

Appendix A. Mulsemmedia Rendering Devices

Table 1 contains a list of rendering devices, categorized by function and type and sorted in release year. Note that the following list of devices is by no means exhaustive to provide various rendering function.

Table 1. List of Mulsemmedia Rendering devices.

Product	Year	Sensation Type	Notation
Glove			
GloveOne ⁶	2014	Vibrotactile feedback	
Mood Glove ¹	2016	Vibrotactile feedback	
Senso Glove ²	2016	Haptic display	Include vibration and temperature fluctuation
Manus VR ⁵	2016	Vibrotactile feedback	
Avatar VR ⁷	2017	Vibrotactile feedback	
Hi5 VR Glove ³	2018	Vibrotactile feedback	
Plexus ⁴	2018	Vibrotactile feedback	
Cyteract ⁹	2018	Force feedback	
Hands Omni ⁸	Under development	Force feedback	
Exoskeleton			
Dexmo ¹⁰	2016	Force feedback	
HGlove ¹¹	2017	Force feedback	
HaptX ¹²	2017	Haptic display	Include realistic touch and force feedback
VRgluv ¹³	2017	Force feedback	
SenseGlove ¹⁴	2018	Force feedback	
CyberGlove ¹⁵	2009	Force feedback	
Thimble			
VRTouch ¹⁶	2017	Force feedback	
Tactai Touch ¹⁷	2017	Force feedback	
Chair			
Emoti-chair ¹⁹	2009	Haptic display	
MMOne VR Chair ²¹	2015	Haptic display	
Telepod ²²	2016	Vibrotactile	
Roto VR Chair ¹⁸	2017	Haptic display	Provide sense of weightlessness
Voyage ²⁰	2017	Haptic display	Provide sense of weightlessness
Yaw VR Motion Simulator ²³	2018	Haptic display	Include locomotion and vibrotactile
Feel Three ²⁴	Under development	Haptic display	Include locomotion and vibrotactile
Vest			
Interactor Vest ²⁶	1994	Vibrotactile feedback	
3RD Space Vest ²⁷	2007	Vibrotactile feedback	
Tactile Gaming Vest ²⁸	2010	Vibrotactile feedback	
ARAIG ²⁹	2013	Vibrotactile feedback	
KOR-FX ³⁰	2014	Vibrotactile feedback	
HAPTIKA ³²	2016	Vibrotactile feedback	
Rapture Vest ³³	2016	Vibrotactile feedback	
Synesthesia Suit ²⁵	2016	Vibrotactile feedback	Functioned as interactive skin
Teslasuit DK1 ³¹	2017	Vibrotactile feedback	
NullSpace VR ³⁴	2017	Vibrotactile feedback	
bHaptics TactSuit ³⁵	2017	Vibrotactile feedback	

Product	Year	Sensation Type	Notation
Woojer ryg ³⁶	2017	Vibrotactile feedback	
NeoSensory Exoskin ³⁷	2018	Vibrotactile feedback	
Fan			
VirWind ³⁹	2015	Non-contact haptic display	Implemented through air blowing
ZephVR ³⁸	2017	Non-contact haptic display	Implemented through air blowing
The Ambiotherm ⁴¹	2017	Non-contact haptic display	Implemented through air blowing and temperature change
VortX ⁴⁰	2018	Non-contact haptic display	Implemented through air blowing blow
Wind-Blaster ⁴²	2018	Non-contact haptic display	Implemented through air blowing
Other Haptic Device			
Novint Falcon ⁴³	2007	Force feedback	
Aireal ⁴⁴	2013	Non-contact haptic display	Implemented through airflow
AirWave ⁴⁵	2013	Non-contact haptic display	Implemented through airflow
Olfactory Devices			
Smell-O-Vision ⁴⁸	1959	Olfactory display	
AromaRama ⁴⁸	1959	Olfactory display	
iSmell ⁴⁸	1999	Olfactory display	
Pinoke ⁴⁸	2000	Olfactory display	
Scent Dome ⁴⁸	2003	Olfactory display	
Kaori Web ⁴⁸	2004	Olfactory display	
Aroma Generator ⁴⁸	2005	Olfactory display	
Aroma Shooter ⁴⁶	2012	Olfactory display	
Smelling Screen ⁴⁷	2013	Olfactory display	
Olorama ⁵⁰	2013	Olfactory display	
Scentasia ⁵¹	2013	Olfactory display	
Aroma Shooter Mini ⁵²	2016	Olfactory display	
Nosulus Rift ⁵³	2016	Olfactory display	
Scentcom ⁴⁹	2017	Olfactory display	
OhRoma ⁵⁴	2017	Olfactory display	
Gustatory Device			
Meta Cookie ⁵⁶	2010	Gustatory display	
Digital Lollipop ⁵⁸	2013	Gustatory display	
Planet Licker ⁵⁵	2016	Gustatory display	
Vocktail ⁵⁷	2017	Gustatory display	
Virtual Lemonade ⁵⁹	2017	Gustatory display	
TastyFloats ⁶⁰	2017	Gustatory display	
Thermal Taste Machine ⁶¹	2018	Gustatory display	
Multisensory Device			
Feelreal Sensory Mask ⁶³	2015	Contact haptic display Non-contact haptic display Olfactory display	Contact haptic display include: water mist, vibrotactile feedback, Non-contact haptic display includes: wind display, thermal display
Virtual Cocoon ⁶²	Under Development	Haptic display, Olfactory display, Gustatory display	

1. <https://knowridge.com/2016/09/mood-glove-a-haptic-wearable-gadget-to-enhance-mood-music-in-film/>
2. <https://www.theverge.com/2016/12/27/14089120/senso-vr-minority-report-hand-tracking-gloves>
3. <https://hi5vrglove.com/>
4. <https://www.vrfocus.com/2018/07/plexus-unveil-affordable-option-for-vr-haptics/>
5. <https://www.wareable.com/vr/manus-vr-gloves-gdc>

6. <https://www.kickstarter.com/projects/gloveone/gloveone-feel-virtual-reality>
7. <http://twittertechnews.com/virtualreality/avatar-vr-provide-a-realistic-sense-of-touch-thanks-to-the-use-of-haptic-technology/>
8. <http://virtualrealityaccess.com/post/hands-omni-vr-gloves>
9. <https://www.startupvalley.news/uk/cynteract-glove-for-rehabilitation-exercises/>
10. <https://www.engadget.com/2016/08/24/dexmo-exoskeleton-glove-force-feedback/>
11. <https://cornershop.immersion.fr/produit/interaction/haptique/haption-hglove/>
12. <https://haptx.com/>
13. <https://www.kickstarter.com/projects/vrgluv/vrgluv-touch-hold-and-interact-in-the-virtual-world>
14. <https://www.vrfocus.com/2018/03/senseglove-showcase-haptic-and-force-feedback/>
15. <http://www.cyberglovesystems.com>
16. <https://www.roadtovr.com/go-touch-vr-haptic-feedback-vr-touch-hands-on-svvr-2017/>
17. <https://uploadvr.com/tactai-touch-ericsson/>
18. <https://www.tomshardware.com/news/roto-vr-delayed-safety-concerns,36776.html>
19. <https://www.cmuse.org/concerts-for-the-deaf-introducing-the-emoti-chair/>
20. <https://www.vrfocus.com/2018/05/positrons-voyager-vr-chair-coming-to-europe-via-mk2-distribution-deal/>
21. <https://www.vrfocus.com/2015/08/ubisoft-invest-in-mmone-full-motion-vr-project/>
22. <https://www.theverge.com/2016/11/3/13513582/the-eje-telepod-vr-egg-will-hide-me-from-the-world>
23. <https://www.vrfocus.com/2018/02/yaw-vr-might-be-the-motion-simulator-youre-looking-for-at-home-and-in-vr-arcades/>
24. <https://www.kickstarter.com/projects/feelthree/feel-three-virtual-reality-motion-simulator>
25. <http://rezinfinite.com/tokyo-game-show-2016-sept-2016-makuhari-chiba-japan/>
26. https://www.avsim.com/pages/0604/aura/aura_interactor.htm
27. <https://www.extremetech.com/gaming/77332-gaming-is-everywhere-gdc-2007/3>
28. <https://iroboticist.com/2010/03/26/tgv/>
29. <https://iftech-technologies.com/articles/games-araig-sensory-feedback-suit-video-games-can-feel-every-painful-bullet/>
30. <http://www.korfx.com/>
31. https://www.reddit.com/r/oculus/comments/5vpz79/teslasuit_the_worlds_first_full_body_haptic_suit/
32. <https://pakwired.com/haptika-virtual-reality/>
33. <https://uploadvr.com/void-rapture-ted/>
34. <https://www.vrfocus.com/2017/01/nullspace-vr-launching-kickstarter-campaign-for-haptic-feedback-suit-hardlight/>
35. <https://uploadvr.com/gamescom-2017-vr-everything-need-know/>
36. <https://www.vrfocus.com/2018/10/woojer-ryg-haptic-vest-storms-past-kickstarter-target/>
37. <https://www.roadtovr.com/high-fidelity-neosensory-partner-launch-exoskin-haptic-jacket-coming-july-2018/>
38. <http://ausimtech.com.au/2017/11/14/zephvr-real-wind-for-virtual-reality/>
39. <https://www.vrfocus.com/2015/07/virwind-launches-kickstarter-campaign/>
40. <https://www.pcworld.com/article/3322915/gaming/whirlwind-fx-vortex-environmental-simulator-review.html>
41. <https://iq.intel.co.uk/ambiotherm-virtual-reality-system-allows-feel-wind-weather/>
42. <https://www.vrfocus.com/2018/08/wind-blaster-vr-peripheral-offers-new-wind-powered-immersion/>
43. <https://www.ign.com/articles/2007/11/06/novint-falcon-review>
44. <https://www.extremetech.com/gaming/156474-disneys-aireal-a-tactile-feedback-device-to-enhance-the-gaming-experience>
45. <https://www.microsoft.com/en-us/research/project/airwave-non-contact-haptic-feedback-using-air-vortex-rings/>
46. https://aromajoin.com/en/events?page_num=4
47. <https://www.cnet.com/news/japanese-scientists-create-smell-o-vision-screen/>
48. <https://thehustle.co/digiscents-ismell-fail>
49. <http://www.scentcom.com/>
50. <https://www.digitalvmagazine.com/en/2017/07/03/olorama-technology-incorpora-el-olor-a-las-experiencias-audiovisuales-y-de-realidad-virtual/>
51. <http://www.timesofisrael.com/scent2you-hopes-to-bring-smell-o-vision-to-your-tablet/>
52. <https://www.ubergizmo.com/2016/10/aromajoin-mini-smartphone-app-unveiled/>
53. <https://vrscout.com/news/ubisoft-fart-smelling-vr-tech-south-park-game/>
54. <https://techcrunch.com/2017/01/18/cam-site-camsoda-announces-ohroma-scent-mask-integration-for-exactly-the-reason-youre-thinking/>
55. <https://www.pcgamer.com/planet-licker-is-a-game-you-literally-play-with-your-tongue/>
56. http://www.telepresenceoptions.com/2010/07/meta_cookie_uses_augmented_rea/
57. <http://cutecenter.nus.edu.sg/projects/virtual-cocktail.html>
58. <https://www.extremetech.com/extreme/171797-the-digital-lollipop-simulating-sweetness-for-dietary-gaming-and-health-greatness>
59. <http://cutecenter.nus.edu.sg/projects/virtual-lemonade.html>

60. <https://spectrum.ieee.org/tech-talk/computing/hardware/tastyfloats-a-levitating-food-delivery-system>
61. <https://innovate.ieee.org/innovation-spotlight/thermal-taste-sensation-virtual-reality/>
62. <http://ricecatalyst.org/volume-8-1/2017/6/the-reality-of-virtual-reality>
63. <https://feelreal.com/>