

Contents

1. Introduction	9
The Delft Virtual Window System (DVWS)	10
Applying the DVWS to baggage inspection.....	10
Previous work	11
2. Information and task performance	17
The direct and indirect perception theory	17
The direct theory.....	18
The indirect theory	20
Comparison of the theories	23
Theoretical usefulness of multiple and particular views.....	24
Requirements for relevant tasks	25
Cues via a monitor	30
Conclusions	34
3. Shooting multiple x-ray images efficiently	37
X-Ray components	37
Generating and sensing x-rays	37
X-ray mirrors	38
X-ray scanners- state of the art	39
Scanners with a fluorescent screen	41
Scanners with a sensor line	42
Computer Tomography scanners	44
Conclusion	44
What images are useful?	45
What views and what quality?	45
Perspective properties- static camera	46
Perspective properties- moving camera.....	48
Perceptual consequences of the perspective combinations.....	50
Discussion and conclusions	53
Mechanisms	54
Outline of possibilities	54
Acquiring multiple views with a conventional scanner	55
Criteria for selecting a concept	56
Chosen concepts	57
Optimised concepts.....	58
Conclusions	60
4. Detecting sharp objects	61
Experiment 1- inspection via a monitor	63
Experiment 2- natural inspection	68
Experiment 3- only high resolution	71
Discussion and conclusions	73

5. Detecting connected objects	75
Experiment 1- view selection with eye position	76
Experiment 2- knob movement	87
Experiment 3-constant camera range	89
General discussion and conclusions	92
6. Following a wire through a knot	95
Experiment 1- reducing the degrees of freedom.....	97
Experiment 2- restricting the number of views.....	102
Summary of the results of Experiment 1 and 2.....	104
Detailed discussion and conclusions	105
7. Bump height matching	107
Coupling methods	109
Previous work	110
Geometric inequivalence	111
Human insensitivity to geometric inequivalence	112
Cues to the flatness of the image	114
Cues from parallax shifts.....	115
Other factors possibly causing distortion	116
Coupling method.....	117
Pilot experiments	118
Experiment	119
Discussion	126
Conclusions	128
8. 'Real' baggage inspection	131
Experiment	133
Discussion and conclusions	138
9. Implications of the findings	141
X-ray baggage inspection	141
Virtual window displays	143
Image quality	143
Cues to the flatness of the display.....	143
Coupling method.....	144
Delay effect	147
Industrial Design Engineering.....	149
Distortions due to coupling method.....	149
Intuitiveness of the user interface	150
Distortions due to geometric inequivalence	151
Task in hand	152
Perceptual theories	153
A. Stereo test	155
Bibliography	157

Summary	167
Samenvatting	171
Acknowledgements	174
Illustration Acknowledgements	175
Curriculum Vitae	176
Index	177

