Overlapping Architecture

Implementation of Impossible Spaces in Virtual Reality Games

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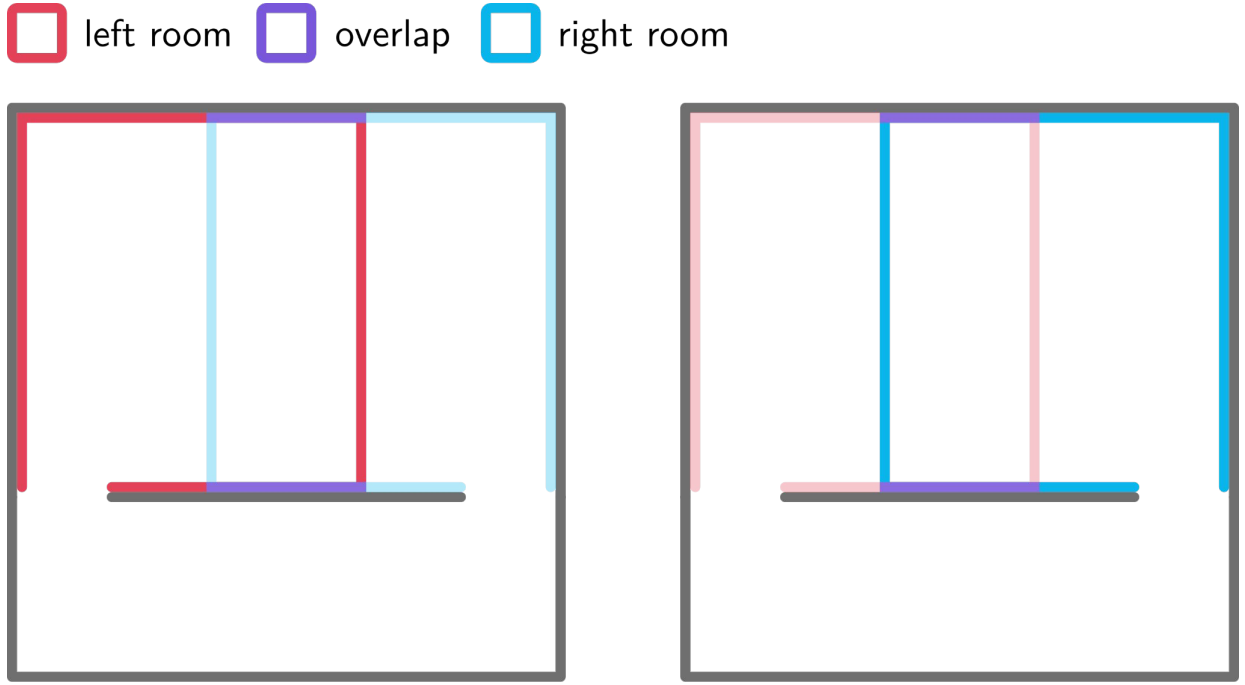
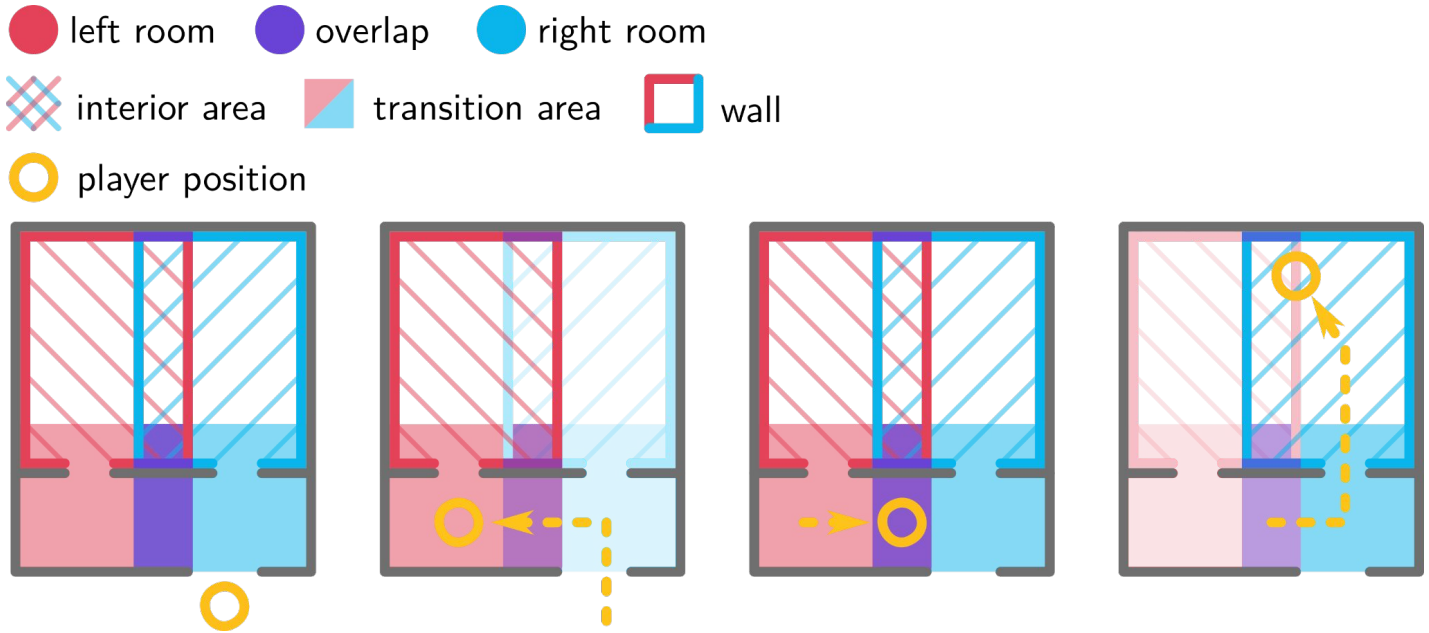
Impossible Spaces: A Redirected Walking Technique



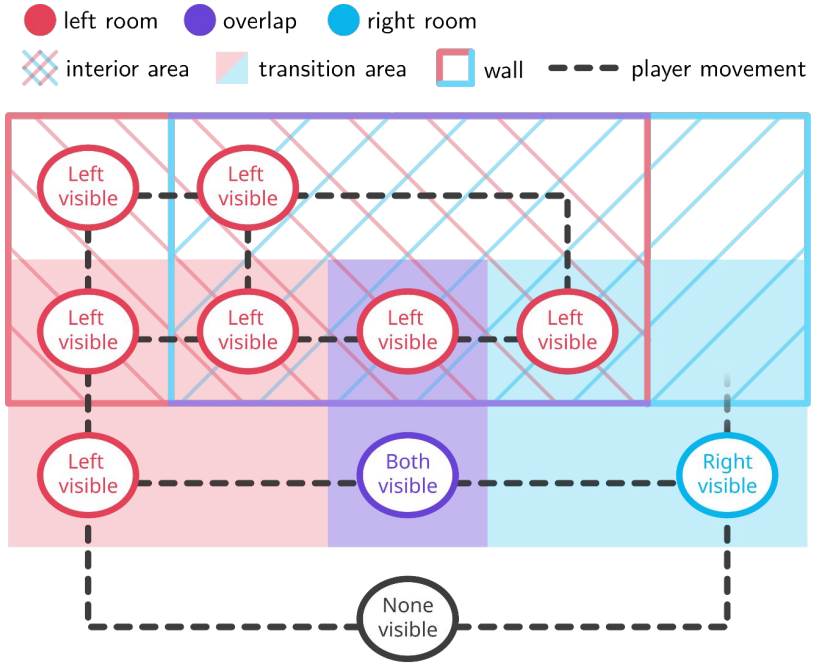
Agenda

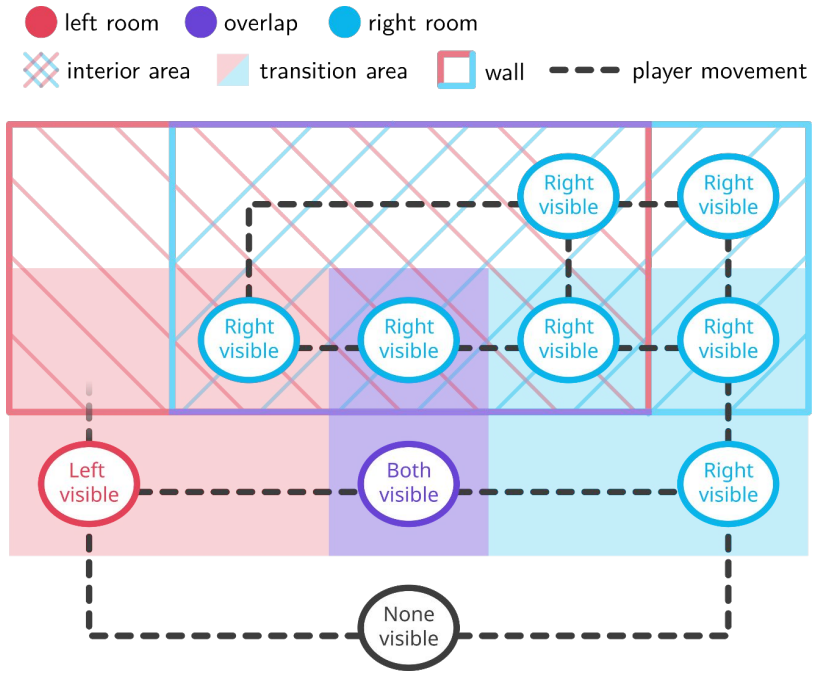
1. Implementation Overview: The Show-And-Hide Method
2. Transitioning Between Rooms
3. Handling Objects With Simulated Physics
4. Precomputed Global Illumination
5. Example Layouts

1. Implementation Overview: The Show-And-Hide Method

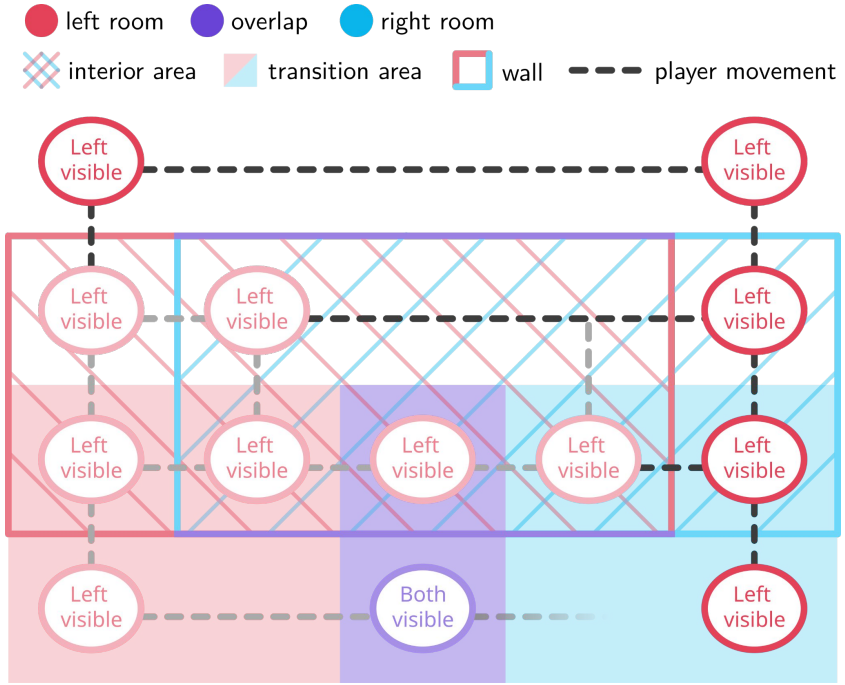


2. Transitioning Between Rooms




left room
overlap
right room
interior area
transition area
wall
player movement
Right visible
Right visible
Right visible
Right visible
Right visible
Right visible
Left visible
Both visible
Right visible
None visible

Transitioning Between Rooms: Illegal Player Behavior



3. Handling Objects With Simulated Physics

Problems:

- Implementation works by hiding child objects of a “room object”
- Objects with simulated physics might be moved between rooms by players
- Objects in overlapping areas cannot interact with objects from other rooms

3. Handling Objects With Simulated Physics

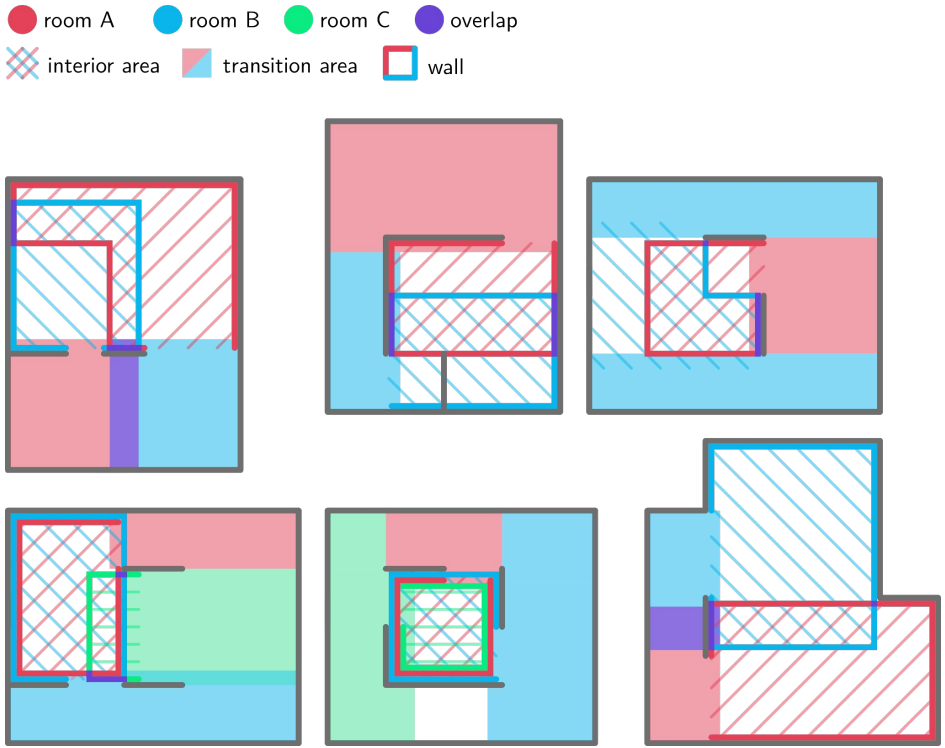
Solution:

- Monitor physics objects entering and leaving room interior areas
- Hide physics objects as soon as more than one room is visible
    - This prevents unwanted interaction in overlapping areas

4. Precomputed Global Illumination

- Performance-intense ray tracing computations encoded in lightmap textures
- Lightmaps cannot be changed at runtime
- Baking a single lightmap for all rooms will show lighting artifacts in overlapping areas
- Bake separate lightmaps for each room

5. Example Layouts



Conclusion

- The Show-and-hide method is a simple and robust implementation of Impossible Spaces
- Challenges in implementing complex room layouts:
  - Illegal player behavior
  - Simulated physics
  - Precomputed global illumination
- Interesting layouts are possible
- Unity Plugin available at github.com/curvaturegames/space-extender

Thanks for listening!

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