UE5 DEMO
PHOTOGRAMMETRY

- Area of using photographic data to understand physical properties of a scene
  - e.g. extracting 3D distances, extracting material properties, etc
- Photographic data is captured at an extremely high resolution
  - Offline productions can use that data as-is
  - Real-time productions traditionally lower resolutions and use displacement/normal maps to capture geometry with fewer polygons
PHOTOGRAMMETRY EXAMPLE

Quixel Megascans (https://quixel.com/megascans/)
VIRTUAL TEXTURING

- Allows for use of very large textures with smaller memory footprint at runtime
- Similar concept as mipmapping but only run on visible pixels
- Mipmaps split into tiles of a fixed size and GPU determines which of the fixed tiles to load
- Runtime Virtual Textures (RVT)
  - Texel data generated by GPU at runtime
- Streaming Virtual Textures (SVT)
  - Texel data cooked and loaded from disk
  - Used for pre-baked lightmaps
“Virtualized Micropolygon Geometry”

- Allows direct importing of high-quality geometry with material info
- Streamed and scaled in real-time
- Handles normal maps and LODS (level of detail) without manual authoring
- Effectively, this performs what mesh decimation tools like Simplygon does without offline bakes, user input, or data loss
Nanite reduces >1B in source geometry to ~20M drawn triangles

For reference:

- inFAMOUS (2014) has 11M drawn tris (PS4)
- Street Fighter V (2016) has 900k drawn tris (PS4)
- FFXV (2016) has 5M drawn tris (PS4)
- The Division (2016) has 5M-6M drawn tris (PC)
- Star Citizen (2019) has 30M drawn tris (PC)
LUMEN

- Fully dynamic global illumination system
- Handles diffuse inter-reflection and indirect specular reflections
- No pre-baked lightmaps
DIRECT VERSUS INDIRECT ILLUMINATION

Light coming from light source

Light coming from secondary bounces
HOW BIG OF A DEAL IS THIS?

- It is a big deal but not unprecedented
- Likely based on VXGI which is NVidia’s voxel-based real-time renderer
HOW BIG OF A DEAL IS THIS?

- It is an enormous deal for how much it simplifies the art pipeline
  - Artists spend a large portion of their time “retopping” (re-topologizing) assets to fit within a memory budget
  - Pre-baked lighting takes a long time and a lot of resources
- Allows artists to focus on “art” side of creation rather than technical issues
CONVOLUTION REVERB

- Signal processing technique to capture physical properties of location for sound playback
  - More accurate sounds based on the space
- Traditionally required offline processing but done in real-time with the advent of better hardware acceleration
IK AND CONTEXTUAL ANIMATIONS

- IK (Inverse Kinematics) handle adjustments to joint angles based on a target position
  - Does not necessarily provide a “natural” solution to this problem
- Motion warping and contextual triggers allow for better-looking solutions and more natural combinations of animations
  - Not new concepts but improvements to the existing UE4 toolset
WHO DOES THIS IMPACT?

▸ Triple A development
  ▸ Unreal becomes an “off-the-shelf” competitor to notable high-end game engines such as EA’s Frostbite or Guerilla Games’ Decima

▸ Indie development
  ▸ Faster art pipeline is good for teams of all sizes

▸ Artists and creatives
  ▸ May represent a change in how developers think about building out an art pipeline
REFERENCES

- VXGI <https://developer.nvidia.com/vxgi>
- Polycount <https://polycount.com/discussion/141061/polycounts-in-next-gen-games-thread>