

Contents

Part I Layout Optimization & Evaluation

1 Architectural Functional Layout Optimization in a Coarse Grid	3
1.1 Introduction	3
1.1.1 Functional Layout: Definition	4
1.2 Coarse Grid Discretization	6
1.2.1 Tatami-Mat System	10
1.3 The Procedure.	11
1.3.1 Creativity and Knowledge	12
1.3.2 The Initial Input	13
1.3.3 Pre-processing of the Initial Input Data: Room Permutations	14
1.3.4 Potential Solutions: Generation of Room Configurations as a Constraints Satisfaction Problem (CSP)	15
1.3.5 Depth-First Search by Backtracking.	16
1.3.6 Classification of Potential Solutions According to the Internal Communication Criterion	20
1.3.7 Classification of Rooms Configurations with Feed-Forward Neural Network.	21
1.4 Sorting of “Proper” Configurations According to Additional Criteria	24
1.4.1 Final Ranking of the Functional Layouts According to Multiple Criteria	26
1.5 A Realistic Case Study.	29
1.6 Estimation of the Dimensions of Search Domain	30
1.7 Conclusions	32
References	33

2	Evaluation of the Quality of an Urban Square	35
2.1	Introduction	35
2.2	Nineteen Plazas Subjected to Human Subjective Evaluation (HSE)	38
2.3	Automated Geometrical Evaluation (AGE) of an Urban Square	38
2.3.1	Smallness	41
2.3.2	Enclosure	43
2.3.3	Regularity	43
2.4	Correlation Between Automated and Human Evaluation of Plazas	44
2.4.1	AGE and HSE Correlation	46
2.5	Conclusions	49
	References	50

Part II Crowd Simulation

3	Crowd-Z	53
3.1	Traditional Grid and Guideline Systems	53
3.1.1	Architecture	53
3.1.2	Urban Design	57
3.2	Crowd Simulation	59
3.3	The Crowd Dynamics Model in Crowd-Z	61
3.3.1	Neighborhood and Metric	62
3.3.2	Distance Potential Field	62
3.3.3	Perkiness	64
3.4	Illustrative Examples	64
3.4.1	Direct User's Input	65
3.4.2	Evacuation from Saint Peter's Basilica	66
3.4.3	Import from CAD	69
3.5	Validating CZ with Three Crowd Simulations	71
3.5.1	Empirical Validation: Bottleneck Evacuation	71
3.5.2	Case Study with PedGo	73
3.5.3	Bottleneck Evacuation Study from the Literature	75
3.6	Conclusions	77
	References	78
4	The Influence of Various Factors on Crowd Behavior	81
4.1	Introduction	81
4.2	Experiment 1: The Influence of Metric and Agent <i>Perkiness</i> on the Crowd Behavior	82
4.3	Three Regular Tessellations	84
4.3.1	CS Setups	85
4.3.2	DFs in Square, Triangular and Hexagonal Grid	85

4.4	Experiment 2: Square Room Evacuation (SRE)	86
4.4.1	Qualitative Analysis: Heat Maps for SRE.	86
4.4.2	Quantitative Analysis: Evacuation Time for SRE.	88
4.5	Experiment 3: One-Directional Flow (ODF)	90
4.5.1	Qualitative Analysis: Heat Maps for ODF	91
4.5.2	Quantitative Analysis: Density-Flow Rate Diagrams for ODF	92
4.6	Conclusions	94
	References	95
5	Application of Crowd Simulation for a Layout Improvement.	97
5.1	Introduction	97
5.2	Pre-processing of the CS Environment	98
5.3	Setting up the Experiment	99
5.4	Designing a Cellular Automaton	100
5.5	Iterative Experiment.	101
5.6	The Suggestion of the Floor-Plan Alteration	103
	References	104
	Glossary	105

<http://www.springer.com/978-981-10-1105-4>

Discrete Optimization in Architecture

Architectural & Urban Layout

Zawidzki, M.

2016, XIV, 105 p. 96 illus., 82 illus. in color., Softcover

ISBN: 978-981-10-1105-4