

ISO 9241-910:2011-07 (E)

Ergonomics of human-system interaction - Part 910: Framework for tactile and haptic interaction

Contents	Page
Foreword	v
Introduction	vii
1 Scope	1
2 Terms and definitions	1
3 Introduction to haptics	4
4 Human haptic exploration	5
4.1 Importance of the haptic sense	5
4.2 Haptics and vision	5
4.3 Manual exploration of objects	6
4.4 Training in exploratory procedures	6
4.5 The problem of getting an overview of a scene with haptics	7
4.6 Minimum physical stimulation: absolute thresholds	7
4.7 Minimum differences needed for perception	7
4.8 Perception of geometric properties of objects	7
4.9 Perception of weight	7
4.10 Perception of material properties	8
4.11 Number and size of contact surfaces in tactile/haptic devices	8
4.12 Summary	8
5 When to use tactile/haptic interactions	9
5.1 General	9
5.2 Accessibility	9
5.3 Desktop interactions	10
5.4 Mobile interactions	10
5.5 Robotics	10
5.6 Medical	11
5.7 Gaming	11
5.8 Art and creativity	12
5.9 Multimodal applications and simulators	12
6 Designing tactile/haptic interactions	13
6.1 Design guidelines for tactile/haptic interaction	13
6.2 Designing tactile/haptic space	14
6.3 Addressability and resolution in tactile/haptic interaction	15
7 User-initiated interactive task primitives	17
7.1 General	17
7.2 Searching	17
7.3 Overviewing	17
7.4 Navigating	18
7.5 Targeting	18
7.6 Selection	18
7.7 Manipulation	19
8 Tactile/haptic interaction elements	20
8.1 General	20

8.2	Tactile/haptic functional effects	20
8.3	Tactile/haptic properties of objects	21
8.4	Control elements	23
8.5	Using multi-point-contact interfaces	23
8.6	Combining elements and effects	24
8.7	Distinguishability	24
9	The range of tactile/haptic interface devices	24
9.1	General	24
9.2	Selection criteria	24
	Annex A (informative) Tactile devices	35
	Annex B (informative) Tactile/haptic devices that provide force feedback	39
	Annex C (informative) Physiology of haptics	44
	Bibliography	50