

CONTENTS

ACKNOWLEDGEMENTS	V
ABSTRACT	VII
CONTENTS	IX
CHAPTER 1: INTRODUCTION	1
1.1 SELF-MOTION PERCEPTION IN EVERYDAY LIFE	1
1.2 HUMAN RESOURCES FOR SELF-MOTION PERCEPTION	6
1.2.1 THE VISUAL SYSTEM	7
1.2.2 THE VESTIBULAR SYSTEM	8
1.2.3 THE SOMATOSENSORY SYSTEM.....	11
1.2.4 COGNITIVE CONTRIBUTIONS	12
1.3 THE CYBERNETICS APPROACH TO SELF-MOTION PERCEPTION	13
1.3.1 PERCEPTUAL THRESHOLDS: QUANTITATIVE MEASURES OF SELF-MOTION PERCEPTION.....	13
1.3.2 EXPERIMENTALLY MEASURING PERCEPTUAL THRESHOLDS	14
1.4 THESIS OVERVIEW	18
1.4.1 AIMS.....	18
1.4.2 PART 1: SUPRA-THRESHOLD SELF-MOTION SENSITIVITY	19
1.4.3 PART 2: PERCEPTION BASED MOTION SIMULATION.....	29
1.5 DISCUSSION AND FUTURE WORK.....	35
1.6 DECLARATION OF CONTRIBUTION	47

CHAPTER 2: THE IMPORTANCE OF STIMULUS NOISE ANALYSIS FOR SELF-MOTION STUDIES 51

2.1 ABSTRACT 51

2.2 INTRODUCTION..... 52

2.3 METHODS..... 56

Amplitude-frequency spectrum analysis 60

Root mean square analysis..... 61

Signal-to-noise ratio analysis..... 63

Deterministic and stochastic noise analysis 63

Instrumentation and environmental noise..... 64

2.4 RESULTS 64

2.5 DISCUSSION 69

2.6 CONCLUSION..... 73

CHAPTER 3: HUMAN SENSITIVITY TO VERTICAL SELF-MOTION 75

3.1 ABSTRACT 75

3.2 INTRODUCTION..... 76

3.3 METHODS..... 79

Participants 79

Setup 79

Procedure 80

Data analysis..... 88

3.4 RESULTS 90

3.5 DISCUSSION 93

Upward and downward sensitivity 94

Vertical self-motion sensitivity..... 96

CHAPTER 4: SELF-MOTION SENSITIVITY TO VISUAL YAW ROTATIONS IN HUMANS103

4.1 ABSTRACT..... 103

4.2 INTRODUCTION 104

4.3 METHODS..... 107

Participants 107

Setup107

Stimulus Generation 108

Procedure 111

Data analysis 113

4.4 RESULTS 116

4.5 DISCUSSION..... 119

CHAPTER 5: HUMAN DISCRIMINATION OF HEAD-CENTRED VISUAL-INERTIAL YAW ROTATIONS127

4.6 ABSTRACT..... 127

4.7 INTRODUCTION 128

Supra-threshold motion discrimination..... 129

Multisensory integration 130

Current study..... 132

4.8 METHODS..... 133

Participants 133

Setup 133

Stimuli 135

Procedure 139

Visual sensitivity 140

<i>Data analysis</i>	143
<i>Stimulus noise analysis</i>	144
4.9 RESULTS	145
4.10 DISCUSSION	150
<i>Discrimination of yaw rotations</i>	150
<i>Multisensory integration</i>	151
<i>Nonlinear self-motion perception models</i>	154
<i>Validity of study comparison</i>	155

CHAPTER 6: VARIABLE ROLL-RATE PERCEPTION IN DRIVING SIMULATION
..... **159**

4.11 ABSTRACT	159
4.12 INTRODUCTION.....	160
4.13 METHODS.....	162
<i>Setup</i>	162
<i>Experimental manipulations</i>	162
<i>Procedure</i>	164
4.14 RESULTS	167
<i>Perceptual thresholds</i>	170
<i>Behavioural measures</i>	170
<i>Subjective ratings</i>	172
4.15 DISCUSSION	177
4.16 CONCLUSION.....	179

BIBLIOGRAPHY **181**

Cover Picture: Max Planck Institute for Biological Cybernetics