

# DIN EN ISO 9241-920:2016-09 (E)

## Ergonomics of human-system interaction - Part 920: Guidance on tactile and haptic interactions (ISO 9241-920:2009)

---

Contents	Page
European foreword .....	5
Foreword .....	6
Introduction .....	8
1 Scope .....	9
2 Applying ISO 9241-920 .....	9
2.1 Recommendations .....	9
2.2 Evaluation of products .....	9
3 Tactile/haptic inputs, outputs, and/or combinations .....	10
3.1 General guidance on tactile/haptic inputs, outputs and/or combinations .....	10
3.1.1 Optimizing performance .....	10
3.1.2 Providing accessible information on tactile/haptic elements .....	10
3.1.3 Providing contextual information .....	10
3.1.4 Using consistent labels .....	10
3.1.5 Identifying system state .....	11
3.1.6 Minimizing fatigue .....	11
3.1.7 Providing alternative input methods .....	11
3.1.8 Maintaining coherence between modalities .....	11
3.1.9 Combining modalities .....	12
3.1.10 Presenting realistic experiences .....	12
3.1.11 Isolation of individual interface elements .....	12
3.2 Intentional individualization .....	13
3.2.1 Enabling users to change modalities .....	13
3.2.2 Enabling force feedback override .....	13
3.2.3 Enabling users to individualise tactile parameters .....	13
3.3 Unintentional user perceptions .....	13
3.3.1 Limiting acoustic output of tactile/haptic display .....	13
3.3.2 Limiting heat gain of contact surface .....	13
3.3.3 Avoiding sensory adaptation .....	14
3.3.4 Recovering from sensory adaptation .....	14
3.3.5 Avoiding unintended perceptual illusions .....	14
3.3.6 Preventing temporal masking .....	14
4 Attributes of tactile and haptic encoding of information .....	14
4.1 High level guidance on tactile/haptic encoding of information .....	14
4.1.1 Using familiar tactile/haptic patterns .....	14
4.1.2 Making tactile/haptic encoding obvious .....	14
4.1.3 Conformity to user expectations .....	15
4.1.4 Using sensory substitution .....	15
4.1.5 Using appropriate spatial addressability and resolution .....	15
4.1.6 Using tactile apparent location .....	15
4.1.7 Using distal body parts for high spatial resolution .....	15
4.1.8 Using higher addressability for trained users .....	15
4.1.9 Using tactile apparent motion .....	15
4.1.10 Preventing spatial masking .....	16
4.2 Guidance on specific tactile/haptic attributes for encoding information .....	16
4.2.1 Selecting dimensions for encoding information .....	16

4.2.2	Discriminating between attribute values .....	17
4.2.3	Limiting the number of attribute values .....	17
4.2.4	Combining properties .....	17
4.2.5	Limits complexity .....	17
4.2.6	Encoding by object shape .....	17
4.2.7	Encoding information by temporal pattern .....	17
4.2.8	Encoding information using vibration amplitude .....	17
4.2.9	Encoding information by vibration frequency .....	18
4.2.10	Encoding by location .....	18
4.2.11	Encoding by temperature .....	18
4.2.12	Encoding by thermal conductivity .....	18
4.2.13	Identifying information values .....	18
<b>5</b>	<b>Content-specific encoding .....</b>	<b>19</b>
5.1	Encoding and text data .....	19
5.2	Encoding and using graphical data .....	19
5.2.1	Displaying tactile/haptic graphics .....	19
5.2.2	Using grids on tactile graphs .....	19
5.2.3	Using landmarks in tactile maps .....	19
5.2.4	Providing scales for tactile maps .....	19
5.3	Encoding and using controls .....	20
5.3.1	Using tactile/haptic controls .....	20
5.3.2	Using size and spacing of controls to avoid accidental activation .....	20
5.3.3	Avoiding difficult control actions .....	20
5.3.4	Using force to avoid accidental activation .....	20
5.3.5	Interacting with controls .....	20
<b>6</b>	<b>Design of tactile/haptic objects and space .....</b>	<b>21</b>
6.1	Tactile/haptic display spaces .....	21
6.1.1	Ease of perceiving multiple tactile/haptic objects .....	21
6.1.2	Ease of identifying adjacent tactile/haptic objects .....	21
6.1.3	Maintaining separation between surfaces of objects .....	21
6.1.4	Separating tactile/haptic elements .....	22
6.1.5	Avoiding empty spaces .....	22
6.1.6	Avoiding volume limits .....	22
6.1.7	Avoiding falling out of the tactile/haptic space .....	22
6.2	Objects .....	22
6.2.1	Using appropriate object size .....	22
6.2.2	Creating discriminable tactile/haptic symbols .....	22
6.2.3	Creating tactile/haptic symbols from visual symbols .....	23
6.2.4	Tactile/haptic object angles .....	23
6.2.5	Tactile/haptic object corners .....	23
<b>7</b>	<b>Interaction .....</b>	<b>23</b>
7.1	Navigating tactile/haptic space .....	23
7.1.1	Providing navigation information .....	23
7.1.2	Supporting path planning .....	23
7.1.3	Providing well-designed paths .....	23
7.1.4	Making landmarks easy to identify and recognise .....	23
7.1.5	Providing appropriate navigation techniques .....	23
7.1.6	Providing navigational aids .....	24
7.1.7	Understanding the tactile/haptic space .....	24
7.1.8	Supporting exploratory strategies (procedures) .....	24
7.2	Reconfiguration .....	24
7.2.1	Reconfiguring the tactile/haptic space .....	24
7.3	Interaction techniques .....	25
7.3.1	Implementing interaction techniques .....	25
7.3.2	Avoiding unintended oscillation .....	25
<b>Annex A (informative) Overview of the ISO 9241 series</b>	<b>26</b>	
<b>Bibliography .....</b>	<b>30</b>	