DAY 1&2
Part 0 : semantics and technical reminders

- **0_Semantics** :
    - real, reality, virtual, actual
    - Experience : Body/Time/Space in physical world, Simulation/Immersion/Interactivity
    - VR experience : body in the physical space viewing in the virtual space
    - AR experience : add virtual object in the physical space through media

- **0_VR technical solutions** :
    - Hardware : VR with virtual reality headset (Oculus Quest) for real-time experiences
    - Web VR (with aframe) vs built-in VR (with Unity, Unreal) : principles and workflow
    - Web VR
        - benefits : No installation (dev, user) / Free / Easy development / Accessibility / Low resources
        - Limitations : bitrate / loading / lowpoly

- **0_HTML reminders**
    - description language (not a programming language) / principle of markups / opening & closing tag
    - structure / html-head-body / charset / H1, p
    - HTML attributes, multiple parameters in attribute, CSS attributes
    - id & class, , # &
    - web color (http://www.w3schools.com/TAGS/ref_colornames.asp) or #RRGGBB coding
    - Link external files (css, javascript)
    - VS Code / Live server

Part 1 : js libraries for web VR/AR

- **1_aframe library**
    - free open-source framework for building web virtual reality (VR) experiences
    - easy coding : markup language like HTML, with tags prefix by a- (exemple <a-scene></a-scene>)
    - https://aframe.io/, basic example, library, HTML include
    - spatial orientation in scene, origin, scale
    - aframe help : aframe camera, a-camera, default position, change position
    - aframe primitive, aframe entity as basic aframe element
    - default camera : implicit declaration
    <a-entity camera look-controls wasd-controls position="0 1.6 0"></a-entity>
    <a-camera id="camera"></a-camera>
    - tools : web debug (console) <ctrl>+<maj>+i; visual inspector : <ctrl> + <alt> + I (<ctrl> + <alt> + I MacOS)

- **2_3D models in a VR scene**
    - files formats : obj, gltf/glb, fbx (demo export from blender)
    - 3D model file format : obj, mtl, jpg files as textures : vertices, edge, face, materials (cube from blender)
    - 3D scenes with 3Dmodels : (download : **3D assets_samples.zip** > extract.copy in assets directory)
        - obj with no material : 1_lowpoly_cat (assets, scale, rotation)
        - obj with data color as materials : 2_lowpoly_tree (mtl, multiple instances)
        - obj with file textures as materials : 3_skull (visual inspector, rotation)
        - gltf+bin+jpg vs glb files
        - lights (default lights) and shadow implementation

    - Finding and testing models (free, lowpoly)
        - free online 3D repositories :
        https://free3d.io/#gsc.tab=0,
        https://www.turbosquid.com/Search/3D-Models/free, https://sketchfab.com/,
        https://quixel.com/ (different resolutions)
        https://poly.cam/explore (from 3D scan sharing)

- ▪ demo https://free3d.com/
  1_search critera
  - • Lowpoly : https://free3d.com/3d-models/lowpoly
  - • Obj : https://free3d.com/3d-models/obj
  - • Animated : https://free3d.com/3d-models/animated
  2_model specifications, download options)

- ▪ Samples
  Obj Models :
  - • Cat : https://free3d.com/dl-files.php?p=5b576a4b26be8bed5e8b45b6&f=0
  - • Skull : https://free3d.com/3d-model/skull-v3--785914.html
    3Dviewer, blender conversion, Gltfviewer, aframe
  - • Trees : https://free3d.com/3d-model/trees-9-53338.html
  - • Fish : https://free3d.com/3d-model/bluegreen-reef-chromis-v2--439073.html

  Download one obj model with textures jpg and write html-aframe file to show it.

- ▪ Animations
  - • Cat : https://free3d.com/3d-model/lowpoly-cat-rigged-run-animation-756268.html
    (simple animation)
  - • Wolf : https://free3d.com/3d-model/wolf-rigged-and-game-ready-42808.html
    (multiple animations)
  - • Robot : https://free3d.com/3d-model/robot-dog-animation-681674.html
  - • Sophia : https://free3d.com/3d-model/sophia-animated-001-idling-130876.html
  - • Eric : https://free3d.com/3d-model/eric-rigged-001-771956.html

- ▪ Viewers
  - • online gltf : https://gltf-viewer.donmccurdy.com/
    https://github.khronos.org/glTF-Sample-Viewer-Release/
  - • online 3D viewer : https://3dviewer.net/

- ==**3_3D animations a VR scene**==
  - o animation mixer library (jsdeliver aframe-extras.min)
    - aframe extra : https://github.com/c-frame/aframe-extras/tree/master
    - animation mixer (loader) : https://github.com/c-frame/aframe-extras/tree/master/src/loaders

  - o simple animation
    - installation :
    <script src=" https://cdn.jsdelivr.net/npm/aframe-extras@7.5.4/dist/aframe-extras.min.js "></script>
    - use : <a-entity gltf-model="#3Danim-glb"animation-mixer> </a-entity>
    - examples : flamingo, parrot, stork

  - o multiple animations
    - syntax : animation-mixer="clip: clipname"
    - examples : (Fox : Survey | Walk | Run)

  - o list animation names
    - gltf viewer (options) :
    - example : (Wolf : 01_Run | 02_walk | 03_creep | 04_Idle | 05_site

  - o animation parameters :
    https://github.com/c-frame/aframe-extras/tree/master/src/loaders

Property	Default	Description
clip	*	Name of the animation clip(s) to play. Accepts wildcards.
useRegExp	false	If true, interpret the clip string as a regular expression. If false, it is treated as a literal string, except for the * character, which is treated as a variable-length wildcard.
duration	0	Duration of one cycle of the animation clip, in seconds. This provides the same functionality as timeScale (apart from pausing), with duration = clipLength/timeScale. This property only has an effect if timeScale is set to 1, otherwise the value of timeScale is used to determine animation playback speed.
crossFadeDuration	0	Duration of cross-fades between clips, in seconds.
loop	repeat	once, repeat, or pingpong. In repeat and pingpong modes, the clip plays once plus the specified number of repetitions. For pingpong, every second clip plays in reverse.
repetitions	Infinity	Number of times to play the clip, in addition to the first play. Repetitions are ignored for loop: once.
timeScale	1	Scaling factor for playback speed. A value of 0 causes the animation to pause. Negative values cause the animation to play backwards.
clampWhenFinished	false	If true, halts the animation at the last frame.
startAt	0	Configures the animation clip to begin at a specific start time (in milliseconds). This is useful when you need to jump to an exact time in an animation. The input parameter will be scaled by the mixer's timeScale. Negative values will result in a pause before the animation begins.

- o Finding and testing animation (free, lowpoly)
  - Cat : invisible
  - Wolf : nom des actions
  - DogRobot : tête desynchro

    https://sketchfab.com/tags/glb

    https://www.turbosquid.com/Search/3D-Models/glb
    Example : Stégosaure
    https://www.turbosquid.com/3d-models/stylized-stegosaurs-game-model-3d-model-1937889

    https://rigmodels.com/ , https://rigmodels.com/online/AutoRig.php
    Example : Zombie
    https://rigmodels.com/online/Animate.php?hash=0QO6SHWOJV2MBBHBHUJPLHT0O&model=Tekken_7_Negan_3d_animated

Part 2 : files workflow for web sharing

- **4_VR workflow : aframe to VR Headset**
  - o Principe : local development (vs code, live server) > web server file hosting > internet browser) access
  - o Demo on Oculus Quest (with SideQuest and VideoProjector)
  - o Github : a cloud-based platform where you can store, share, and work with others to write code
    - repository address : https://github.com/userid/repository
    - add file / commit / … delay
    remark : Git = decentralized version management software (free, open source, 2005 Linus Torvalds)
    - web access address : https://userid.github.io/repository/
  - o Markdown language for on-line menu https://www.markdownguide.org/basic-syntax/

- **5_ on line testing**
  - o Sharing web access address on github
  - o VR experience : origin, limits

- **6_3D animations a AR scene**
  - o AR library : https://raw.githack.com/AR-js-org/AR.js/master/aframe/build/aframe-ar.js
  - o AR coding : **<a-scene arjs>**

Part 3 : and more (if possible)

- **7_aframe complements**

  - **lights, shadow :** https://aframe.io/docs/1.7.0/components/light.html
    - <u>Lights</u> :
      - types . ambient, directional, hemisphere, point, spot, probe.
      - default lighting :
      <a-entity light="type: ambient; color: #BBB"></a-entity>
      <a-entity light="type: directional; color: #FFF; intensity: 0.6" position="-0.5 1 1"></a-entity>
      - modify parameters in aframe Visual Inspector *<ctrl> + <alt> + I (<ctrl> + <alt> + I MacOS)*
    - <u>Shadow</u> :
      - lights (point, spot, directional only) castShadow: true
      - plane : shadow="receive: true", objects : shadow="cast: true"

  - **aframe components in javascript :** https://aframe.io/docs/1.7.0/core/component.html
    - **example** : frequency
    - **external lib** : local path, url

  - **audio management** https://aframe.io/docs/1.6.0/primitives/a-sound.html
    https://pixabay.com/
    - <u>sound integration</u> :
      <audio src="" preload="auto" autoplay="true" volume="1" loop="true"></audio>
    - <u>iOS permission</u>

  - **some other 3Dressources**
    - <u>mixamo (adobe)</u> : animated characters https://www.mixamo.com/
    - <u>poly.cam</u> : from scan3D to glb export … and other free tools https://poly.cam/

Part 4 : final VR/AR experiences

- **8_Scenography of animated dancers in a VR scene**
  - <u>Sharing 3D animated models</u>

  - <u>VR and AR version</u>
    - VR skeleton
    - AR skeleton
  - <u>Upload for XR experience</u>

- **9_ Real-time performance : "SHADOW MOVE CONTEST"**
    - Group performances
    - Video captations