

# ISO/TR 9241-393:2020-03 (E)

## Ergonomics of human-system interaction - Part 393: Structured literature review of visually induced motion sickness during watching electronic images

---

<b>Contents</b>		<b>Page</b>
Foreword .....		v
Introduction .....		vi
1	Scope .....	1
2	Normative references .....	1
3	Terms and definitions .....	1
4	Theories of visually induced motion sickness .....	2
5	Measurement of visually induced motion sickness .....	3
6	Effective factors of visually induced motion sickness .....	8
6.1	General .....	8
6.2	Effective factors: Visual image factors .....	8
6.2.1	General .....	8
6.2.2	Role of visual motion .....	9
6.2.3	Real and virtual motion .....	10
6.2.4	Constant rotation of global image motion .....	11
6.2.5	Change of velocity of global image motion .....	14
6.2.6	Cyclic rotation of global image motion .....	16
6.2.7	Cyclic translation of global image motion .....	17
6.2.8	Velocity effects of forward motion with complicated motion .....	18
6.2.9	Off-axis rotation of visual yaw rotation .....	20
6.2.10	Combination of different axes of visual motion .....	22
6.2.11	Anisotropy effects of back and forth translation .....	25
6.2.12	Spatial frequency of visual image .....	26
6.2.13	Spatial pattern of visual image .....	27
6.2.14	Independent visual background from visual motion .....	28
6.2.15	Chromaticity of visual image .....	29
6.2.16	Blur of visual image .....	30
6.2.17	Cognitive orientation cues of visual image .....	31
6.2.18	Stereoscopic image .....	32
6.2.19	Prediction signs for motion .....	38
6.3	Effective factors: Visual environmental factors .....	41
6.3.1	General .....	41
6.3.2	Image size in visual field .....	42
6.3.3	Perspective difference between capturing and rendering images .....	45
6.3.4	Time delay in HMD .....	46
6.3.5	Duration and repeated exposure to visual stimulus .....	48
6.3.6	Changes in illumination colour .....	49
6.3.7	Auditory stimulation .....	51
6.3.8	Odour simulation .....	52
6.4	Effective factors: Individual viewer factors .....	53
6.4.1	General .....	53
6.4.2	Gender .....	54
6.4.3	Gender - Menstrual cycle - .....	57
6.4.4	Age .....	58
6.4.5	Active/Passive viewing .....	59

<b>6.4.6</b>	<b>Fixation .....</b>	<b>60</b>
<b>7</b>	<b>Susceptibility probability of motion sickness .....</b>	<b>62</b>
<b>8</b>	<b>Scaling of VIMS severity .....</b>	<b>63</b>
<b>9</b>	<b>Summary .....</b>	<b>65</b>
	<b>Annex A (informative) Overview of the ISO 9241 series .....</b>	<b>66</b>
	<b>Annex B (informative) Scaling symptoms severity induced by visual motion .....</b>	<b>67</b>
	<b>Annex C (informative) Effective factors from the viewpoint of image production .....</b>	<b>69</b>
	<b>Bibliography .....</b>	<b>78</b>