



# Oculus Story Studio Making Compelling and Immersive Story at 90 FPS

**Maxwell Planck**  
Oculus Story Studio

GAME DEVELOPERS CONFERENCE March 14-18, 2016 · Expo: March 16-18, 2016 #GDC16





# Maxwell Planck

Technology Director & Co-Founder of Oculus Story Studio,  
CG Supervisor of Lost, Producer of Henry



- We founded Oculus Story Studio with a **mission to expand the capability of positionally tracked VR.**
- Specifically to show the world that VR is **a medium to tell all different kinds of stories** that can have a **deep emotional impact** we've never felt before

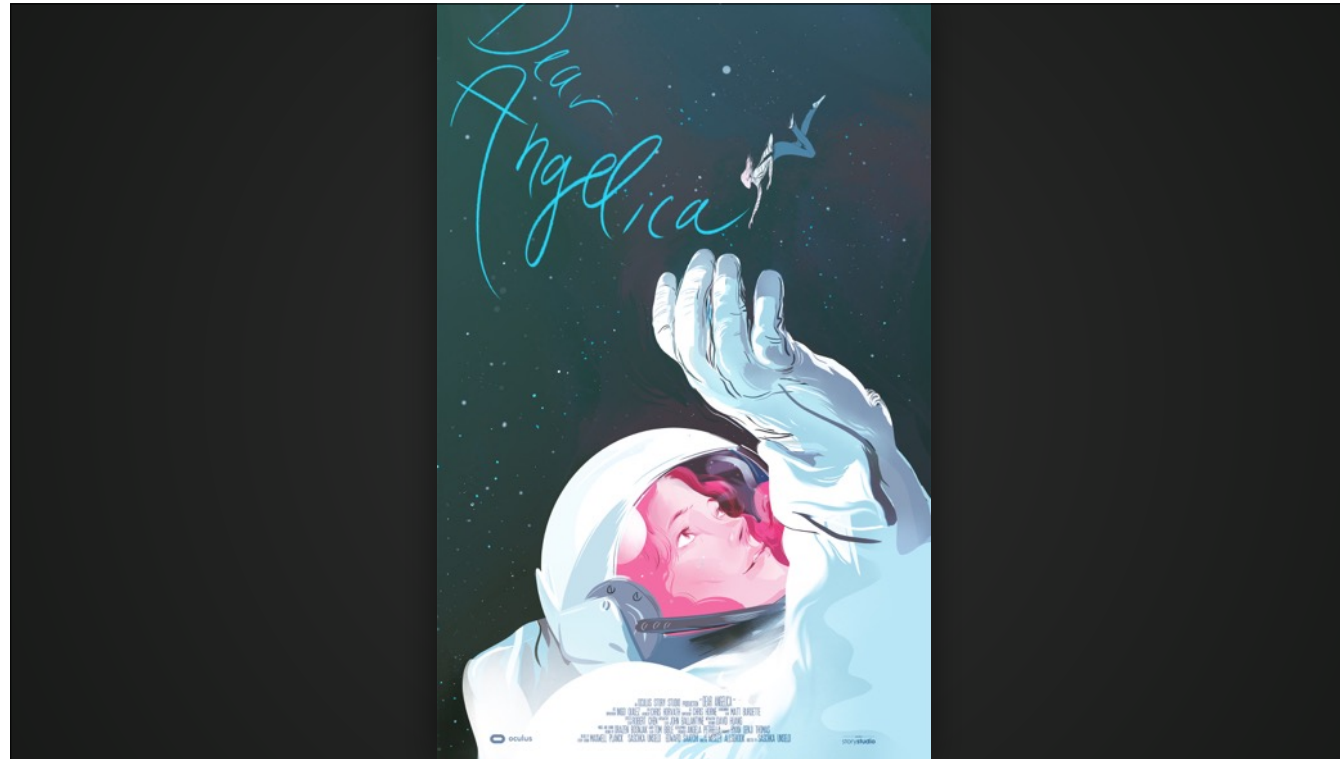


- And to do that, I believe those stories need to be told in a realtime game engine, Unreal Engine 4 in our case.
- Began with Lost
- Awe and wonder
- Really a minimum viable product to show that you can tell any kind of story.





- We made Henry with the hope to make a family friendly comedy
- Found that an empathy for his loneliness had a much more powerful effect. So we kept some of the humor but really doubled down on the feels



- Dear Angelica, our next project, is exploring a new artistic style for telling a story
- With this story, we're exploring grief and acceptance, and starting to play with a little bit more interactivity.



Stories are a way for us to share experiences we wouldn't otherwise be able to have because of the limitations of **who we are**, our **lifetime**, **what's possible in the physical world**.


And through **sharing those experiences**, we gain experience we wouldn't **otherwise be able to have on our own**, which allows us to **exercise a stronger imagination**, and to **better deal with our own obstacles and emotions**.

## Why tell stories in VR?



- So if you believe my theory,
- The "capital P" Presence that VR delivers that no other medium can, taps deeper into the brain and conveys an experience as if you were there.
- As Roger Ebert said, **movies are a machine for empathy**. My theory is that **adding the feeling of being** there makes VR an even more powerful machine.





## The Holodeck is a LONG way off

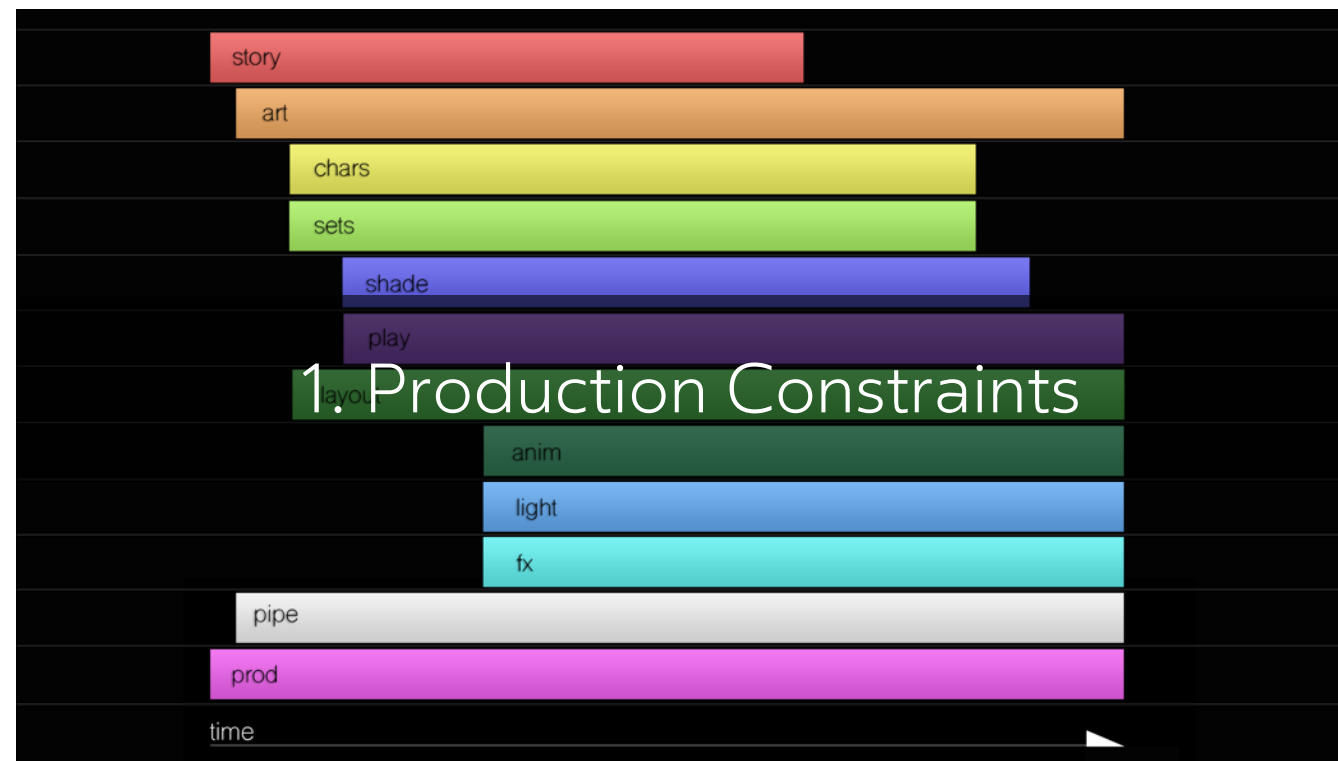
- But here's the problem right now.
- There are a lot of **expectations of what VR should be** because of what science fiction has filled our imagination with
- And I feel like a lot of VR makers are failing to make compelling content because they are reaching too far.



## Embrace the Constraints

1. Production Constraints
2. Technical Constraints
3. Creative Constraints

- And so the bulk of my talk is about being pragmatic about what VR is right now as a medium and how you can work with its limitations to make compelling and immersive experiences.
- And I'll be breaking the talk into the 3 sections of discussing **production, technical and creative constraints**

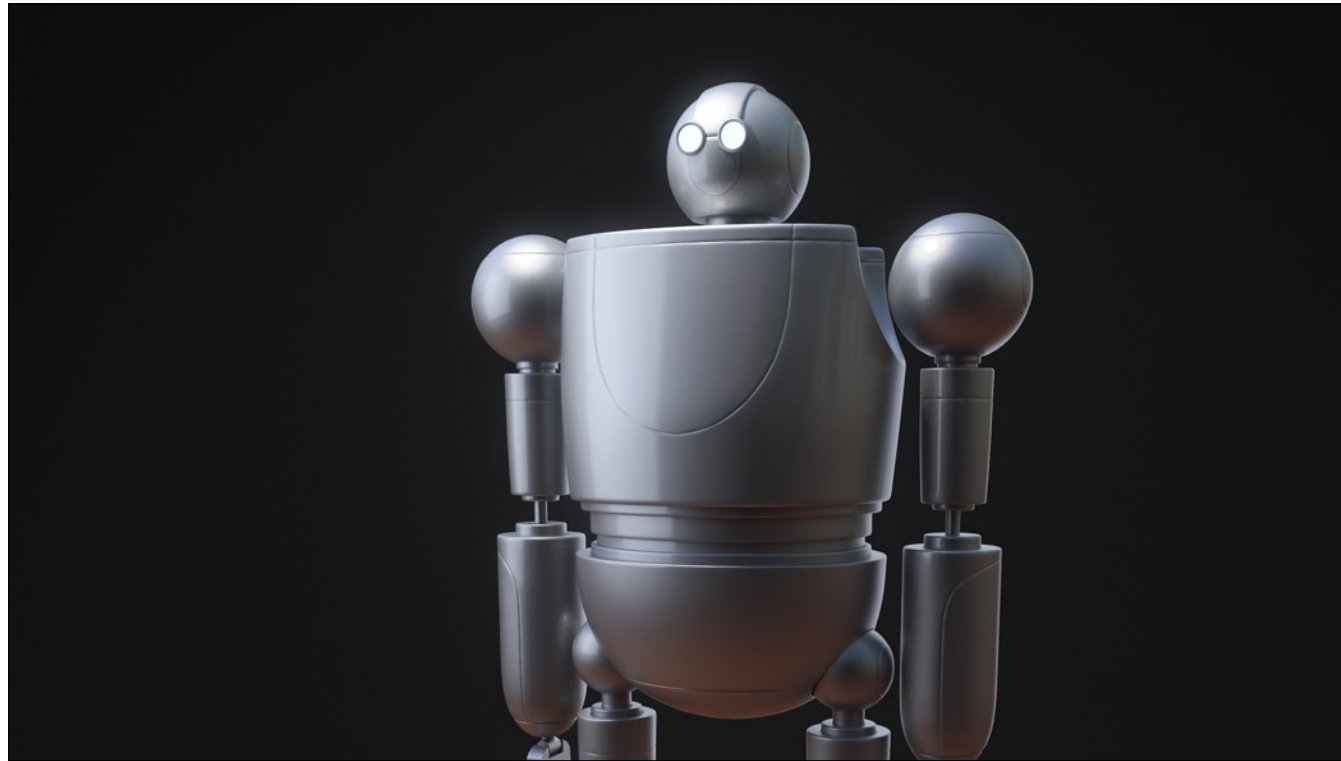


- Starting with production constraints, how is the process, the factory floor layout, of telling a story changed by the novelty of VR?
- When we thought about the flow of making a computer animated realtime experience, we copied from what we knew on film and added in interactive development as a production department we called play.
- Our thought was that once the story feels good, you can work on how interactive helps tell the story.

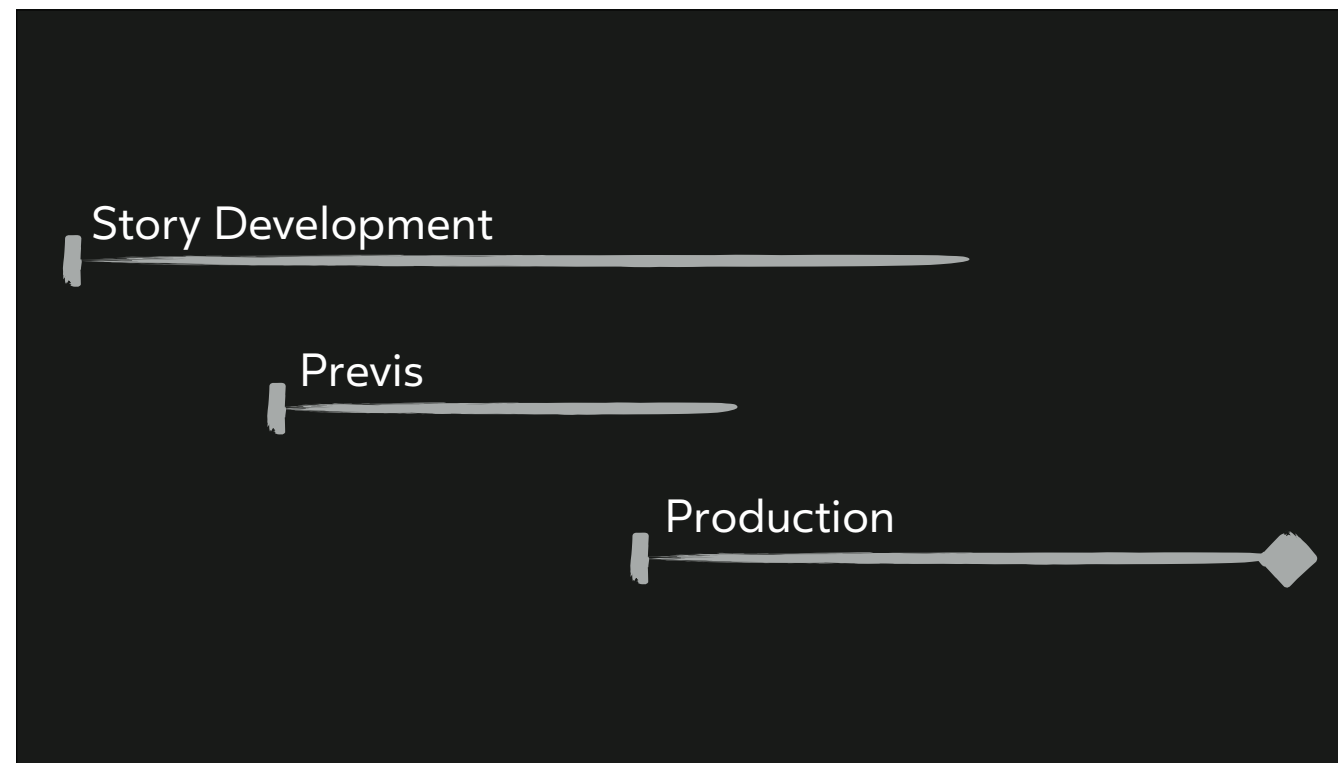


- And have found that this was naively inaccurate.
- For example, Henry

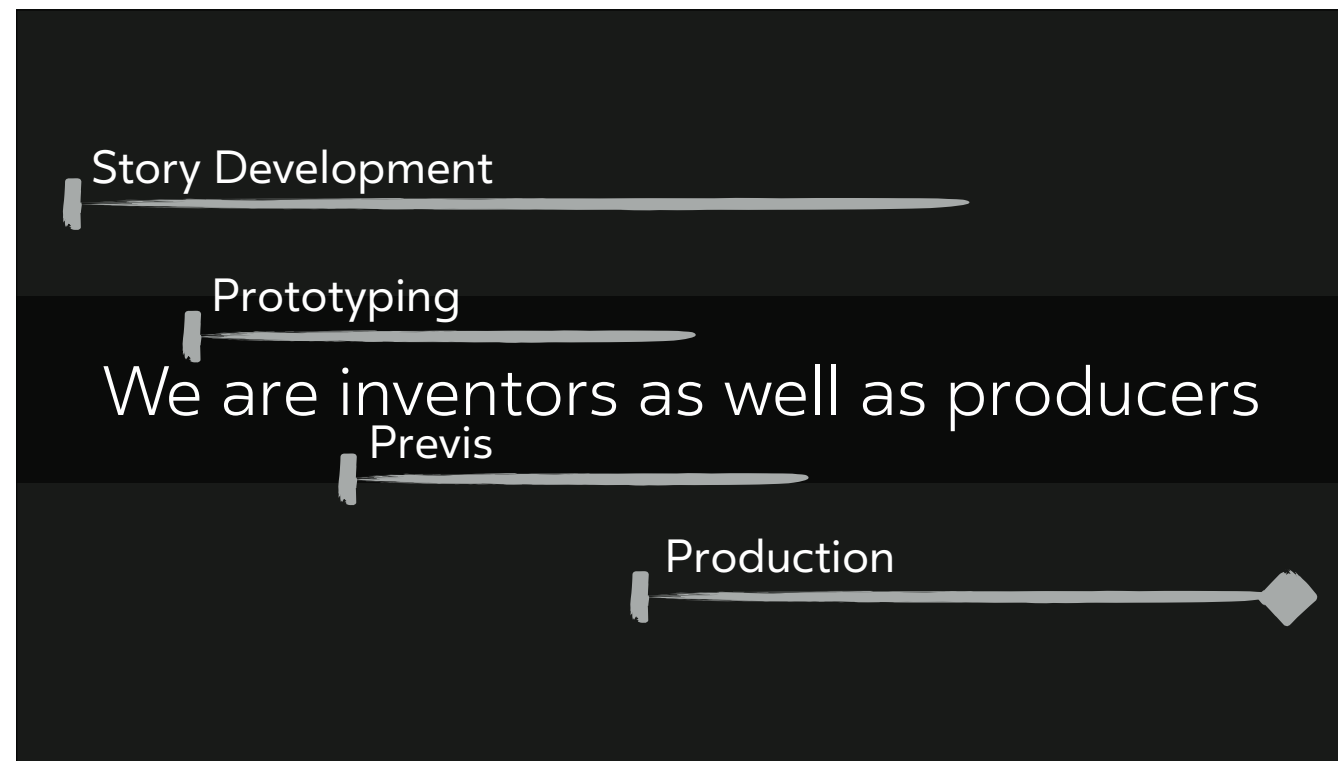




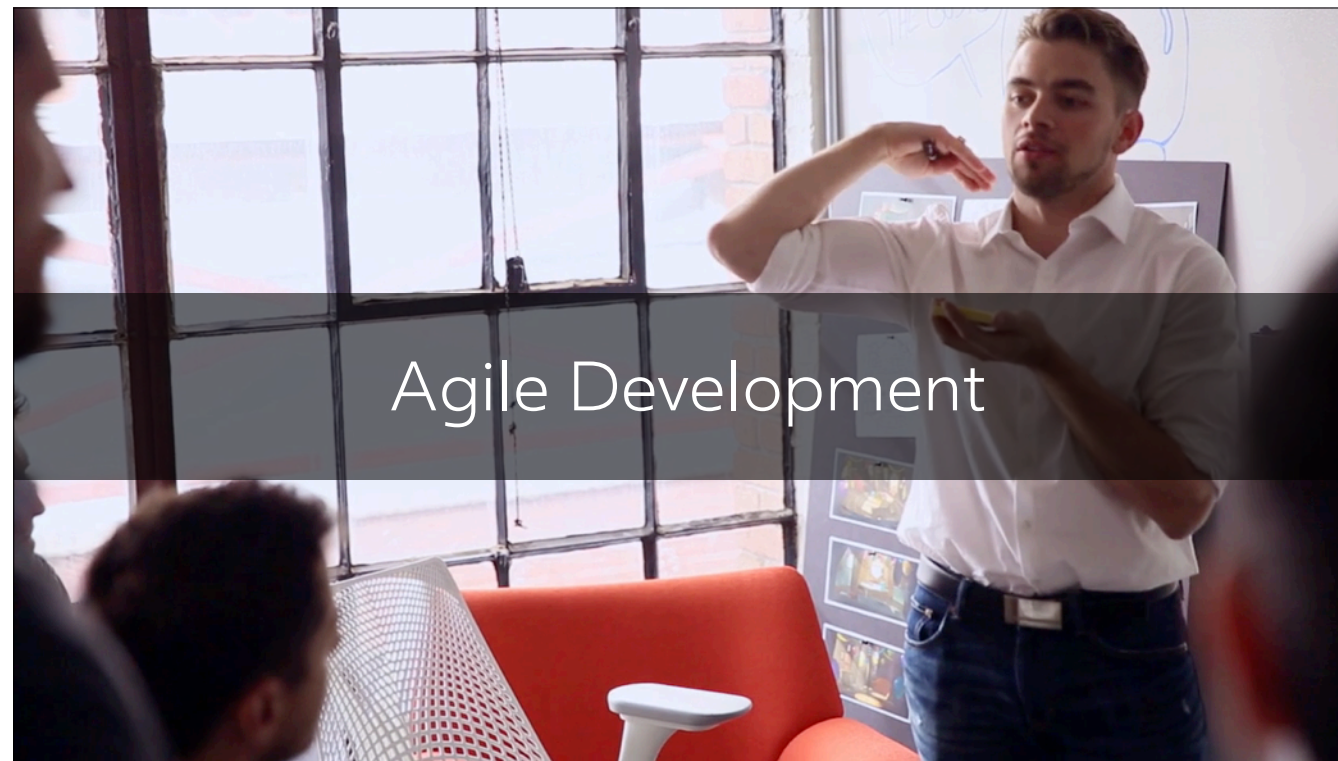
- On Lost, once we had a story we liked, we started adding gaze based triggers
- Felt like a shooting gallery



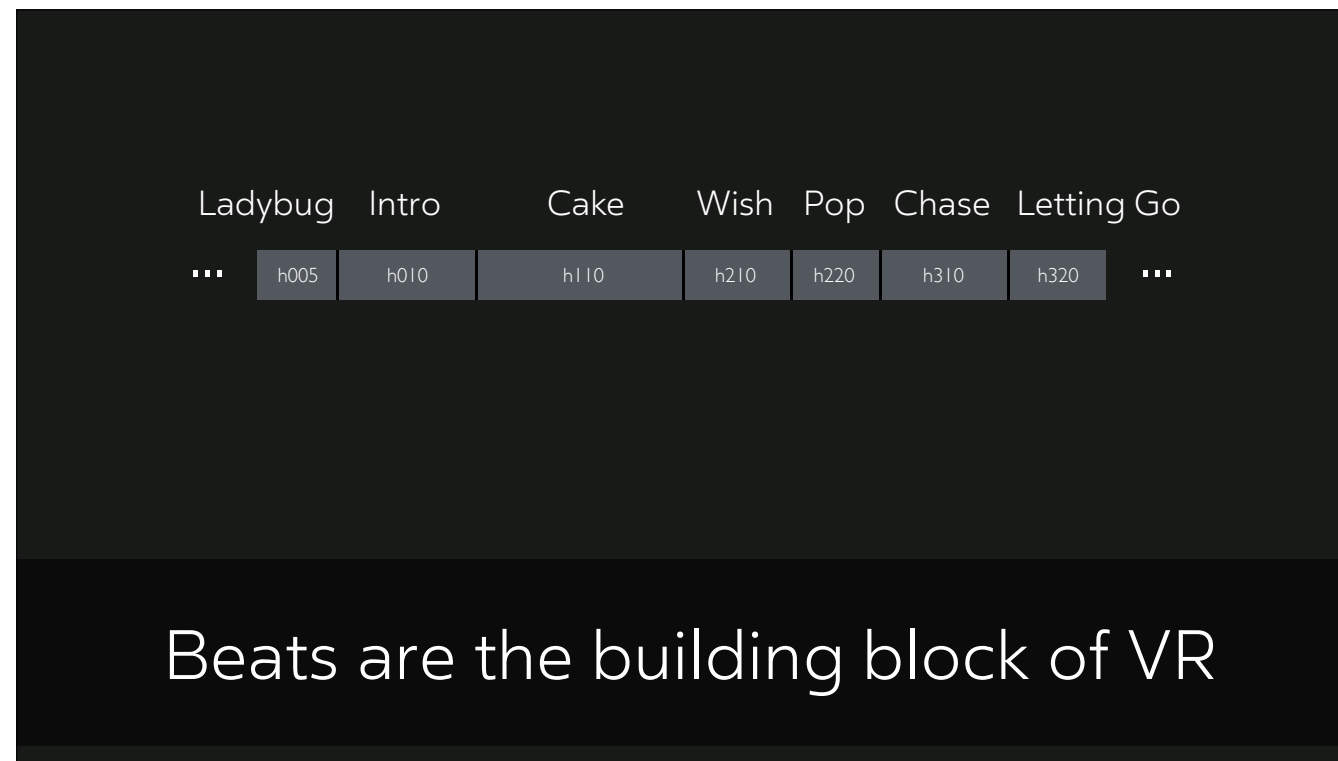
- At Pixar, we had seen and made enough films that we could tell if a story was working, even when it was just storyboards and animatics.
- We don't know what the medium of VR will become, and so we are as much inventing a new medium as we are trying to tell a story in it.
- And so the same way of making film doesn't work.



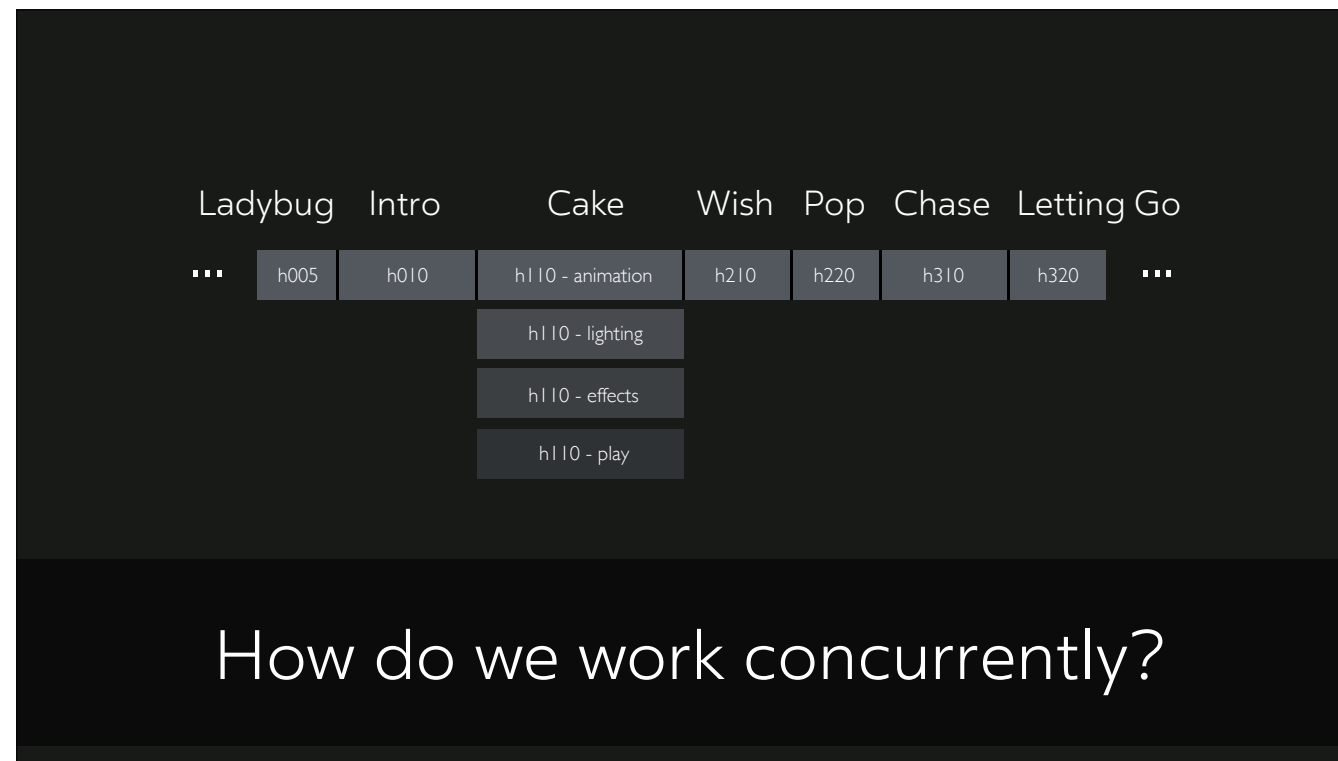
- We're finding that we need to mix parts of story development, with game development (gray boxing) and previs. We're calling it Protovis
- Making a film is naturally messy, and this process is even messier.



- We need an adaptable process.
- Agile is your friend
- Game making has been using agile for a while. Story development has not.
- We've found that working in sprints and setting quicker milestones is a good way to assess if what we're doing is making progress.



- Shots are the building block of Film (Levels for Games, Scenes for Theatre)
- Right now, story beats are our building block but they aren't as clean as shots which have dramatic camera changes with each cut
- For example, two different animators could be working on subsequent shots and you wouldn't notice the discontinuity between the poses.
- On Henry, part of the animation process was making sure the end pose of one story beat matched the start pose of the next story beat. Causes a dependency problem.



- In computer animation, 3 seconds of animation was worked on by dozens of people. To hit the level of fidelity of a Pixar film, you need a workflow where your lighter, animator, fx artist, etc. can work on the same timeline at the same time.
- So far, our experience with realtime engines has made this hard.
- But things are going in the right direction, UE4's recent work on Sequencer is really exciting in this space.

Movie	Theater	Game	VR
90 - 140 mins	90 - 120 mins	20 - 40 hours <small>(indie is challenging this)</small>	??

Audience has no length expectations

- For the mature mediums of storytelling, the audience already has expectations of how long an experience should last.
- Movies and Theaters are around the time it takes before you need to go to the bathroom.
- a \$60 game is supposed to provide 20 to 40 hours of entertainment.



- But movies weren't always like this and evolved from the nickleodean to a multiple hour movie
- we are at the time where an audience will pay a nickel



Movie	Theater	Game	VR
90 - 140 mins	90 - 120 mins	20 - 40 hours <small>(indie is challenging this)</small>	??

Audience has no length expectations

- VR resets audience expectations
- So embrace the beginning for now and realize that a short, well done experience can be very appealing for the novice audience.



- Something we haven't solved - but something we need.
- Dailies workflow in which we can all be in VR



- To make VR, you need to work in VR
- On Dear Angelica, we began by trying to take 2D illustrations and projection map them into a 3D space.



- But we found that we needed to rethink our asset creation process and instead have our art director create within the medium we were creating for.
- Quill was born and completely redefined how our production process worked.
- Be ready for upheaval when invention finds a new path.

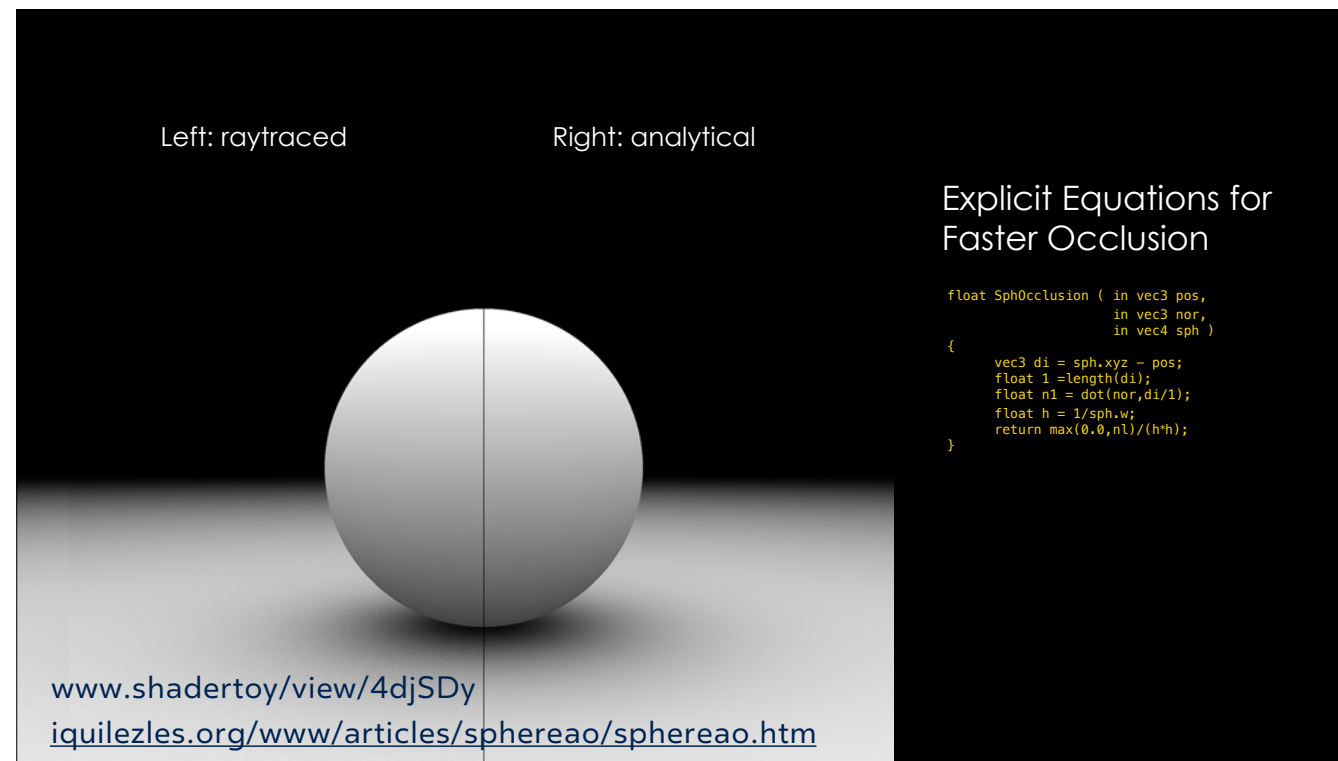


## 2. Technical Constraints

- That's it for production constraints.
- For those of you who have developed realtime VR, the 11 millisecond deadline (90 fps) is brutal.
- In VR, you're rendering more pixels to 2 eyes in much less time than the 16 or 33 ms you're used to.
- As we like to say at story studio, it's all about trying to fit a big cat into a small box.

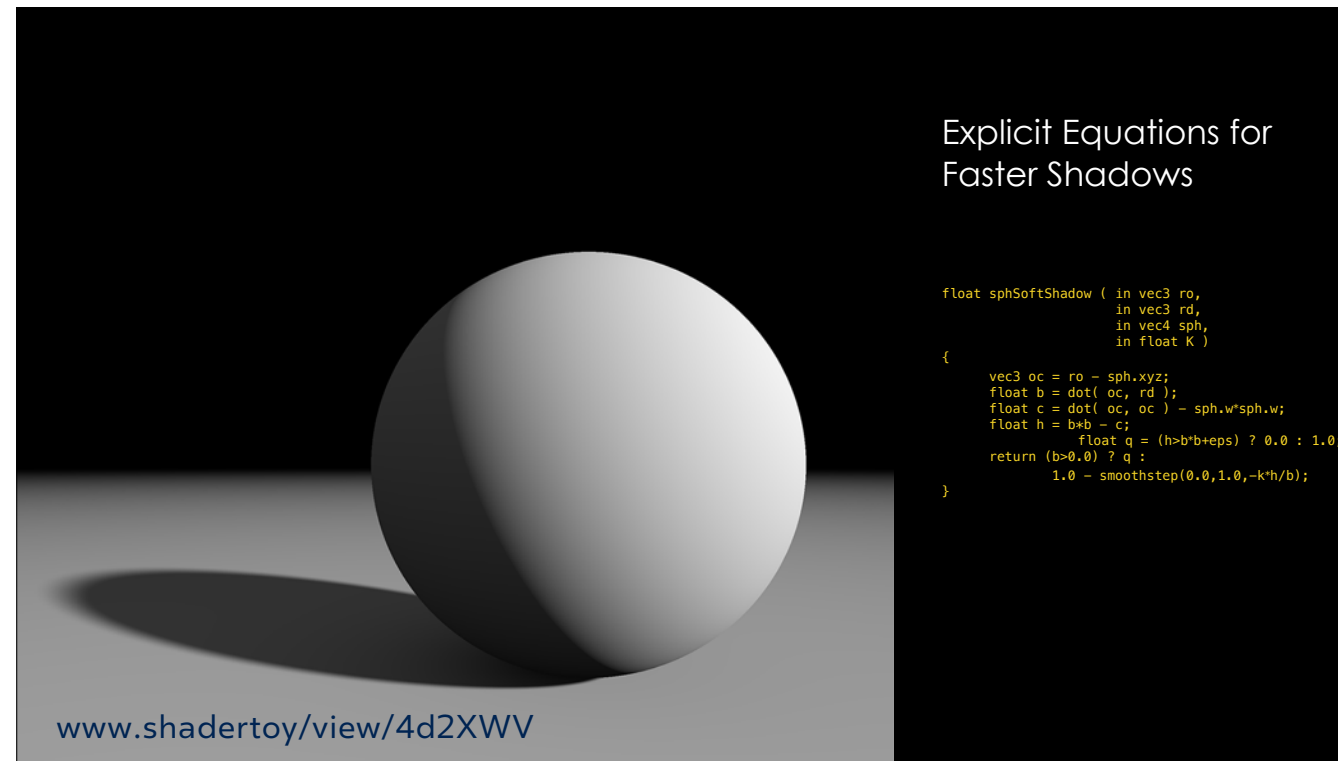


- Need to make hard choices that might break assumptions.
- In Henry, we decided early on that we would have no dynamic shadows. That informed how we designed lighting, shading and the experience.
- Because we have more control over where the user stands and what he sees (we're not giving him a controller), we can use more smoke and mirrors tricks.



- Replace Henry with 4 spheres





- And soft shadows from a directional source





And so all of Henry's shadowing is done by explicit equations



- As for the other shadows, all of these are statically baked as projected textures.
- For the props that move in the scene based on deterministic animation, we bake projected textures at their start and rest position.
- When they start animating (for example when Henry knocks over his bench), we blend off the rest position shadow and transition to the sphere approximation trick. When they come to rest, we blend back in their final rest position.



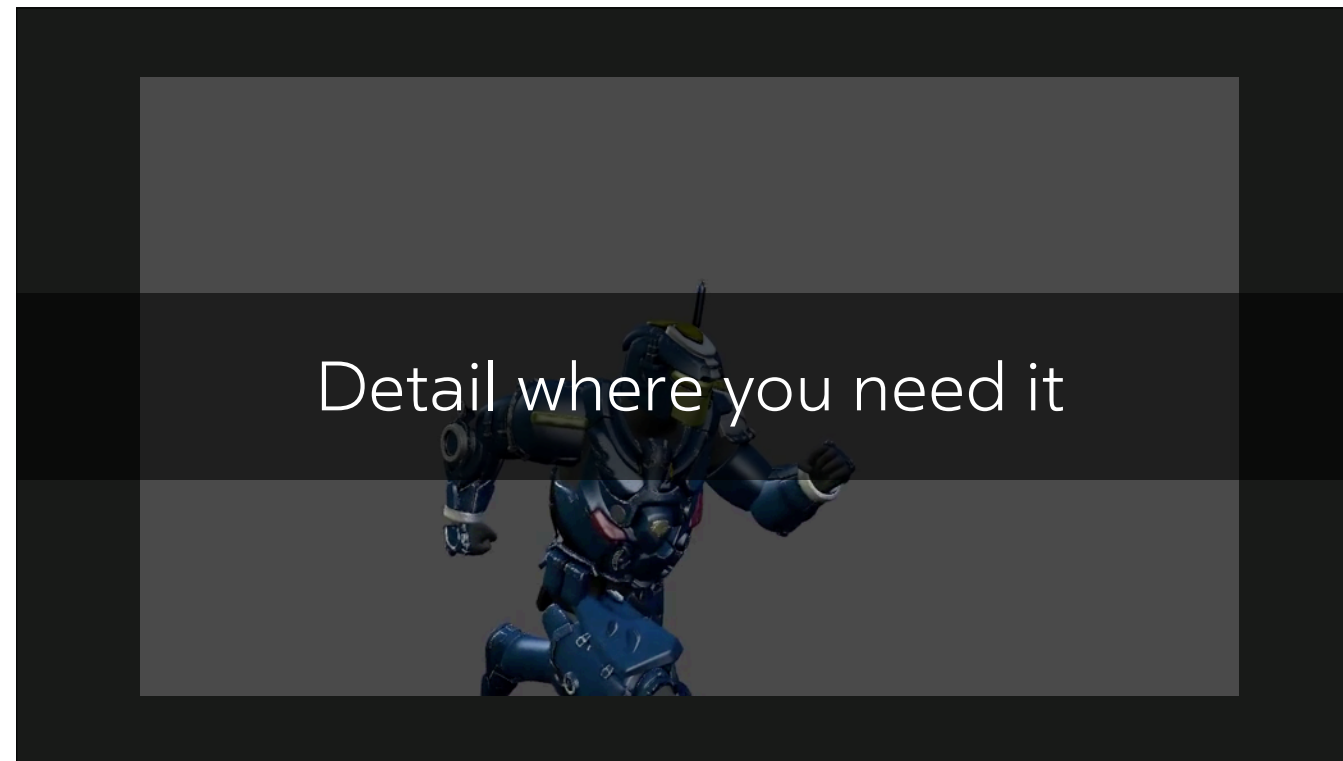
Budget those vertices and textures

- Henry was our main character, so he received most of the budget.





- 18k textured **cards** (70k vertices)
- No **transparency**/blending support. We fed the texture alpha in a time shifted screen-space bayer dithering pattern to drive binary alpha masking (TAA smoothed results out)



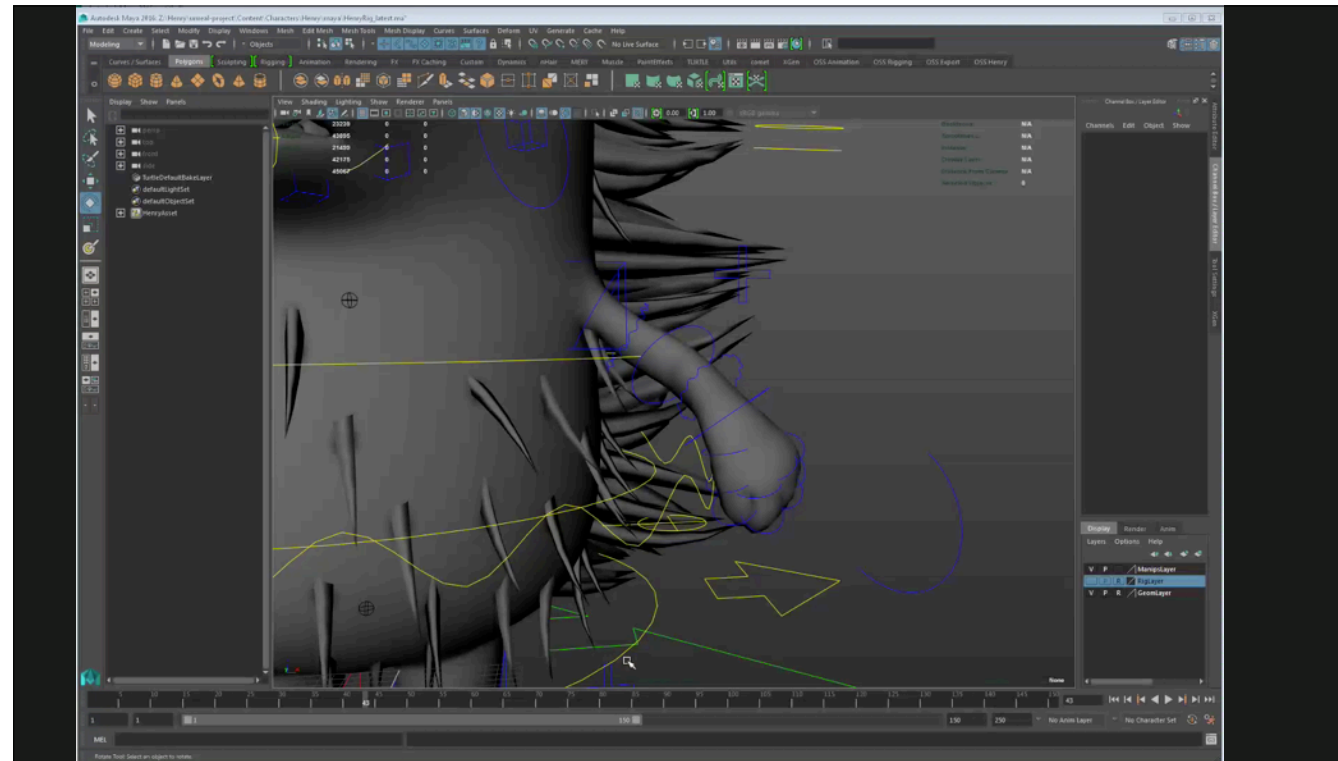
- Coming from Pixar, we modeled everything as subdivision surfaces. Only recently has the tech evolved to the point where we think it can fit in the 11 ms box, and we think this can work just barely.
- Even then we'll need to sacrifice other features (post process shaders, dynamic lights, etc.) to make it work.



Finally, make design choices that limit complexity.

On Lost, one reason we went with a mechanical character is that they are easy to rig and animate.

We also chose a moody night time scene to hide the fact that we didn't have much detail in our forest modeling or texturing.



- On Henry, we increased complexity on our character, but still limited ourselves from using lots of corrective shapes and many bones.



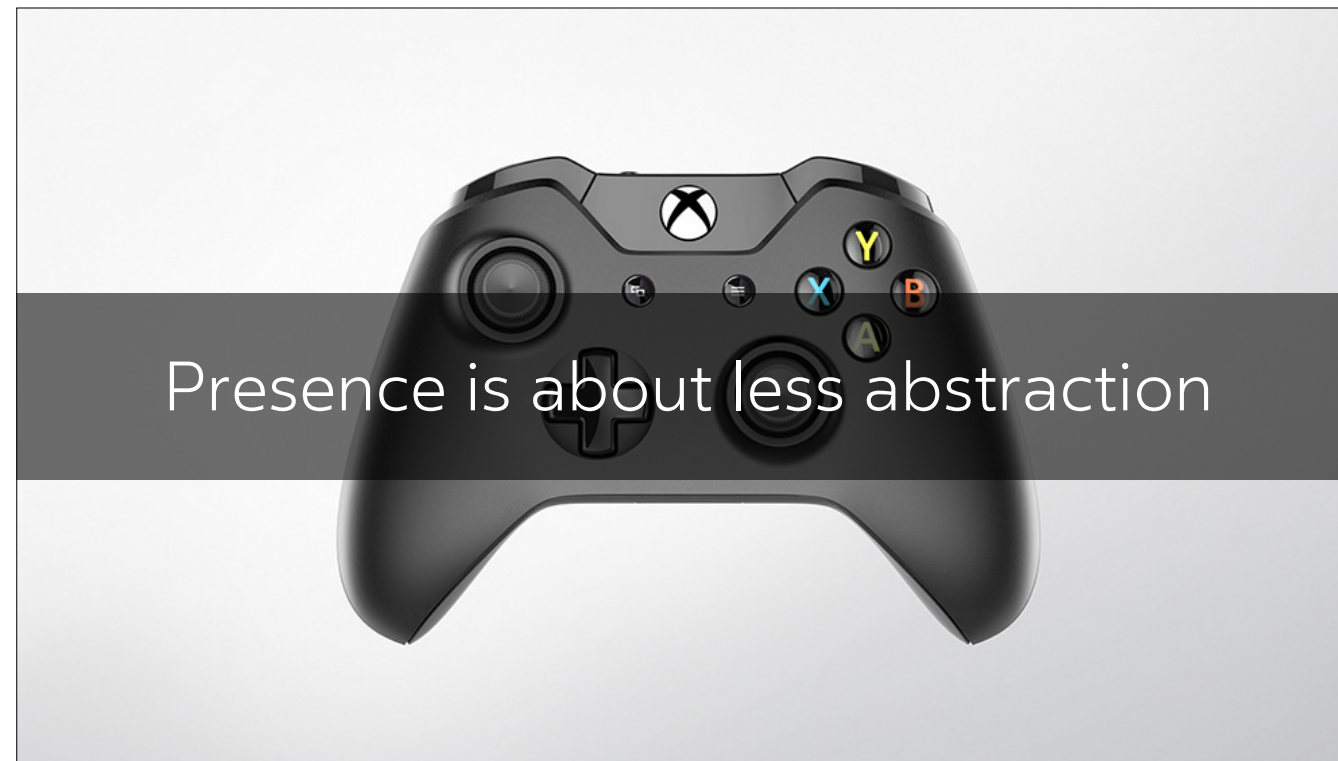
- It helped that Ramiro designed Henry's form so that he was a big pill on stubby legs.
- As you can see, we solved some of our technical constraint with clever tricks, but most of the time, it was through design decisions that we were able to fit in the 11ms box.



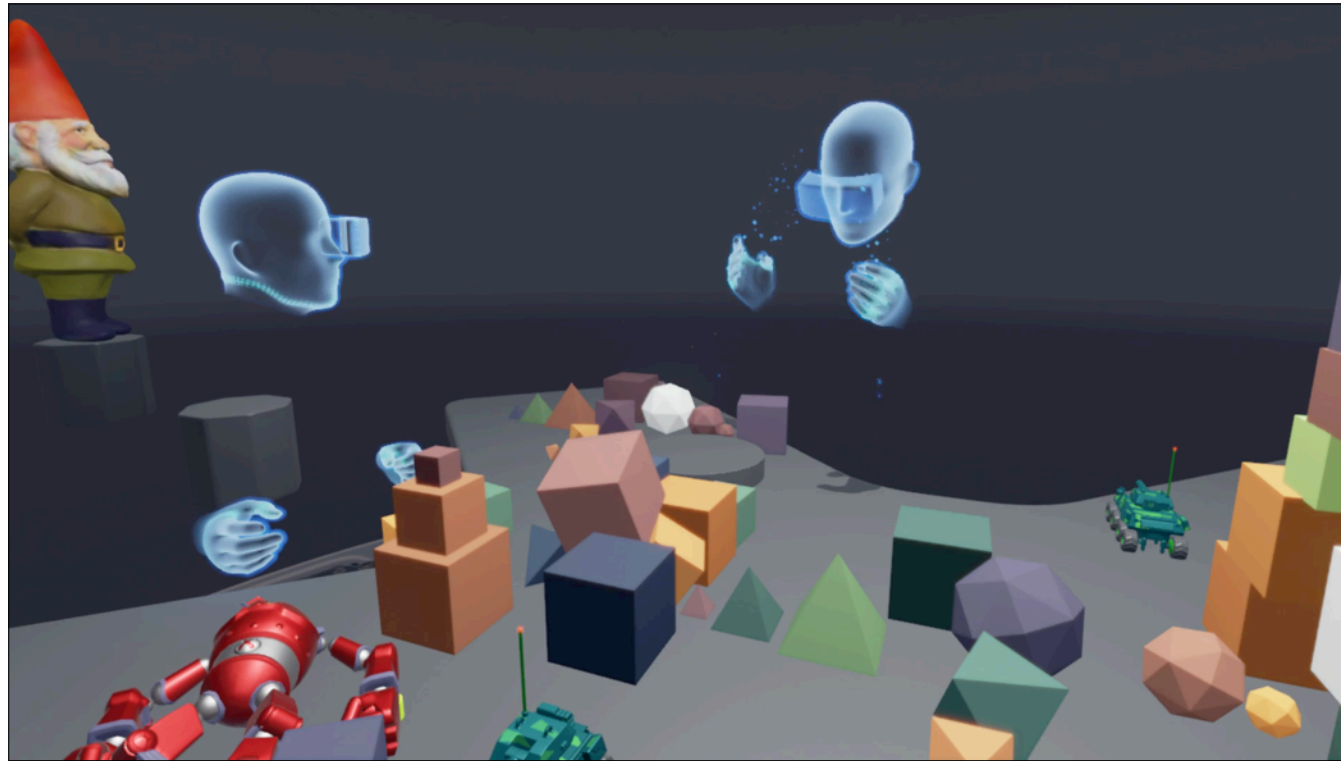


### 3. Creative Constraint

- And this is where technical and creative constraint work together.
- Most of my career being at Pixar, I learned that **if you can't make appealing humans** with what you can do technically, make a movie about toys.
- But besides the design decisions you can make to help technical, there are other constraints besides technical that creative needs to consider



- Presence (with a capital P) is what defines VR.
- Games have controllers as an interface, which unless you grew up with them, are pretty obtuse ways of controlling how your avatar looks or walks.



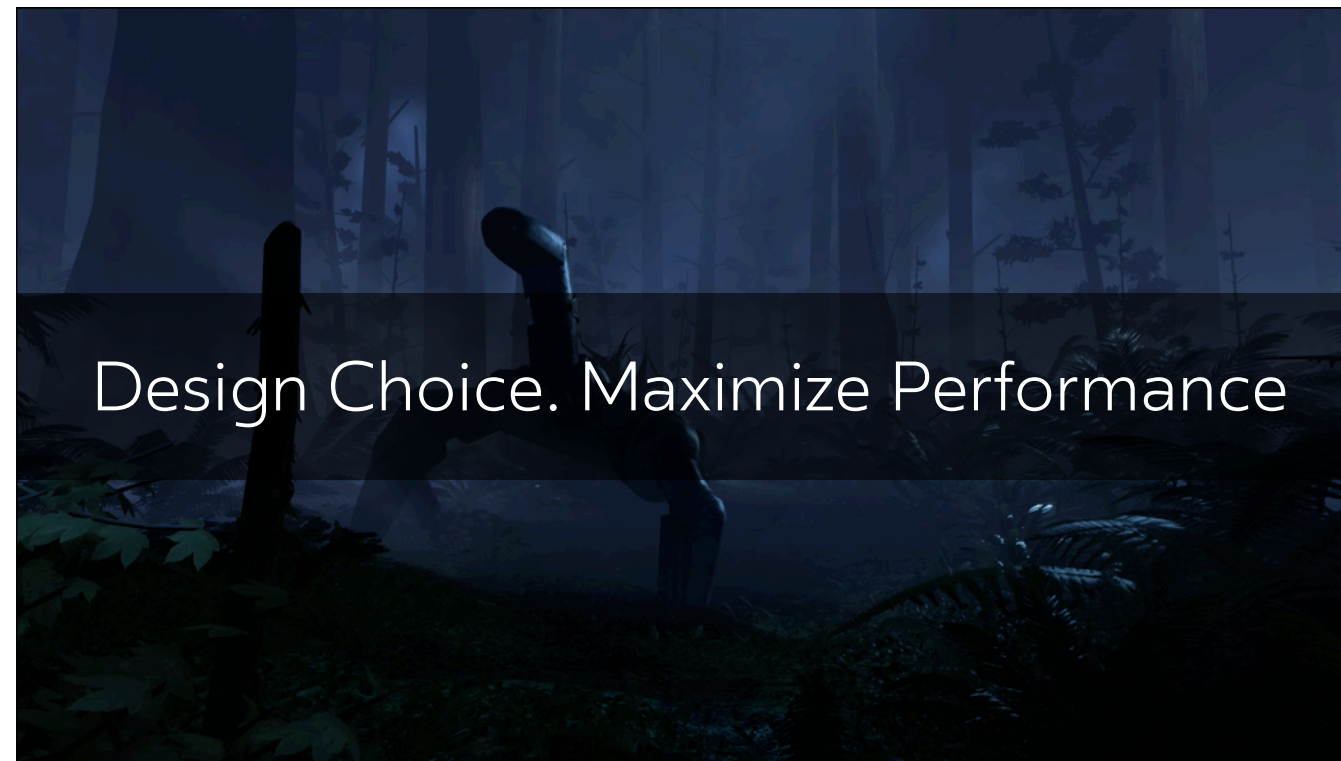
- But really, what Presence represents for me is the fact that the **abstraction layer between how a user gives input and how they receive feedback is much thinner.**
- All people who jump into Oculus' Toybox experience (gamers and non gamers) **start picking up the mechanics in seconds.**
- With VR, **everyone knows deep down in their lizard brain** how to walk, look and reach.
- So my argument is that because there is **less remapping happening in your brain** to engage the experience, your brain can more easily process the world presented by the director.



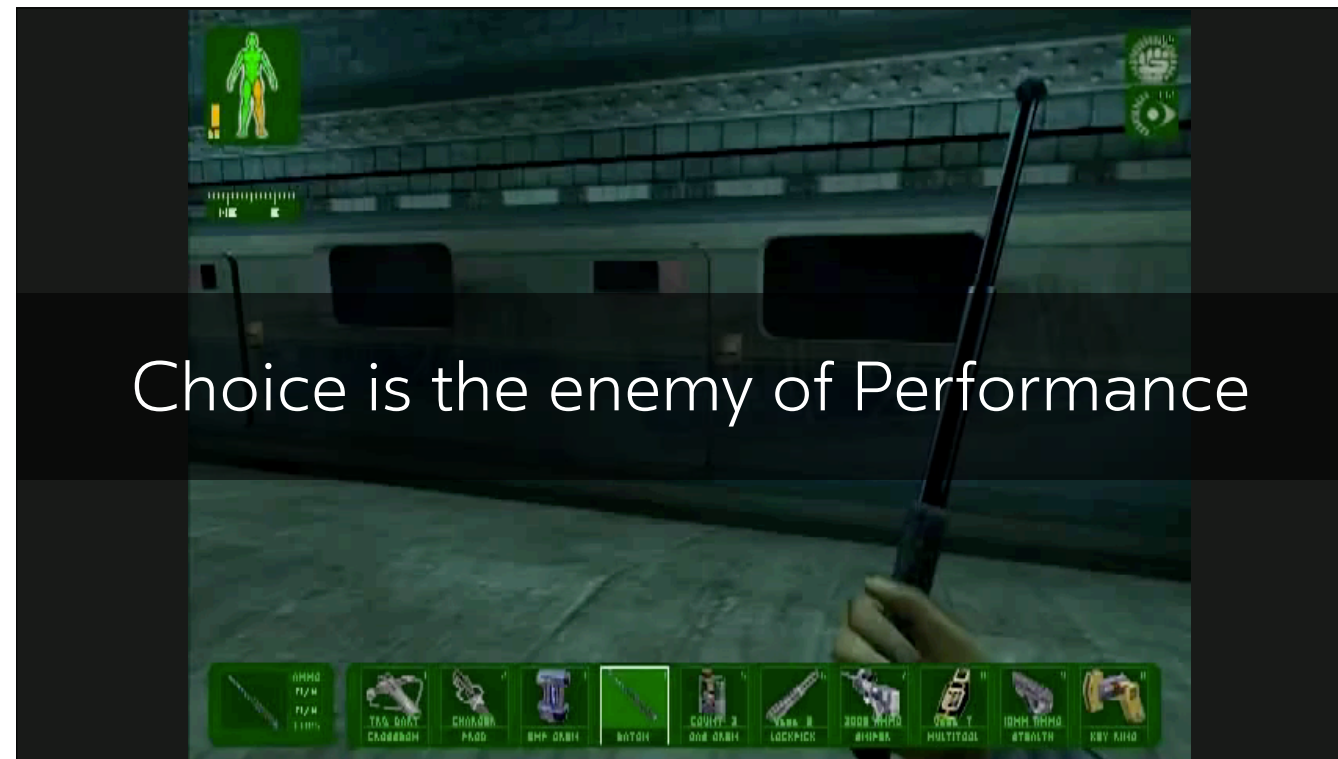
- Which presents the problem that the audience is using a very different part of their brain to take in the story we're trying to tell. **And what may be forgiven in movies, is not easily forgiven on films.**
- Early on Henry...



- Furthermore, we're using a realtime engine to provide our immersion and it feels like you're in our characters space.
- It feels weird if you don't establish rules of how that character should interact with you. Are you a ghost? Are you a character? Are you role playing.
- When we met a rigged and animated Henry for the first time, we wanted to hug him, pet him, have him react to us.
- And so late during production, we started playing with him looking at our eyes.



- The problem of giving too much choice means you can't make believable performance. So right now, design for less choice and more performance.
- People are already blown away that they are in VR.



- Deus Ex is an example of lots of choice which made it a great experience.
- But since VR tricks the brain into thinking you are there, we've found our audience is less forgiving of bad animation

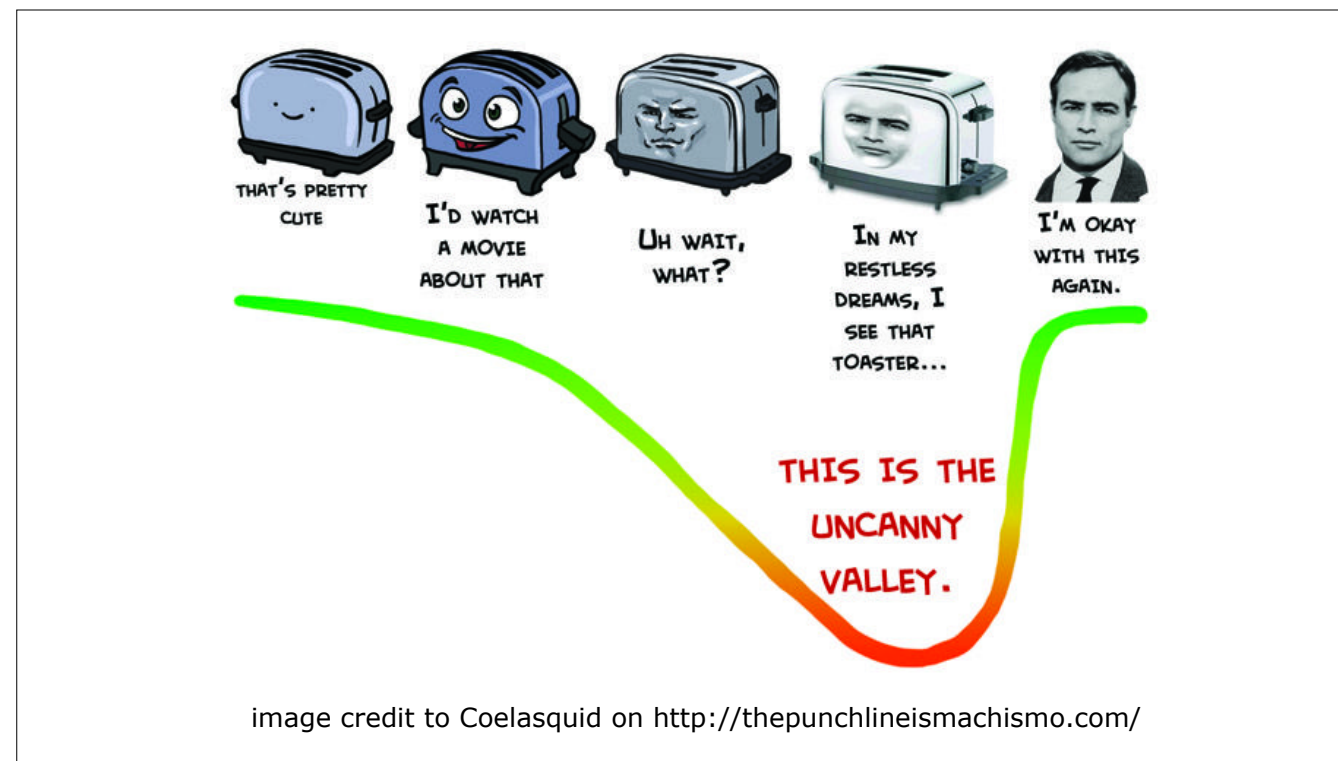
VR makers  
aren't ready for long form

- Novelty phase of this medium.
- We don't know what we're doing.
- Start small





- And the audience isn't ready for long form.
- Adding time, adds complexity.
- Right now, people are freaking out that there's a bush or tree right there in front of you.
- They won't appreciate the added complexity as much, so why over budget



- Willing suspension of disbelief is more fragile in VR
- Stay away from going photoreal. Create stylized and appealing.

## Embrace the Constraints

1. Production Constraints
2. Technical Constraints
3. Creative Constraints



The hard truth about being in the VR space right now is that VR as a medium is underdeveloped and inferior compared to the more mature technologies.

You can tell a rich, complicated, emotional story in a movie and you're audience will be medium savvy enough to understand it.

We need to accept that as VR pioneers, it is a long road of baby steps to get towards the Holodeck. And for those baby steps to be successful, we need to recognize our capability and audience at this time.



One advantage we have is that we have a lot of examples in great films and game experiences,





and Theater to steal from.



- As a result, the early experiences in VR are going to feel derivative and perhaps awkward.
- And it's only going to be through little innovations that capture something new and appealing about VR, that we'll create a feedback loop of inspiration - and discover what makes VR unique.
- I'm very proud of what we made with Henry and Lost, but I consider them baby steps, and it's my hope that 5 years from now, I'll look back at them and laugh

Questions?

@ovrstorystudio

Maxwell Planck [@maxwellplanck](#)