



# Introduction to MARG

Module: Mobile Augmented Reality Games for learning and entertainment

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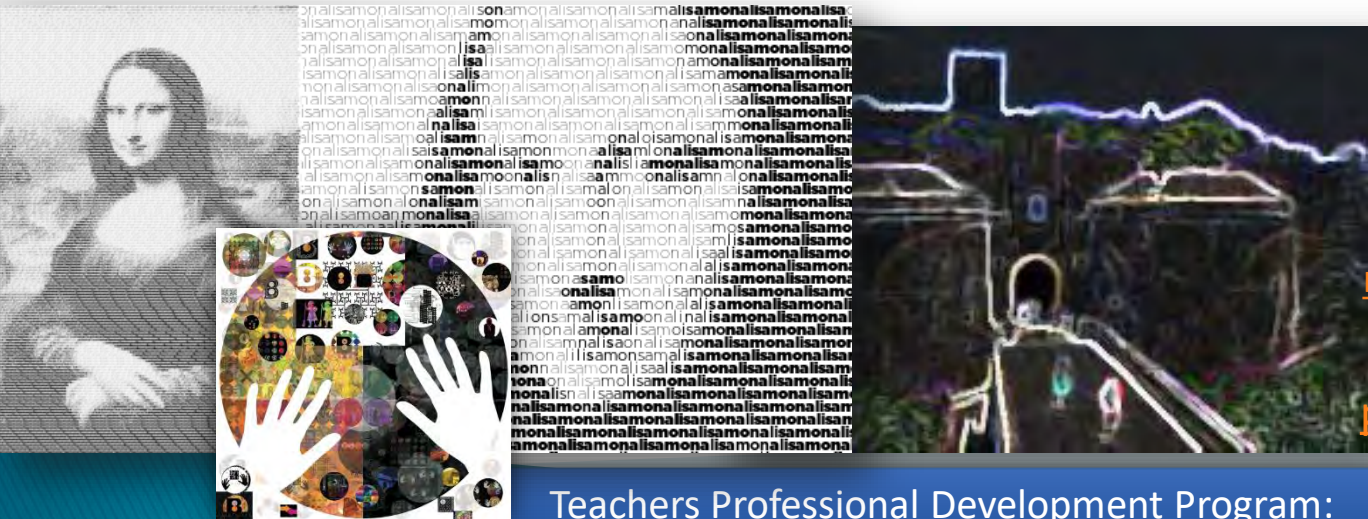
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# Mobile Augmented Reality

**Mobile Augmented Reality in one sentence**

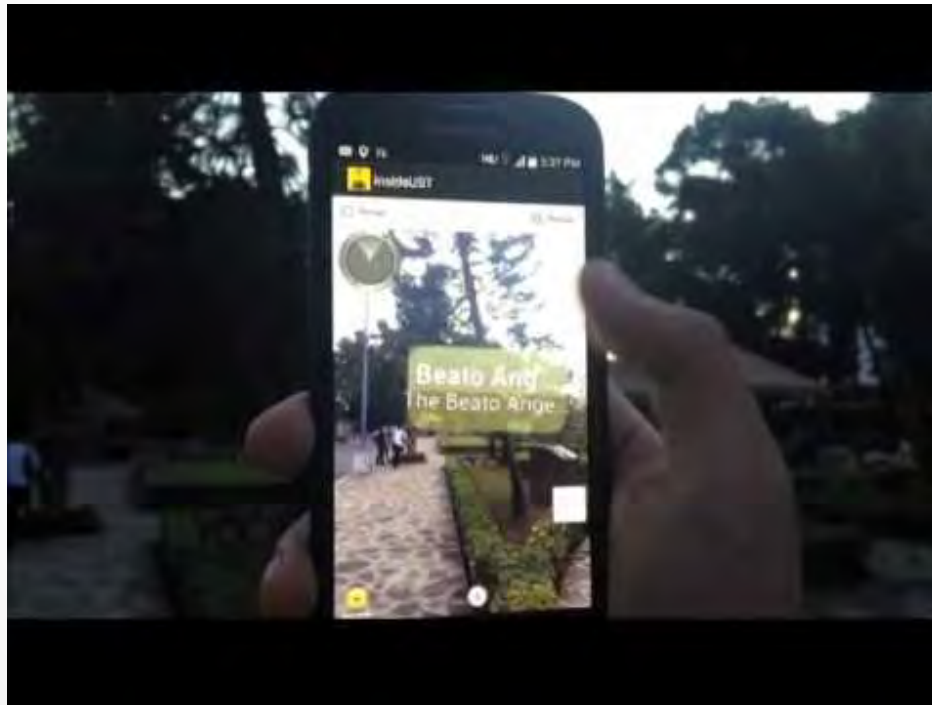
Overlaying digital information onto the real world





# Mobile Augmented Reality

## ► An example...



[https://www.youtube.com/watch?v=C4BG\\_0vIZR4](https://www.youtube.com/watch?v=C4BG_0vIZR4)

<https://www.youtube.com/watch?v=ddyUp26qvhw>



# Mobile Augmented Reality

- ▶ **Definition** (Azuma, R. (1997). A survey of augmented reality. Presence: Teleoperators and Virtual Environments, 6(4), 355e385.)
  - AR is a system that fulfills three characteristics
    1. It combines the real and virtual world.
    2. It allows real-time interaction.
    3. It aligns real objects or places and digital information in 3D.





# Mobile Augmented Reality



- **Augmented Reality** supplements the user's perception of the real world by the addition of computer-generated content registered to real-world locations



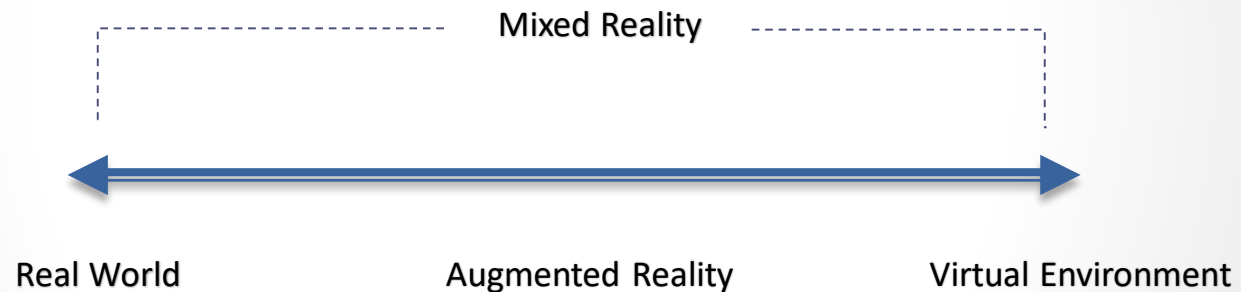
- **Virtual Reality** immerses a user in a synthetic environment





# Mobile Augmented Reality

- ▶ Augmented Reality can be considered to lie on a “**Reality–Virtuality Continuum**” between the real environment and virtual environment (Milgram, Takemura, Utsumi, & Kishino, 1994).





# Mobile Augmented Reality

- ▶ MAR uses mobile devices such as smartphones and tablets, to allow users to interact digitally, by sending or receiving digital information relevant to the physical environment
  - **Location-based augmented reality based on GPS technology.**
  - **Vision-based augmented reality**





# Mobile Augmented Reality

## Location-based augmented reality

The applications of this type use GPS technology deliver information to the users according to their geographical position.

The digital information is triggered via GPS and presented to user's screen to augment physical environment with narrative and information related to the location.





# Mobile Augmented Reality

## Vision-based augmented reality

Vision-based MAR applications demonstrate digital information to the user after pointing the camera of the mobile device to a specific target, e.g. a physical object or a QR-Code. This function is based on automatic image recognition technology.





# Some demos

- ▶ <https://www.youtube.com/watch?v=GBKy-hSedg8>
- ▶ <https://www.youtube.com/watch?v=uHlxYpBW7sc>
- ▶ <https://www.youtube.com/watch?v=EYm3DRHRuzs>



# Mobile Augmented Reality

- ▶ Hardware Requirements
  - Mobile device with
    - the presence of a video camera to capture live images,
    - a powerful processor to either composite virtual and real objects or display a 3D-simulated environment in real time



# Mobile Augmented Reality

## ► Useful Technologies

### ◦ **GPS Technology**

- allows the system to take into account the user's real-world location, ensuring that contextually relevant virtual data are provided to the user at geographically significant locations.

### ◦ **Image Recognition Software**

- enables real-world images and objects to act as “triggers” for multimedia and model overlays, and also to anchor virtual data in the environment.

### ◦ **Speakers and Sound Systems**

- enables relevant sounds and audio recordings to be played.

### ◦ **Internet Access**

- provides a means of storing, retrieving and sharing content using social media and Web 2.0 technologies.

### ◦ **Intuitive Interfaces**

- advances in touch screen, gyroscope and haptic input technologies provide more natural means to interact with and manipulate virtual objects.



# Mobile Augmented Reality

## ► Some Applications

- Wikitude World Browser ([Android](#)/[iOS](#)/[Blackberry](#)/[Windows Phone](#)) — Free
- Yelp Monocle ([Android](#)/[iOS](#)/[Kindle](#)) — Free
- Google Ingress ([Android](#)) — Free
- SnapShot Showroom ([iOS](#)) — Free
- Paper 4D ([Android](#)/[iOS](#)) — Free
- <http://www.quivervision.com/>





# Mobile Augmented Reality

## ► Uses of Augmented Reality

- The use of Augmented Reality systems has been investigated in a range of industries since the early 1990s, including
  - Medicine
  - Manufacturing
  - Aeronautics
  - Robotics
  - Tourism
  - **Education**



# Mobile Augmented Reality in Education

- ▶ Several educational uses of this Augmented Reality have already been documented in the literature.
  - Chemistry
    - *Chen, Y.-C. (2006). A study of comparing the use of augmented reality and physical models in chemistry education. In Proceedings of the 2006 International Conference on Virtual Reality Continuum and its Applications, Hong Kong, China: ACM*
  - Environmental Science
    - *Klopfer, E., & Squire, K. (2008). Environmental detectives – The development of an augmented reality platform for environmental simulations. Educational Technology Research and Development, 56, 203–228.*
  - Biomedical science
    - *Rasimah, C., Ahmad, A., & Zaman, H. (2011). Evaluation of user acceptance of mixed reality technology. Australasian Journal of Educational Technology, 27, 1369–1387.*
  - Mathematics
    - *Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. Journal of Science Education and Technology, 18, 7–22.*



# Mobile Augmented Reality in Education

Interactive Storytelling (IS) is gaining increasing attention by research communities of

- Humanities Informatics,
- Digital Games Based Learning and
- Information and Communication Technology (ICT)

and that



- Situated learning
- Enquiry-based learning
- Games-based learning
- Augmented reality system can be used to facilitate immersive games-based learning by creating a **digital narrative**, placing students in a role, providing authentic resources and embedding contextually relevant information
- Using Augmented Reality systems to turn the real world into the environment in which games are played can often make skills transfer to real-life applications simpler and easier



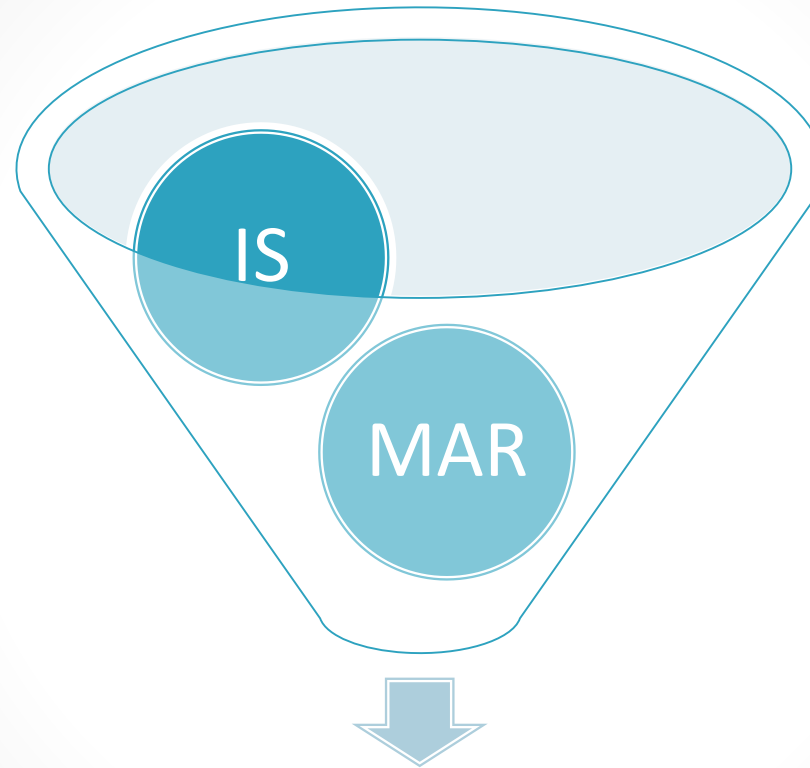
# Mobile Augmented Reality in Education

- ▶ Beyond the traditional ones, **interactive stories**
  - enable the reader/player to participate and affect the **plot** of the story
  - offering new genres of narrations, more **engaging** and **adaptive**
  - present a dynamic sequence of events and a **nonlinear** plot which is determined during the “reading” of the story according to the user’s actions and choices
  - the end of an interactive story is not predetermined by the author.





# Mobile Augmented Reality in Education

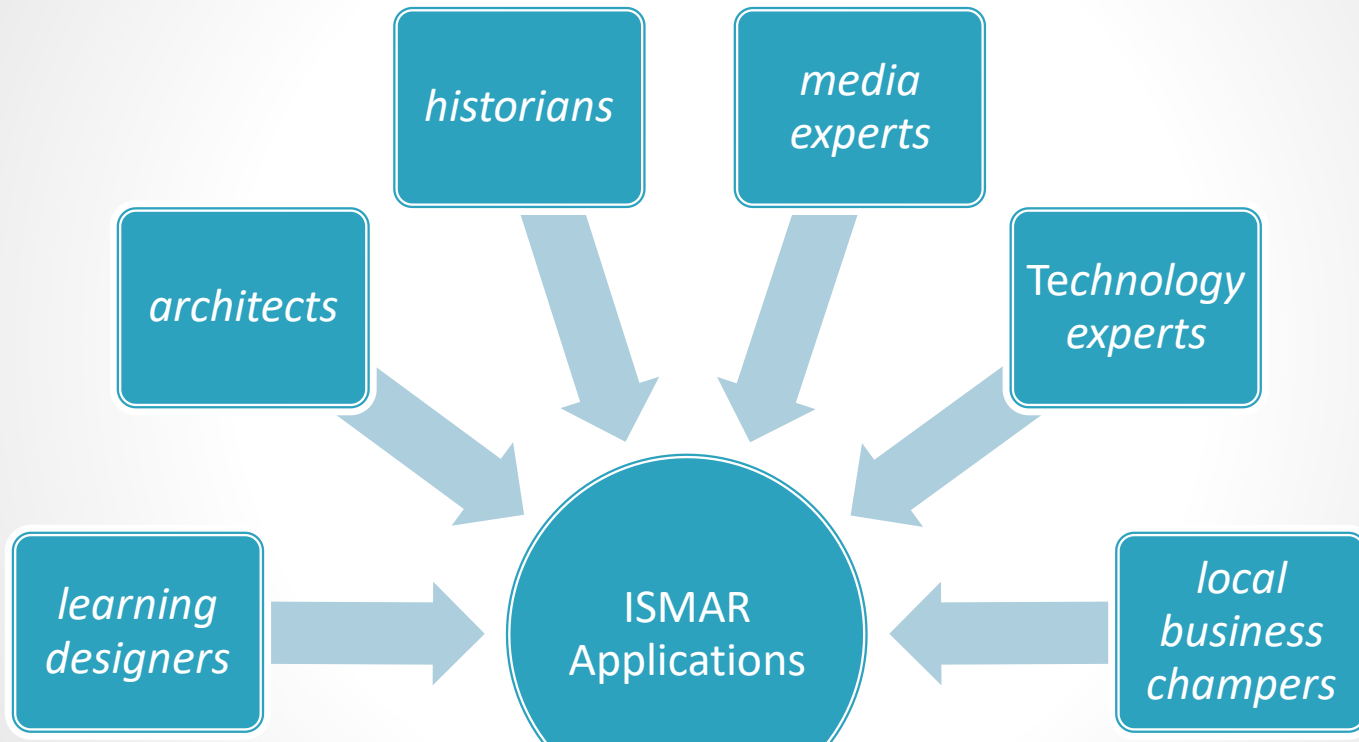


***Interactive Story Mobile Augmented Reality  
(ISMAR)***





# Mobile Augmented Reality in Education



small number of existing applications



# Mobile Augmented Reality in Education





# Mobile Augmented Reality in Education

- ▶ The description of ISMAR serious games genres that will serve as models or design guidelines could result to the increasing of available IS applications.
- ▶ Such genres include:
  - *quests,*
  - *adventure games,*
  - *mystery games,*
  - *treasure hunts,*
  - *scavenger hunts,*
  - *races,*
  - *real world simulations,*
  - *role playing games,*
  - *time travels and*
  - *journalistic games.*

A large, stylized 3D graphic of the words "Adventure" and "GAMES". "Adventure" is in a large, orange-to-red gradient font with a 3D effect. "GAMES" is in a smaller, blue-to-white gradient font, also with a 3D effect, positioned below "Adventure".



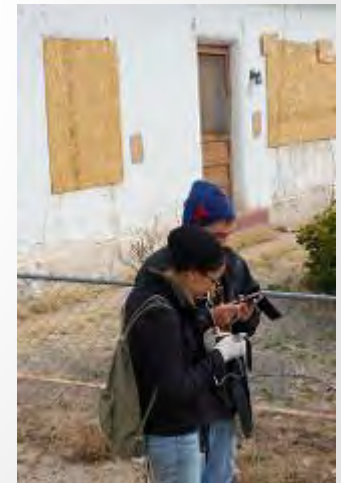
# Mobile Augmented Reality in Education

Game	Story genre and Structure	Pedagogy	Subject
<i>Mentira</i>	Mystery. Static, fiction	Collaborative Inquiry	Spanish
<i>Alien Contact</i>	Mystery. Static, science fiction	Collaborative Inquiry	Maths
<i>Mad City Mystery</i>	Mystery. Static, science fiction	Collaborative Inquiry	Biology
<i>Outbreak @ the Institute</i>	Mystery. Interactive, science fiction	Collaborative Inquiry	Biology
<i>Frequency 1550</i>	Quest, Static, history based fiction	Inquiry	History
<i>Dow Day</i>	Journalistic. Static, history based fiction	Inquiry learning	History



# Mobile Augmented Reality in Education

- ▶ In location-based ISMAR Applications, the presentation of information does not have to contain 3D virtual content registered in relation to real environments.
- ▶ Players usually work in groups to solve a problem. Each of them plays a different role, e.g., a chemist, a doctor, an environmentalist, or other domain experts.
- ▶ Players taking on different roles have to resolve a variety of tasks, which are pieces of a larger puzzle.







# Mobile Augmented Reality in Education

## Advantages

MAR

contextualize learning

narration engages the users

create stronger relations between the participants and local society

cost

safety



# Mobile Augmented Reality in Education Classroom

- ▶ Significant barriers to successful use of Augmented Reality in the classroom
  - Lack of time
  - Lack of Technical Expertise
  - Lack of Technical Materials



Teachers may need a very high level of support to ensure a positive outcome when using Augmented Reality



# Mobile Augmented Reality in Education

## Authoring Tools

- ▶ The development of AR applications has evolved impressively. The first AR applications development was very hard because it required the mastering of several complicated technologies.
- ▶ In 2008 the first AR browser (wikitude) appears, marking the passage from the isolated applications development to the model of AR authoring for browsers.





# Mobile Augmented Reality in Education

## Authoring Tools

- ▶ Recently, authoring tools designed especially for the development of MAR serious games became available.
  - Free
  - Rapid prototyping even by students

### ARIS

*The conceptual model of ARIS seems to support more efficiently the Interactive Storytelling development since it provides abstract constructs like “scene”, “dialogs” and “quest”.*



- ▶ **ARIS GAMES**
  - <http://arisgames.org/>
- ▶ **ARIS GAMES MANUAL**
  - <http://manual.arisgames.org/>
- ▶ **ARIS FORUM**
  - <https://groups.google.com/forum/#!forum/arisgames>
- ▶ **Local games lab ABQ**
  - <https://localgameslababq.wordpress.com/>
- ▶ **YouTube!!!**





- ▶ ARIS is an easy to use platform for creating and playing augmented reality experiences on iOS devices. These experiences include:
  - Interactive Stories
  - Scavenger Hunts
  - Tours
  - Data Collection Activities
  - ...

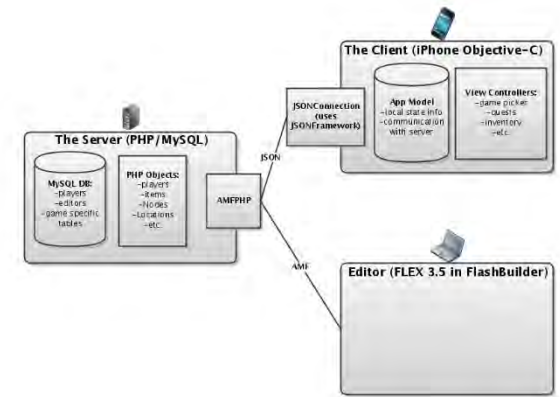


- ▶ These experiences can include interaction based on:
  - player location (GPS)
  - QR codes
  - navigation of the on-screen map
  - entering alphanumeric codes (e.g. "enter the price of a cheese pizza and large soda at Panucci's Pizza")
  - media collection
  - social interaction around media collection



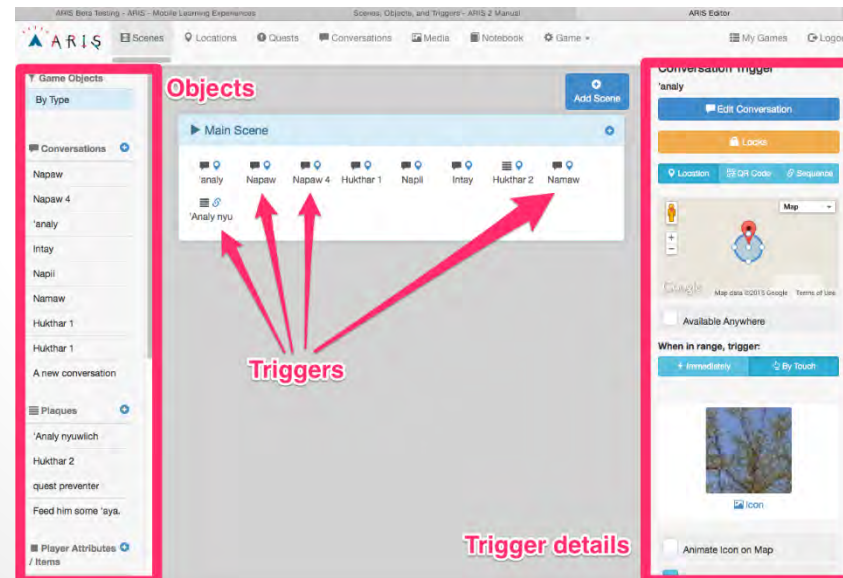
## ► ARIS consists of three pieces of softw

- Client (app)
  - to play games and collect data
- Editor
  - to make ARIS experiences.
- Server
  - Games live on a database in the cloud. The client and editor read from and write to it. Upside - No need to install games or go through the app store. Downside - you need an internet connection to play.





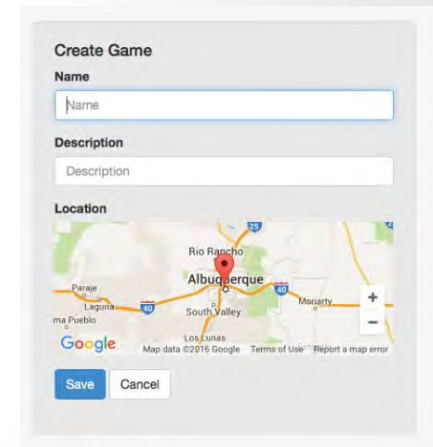
- ▶ The basic conceptual model for ARIS authoring involves **objects**, **triggers**, and **scenes**.
  - Media content = **objects**
  - How a player accesses content = **triggers**
  - Organizational units for triggers = **scenes**





- ▶ **Objects** in ARIS are containers for the content you'd like your players to see and interact

- Plaque
- Item/Attribute
- Conversation
- Webpage
- Factory (a meta-object)



- ▶ To make your **object** available to players, you must also create at least one **trigger** to point to that object. Each trigger lives in a scene.





- ▶ **Triggers** provide players access to objects.

How to Enable	Type
<ul style="list-style-type: none"><li>• <b>Location</b></li><li>• <b>QR Code</b></li><li>• <b>Sequence</b></li></ul>	<ul style="list-style-type: none"><li>• Start Conversation</li><li>• View Plaque</li><li>• Inspect Item</li><li>• Visit webpage</li><li>• Switch Scene</li></ul>

*Each type of trigger is related with a certain type of object*



- ▶ Objectively, scenes are containers for collections of game objects (plaques, conversations, etc.).

*Every game needs at least one scene.*

- ▶ *Every object needs at least one trigger to provide the player access.*

- ▶ *A trigger is created within a scene.*

between scenes could become quite complex if you want.





- ▶ Every game needs at least one **scene**
- ▶ A player can only be in one scene at a time.
- ▶ You create one or more **scenes**, and add **triggers** to these scenes to move action along within them





- ▶ <http://www.wikitude.com>
- ▶ <https://blippar.com/en/>
- ▶ <https://www.aurasma.com/>
- ▶ <https://www.vuforia.com/>
  
- ▶ <https://en.wikipedia.org/wiki/Layar>
- ▶ <https://en.wikipedia.org/wiki/Junaio>



# The End!