Mixed Reality: a practical case

In this tutored class, we make a prospective step forward in time with the help of a recent Japanese animated series, featuring many situations where augmented reality plays a central role. A careful analysis of an episode of the series will reveal the future possibilities (and foreseeable limitations) of Mixed and Augmented Reality

The animated series is called Denno Coil. It was released in 2007 by the "anime" studio **Madhouse** and is the work of **Mitsuo ISO**. It received the Excellency award in the animation category at the **Japan Media Art Festival** in 2007.

The series has 26 installments. You can have a look at the Wikipedia page for complete information.

Let us have a look at episode 1.

Question 1: What's real / what's not.

"*Reality is merely an illusion, albeit a very persistent one.*" – Albert Einstein

"*Everything you see or hear or experience in any way at all is specific to you. You create a universe by perceiving it, so everything in the universe you perceive is specific to you.*" – Douglas Adams

Reality is a very elusive, self-referring concept (Reality is what exists). Scientific consensus calls for a set of independently verifiable phenomena, which, all together, form reality. That is ok, but how do we do in our daily life? We confront our idea of reality with what our senses provide: the sensible world.

This is the alternative definition of reality, not to be confused with the previous one:

Reality is what we perceive.

Beware! Computer scientists do not limit reality to what we perceive. But in the terms Virtual Reality or Augmented Reality (AR), it is the meaning of the term.

This is not just small talk or definition nitpicking. Indeed in Augmented Reality, we're going to "augment" the thing called "reality". As a matter of fact

*Reality itself cannot be augmented, but our perception of it can.*

In Augmented Reality, "reality" (the true thing) has been reorganized so that new, numerical objects are created. However, it bears no importance to us until it enters the realm of human perception, one way or another.

AR is just a (nifty) way of doing this. Books are another way of achieving this. They require less technology, and affect our senses only marginally. But they make good use of our brain to convey alternative worlds. The difference is that

Blending perception and imagination (brain space) takes craftsmanship

Think of at least two ways mankind has used prior to the Computer Age to achieve augmentation. How are they similar/different from AR?

Question 2 : The train Stop
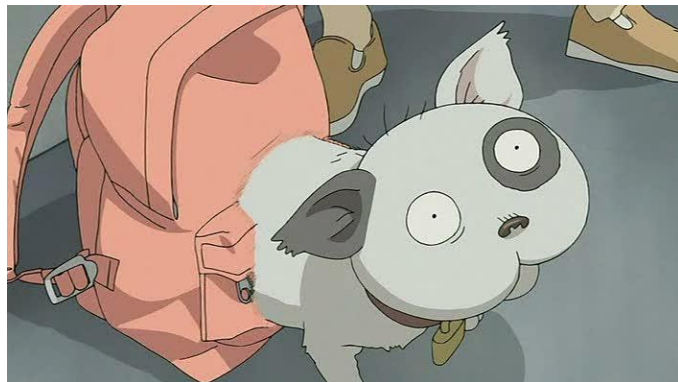
Stop the anime at **2:10**

- This is the first example of Real/Virtual combination. Can you tell what is real / virtual? Identify the cues that help you decide.

- What would be necessary in today's world (the anime is supposed to happen in 2027) to achieve such situation?

- Note: please consider what the characters wear in terms of AR devices. Does the dog disappear when the girls do not look at it?

The maker of Denno Coil says:

If I had to present the background of the series in one sentence, it would be "a time when glasses to see the spirits are freely available." But these glasses are in fact "Dennou Megane".

Denno (电 脑) is an abbreviation of the Japanese official term used to describe a computer (电子 计算机). Megane (眼镜) means pair of glasses. As depicted in the series, the Denno Megane are computers shaped as glasses.

AR raises the question of discernability between virtual content and physical (real) objects. Recent experiments show that humans, under certain conditions, can be fooled about what is "real" and what is not. So the question, again, is not a purely philosophical one anymore.

Question 3: A ghost and a sphere

Stop the anime at **2:57**

- A new entity is presented: real or virtual? How can you tell? Why does the cat respond to it (the answer is at 7:05).

Stop at **3:23**
- What happens? Is the sphere real or virtual? How does the girl stop it?
- Think of an example of such interaction that already exists in today's world (but not in AR)

**Question 4: Look! No girl!**

Stop at **3:45**
- How do you explain that the sphere does not see the girl?

This is an example of *diminished reality*. See the movie of Jan Herling and Wolfgang Broll from the Ilmenau University of Technology.

- Any idea on how this is achieved?

Note: there is an evident link between the situation exposed in the anime and earlier, more magical explanations:

    - invisibility cloak
    - cloaking device in Start Trek
    - "circle of protection" in all magical traditions:
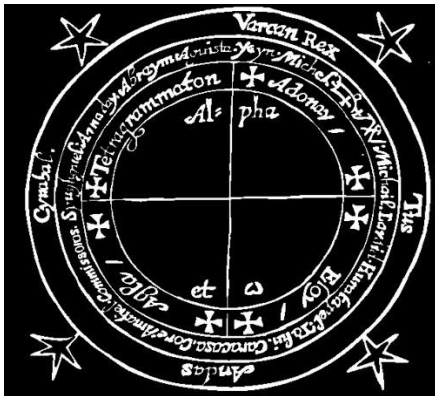
Is there something similar in today's AR technology? Hint: ARToolkit.

Question 5: interacting in AR

Stop at **4:23**

- What does this scene imply? Do you think we can do that with current AR technology?
- What is the older girl doing? Is this AR? Do you think this is a plausible interface with today's technology?

Note: At 5:44, we finally get an explanation of the AR visual interface. Notice how the little girl does not even seem to care for the difference between real and virtual.
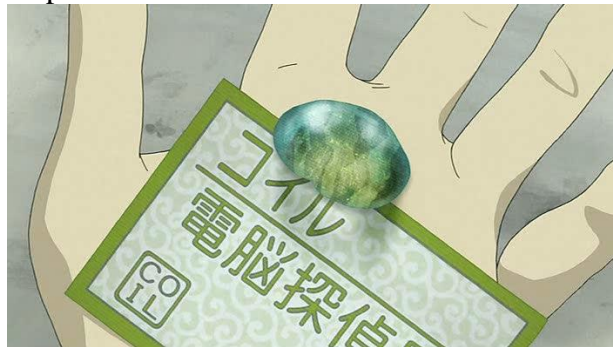
- Stop at 6:18: what is this?
- Compare 7:05 and 8:13:

Again, what is the problem with the situation depicted here?

Question 6: Tangibles

- Stop at **9:10** : AR is sometimes called Mixed Reality.

How is this object an example of MR ?

- Stop at 9:54 :

- What does the girl actually see? Is this a tangible object?
- Stop at 9:58:

Super, ils sont dans le voisinage.

- What does the girl actually see? Now, is this a tangible object? Was it necessary? How would you implement this "tracker" solution?

  Note: AR brings forth the question of design and interaction very acutely, because AR makes the 3D world responsive to all kinds of inputs, generalizing the notion of situated computing. In the 1990's it was thought that computers would become nomadic and hence bring AR to users. It seems smartphones will become AR devices much sooner than computers (tablets?).
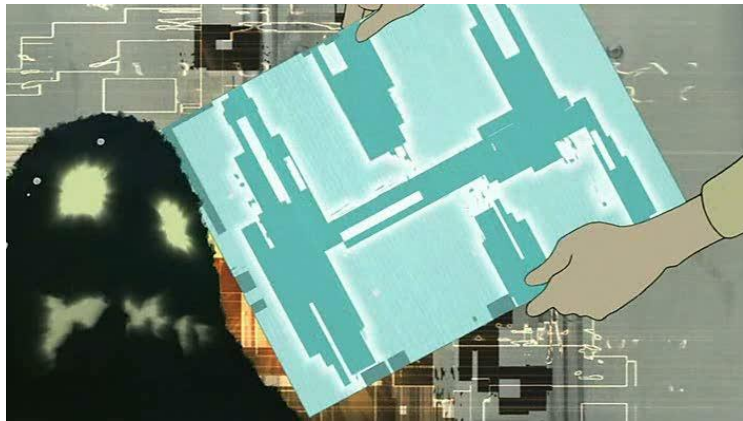
Stop at 10:12:

- Is it now obvious that this interface is tangible? In what sense?

データが
ありません

Stop at 10: 22:

- Do you know how this special AR object is called? What does it require in terms of hardware/software do be achieved? Think of possible uses in today's world.

Question 7: Audio AR

Stop around **11:40:**

- What's new in this scene? Again, what kind of "hidden" technology is appropriate to replicate this kind of situation in real life?

Stop around **12:10** :

- Again, where is the "phone"?

Answer is at 13:32:

- What seems to be wrong here?

INTERLUDE: yuko's flashback

- What does the AR interface seem to consist in?
- Is the object in itself interesting to Yuko? Does it have a practical use?
- What's the dog reaction?

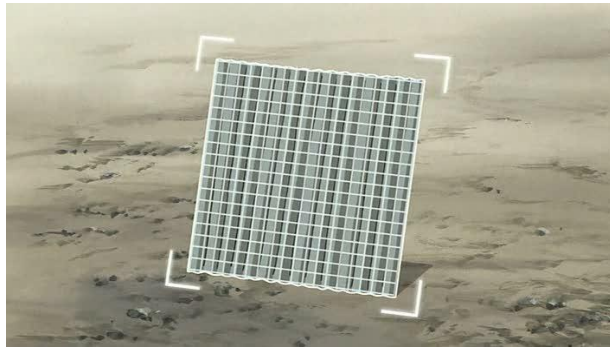NOTE: the paper says: "Yuko, put the glasses on. Gran'Pa."

The situation depicted here is a stretched scenario of what is called "Affective computing" (see slides).

Question 8: Searching for the dog

Stop at **15:21**:

- What is an "obsolete" space? Which notion does it generalize?

Stop at **16:53**:

- What does the girl do? What is the purpose of her sequence of actions?
- Please detail this sequence and state the software/harware tools you would deem appropriate for the job.
- Is this action specific to AR, i.e. can you find an example of a similar procedure (in essence, not in operation) with today's technology?


Stop at **18 :40 :**

- Explain precisely what is happening here in terms of real/virtual environment and their interaction, and what is perceived from all the actors of the scene (pretty complicated, huh?)
  - What is the difference with a similar situation in Virtual Reality?
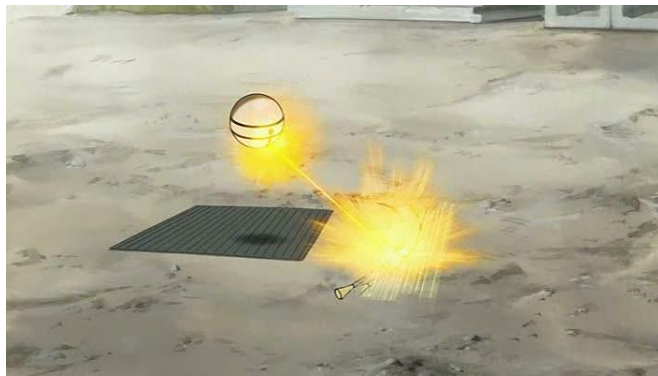   (see excerpt from "Johnny Mnemonic" movie).
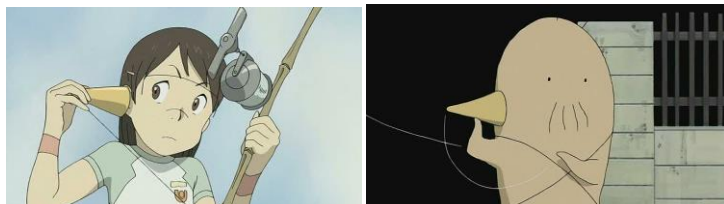
Stop at **19 :41 :**

- Explain what kind of communication is this? Why is it augmented audio? Do you see what's wrong here ?
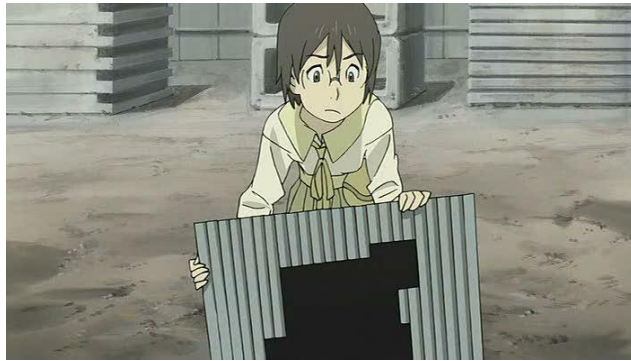
Stop at **21 :40** :

- Why does Yuko do this? How does she proceed ?

Stop at **22 :50 :**

- What happens here exactly? Is this real/virtual/augmented? What was the fishing rod composed of finally?