Designing Atmospheres

Research and Design for Thermal Comfort in Dutch Urban Squares

Sandra Lenzhölzer

Thesis

Submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. dr. M.J. Kropff,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Friday 18th of June 2010
at 1.30 p.m. in the Aula.
# Table of contents

**Preface and acknowledgements** 8

1. **Introduction** 11
   1.1 Motivations for this research 12
   1.2 Overview: urban thermal comfort studies and identification of knowledge gaps 13
   1.2.1 Thermal comfort research originating from the building sciences 13
   1.2.2 Research in urban mesoclimate 15
   1.2.3 Urban microclimate research 15
   1.3 Research questions and research methods 17
   1.3.1 The research questions in general 17
   1.3.2 Specific research questions and research methods 18
   1.4 Brief overview of contents of chapters 20

2. **Phenomenology and related thought - inspirations for the project** 23
   2.1 Overview 24
   2.2 Brief sketch of major concepts in phenomenology 24
   2.3 Critique of ocularcentrism and attention for proximal senses 26
   2.4 Embodied experience and synaesthetic perception 27
   2.5 Relation of experience and reality 29

3. **A city is not a building - architectural concepts for public square design in Dutch urban climate contexts** 31
   Abstract 32
   3.1 Introduction 33
   3.2 A brief overview of developments in the design of Dutch public spaces since WW II 36
   3.3 The idea of a public square as a 'building' 39
   3.4 Urban squares as 'voids' 40
   3.5 Dutch squares as 'hard places' 44
   3.6 Cool, bright colours 45
   3.7 Refined urban furniture 46
   3.8 Specific conclusions and design recommendations 47
   3.9 General conclusions 51
4. **Engrained experience - a comparison of microclimate perception schemata and microclimate measurements in Dutch urban squares**

Abstract 54
4.1 Introduction 55
4.2 Methods 57
4.2.1 Study squares 57
4.2.2 Generation of cognitive microclimate maps 58
4.2.3 Measurements and simulations 60
4.2.4 Comparison method 62
4.3 Results and discussion 63
4.4 Conclusions 65

5. **Immersed in microclimatic space: Microclimate experience and perception of spatial configurations in Dutch squares**

Abstract 58
5.1 Introduction 69
5.2 The research 71
5.2.1. Generation of cognitive maps and analysis 73
5.2.2. Microclimate measurements 78
5.2.3. Relating spatial cues for microclimate to microclimate reality 79
5.3 Conclusions 86

6. **Thermal experience and perception of the built environment in Dutch urban squares**

Abstract 90
6.1 Introduction 91
6.2 Methods 94
6.2.1 The squares 94
6.2.2 The fieldwork 97
6.2.3 Data analysis 100
6.3 Results and discussion 101
6.4 Conclusions 108
6.5 Acknowledgements 110
# Table of Contents

7. *Research by design* in academic landscape architecture 111
   7.1 Overview 112
   7.2 What is 'Research by design'? 112
   7.3 'Research by design' in landscape architecture and urban design 117
   7.4 'Research by design' procedure in landscape architecture and urban design for new design guidelines 120

8. Designing for thermal comfort in Dutch urban squares 123
   8.1 Introduction and overview 124
   8.2 Method 124
   8.2.1 Relevant Dutch climate situations 125
   8.2.2 Scientific knowledge basis for microclimate comfort patterns 131
   8.2.3 Preliminary spatial patterns for microclimate comfort 133
   8.3 Testing alternatives on the case-squares 138
   8.3.1 General remarks 138
   8.3.2 Developing and testing alternative 1 139
   8.3.3 Developing and testing alternative 2 142
   8.3.4 Developing and testing alternative 3 147
   8.4 An optimized model from 'research by design' 151
   8.5 Alternative climate-responsive design 152

9. General conclusions 155
   9.1 'Research on design' 156
   9.2 'Research for design' 156
   9.3 'Research by design' 158
   9.4 Theoretical implications 159
   9.5 Future research 161

References 163

Summary 179

Samenvatting 186

Completed training and supervision plan 192

About the author 195