

Photo Jana Sklenářová, 2016

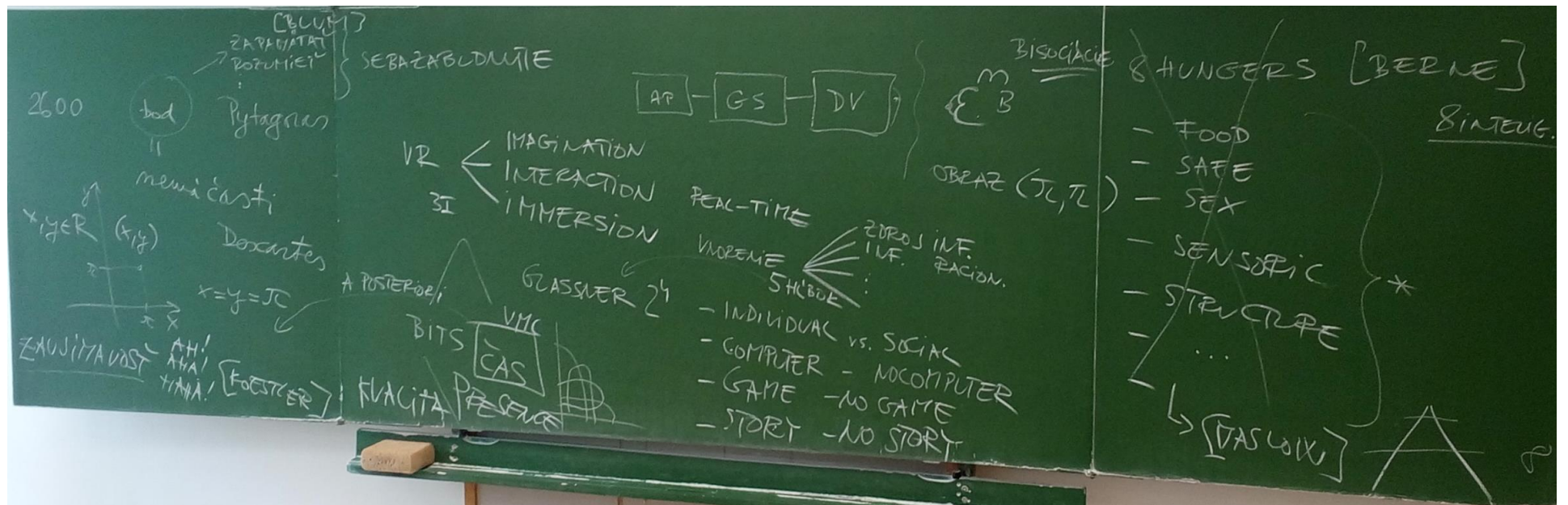


Photo Peter Lacika, 2015

**Virtuálna a rozšírená realita**, povinne voliteľný predmet v magisterskom štúdiu MPG, AIN na FMFI UK od roku 2015, po absolvovaní budú študenti ovládať teoretické základy a praktické zručnosti pri autorskej (aj tímovej) tvorbe aplikácií rozšírenej a virtuálnej reality.

Stručná osnova predmetu:

Virtuálna realita, definície a základné pojmy.

Jazyky na popis VR. Autorské nástroje.

Virtuálna interakcia podľa Qvortrupa.

Virtuálne galérie, múzeá a mestá.

Vybrané techniky konštrukcie virtuálnej populácie (avatari, autonómni agenti).

Rozšírená realita, definícia pojmov, história, významné medzníky, motivácia, aplikácie rozšírenej reality.

Systém pre rozšírenú realitu: vstupy, výstupy, hardvér, Fish tank-základné nástroje.

Registrácia v rozšírenej realite (Marker, Markerless, RGBD, GPS)

Mobilná rozšírená realita (Vuforia, Layar, Metaio...)

Priestorová rozšírená realita-projekcie (hardvér, kalibrácia, kombinácia projektorov).

Odporúčaná literatúra:

Real-time rendering / Tomas Akenine-Möller, Eric Haines, Naty Hoffman. Wellesley : A. K. Peters, 2008

Vlastné elektronické texty vyučujúceho predmetu zverejňované prostredníctvom web stránky predmetu.

Jazyk, ktorého znalosť je potrebná na absolvovanie predmetu: slovenský, anglický

...

Vyučujúci:

doc. RNDr. Andrej Ferko, PhD. - prednášajúci

RNDr. Stanislav Stanek, PhD. - prednášajúci, cvičiaci

RNDr. Zuzana Haladová - cvičiaci

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Dátum poslednej zmeny: 31.03.2014, Schválil: prof. RNDr. Roman Ďurikovič, PhD., prof. RNDr. Július Korbaš, CSc.

Predmet v zimnom semestri 2015 prednáša A. Ferko, cvičenia vedie RNDr. Ivana Varhaníková, PhD., v roku 2016 RNDr. Mirka Valíková, PhD., prednášky o histórii a spracovaní zvuku prednášali hostia dr. Varhaníková a dr. Lúčan

Na nasledujúcej strane je tzv. Big picture pre danú oblasť komunikácie, nad rozhraním GUI su vybrane stavy porozumenia.

Imagine, please, the user above this page and read it from the bottom line to this line, in a reversed ordering of lines. The user shares affective and cognitive responses, e.g. bisociation, hermeneutic gap filling...

**VIS** <<< visualization... activation >>> **HCI**  
e.g. no clue, visible meaning or entymeme e.g. observe only or (inter)act

.....  
**Uncertainty:** unsure meaning, e.g. symptom, strife, misunderstood meaning, incomplete data or method not clear... like filtering  
.....

**Depth of Immersion:** e.g. curiosity, empathy, identification... like calibration  
.....

No story, no game   Story   Interactive Story   Story and game   Game   Interactive Storytelling

**Story environment:** ostension, exposition, argumentation, description, narration or a move in the game (**game loop 1..8**)

1. **Observe**, 2. **Set goals**, 3. **Prepare**, 4. **Commit and execute**
5. **Compare against goals (and, eventually, stop)**
6. **Evaluate for self (and, eventually, stop)**
7. **Evaluate for others (and, eventually, stop)**
8. **Go to 1**

**Visualisation metaphors** (Rhetorics) **HCI metaphors**  
e.g. cartographic map with weather forecast e.g. desktop metaphor, phone, walk, fly, repeat

**Patterns recognized**, e.g. visual rhyme, Propp function in a fairy tale, music motif

**Semiotic layer:** iconic, indexed, symbolic, signal, or symptom representation

**Object space** (user can pick an object and manipulate/interact with it)  
Graphics (multimedia) objects with geometric support (shape) and characteristic function (color, sound)

===== **Output/input space (GUI, human-computer interface)** =====  
Graphics output primitives (e.g. triangle)                      Input data record (e.g. location, string)

**Hardware and software layer** (bits/pixels/inputs only, run time)

**Implementation** for given hardware and software platform

**Representation for computer** (encoding, e.g. ASCII code, signed integer)

**Mathematic model** (or another conceptual model)

**Real world problem** (e.g. hunger by Berne, stimulus hunger, time structure hunger, contact hunger, e.g. needs by Maslow)

The following commentary is written in reversed order as was the recommended reading ordering at the previous page.

Each living organism deals with solving an actual real world problem (breathing, survival, safety). After Eric Berne, humans drive actions in response to **six Berne hungers**: 1. Stimulus hunger, 2. Recognition hunger, 3. Contact hunger, 4. Sexual hunger, 5. Time structure hunger, 6. Incident hunger, [http://changingminds.org/explanations/needs/berne\\_hungers.htm](http://changingminds.org/explanations/needs/berne_hungers.htm). These hungers are incomplete and this psychological approach can be replaced by sociologic 8 needs by Maslow. The solutions can be found either in reality or by imagination, often structured into stories or games.

According to Glassner, the communication activities spectrum can be subdivided into 16 parts. These combine four alternatives: individual/social, computer/no computer, game/no game, and story/no story. In the following, we focus on individual/computer/story subset of options. The real world problem is mathematically modeled, digitally represented, and implemented for given hardware/software configuration. This happens before runtime.

During runtime, there are just **bits** in the digitalized memory, **pixels** at the display, and elementary **input events** like mouse clicks. The ISO input model distinguishes the following phases. The user observes prompt in text or graphic mode, creates an intermediate measure, and shares the echo. If the echo is acceptable, the user confirms by trigger the right time to finalize the measure into the input data record, e.g. location, string, value, choice number, picked ID of a graphical object. The input data record is processed by software and the input loop is repeated in another state of software execution and another state of mind of the individual user. These two processes can be understood as a coevolution of content creation and decision making, i.e. affective and cognitive responses. Originally, says Britannica, "coevolution, the process of reciprocal evolutionary change that occurs between pairs of species or among groups of species as they interact". Here we use the coevolution instead of genes, for memes, the cultural analogues of genes. Maybe we should name the interplay between the two processes **memetic coevolution**.

A **meme** is "an idea, behavior, or style that spreads from person to person within a culture," which acts as a unit for carrying cultural ideas, symbols, or practices that can be transmitted from one mind to another through writing, speech, gestures, rituals, or other imitable phenomena (wording by Wikipedia, the meme notion coined by Dawkins, Selfish Gene book). One can observe/interact with just a single + marker in the input/output space. This tiny + can be already a meme, or not. The meme can be composed from multiple output primitives (polyline, polymarker, fill area, text) in a form of a graphics object, which can be picked by its ID for input. We perceive the **object space** at this level as programmers and we name it a **scene** as users or players. However, the meme can be already here, or not. The scene or object space can be extended by sound space at this level and the presented objects can be multimedia ones, visible, audible, even touchable, but for the perception and understanding there is often needed more. The missing layer we name **semiotics**.

The meaning of a rendered + can be in five categories, semiotics speaking. If the meaning is a rendered +, we speak about **iconic representation**. If it denotes a **symbol**, it is represented symbolically. When appended to a number, 3+, it represents an **index** for more than three. Another indexed representations are abc, etc. The part stands for the whole here, pars pro toto, this offers, so to say, the zipped meaning. If the + denotes a given time of start or end, it is a **signal**, like curtain in the theatre or pipe sound in sports. If it indicates but not defines something, it is the **symptom**. The simplest **semiotic system** Yes/No has two meanings, the most complex one, music, has no vocabulary of meanings, but one can recognize **patterns** or motifs, pre-memes visual, audible, touchable... Semiotic systems are linguistic and non-linguistic. We use both for meaning-making with signs and symbols in a virtual museum. However, for completing a meme, we still need more. We cannot isolate focus and context, object and background, text and subtext. For contextualization, we employ **Visualisation metaphors, (Rhetorics), and HCI metaphors**. Rhetorics is closed here to indicate excluding it at this level as a whole, but we know that metaphor is just one of tens of rhetoric figures. To share the context of signs, we require e.g. a cartographic map with weather

forecast, a globe to show the Columbus discovery journey, a contrasting background for the Pythagorean formula. To profit from context at the input side, we are immersed into, e.g. desktop metaphor, phone, walk, fly, or we repeat the same standard guided tour in a virtual museum, YouTube videoclip or Da Vinci virtual exhibition.

The following layer is a **Story environment**, the notion coined by Andrew Glassner in the Interactive Storytelling book. According to rhetorics, there are the following four modes 1. ostension, 2. exposition, 3. argumentation, 4. description, 5. narration. Yes, they are five, we added the ostension, showing of a particular thing, gesture, tongue, pixel, triangle, original museum exponat with the aura, or its image, video, panorama. Moreover, we append a number 6 to this layer, the move in the game (**game loop G1..G8**)

1. Observe the situation
2. Set goals
3. Prepare
4. Commit and execute
5. Compare against goals (and, eventually, stop)
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The infinite loop has three halting conditions, roughly speaking, rational, emotional, and social. These correspond to adult, child, and parent layer of human personality. Their prevailing media channels are symbolic, visual, and audio. The reason to understand the **six extended rhetorical modes** at this level is caused by a very serious reason. Above, we neither excluded nor included the game. The story environment is given by the scene and game rules and the story is one particular playing of given game. Imagine the shortest chess game (three moves only) or a football match in world finals. Their description or video record can be a story. The difference between description (writing) and story (narrative) is given by Chris Crawford. When the one dimensional description includes a two dimensional social network, it is a story. Thus, telling the three chess moves only belongs to description, while narration of their players makes from the same content the story.

Vice versa, the game loop models the expectation (set goals) and its success or fail. In other words, the game loop happens with reading, listening, story perception, at this level.

The spectrum of six broad alternatives within story environment is formed by the following items: 1. No story, no game, 2. Story, 3. Interactive Story, 4. Story and Game, 5. Game, 6. Interactive Storytelling. The highest one, interactive storytelling, offers to the user both authoring and perceiving the story within given story environment. The interactive story offers just the interaction and does not change the story content, prepared by an author.

The perception of a story or game can be influenced by two perceptual layers, which are analogues to calibration and filtering in visual perception. Their influence can be understood, again, as a coevolution of two dynamic processes: immersion and uncertainty. **Depth of Immersion or Engagements** is related to a character in the story and it is subdivided by Glassner into five depths: 1. curiosity, 2. sympathy, 3. identification, 4. empathy, 5. transportation. They can be extended by decreased attention, e.g. in alpha state of brain (day dream, one of four brain states with different concentration). On the other side, the meaning of perceived content can be damaged by objective or subjective **Uncertainty**, unsure meaning, e.g. symptom, ambiguity, strife, misunderstood meaning, incomplete data or method not clear.

We can distinguish at the top of completing meaning, resp. understanding of the presented content either the visualization or activation, passive consumption of multimedia content or user activation. This spectrum of possibilities is expressed by Cameron-Kenderdine as quality or type of virtual museum. In fact, they recognize three types of virtual museums, visualization, activation, and hermeneutic ones.

We claim that the border between visualization and activation is not sharp, e.g. the same minimal chess game content can be accepted passively (as an expository message) or actively as a story with the joy of recognized stupidity of the suicidal move at the black side. Moreover, we claim, that the hermeneutic gap filling, i.e. adding invisible to visible (inaudible to audible) is present in both virtual museum types, at both sides of our mind map.

<b>VIS</b>	<b>&lt;&lt;&lt; visualization... activation &gt;&gt;&gt;</b>	<b>HCI</b>
e.g. no clue, visible meaning or entymeme		e.g. observe only or (inter)act
	affective and cognitive responses, e.g. bisociation, hermeneutic gap filling	

Let us introduce the new notions in these three lines: entymeme, hermeneutic, and bisociation. In rhetorics, **entymeme** is the final argument to persuade the audience. It is constructed by presenting a gap, which is bridged by the audience. Completing the told and untold makes the audience coauthoring the message. In a virtual museum, the entymeme is composed from multiple semiotic systems (texts, images, audio). Entymeme causes a single gain in understanding. **Hermeneutic** virtual museum denotes such a presentation, which allows the user to share invisible (for a detailed explanation refer to Cameron-Kenderdine). The **bisociation** is introduced by Arthur Koestler in his major creatologic book Act of Creation (1964).

„The *enthymeme* may be translated in numerous ways in the realm of virtual space and its virtual museums. The general idea remains the same: the creators of a virtual museum and their audience reach a conclusion together — a conclusion that is already known by the authors, who have given their audience the necessary means to reach it. An excellent example of an *enthymeme* is apparent after a virtual visit to the *September 11: Bearing Witness to History* exhibit created by the Smithsonian Institute to document the terrorist attacks of September 11, 2001, in the United States.“ [Cameron-Kenderdine, p. 265].

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## Architektúra a jazyky na VR

### Kódovania

Rosetta, ASCII = IS 646 = UTF-8, IS 2022, UNICODE, CGM, ((SGML)), HTML (Anchor), VRML (3D), XML, X3D (Collada (FX), Maya MEL)

### Funkčnosť

Prirodzené algoritmy, na počítačoch ad hoc aplikácie, GKS (Turbo C, Graph), PHIGS (OpenGL), ((CGRM)), PREMO

**Architektúra** Gutierrez, Mario, Vexo, F., Thalmann, Daniel . 2008. Stepping into Virtual Reality. Springer.

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Time of visualization, activation, and hermeneutics.

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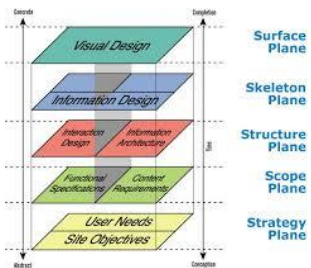
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Time of authoring. **PREMO activ.**







Time of visualization, activation, and hermeneutics.

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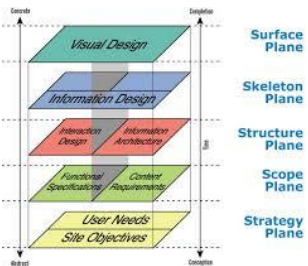
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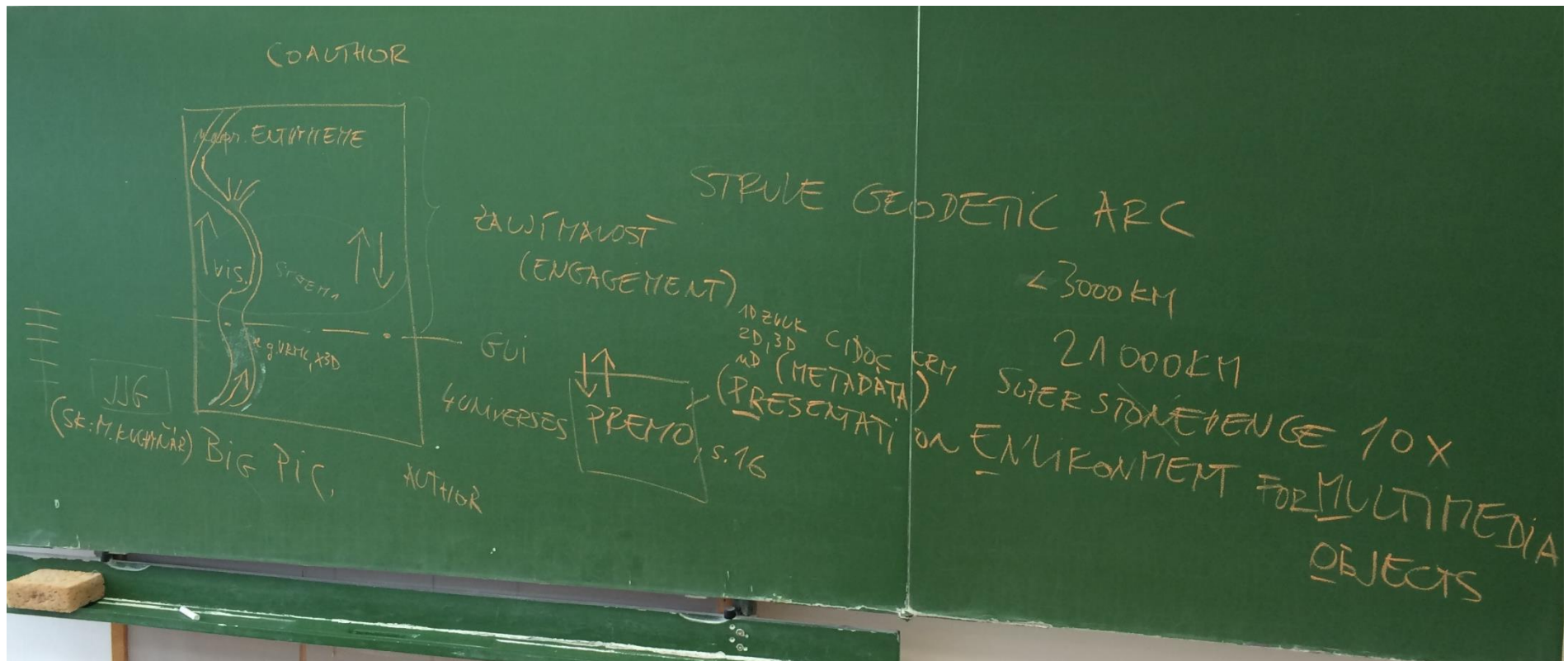
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Time of authoring. **PREMO** activ.

Gnomic time (no time, just memory, truth or something untrue or unsure) e.g. 2Cor 9:7 God **loves** [as a general, timeless fact] a cheerful giver. [[religious no time, resp. Eternity, AF]] Or:  $a^2+b^2=c^2$ ,  $a, b, c$  real numbers, the lengths of triangle sides. [[ mathematics absolute truth, AF]] There are no other absolute truths available.

Cathachresis, „abuse“, „all is in the hands of a horse“, another example at the ethymeme height. Enthymeme provides verification, cathachresis falsification.



Oranžovou kriedou doplnenie autorských metodík pre vizualizáciu a aktivizáciu podľa J.J.Garett v slovenskom preklade Martina Kuchyňára a ISO normy PREMO. Pre operátora či používateľa sa tu navrhuje označenie spoluautor. Komunikačné rozhranie človek-stroj, konvenčne označované ako GUI, sa presne definuje v norme PREMO ako Presentation. V normách VRML, X3D a PREMO sa už predpokladá aj zvukový priestor a vizualizácia metadát, napr. podľa ontológie CIDOC CRM. Ako príklady globálnej zaujímavosti sa uvádzali Google Search (na strane vizualizácie, kde spoluautor dopĺňa otázku) a pamiatky zo zoznamu UNESCO Struve Geodetic Arc (cca 2800 kilometrov), Great Wall (cca 21000 kilometrov), a Superstonehenge, 10-krát väčšie. V schéme je vyznačený prúd informácií, ktorý môže a nemusí dosiahnuť enthymeme (kde spoluautor dopĺňa odpoveď, kognitívnu, afektívnu...). Nižšie účinky v oblasti zaujímavosti charakterizuje psychológ Daniel Kahneman, ktorý ich označuje ako Systém 1 (rýchle myslenie, napr. 7/22 rýchlo rozpozná prevapenie). Photo Milan Darjanin.

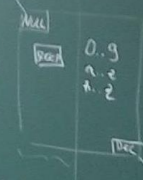
ROSETTA ne pisma, 2 jazyky  
 ↳ BABELON  
 LANGUEN model modelu

3I

pubek napravnika sa amozit

Egypt ~ 800... Champion... ASCII 7  
 MITEV Balyg. gref majore 15 2022 g

0000000



$2^7 < 6088_{10}$

(E9)(E9)

1111111

ISO/IEC JTC1 Inf. Technology / SC 29 JT

MPEG-4, 7, 21

SC 27 PESO UK (BSI)

(GLASSNER)

$2^4 = 16$

INDIV. - KOLEKT.  
 BEZPOC. - POCTIX  
 HRA - KEHRA  
 PRIBEH - KEPEPEH



(GM [P<sub>u</sub>])  
 KEMOV NAFRAM



→ Rozprávka - zpostat  
 1 NEJOSTAC PROTAGONISTA,  
 PRIPRIVE TUKCIE

NOBPO

zlocuclano  
 ANTAGONISTA, HELPER

PRIBEH TO INFOVATICKY (4)

DATA S NULOVU SPROSTRE DEKLAROSTOU (AUTOR, NAZOV, JAZEK, VID, ...)

DB: HODNOTY, MAPA VOJA  
 DYN. SITUACIE, FABULA (DEJ)

[TOPANE PONAUČENIE]

~ DOKAZ PRAVDY

~ DEKLARATIVE, STATICKE  
 EMOCIE

Poznámky pred záver semestra o tvorivosti, utorok 16.12.2014.

KOBSA, A.2014. *Important HCI metaphors*. <http://www.ics.uci.edu/~kobsa/courses/ICS104/course-notes/metaphors.htm>

<b>ORGANIZATIONAL FACTORS</b> training, job design, politics, roles, work organization		<b>ENVIRONMENTAL FACTORS</b> noise, heating, lighting, ventilation	
<b>HEALTH AND SAFETY FACTORS</b> stress, headaches, musculo-skeletal disorders	cognitive processes and capabilities <b>THE USER</b> motivation, enjoyment, satisfaction, personality, experience level		<b>COMFORT FACTORS</b> seating, equipment layout
<b>USER INTERFACE</b> input devices, output displays, dialogue structures, use of colour, icons, commands, graphics, natural language, 3-D, user support materials, multi-media			
<b>TASK FACTORS</b> easy, complex, novel, task allocation, repetitive, monitoring, skills, components			
<b>CONSTRAINTS</b> costs, timescales, budgets, staff, equipment, building structure			
<b>SYSTEM FUNCTIONALITY</b> hardware, software, application			
<b>PRODUCTIVITY FACTORS</b> increase output, increase quality, decrease costs, decrease errors, decrease labour requirements, decrease production time, increase creative and innovative ideas leading to new products			

Factors in HCI.

Interface metaphors evoke an initial mental model in users of the system's structure and operation. Metaphors should relate to users' past experiences and should be consistent.

(Typewriter metaphor): Evoked easily due to physical similarities. Should be avoided

**Desktop metaphor:** Once the most important metaphor, now slowly disappearing.

Book metaphor: For hypertext, online catalogues

Filing cabinets for online documentation, subdivisions in web offerings, system settings

orientation problems with tabs that have more than one level

Office metaphor: For collections of documents

**Library metaphor:** For large collections of documents

Building metaphors , city metaphors, etc.: for virtual worlds

Traffic metaphor

**Animated agent metaphor:** for guidance, recommendation, persuasion

**Composite metaphors.** Combine 2 or more metaphors (like office, file cabinet and desktop) The learning and retention of a system's functionality is considerably facilitated by meaningful and consistent metaphors.

**Preklad A. Ferko:** Dôležité HCI metafory. By mali vyvolať počítačové mentálne modely u používateľov, o štruktúre a fungovaní systému na základe minulých skúseností užívateľov, a mali by byť konzistentné.

(Typewriter metafora): ľahko vyvolal kvôli fyzickej podobnosti. Je potrebné sa vyhnúť

Plocha: Jednou z najdôležitejších metafory, teraz pomaly mizne. Book

metafora: Pre hypertext, on-line katalógy (5,8 mb) kartotéky pre on-line

dokumentáciu, členenie v internetových ponukách, nastavenie systému

orientácia problémy s kartami, ktoré majú viac než jednu úroveň Kancelária

metafora: Pre zbierky dokumentov Metafora Library: Pre veľké zbierky

dokumentov Stavebné metafory, mesto metafory, atď.: Virtuálnych svetov

dopravné metafora Animované zástupca metafora: pre poradenstvo, odporúčania, presvedčanie kompozitné metafory Spojte 2 alebo viac metafor (ako kancelária, kartotéky a na ploche) výučbu a zachovanie funkčnosti daného systému je značne uľahčené zmysluplných a konzistentné metafor.

Vo výklade ďalej pokračuje **doc. Šperka** v knihe **HCI Design...** metaforami pre VR navigáciu (**walk, fly, jump, repeat**) a herne situácie (**shooting**) a implementačne pokračovať možno **vo VRML knihe od J. Žáru**, ako sa da využiť avatar-návštevník a uzol NavigationInfo a senzory VRML na riadenie interakcie, keď už nie je treba vstupné dátové záznamy vytvárať a komunikovať iba cez ohraničený 2D obdĺžnik okna alebo obrazovky s príslušenstvom.



DEPTH OF IMMERSION [GLASSNER]

MEASURE OF INTERESTINGNESS [CABERON-KEMERDING]

96 00

MEMORY

VISIBLE

INVISIBLE

URGENT IMM-URGENT

2

2.2

DECISIONS

LINE

IMPORTANT

HEED

SECOND WIND

240 YRS

!

2.2

HEADING

MULTIPLE TMT

SMS

ADS.

WIFI

SSID:

VMUST2013-1

VMUST2013-2

PWD: VMUST2013

MUSEUM

PEOPLE

THINGS

EXHIBIT

VISUALIZATION

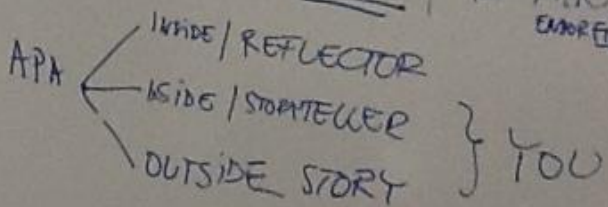
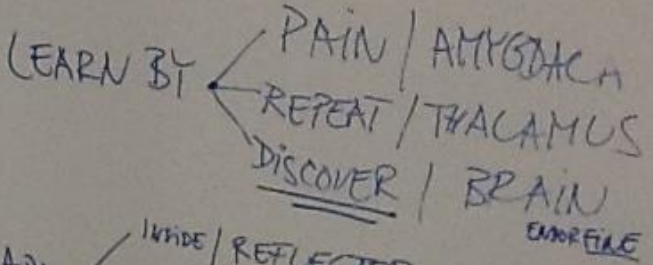
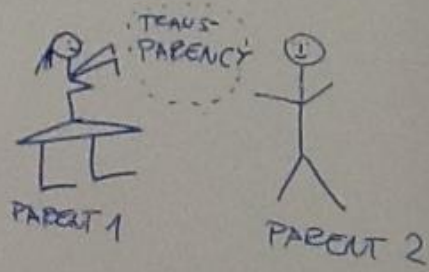
ACTIVATION

HERMENEUTIC

SEPARATE

COFFEE SEVDAH

LETALIA SEVEDIVA



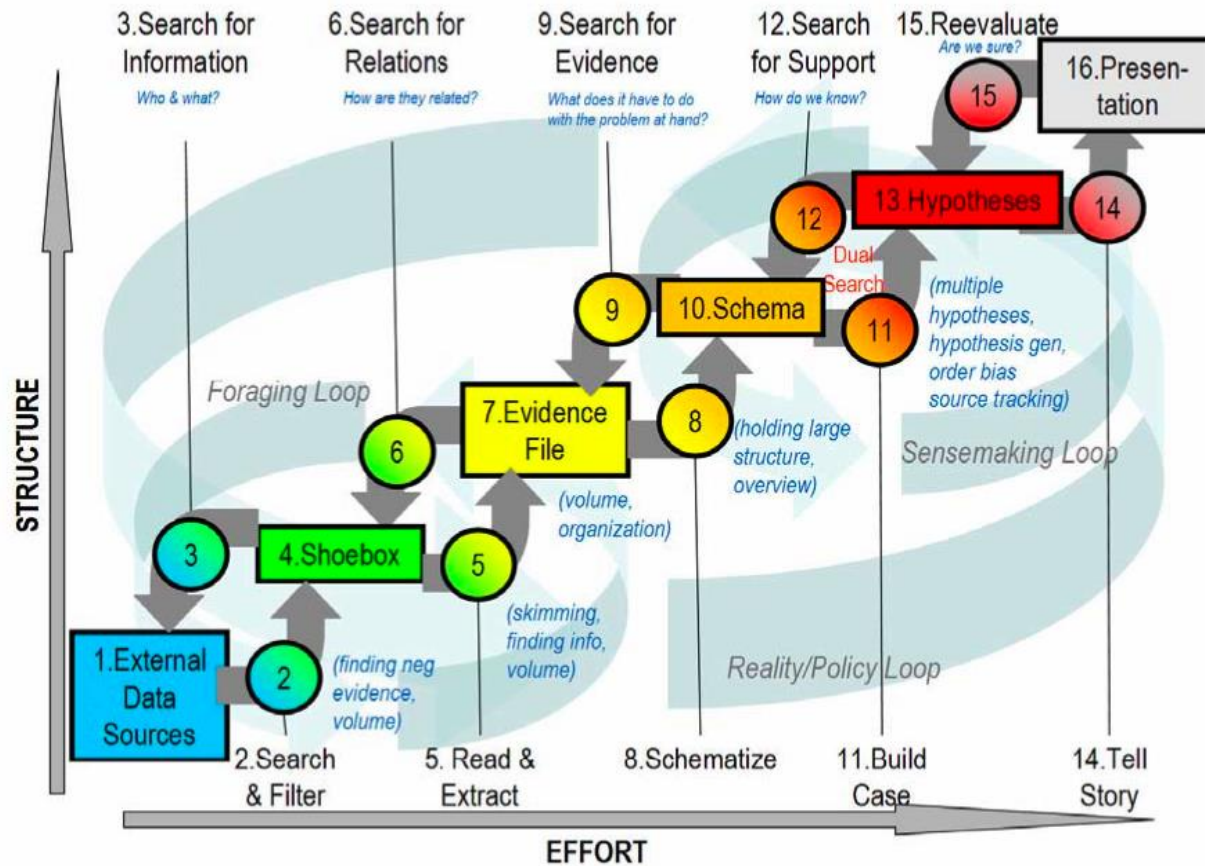
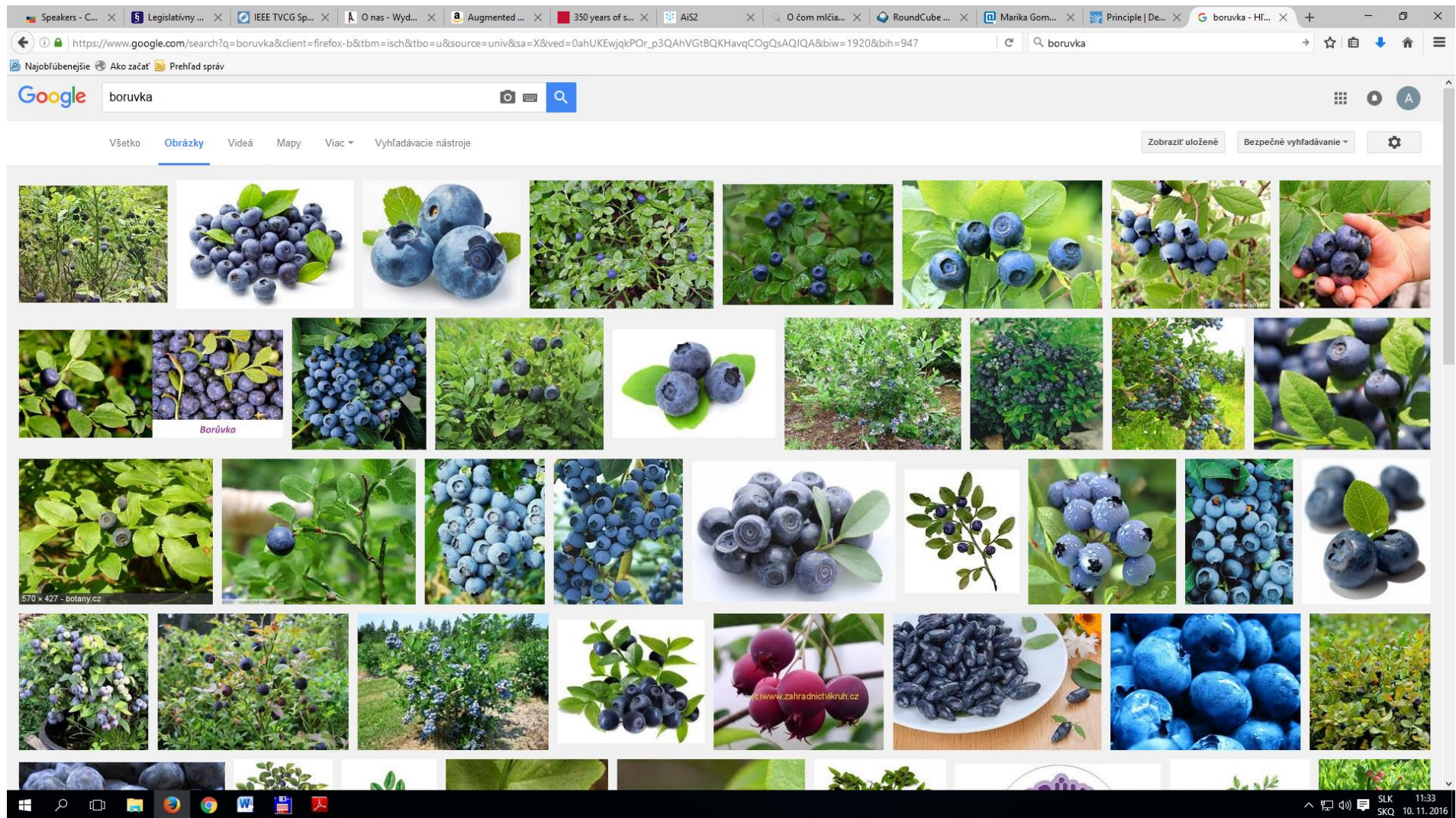


Figure 1.1: The sensemaking process described by Pirolli & Card [PC05]. The Exploration process within visualization is analogous to the foraging loop, e.g. collecting evidence in a shoebox, while analysis is the consideration of this evidence. Ultimately any hypothesis or evidence found must be presented in one way or another.



**Čučoriedčie, Google Search Images: Boruvka, na ilustráciu cieľov normy MPEG-7,**

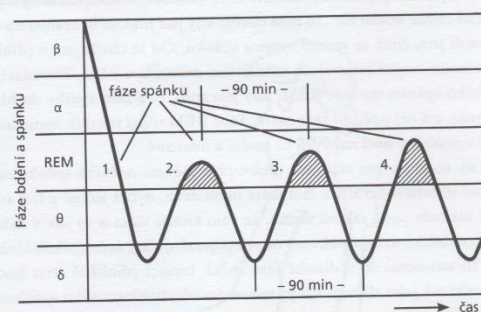
**M. Lechan: Čo je čučoriedka? Opak čučohustej.**

## Relaxační techniky

### Power-napping: mikrospánek který občerství

Power-napping je speciální metoda mikrospánku, známá též jako technika klíče. Jakkoli to zní neuvěřitelně, můžete se díky této metodě tak uvolnit a načerpat tolik energie, jako byste prospali hodinu. Tuto techniku můžete velice dobře použít při dlouhotrvajících schůzích apod., při dlouhém vyjednávání a vyčerpávajících diskusích. O přestávce, kdy ostatní pokračují v diskusích, vy se na nějakých deset minut stáhnete do ústraní. Zatímco pak budou ostatní zápasit s únavou a malátností, vy budete dokonale fit.

Spánkový rytmus



Na tomto vyobrazení můžete vidět, v čem spočívá tajemství power-nappingu, totiž fázi nočního snění. Elektrická aktivita mozku se proměňuje v průběhu jednotlivých fází spánku a bdění. Pomocí elektroencefalografie (EEG) můžeme měřit a zaznamenávat elektrické proudění v mozku. Zaznamenaná vlnovka nás informuje o různých fázích. Rozlišujeme fáze, kterým říkáme fáze beta, fáze alfa, fáze REM, fáze théta a fáze delta.

## Local and Global Interestingness in Virtual Time

Andrej Ferko, Comenius University

We present an authoring method how to create locally and globally interesting stories for virtual museum in a relatively short time. The overview of necessary notions includes virtual time, bisociation, energy of mistake, and enthymeme. We discuss the usability of the approach in diverse applications, like measuring of engagement or teaching polygon triangulation using wrong metaphors.

### Key References

KOESTLER, A. 1964. The Act of Creation. Penguin Books.

GLASSNER, A. 2004. Interactive Storytelling: Techniques for 21st Century Fiction. AK Peters.

Andrej Ferko is an associate professor at Comenius University in Bratislava and he co-authored about 200 papers and books (including some fiction ones). He was a co-chair (with Prof. David Arnold, UK) for Cultural Heritage Papers at EG 2007.

No time, just memory.

Gnomic time case.

<http://www.bcbsr.com/greek/gtense.html>

## The Tenses

In general, *tense* in Greek involves two elements: *aspect* (kind of action, [sometimes call *Aktionsart*, though a difference does need to be made between the two]) and *time*. Aspect is the primary value of tense in Greek and time is secondary, if involved at all. In other words, *tense is that feature of the verb that indicates the speaker's presentation of the verbal action (or state) with reference to its aspect and, under certain conditions, its time.* [See Wallace's discussion of the significance of tense, aspect, and time, and also his discussion of the difference between portrayal and reality.]

<http://www.bcbsr.com/greek/gvoice.html>

Voice is the property of the verb that indicates how the subject is related to the action (or state) expressed by the verb. In general, the voice of the verb may indicate that the subject is *doing* the action (active), *receiving* the action (passive), or both *doing and receiving* (at least the results of) the action (middle).

<b>Voice</b>
<b>A. Active Voice</b>
1. Simple Active
2. Causative (Ergative) Active
3. Stative Active
4. Reflexive Active
<b>B. Middle Voice</b>
1. Direct (Reflexive) Middle
2. Indirect Middle
3. Causative Middle
4. Permissive Middle
5. Deponent Middle
<b>C. Passive Voice</b>
1. Simple Passive
2. Deponent Passive

# Greek Grammar

NOUNS	VERBS			CLAUSES
<u>Cases</u>	<u>Voice</u>	<u>Mood</u>	<u>Tense</u>	
<u>Nominative</u> <u>Vocative</u> <u>Genitive</u> <u>Dative</u> <u>Accusative</u>	<u>Active</u> <u>Middle</u> <u>Passive</u>	<u>Indicative</u> <u>Subjunctive</u> <u>Optative</u> <u>Imperative</u>	<u>Present</u> <u>Imperfect</u> <u>Future</u> <u>Aorist</u> <u>Perfect &amp; PP</u>	In General Conjunctions Conditionals Volitional
<u>The Article</u> <u>Adjectives</u> <u>Pronouns</u>	<u>Infinitive</u>			
	<u>Participle</u>			<u>Prepositions</u>

## Augmented Reality, Principles and Practice

Dieter Schmalstieg & Tobias Höllerer

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“**Augmented reality** has the potential to become the leading user interface metaphor for *situated computing*. This is because augmented reality has the unique quality of providing a direct link between the physical reality and virtual information about that reality. The **world becomes the user interface**, thus:

Back to the real world!

**Virtual reality**, the vision of immersing ourselves in artificial worlds, has propelled the development of game consoles with amazing 3D graphics and led to consumer devices such as head-mounted displays and gesture tracking devices. However, a user interface metaphor such as virtual reality, which by definition monopolizes our attention, is not necessarily a good fit for everyday and spontaneous use of computing.” [SH2016, p. 7/495]

**The world becomes the user interface - - - bold by A.F. => Ucelená vízia sa nazýva MEMEX, lit**

1945 MEMEX

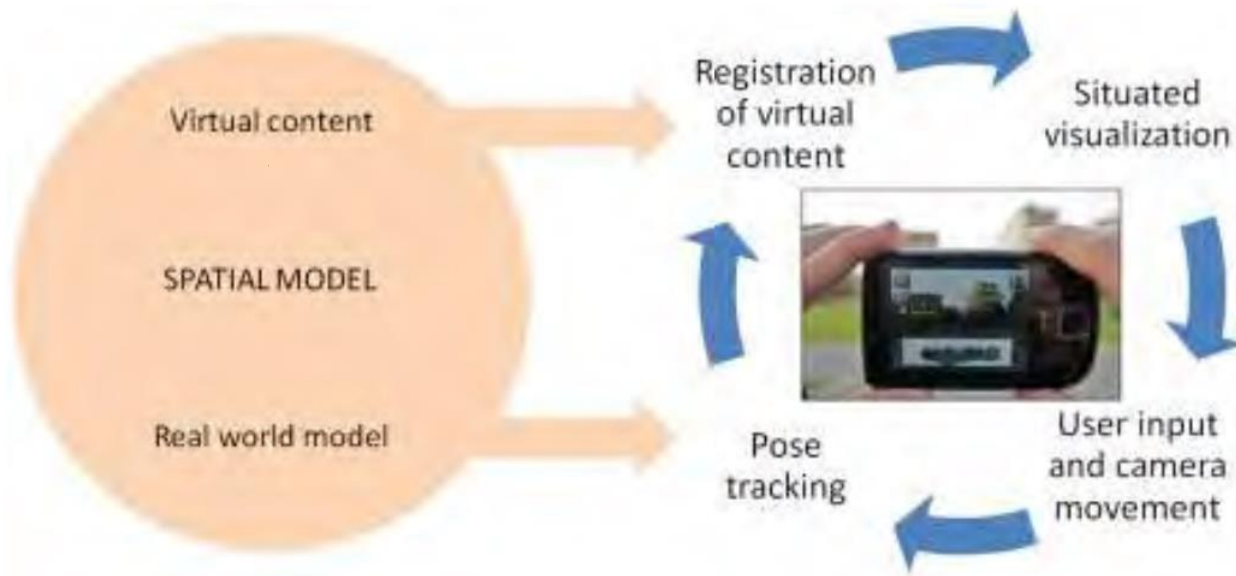
<http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/3881/1/>

## **As We May Think**

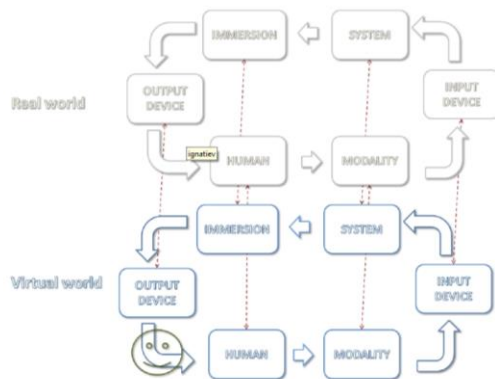
By Vannevar Bush

„Mendel's concept of the laws of genetics was lost to the world for a generation because his publication did not reach the few who were capable of grasping and extending it; and this sort of catastrophe is undoubtedly being repeated all about us, as truly significant attainments become lost in the mass of the inconsequential.“



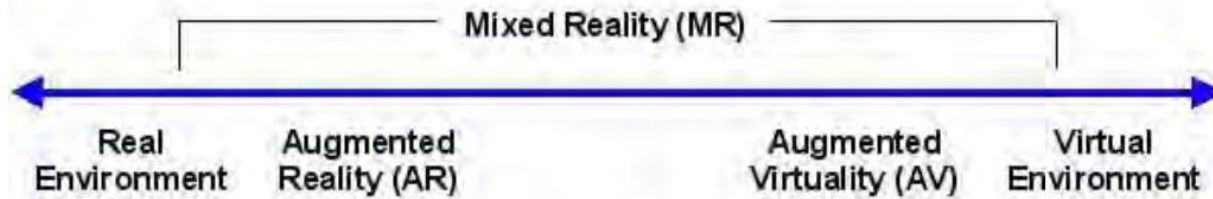


**Figure 1.1** AR uses a feedback loop between human user and computer system. The user observes the AR display and controls the viewpoint. The system tracks the user's viewpoint, computes registration and presents situated visualization.



# Mixed Reality Continuum

A user immersed in virtual reality experiences only virtual stimuli, for example, inside a CAVE (a room with walls consisting of stereoscopic back-projections) or when wearing a closed HMD. The range between reality and virtual reality, which allows various degrees of combining real and virtual elements, is therefore called **mixed reality** (MR). Some people prefer the term “mixed reality” over “augmented reality,” because they appreciate the broader and more encompassing notion of MR.



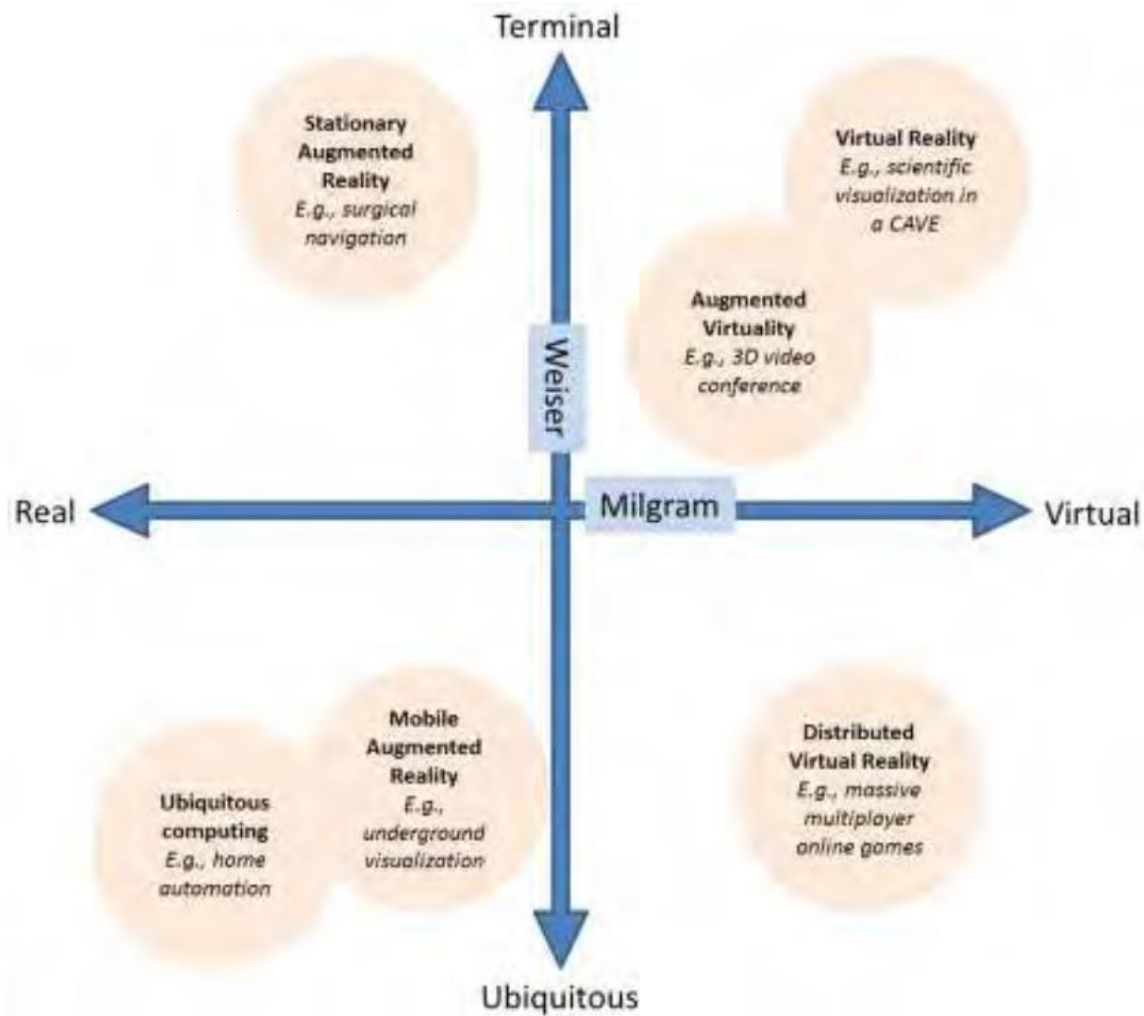
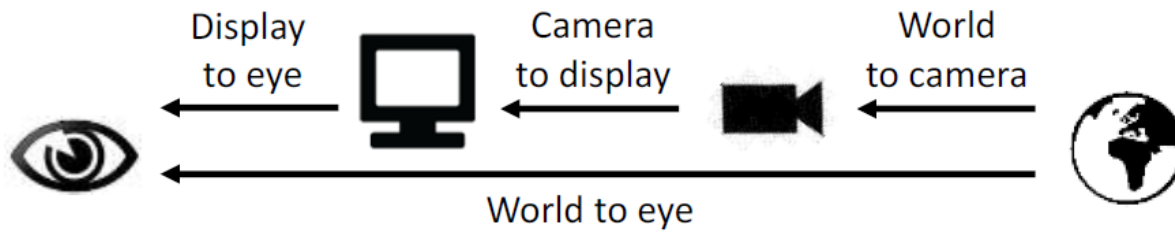
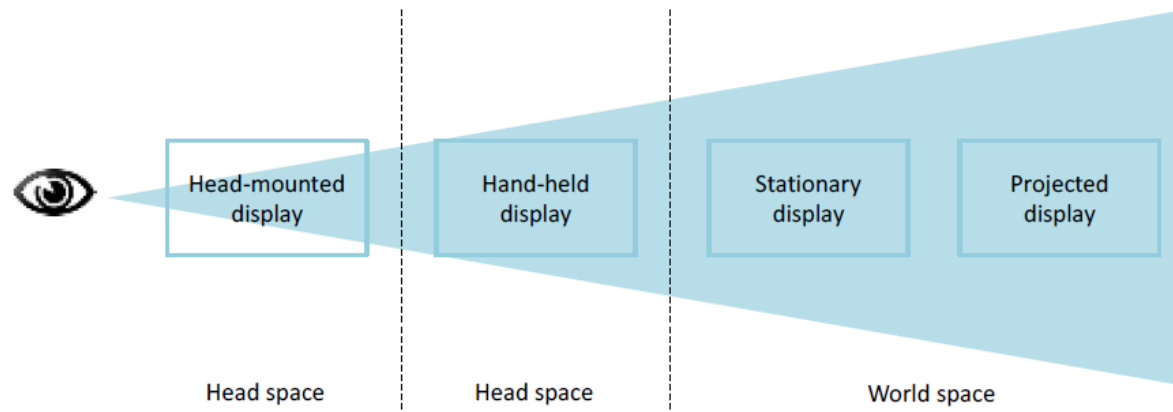


Figure 1.39 The Milgram-Weiser chart visualizes the relationship of various user interface paradigms



**Figure 2.12** The geometric model of most AR displays can be defined as the spatial relationship of up to four components: the user's eye, the display, the camera and the world. VST routes the user's perception of the real world through a camera, while OST lets a user see the world directly.



**Figure 2.13** AR displays can be categorized according to the distance from eye to display.



**Figure 2.15** The Rift is a binocular HMD intended for immersive computer games. It is under development by Oculus, which was acquired by Facebook in 2014 for 2B\$. This large acquisition has raised the interest in HMD technology world-wide.

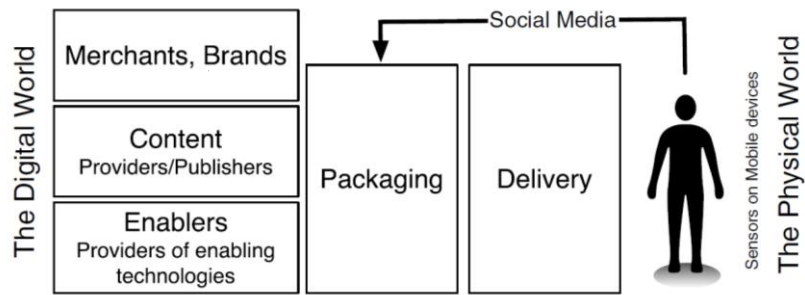
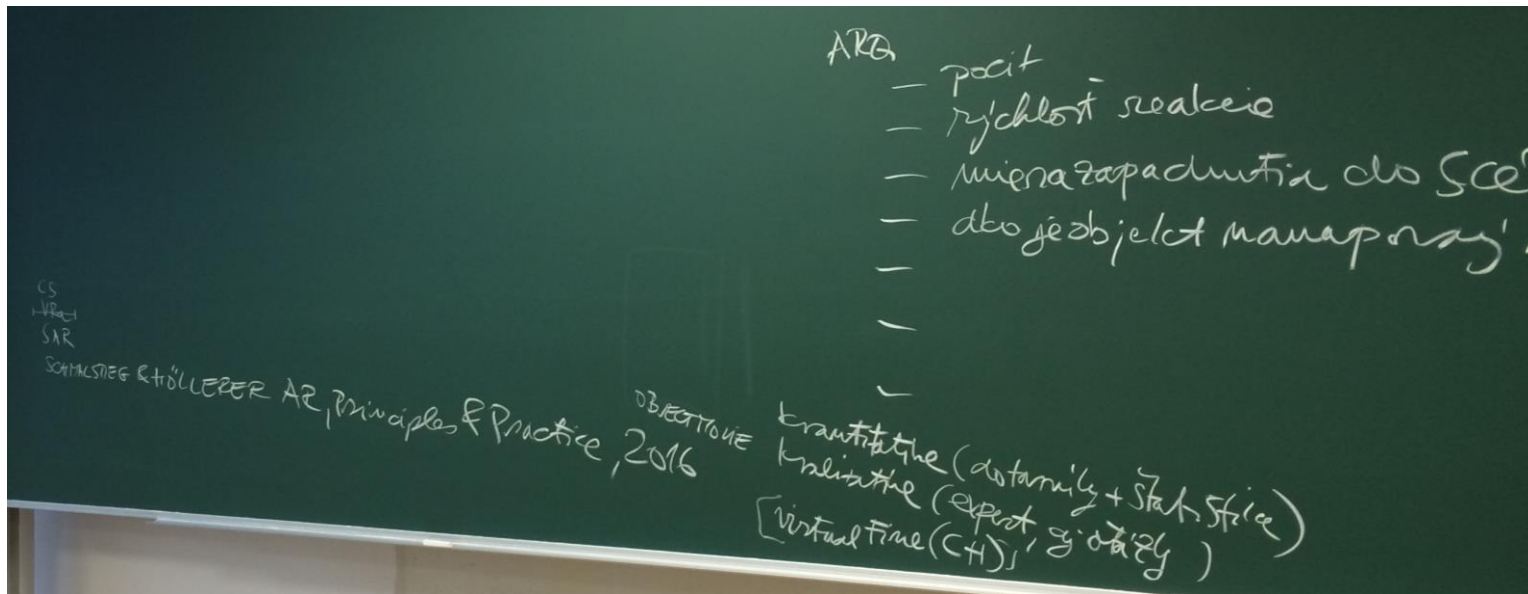


Fig. 1 Ecosystem of mobile AR Segments



ARQ

- pocit
- rychlost reakce
- míra zapadnutí do scény (do sa to tam hodi)
- do je objekt manapraz' na pruch
- 
- 
- 

krantitativne (data, family + Stat. St. (a))

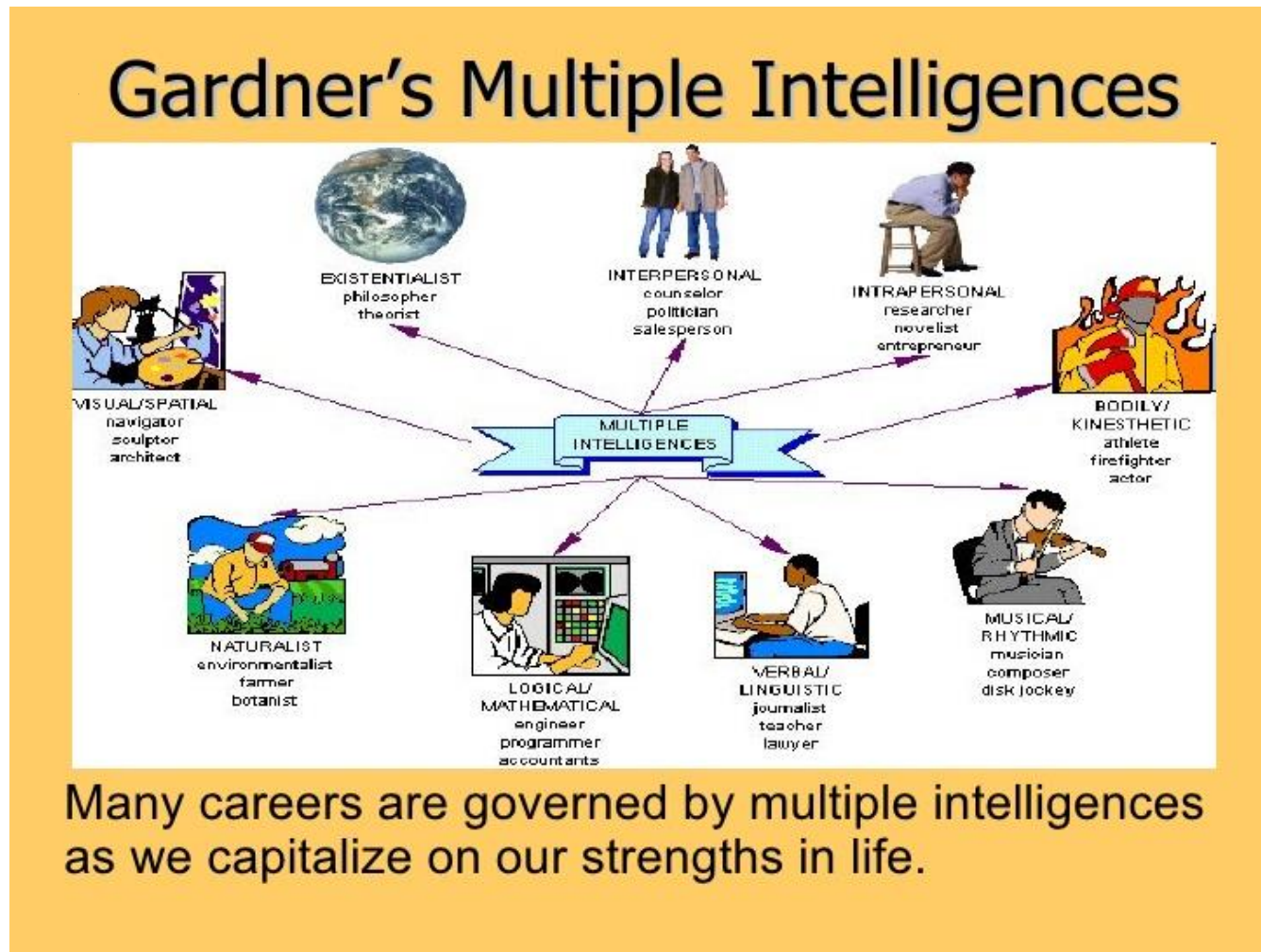
krantitativne (expert, g. otázky)

[virtual time (CH)]

Oblasť duchovnej kultúry	Sociálne projektovanie	Spoločenské vedy	Filozofia a matematika	Politické a právne vedomie	Styk s inštitucionalizovaným partnerom
	Inžierske projektovanie	Prírodné vedy		Náboženské vedomie / Estetické vedomie	Styk s imaginárnym partnerom
	Projektovanie človeka	Humanitné vedy		Mravné vedomie	Medziosobnosťný styk
	Sebavýchova	Sebapoznanie		Sebahodnotenie	Autokomunikácia
Oblasť umeleckej kultúry	Slávessné umenie	Veda o umení a umeleckej činnosti		Umelecká kritika	
	Hudba	Umelecká		Umelecká	
	Herectvo	Choreo - grafia		Umelecká	
	Výtvarné umenie	výroba	Estetika	spotreba	
Oblasť materiálnej kultúry	Architektúra				
	Sociálno - politická kultúra		Sociálno - praktický styk		
	Fyzická kultúra		Športovo - hravý styk		
	Kultúra reprodukcie ľudského rodu		Pohlavný styk		
Materiálno - technická kultúra		Výrobný styk			
				Vrstva duchovnej kultúry	
				Vrstva umeleckej kultúry	
				Vrstva materiálnej kultúry	



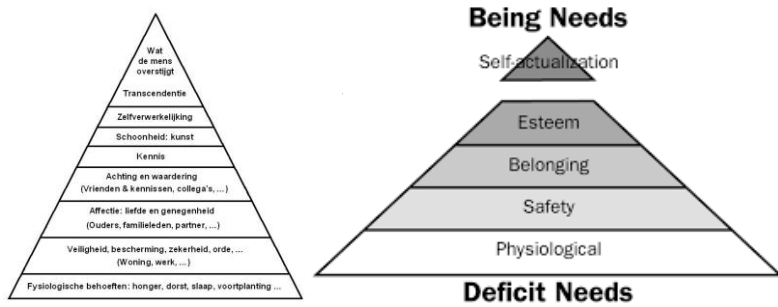
Obr. Xx: Oblasti kultúry [Kagan, M.S. 1974. Ľudská činnosť. Slovenský preklad. Bratislava: Pravda 1977.] Hlavné činnosti: styk, hra, umelecká tvorba, učenie, práca (pretváranie), styk (komunikácia).



Obr. Xx: [Gardner, H. 1983. *Frames of Mind: The Theory of Multiple Intelligences*. Basic Books. Inteligencie: vizuálna, logická, verbálna, prírodná... Google Search No.1: <http://www.tecweb.org/styles/gardner.html>

[https://www.google.sk/search?q=multiple+intelligences&safe=off&espy=2&biw=1680&bih=949&tbm=isch&tbo=u&source=univ&sa=X&ved=0CCKQsARqFQoTCNHqicPils\\_gCFcRMFAodA1AGwg#imgrc=U9NQ8V8S4fa8xM%3A](https://www.google.sk/search?q=multiple+intelligences&safe=off&espy=2&biw=1680&bih=949&tbm=isch&tbo=u&source=univ&sa=X&ved=0CCKQsARqFQoTCNHqicPils_gCFcRMFAodA1AGwg#imgrc=U9NQ8V8S4fa8xM%3A) Viac obrázkov na Google Search "multiple intelligences".

**Obr. Xx:** Maslowova pyramída (potrieb) znázorňuje hierarchiu ľudských potrieb [Maslow, H. 1943]. Päť základných potrieb: fyziologické potreby, potreba bezpečia, istoty, potreba lásky, prijatia, spolupatričnosti, potreba uznania, úcty, potreba seberealizácie. Prvé štyri Maslow pokladal za nedostatkové, piatu za potrebu bytia či rastovú potrebu.



Glassner na s. 77 uvádza rozšírenie na 8 stupňov.

**Tab. 1:** Revidovaná obmena (Anderson – Krathwohl et al. 2001a, b) pôvodnej taxonómie edukačných cieľov (Bloom et al. 1956). Viac prof. Švec,

**(I) Separate Knowledge dimension**

	A	B	C	D
	Factual	Concep- tual	Proce- dural	Metacog- nitive
<b>1. Remember</b>				
<b>2. Understand</b>				
<b>3. Apply</b>				
<b>4. Analyze</b>				

---

## 5. Evaluate

---

## 6. Create

---

1. ŠVEC, Š. 1983. *Teoretická analýza pedagogických cieľov a ich taxonómia*. Bratislava : Filozofická fakulta Univerzity Komenského. 139 s.
2. ŠVEC, Š. 2005. Učiteľská taxonómia: Systematika programových cieľov, učebných aktivít a hodnotených výsledkov. In *Pedagogická revue*, roč.57, č.5, s.453 – 476.

Current Status of Standards for Augmented Reality

23

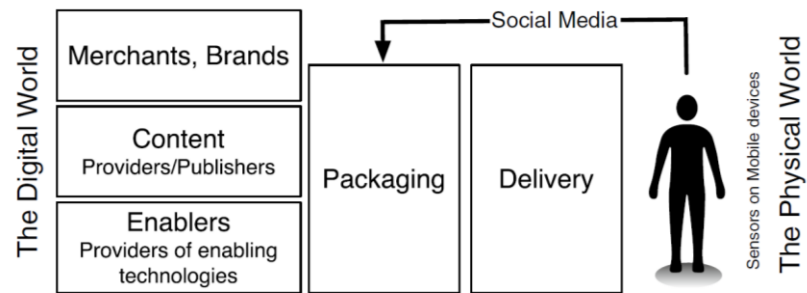


Fig. 1 Ecosystem of mobile AR Segments

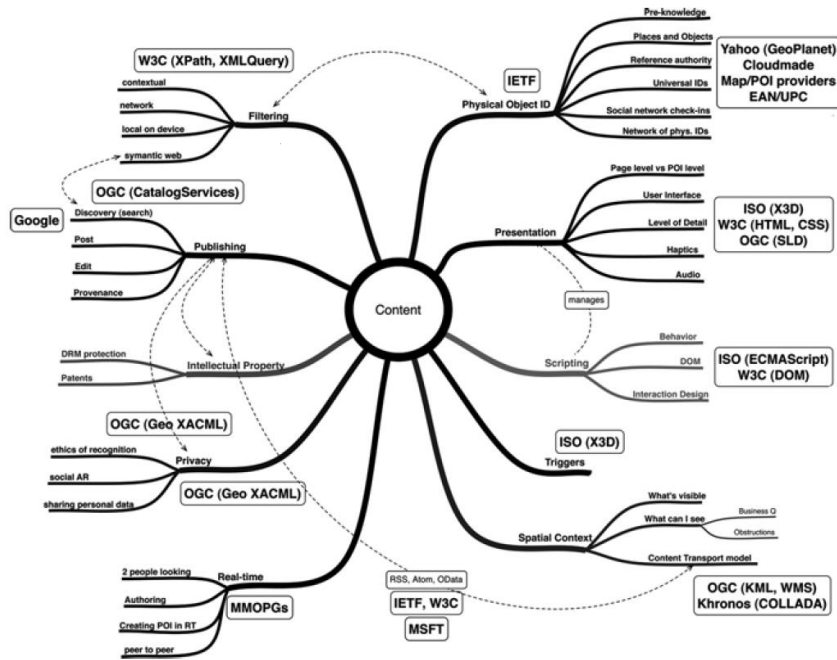
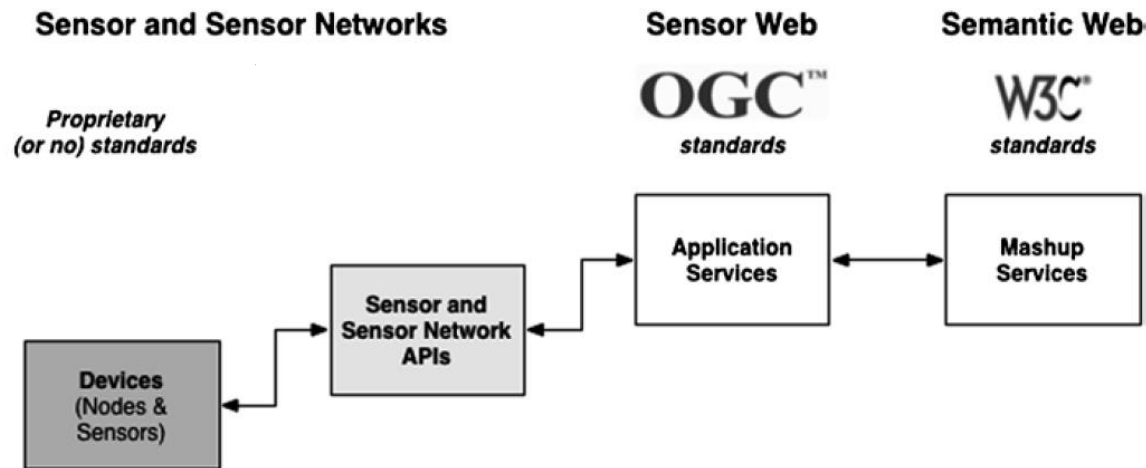


Fig. 2 Standards Landscape of Impact to Mobile AR

**Table 1** Existing Standards for Use in Geo-location-based Mobile AR

Standards	Organization	url
Geography Markup Language	OGC and ISO	<a href="http://www.opengeospatial.org/standards/gml">http://www.opengeospatial.org/standards/gml</a>
CityGML	OGC	<a href="http://www.opengeospatial.org/standards/citygml">http://www.opengeospatial.org/standards/citygml</a>
KML	OGC	<a href="http://www.opengeospatial.org/standards/kml">http://www.opengeospatial.org/standards/kml</a>
SensorML	OGC	<a href="http://www.opengeospatial.org/standards/sensorml">http://www.opengeospatial.org/standards/sensorml</a>
Sensor Observation Service	OGC	<a href="http://www.opengeospatial.org/standards/SOS">http://www.opengeospatial.org/standards/SOS</a>
Web Map Service	OGC and ISO	<a href="http://www.opengeospatial.org/standards/wms">http://www.opengeospatial.org/standards/wms</a>
OpenGL	Khronos	<a href="http://www.opengl.org/">http://www.opengl.org/</a>
SVG	W3C	<a href="http://www.w3.org/Graphics/SVG/">http://www.w3.org/Graphics/SVG/</a>
Style Layer Descriptor	OGC	<a href="http://www.opengeospatial.org/standards/SLD">http://www.opengeospatial.org/standards/SLD</a>
ECMAScript	ISO	<a href="http://www.ecmascript.org/">http://www.ecmascript.org/</a>
HTML	W3C	<a href="http://www.w3.org/html/">http://www.w3.org/html/</a>
Atom	IETF	<a href="http://tools.ietf.org/html/rfc4287">http://tools.ietf.org/html/rfc4287</a>
X3D	Web3D/ISO	<a href="http://www.web3d.org">www.web3d.org</a>
GeoRSS	Georss	<a href="http://www.georss.org">www.georss.org</a>
COLLADA	Khronos	<a href="http://www.collada.org">www.collada.org</a>

## 6 Mobile AR Standards Considerations



**Fig. 3** The OGC Sensor Web Enablement Standards Landscape

- ARWave Project Web page <http://arwave.org>
2. CityGML. 2008. OGC CityGML Encoding Standard. Open Geospatial Consortium, <http://www.opengeospatial.org/standards/CityGML>.
  3. ECMA-262. 1999. Standard ECMA-262 3rd Edition. European Association for Standardizing Information and Communication Systems, <http://www.ecma.ch/ecma1/STAND/ECMA-262>.
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  4. GML. 2006. OGC Geography Markup Language Encoding Standard 3.2.1. Open Geospatial Consortium, <http://www.opengeospatial.org/standards/gml>.
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  11. WMS. 2007. OGC Web Map Service Interface Standard 1.3. Open Geospatial Consortium, <http://www.opengeospatial.org/standards/wms>.
  12. WPS. 2009. OGC Web Processing Service Interface Standard. Open Geospatial Consortium, <http://www.opengeospatial.org/standards/wps>.