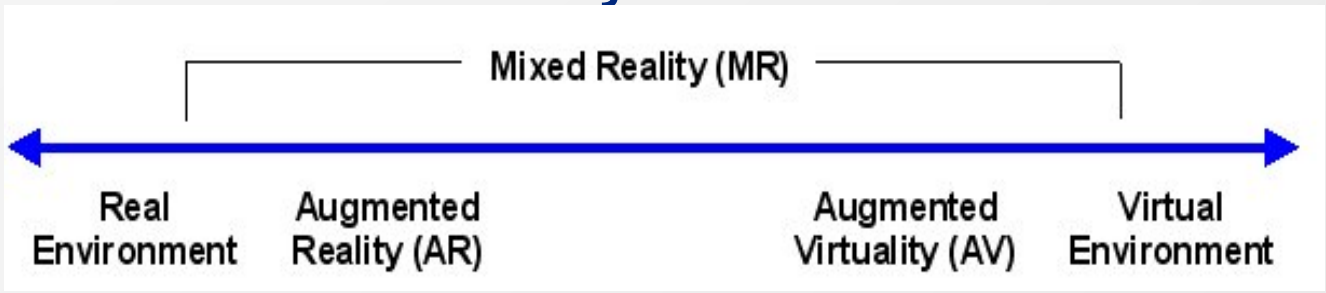
MASARYKOVA UNIVERZITA

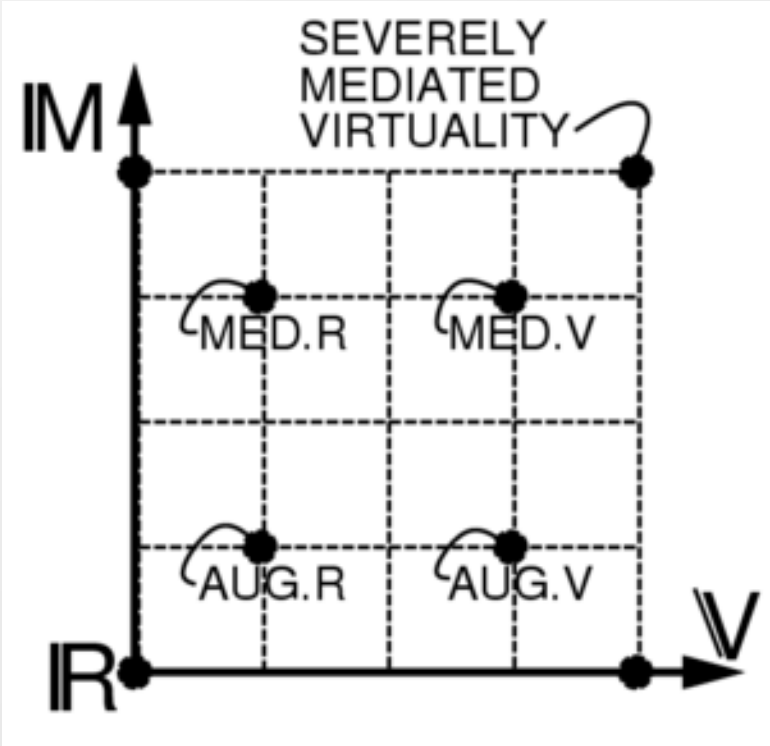
Virtual and Augmented Reality

Educational potential

Virtuality continuum



Milgram, Paul; H. Takemura, A. Utsumi, F. Kishino (1994). Augmented Reality: A class of displays on the reality-virtuality continuum. *Proceedings of Telemanipulator and Telepresence Technologies*.

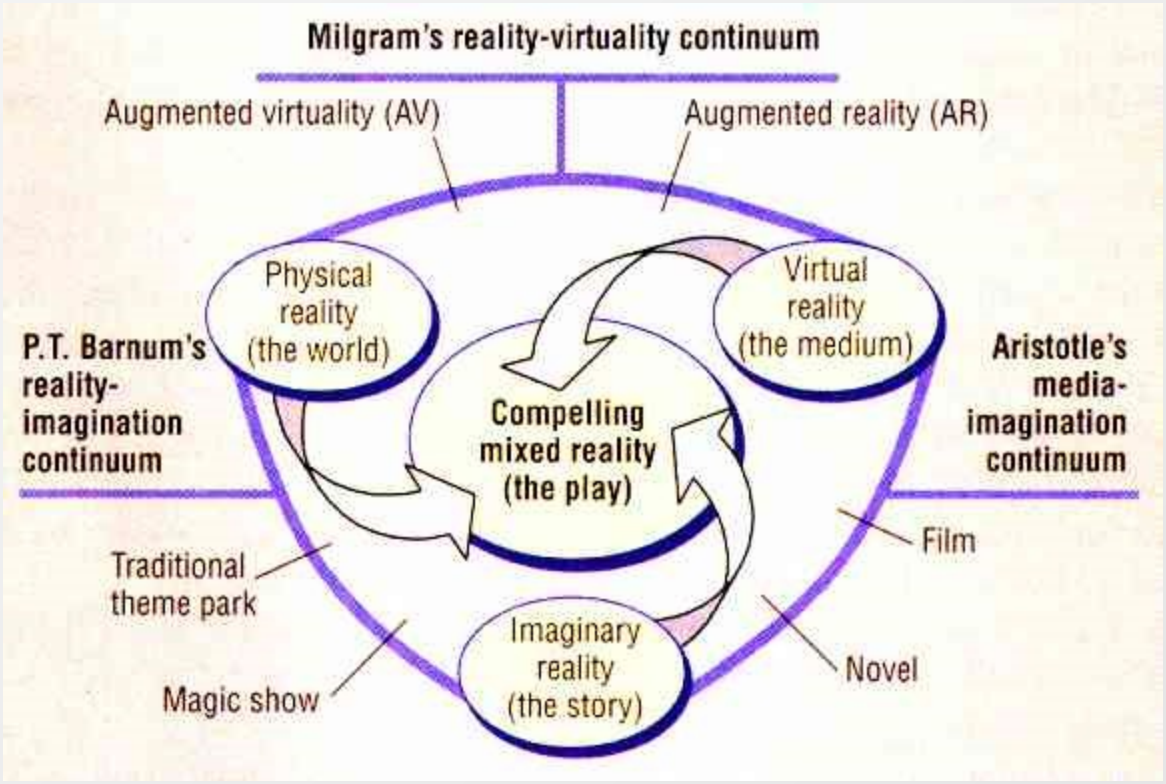


http://en.wikipedia.org/wiki/File:Mediated_reality_continuum_2d.png

Virtuality continuum

- computer interfaces placed on a continuum according to how much of the user's world is generated by computer
- 2 dimensions - „virtuality" plain and "vicariousness" plain
- R – nonmodified reality
- virtuality axis (V) include reality enhanced by graphics (augmented reality), graphics enhanced by reality (augmented virtuality)
- vicariousness axis include modification of reality a virtuality according to mediation rate – mediated reality, mediated virtuality (multiple effects – modulation – reduction of reality)
- up right virtual words – strongly modified version of reality

Virtuality continuum

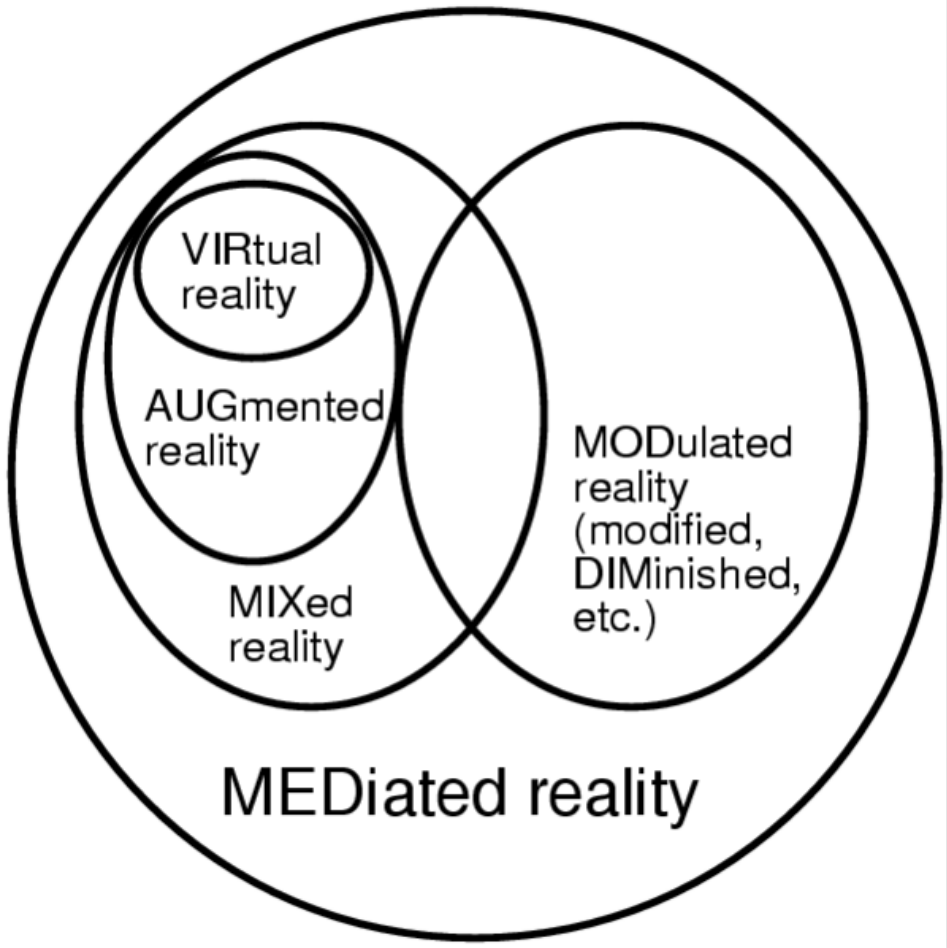


http://www.flatrock.org.nz/topics/info_and_tech/assets/mixed_reality.jpg

Virtuality continuum

- Steve Woolgar - 4 rules of virtuality:
- The way in which media and technology affect people relies on their non-information communication technology (ICT) related background which may include gender, age, social status, income amongst others
- Risks and fears in regards to new media and technology are unevenly socially distributed
- Advancements in media and technology supplement rather than replace existing activities in reality
- New media and technology tends to create new kinds of localism rather than furthering globalization

Computer-mediated reality



http://en.wikipedia.org/wiki/File:Viraugmixmodmediated_reality.png

Virtual reality

- concept – seeming, artificial reality
- what is true reality?
- reality around us entre to our awareness through senses
- when we perceive, when we perceive, we didn't transfer external world to ourselves
- child thinks as it perceive, adult perceives as he think
- influence of his own image of the world built through his life
- conditioned by cultural traditions, bounded by effect of reality - limited segment of space and time
- senses evolved because of ability to quickly react when change in environment take place, not for understanding to entirety of the world

Virtual reality

- reason enable humans to set free from sensual perception
- science – tool for discovering reality
- physics – mediates reality transcending impressionable ability of human
- scientific knowledge of world – just hypothetic, conjecture
- we can not to prove them even they are proof based (verification), but!
- we can refute them (falsification).
- example – models of universe

Virtual reality

- What is virtual reality (VR)?

→ condition under which human experiences convincing feelings he is in other world where he is not

→ user disengaged from percepts of real external world, his senses are feed by artificial percepts

→ projected artificial world where human can exert certain activity and use his own will

→ VR is implemented by technical devices connected with computer

Virtual reality

- **Classical virtual reality:**
- computer + peripheral devices:

→ helmet with stereoscopic glasses and earphone – read head moves and update pictures

→ sensors detects space position of user

→ data glove – imaging of tactual impulses

- 1968 – Ivan Sutherland, first VR display in glasses

Virtual reality

- 2 factors affect quality of illusion:

1) quality of display (number of edges or rendered surfaces)
2) speed of scene redrawing – more important. Delay annuls effect

- **Autostereoscopic technology:**

→ holographic image floating in space

→ usage: teleconference – encounter of persons in virtual p

→ Denis Gabora – Nobel price, holography invention

Hologram = complex of all perspectives of reflected entity composed into record medium by means of variously modulated light

→ Stephen Benton – invention of hologram represented by zobrazitelný visible light transmittable remotedly

Virtual reality

→ sensual experience: we evaluate whole, not parts

- experiment : 2 TV - same quality of display, different quality of sound. People evaluate worse quality of display together with worse quality of sound

- **Telepresence**

→ connection of TV, sound record, impulse sensor and other technical devices + computer

→ remote presence, more complicated than VR

→ transfer of human sensorium to other place – problem solving in remote place by means of distance control

→ our brain control brain distantly as well

Virtual reality

- system of virtual reality – overcomming of barrier human x computer – not just keyboard writing. Human fastens to computer like driver to his car
- difference: error in VR doesn't mean tragic outcomes
- VR can be more real than reality. Example: aviator can be exposed to all kinds of unusual situations with low probability in reality

Virtual reality

- reader of books immersed in plot – he is in other word, technical tool – book
- virtual reality continuation or technical peak of media tools from books, films, radio and TV, mediating virtual words
- VR will not be able to replace true reality according experts. it will just come nearer to it

Virtual reality - application

→ designing: walking through models of buildings, evaluating of theirs interiors, testing acoustics (concert halls, theaters)

→ simulators: driver and aviator training

→ medicine: rehearsal surgical operation. Application of telepresence as well

→ science and education: virtual visits of places and events

→ entertainment: computer games in virtual words

Danger of virtual reality

- similar to overuse of TV

→ drug for children and teenage

→ diversion of our attention from real problems of our planet and everyday life

→ erosion of equilibrium between nurse of natural world and immersion to artificial, virtual world

→ life is fickle, incidental, insecure. VR is computed, it is possible to afford almost anything – it offers area of certainty. Thats why it is so attractive. It is escape of human from reality to dream world

→ challenge of VR: rediscovery of enchantment and beauty of everyday reality

Mediated reality

- frame of mediated reality describe devices modifying reality
- ability to add or take away information or manipulate with reality by means of computers and handheld devices like Smart Phone
- visual perception of environment is mediated
- electronic devices are filters between real and perceived world

Mediated reality

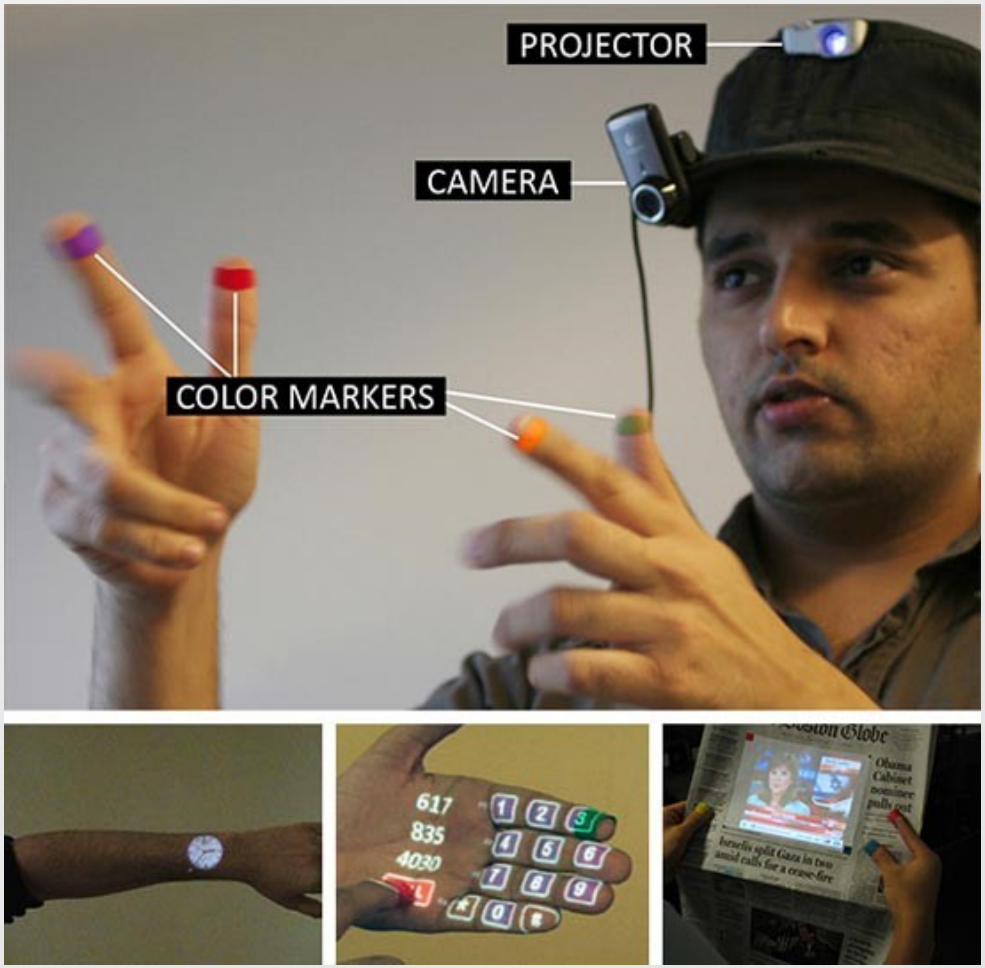
- hand-held device

http://techie-pinoy.com/wp-content/uploads/2009/08/DynaVox-Xpress-Handheld-Device.jpg

- Eye tap

http://www.deseretnews.com/photos/1693963.jpg

- wearable computers



http://eddieespinal.com/wp-content/uploads/2009/03/sixthsense.jpg

Mixed reality

- **Mixed reality (MR)**
- reality connecting real and virtual worlds in new environment or visualization where coexist physical and digital objects in real-time
- mix of reality, augmented reality, augmented virtuality and virtual reality
- http://youtu.be/kzGljuievpM
- http://www.youtube.com/watch?v=avBDStDmXcg

Mixed reality

http://www.vtt.fi/img/research/ict/mixedreality_640.jpg

Augmented virtuality

- incorporates object of real world into virtual world
- it is possible to manipulate digital objects whereby tangible entities
- denotes predominantly virtual world which dynamically integrate physical objects and humans in virtual world where they could interact
- various facilities: stream video recorded in physical spaces – by web camera, 3D digitization of physical objects

Augmented virtuality

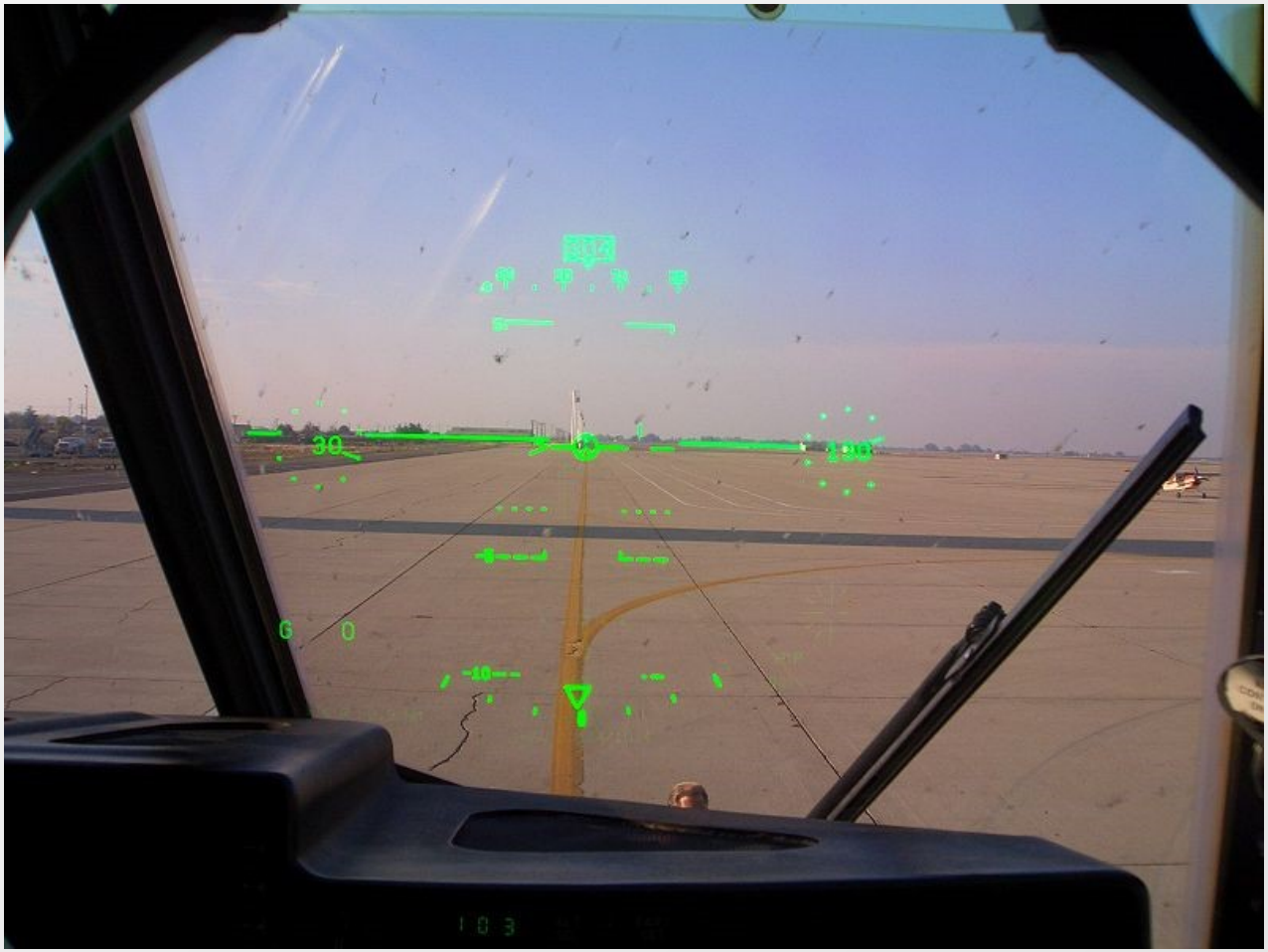
http://kommerz.at/Files/176/mriMRI1.jpg

- http://www.architecturemixedreality.com/Augmented_Virtuality/Augmented_Virtuality.gif

Augmented reality (AR)

- http://youtu.be/b64_16K2e08
- extend reality with computer generated information (synthetic information)
- technology functions strengthen our ordinary perception of reality
- augmentation is usually followed in real time and semantics context through components of environment. Example: display of score during sport match
- information about world around user become interactive with the aid of AR technologies (add of digitized image processing and recognition of objects)
- artificial information about environment can be stored and traced as information layers which overlap view of real world
- it is supposed term augmented reality was for the first time used by Thomasem Caudell, employee of Boeing, in 1990

Augmented reality



http://en.wikipedia.org/wiki/File:C-130J_Co_Pilot%27s_Head-up_display.jpg

Augmented reality (AR)

- http://www.wired.com/gadgetlab/tag/augmented-reality/
- http://www.youtube.com/watch?v=U2uH-jrsSxs
- http://www.youtube.com/watch?feature=endscreen&NR=1&v=e_T1XRuPyBY
- accepted definitions:
- 1997 – definition of AR by Ronald Azuma:
- it combines real and virtual
- it is interactive in real time
- it is recorded in 3D

Augmented reality (AR)

- **Displays:**
- **A Head Mounted Display (HMD)**
- puts image of virtual graphical objects over user's view of real world
- **Handheld Displays**
- small programmable devices
- **Spatial Displays**
- use digital projectors to image graphical information on physical objects. Display is separated from user of system. Because display is not interconnected with every user, augmented reality can be extended over group of users and it allows collaboration among users in particular place
- **Monitoring**
- modern mobile systems of augmented reality use monitoring technology: digital cameras, gyroscope, RFID, optical sensors, solid state compass, wireless communication

- Head Mounted Displays

http://www.slipperybrick.com/wp-content/uploads/2009/01/wrap2_view1.jpg

- Handheld Displays

http://www.digitaltrends.com/wp-content/uploads/2009/11/layar.jpg

- Spatial Displays

http://cdn.cbsi.com.au/story_media/339300314/samsung-monitors_1.jpg

- Input devices - gloves

http://www.architecturemixedreality.com/Virtual_Reality_Gloves/Virtual_Reality_Gloves.htm

Augmented reality- application

- medicine – visualization of viscus, internal intervention (puncture, biopsy), visualization of MRI or CT entries invisible just by eyes, instruction how to proceed during intervention for novices
- motoring – information about direction or surrounding objects on windscreen of a car
- military plane – navigation and flight information, sights
- industry – visualization of reparation and modification of complicated machines (Boeing)
- tourism – orientation in environment
- entertainment
- education – m-learning, s-learning (project ARiSE - http://www.arise-project.org/index.php?id=35)
- Augmented Reality in Education - http://augmented-reality-in-education.wikispaces.com/