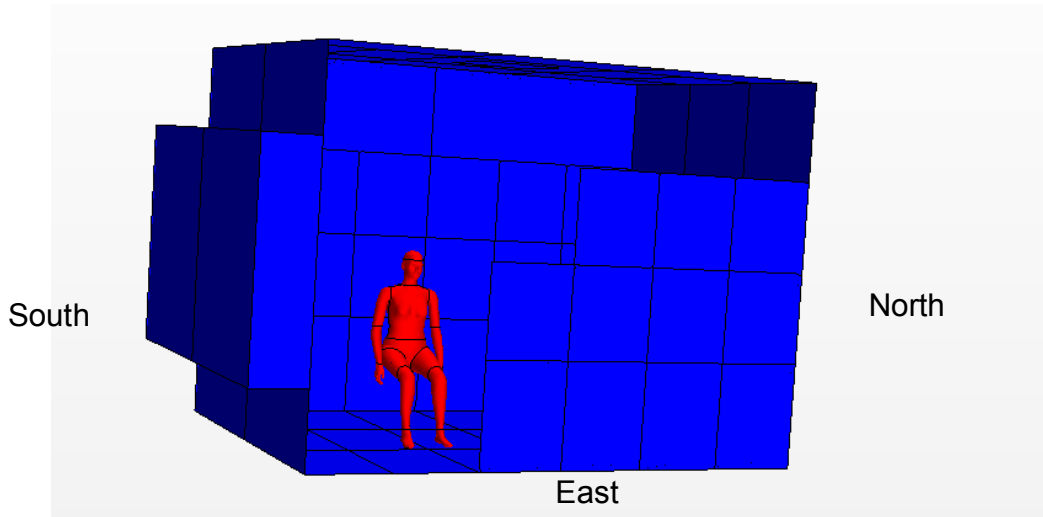
19

Comparison of View Factor

1	4	2	4	2
4	16	8	16	
2	8	4	8	
4	16	8	16	
1	4	2	4	

Ray
tracing

20

Calculated View Factors
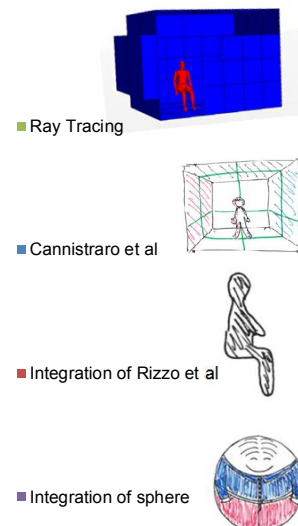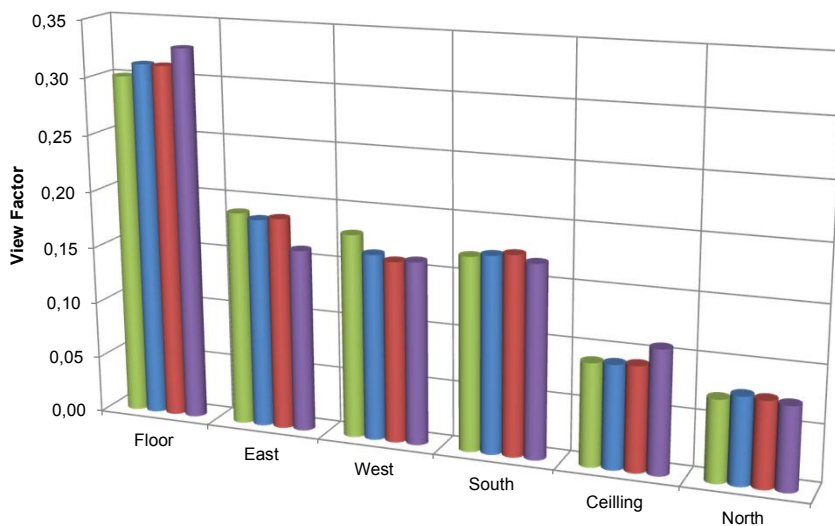
Effect on mean radiant temperature
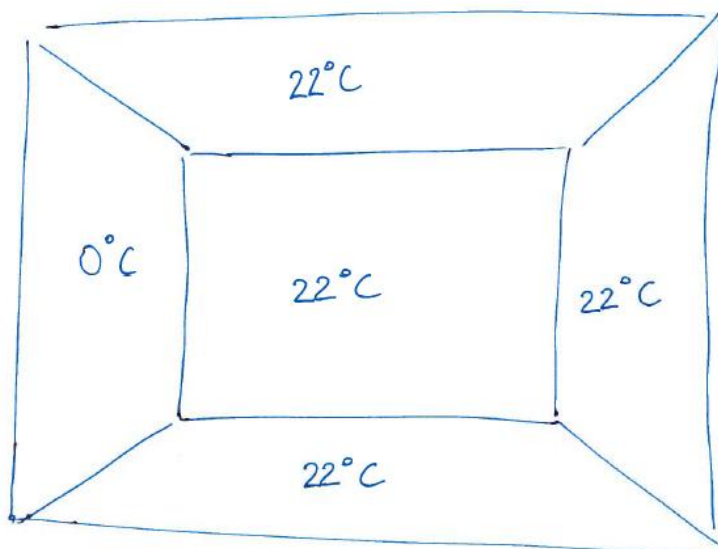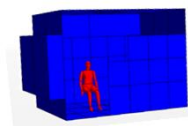

18,30°C

18,25°C

18,79°C

18,22°C

22°C

0°C

22°C

22°C

22°C
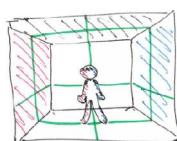
Summary

- Compared to Fanger's measurements, the best projected area factors are calculated with calculated with the most complex model

- The calculation time for projected area factor is very short

- The view factors calculated with a sphere, were different from the other

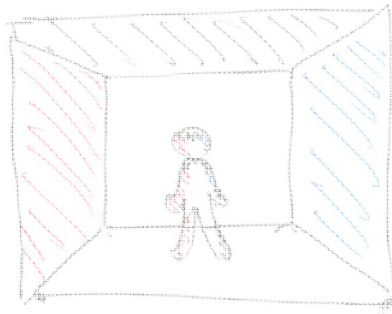- Which of the that is best is hard to tell

What is next?

- Contact Italiens to make a better algorithm for projected area factor

- View factor calculations for complex rooms

- Find out the postures influence of projected area factor and view factor
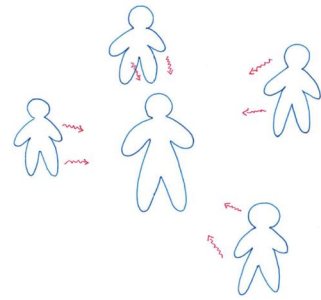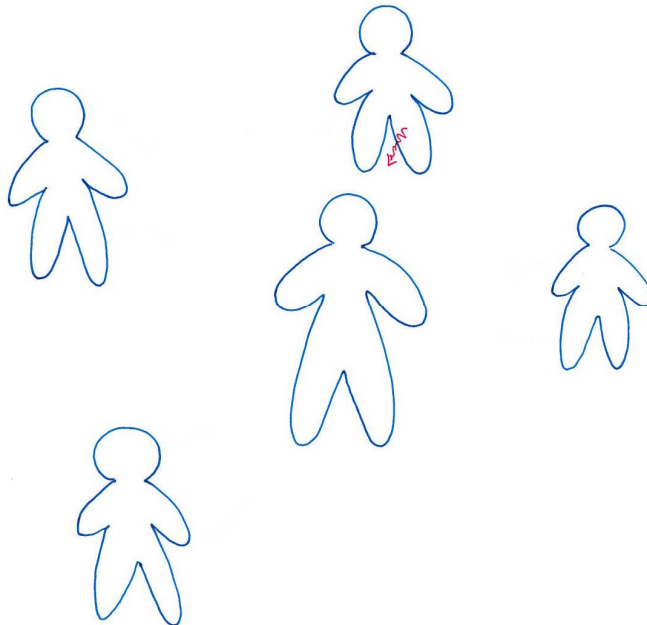
Overview
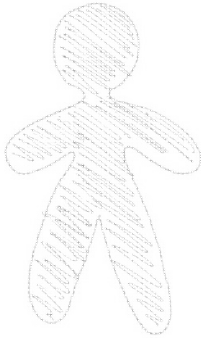
Projected area factor
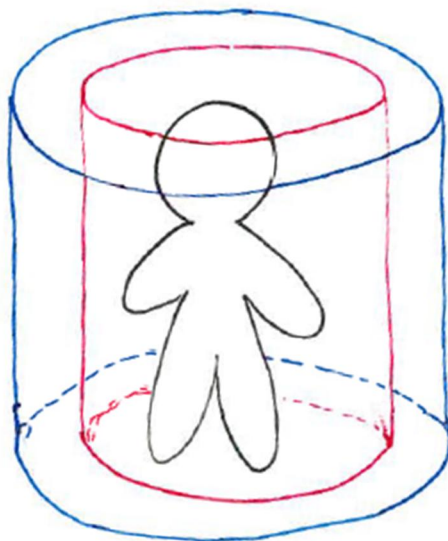
View factor

Radiation from other persons

25

Radiation from other persons

26

Radiation from other persons

27

14