

IUI 2011 Workshop on Location Awareness for Mixed and Dual Reality

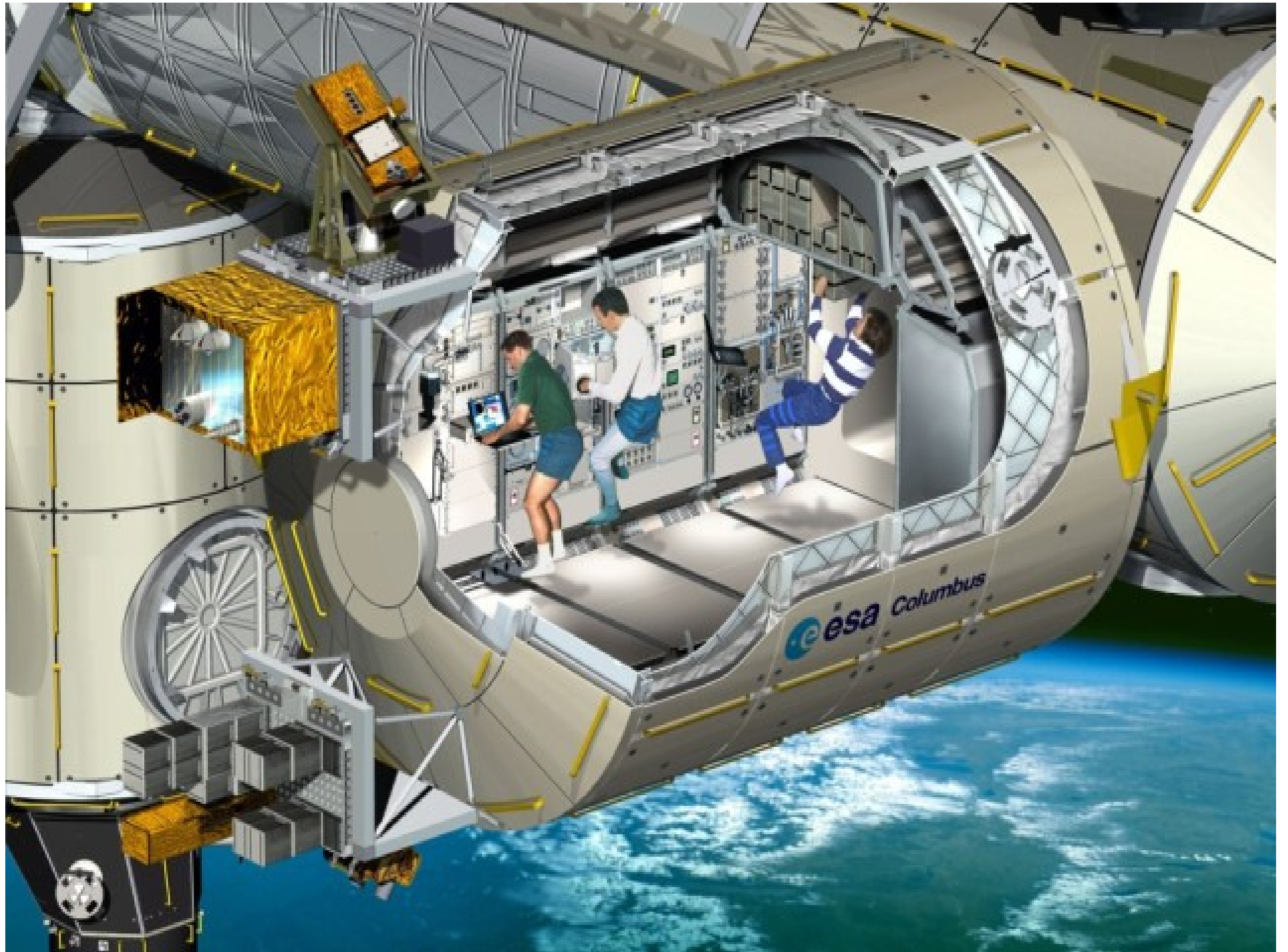
Indoor Positioning: Group Mutual Positioning

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In all these cases you may want to share social experiences with family or friends who are far away

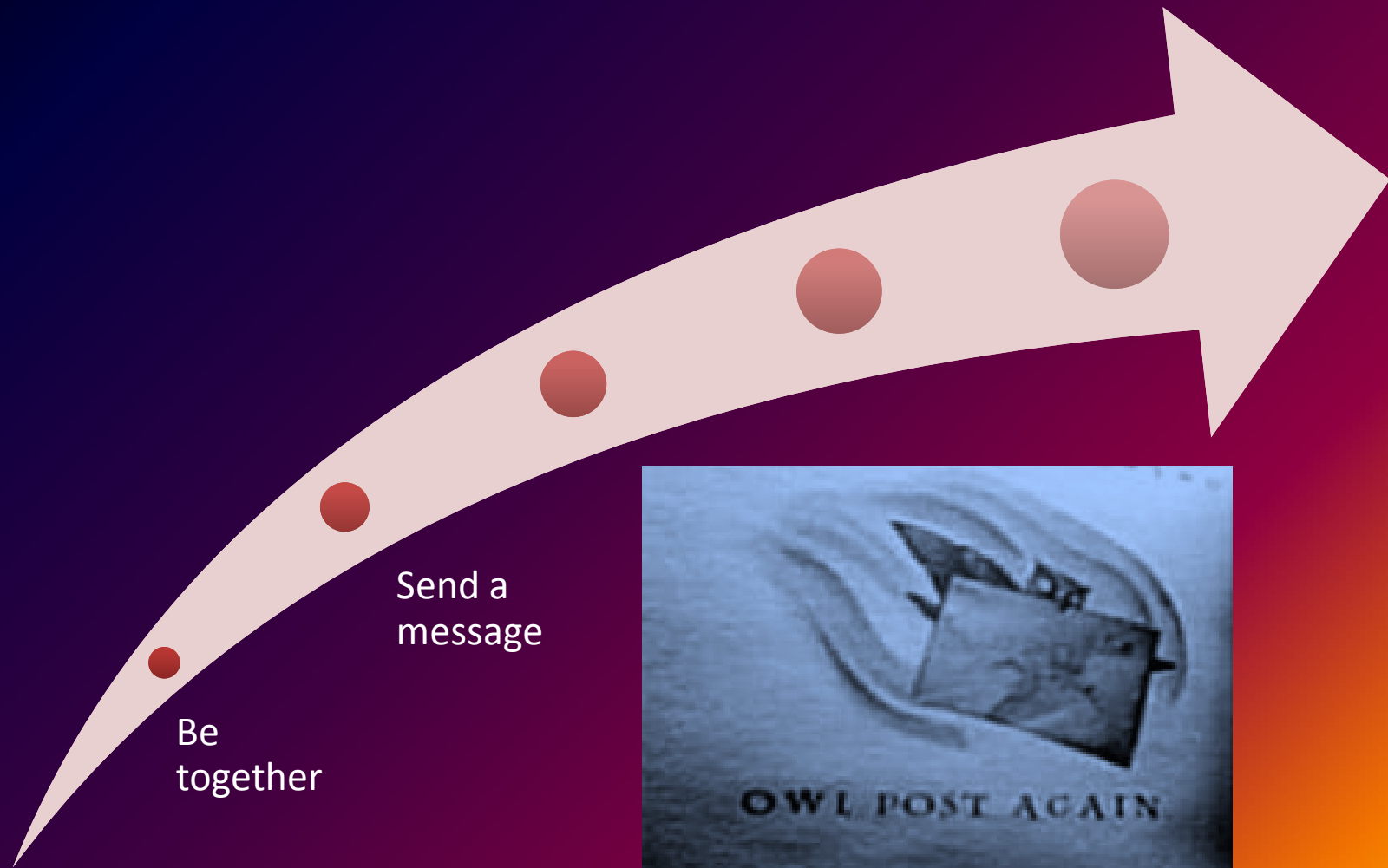
Social Experience



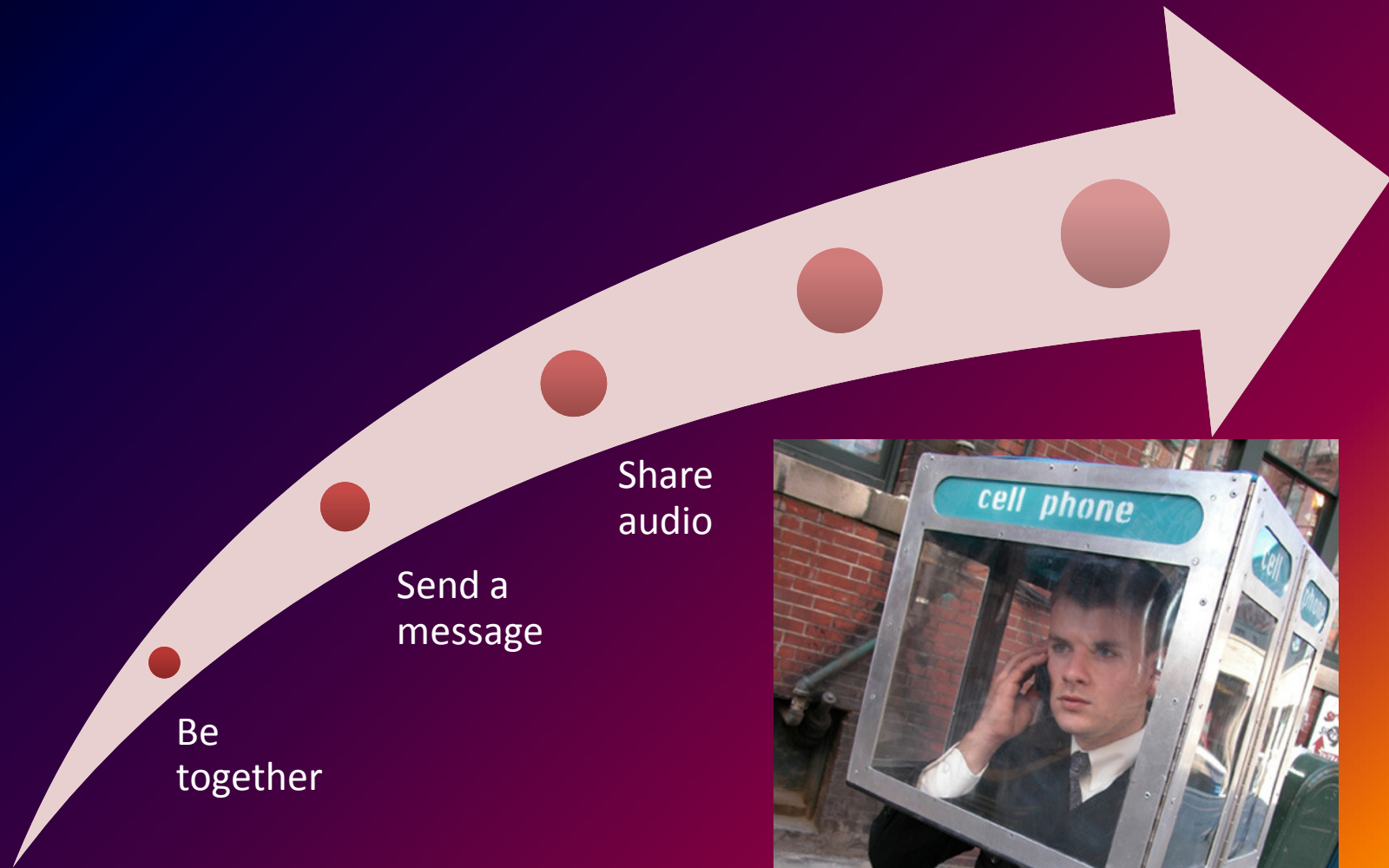
Be
together



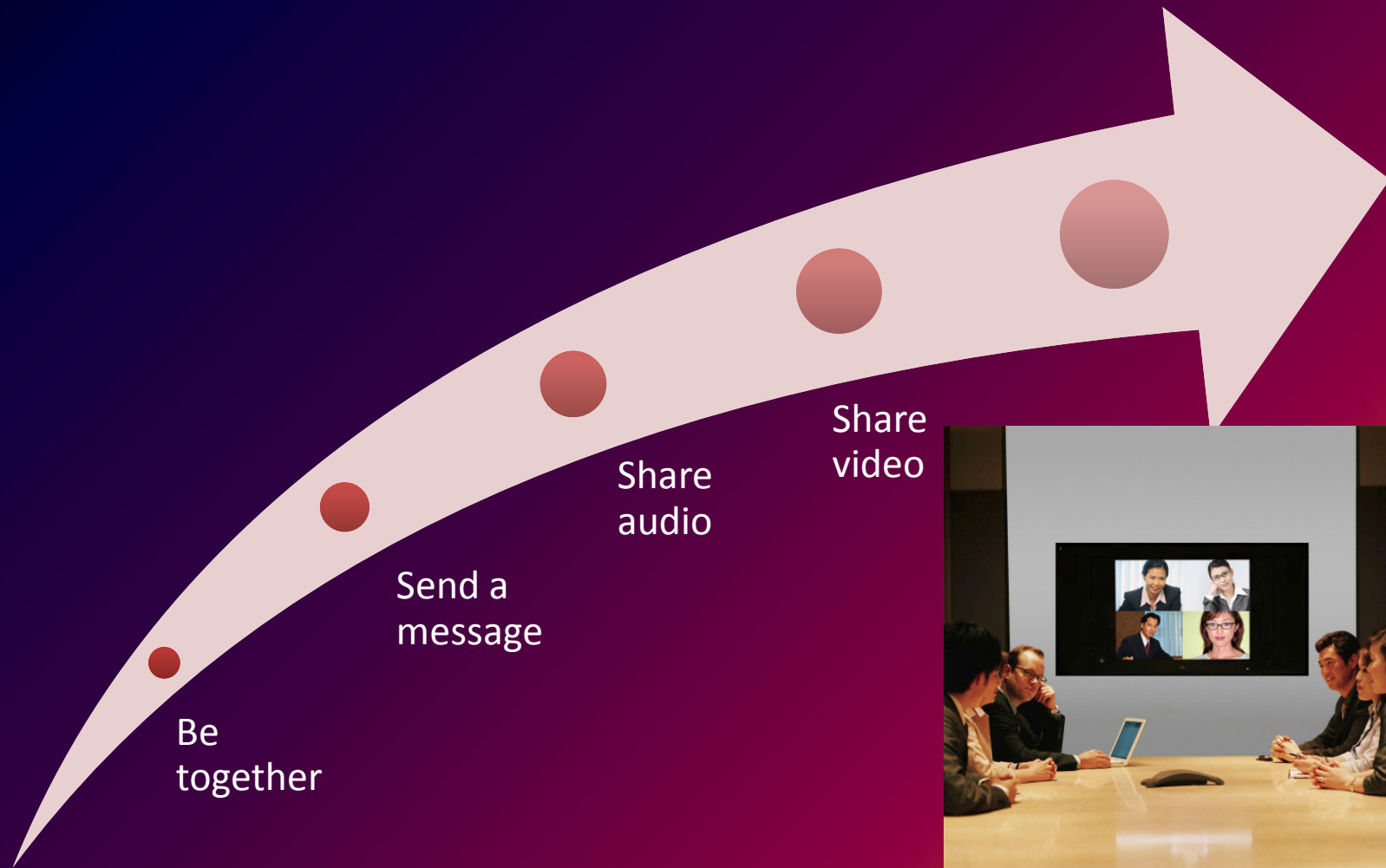
Social Experience



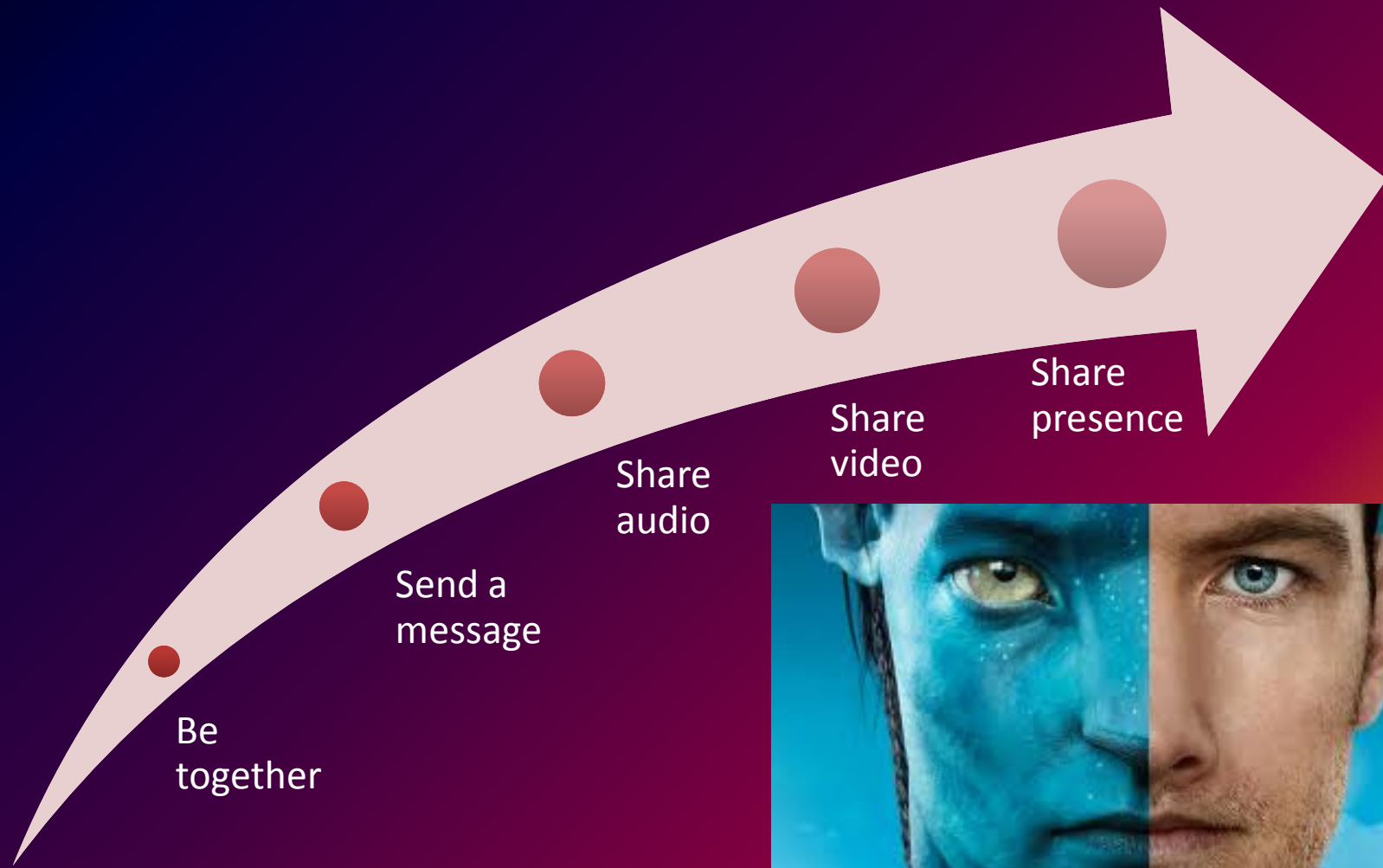
Social Experience



Social Experience



Social Experience



Shared Presence

Be here

Feel as if you are there

Appear there as if you are there

Shared Presence Prerequisite

- Need to detect, transmit and represent:
 - Individual context
 - Social context

Context

“Any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves”

[Dey and Abowd, 2000]

Social Context

- Who is in the social group
- Group characteristics (e.g. cohesiveness)
- Group member characteristics (e.g. friendship, leadership, role, dominance)
- Interpersonal characteristics (e.g. being polite, heaving empathy, arguing)
- Current status (e.g. involved in conversation)
- History of relations
- Inter-group relations
- Mob

Sensors for Context Detection

Examples

- Positioning and proximity
- Orientation – compass, gyro
- Voice – voice detection, recorders
- Body language – video, markers
- Eye gaze sensors
- Brain activity
- Vital signs
- Artificial nose



Positioning and Proximity Sensing Examples

- RFID
- Wifi
- Cellular
- IR
- GPS (outdoors), → Pseudolites (indoors)
- INS
- Video
- Active floor
- Ultra sound
- Markers
- Air flow pressure changes
- Power line positioning

Determining Position Examples

- Proximity
- Trilateration
- Time of flight
- Angle of arrival
- Signal Strength
- Dead Reckoning

Positioning Problems

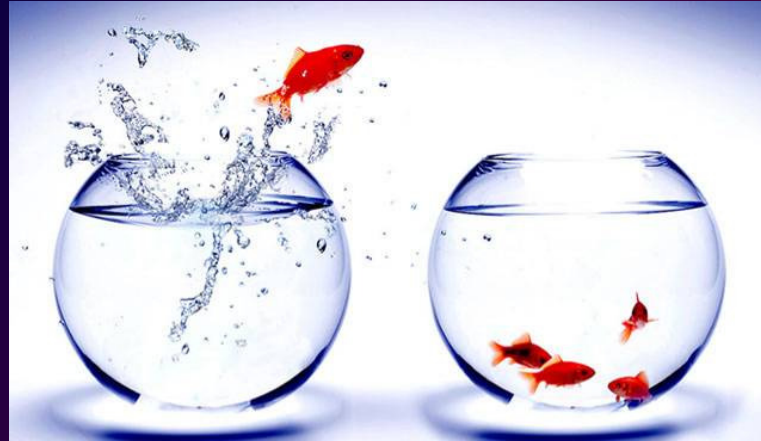
- Holes in detection
- Sensor networks - holes in transmission
- Interferences
- Reflections
- Occlusion and shielding

Mutual Positioning

Research Environment

- The research is conducted in Museums
- Exploring ways to measure museum visitors behavior, analyze it, and suggest smart services to the visitors
- One important aspect, that can influence these services is the social context of the museum visitors

Museums – Social Activity

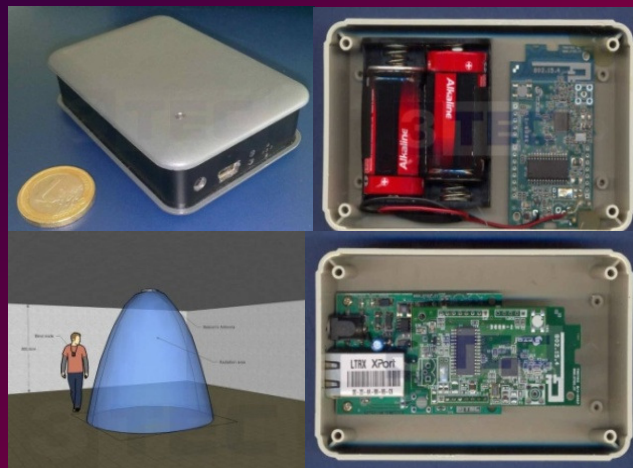


The overwhelming percentage of visitors come in groups — usually with families or friends ...
Consequently, museum visitation is, to a large extent, a social experience

[Bitgood, 2002]

Sensors at the Hecht Museum (PIL Project)

- Proximity to a stationary point (RFID, signal strength)
- Proximity to a mobile device (RFID, signal strength)
- Orientation (magnetometers)
- Voice detection (microphone)
- Motion detection (accelerometers)



Requirements from a Positioning System

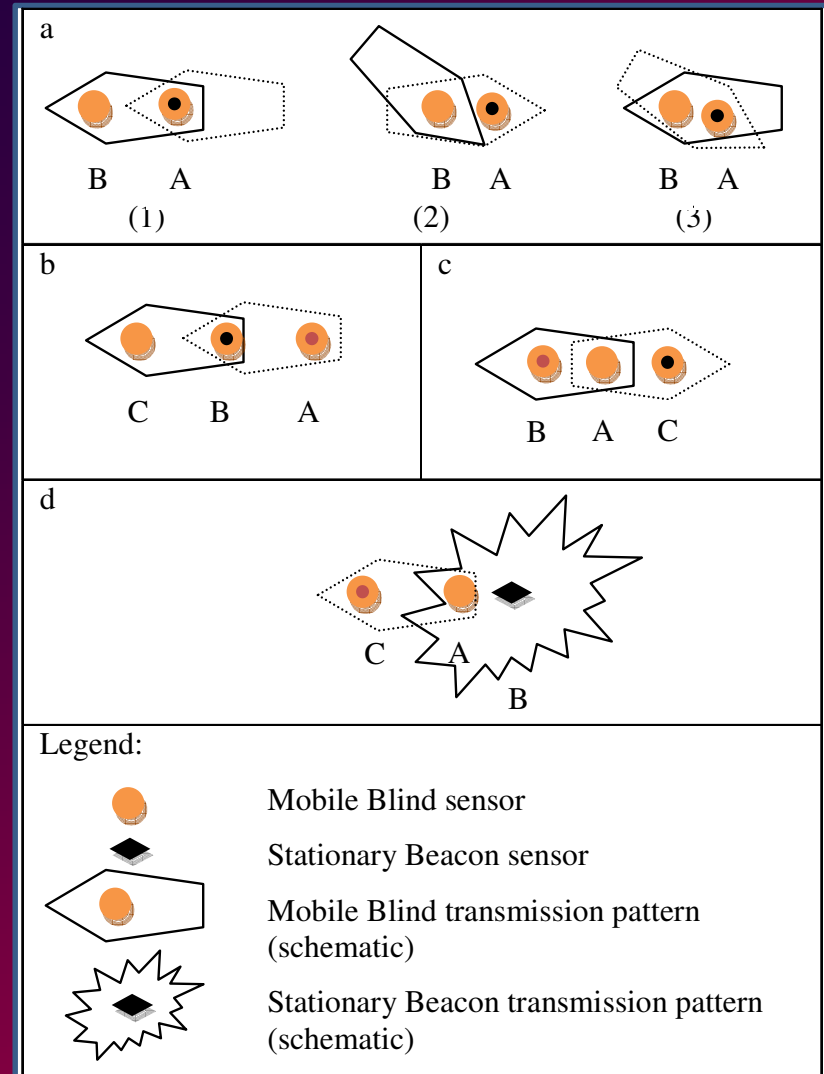
- We would like positioning data to be:
 - Precise
 - Accurate
 - Continuous
 - Complete
 - Error free
- This is not the case for indoor positioning

Can Social Behavior Assist in Positioning?

If A is near B, the position of A is unknown and the position of B is known, we may be able to infer the position of A from the position of B

The Nature of RFID Proximity

- Pair mutual proximity
- Triple mutual proximity
- Mutual proximity accuracy



Test Case

- 13 small groups (4 groups of 3, 9 pairs)
- Museum visit time 35 – 135 minutes (64 minutes average)
- 113,441 messages
- 10.1% were proximity messages (0.7% proximity to two other people) . Out of them:
 - Only 21% had positioning reports
 - Mutual positioning added 7.8% , an increase of 37% in regards to the available positioning messages

Discussion

- Mutual positioning decreases **accuracy**
- **Increased quality of service and coverage** would contribute to proximity assessment (if the position is accurate and continuous then the proximity is known too)
- Proximity would contribute in cases of **decreased quality of service and coverage**
- **Spatiotemporal separation of group members** decreases the chances for mutual positioning, and being joint increases them
- **Crowding** may increase the chances for mutual positioning, while adding interferences
- **Complementary social factors** such as conversation and orientation may help in assessing proximity

Conclusions

- Where you are and whom you are with are equally important in order to share contexts in mixed reality
- Positioning may contribute to proximity detection and vice versa

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Thank
you

