

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