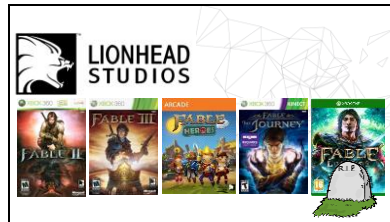Slide 1

Hi, my name's Bryn Davies, I work as Technical Director of Level Design at Ubisoft Toronto and I've been in the games industry for about 10 years now.
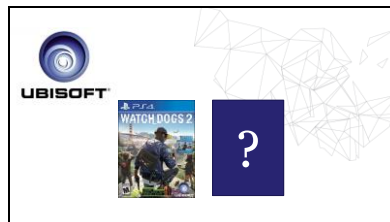
Slide 2

You can probably tell from my accent – I'm not from around here.
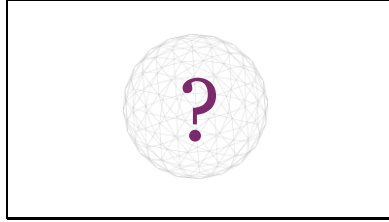
I used to work at Lionhead Studios back in the UK, where I spent 7 years working on a lot of Fable games.

Slide 3

3 1/2 years ago I moved to Canada and since then I've been working at Ubisoft Toronto, shipping Watch Dogs 2 last year and now working on an elusive Unannounced Project.

Slide 4

So, I realised before I could really jump into talking about Level Design, I have to define what a "level" is.

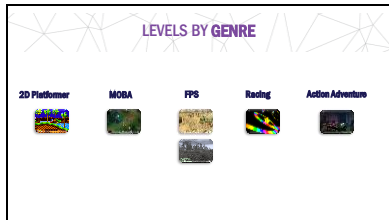Initially this seems like a pretty stupid question.

Slide 5

I know what a level is. You know what a level is.

We can all name a whole bunch of levels, from Green Hills Zone to Dust to Rainbow Road and beyond.

The problem is - they're all so different from each other.

Slide 6

LEVELS BY GENRE

2D Platformer   MOBA   FPS   Racing   Action Adventure

Nearly all the levels are from a different genre of game. Each has very different mechanics, thematic and sense of agency.

Slide 7

LEVELS BY **GOALS**

Get To The End
Back / Forth & Get To The End
Survival Objective-based

Each support different player goals too.

In some the objective is simply to survive to "the end".

In multiplayer levels, progression tends to be measured against how well you're doing compared to other players, and what objectives you've completed in the map.

Slide 8

LEVELS BY **PLAYFIELD**
- Joel Burgess

3D Avatar
2D Avatar
Overview
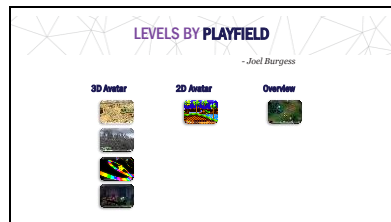
However one way we can group these is by "playfield" – that is to say, the general context within which we interact with the level's content.

The 3D Avatar gives us control of an agent in 3D space.

2D Avatar is much the same, albeit in 2D space.

The Overview playfield is more a strategic perspective.
Typically you're less connected to the agents you control, and there's not as fine grained interaction with your environment as there might be in other playfields.

(A good overview here: https://www.youtube.com/watch?v=EFJ5IE7ud_s)

Slide 9
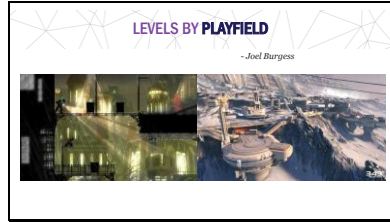
2D and 3D Avatar games might have some similarities, but there's huge differences that affect their level design.

In 2D games, the player's field of view is constrained to the way the screen is cropped. If an enemy off the screen were able to spot them or kill them, that wouldn't be fair, because how could the player know they were there? Cropping, and the way in which the player may move independent of the screen's camera, is a major factor in the mechanics and level design of 2D games.

3D games, particularly in shooters and especially in multiplayer, have sightlines as their number 1 consideration. Balancing the pickup location of a powerful weapon, for instance, by making its position relatively open and vulnerable to distant fire, or giving sniper nests blind spots are common practice.

Slide 10
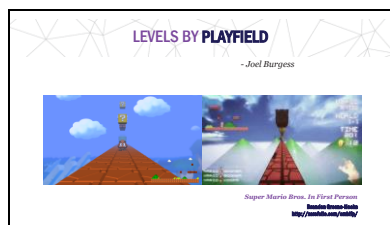
It may seem obvious then, that levels designed for 1 particular playfield do not translate well to another, unless there's conscious effort to work out its issues. An extreme but entertaining example is Super Mario Bros in First Person.

Slide 11
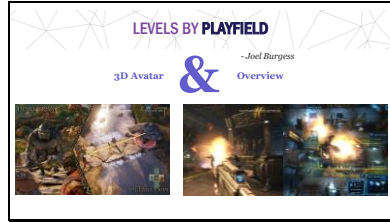
But there's no reason you can't design for more than 1 playfield at a time.

The game Natural Selection 2 and the last project I worked on at Lionhead, Fable Legends (RIP), are both played from 2 different perspectives (3D Avatar and Overview) in the same level based on the player's chosen role. If you thought designing a level that could be played simultaneously with 2 very different camera systems and control schemes might be complicated – you'd be right!

Slide 12
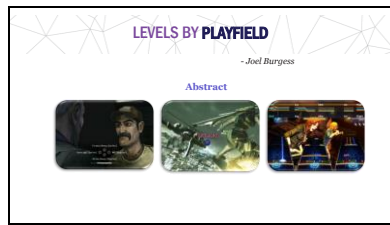
And what about adventure games, or Quick Time Events, or hell – a song in Rock Band or Guitar Hero?
These are lumped into the **Abstract** playfield. Whilst there may be physical spaces that needed creating for each of these levels, the component we might call **the level design** is something less tangible – it's the sequence of interactions the player is presented with.

Slide 13

So an accurate description of a level would be a structured container for interacting with the game's content

Slide 14
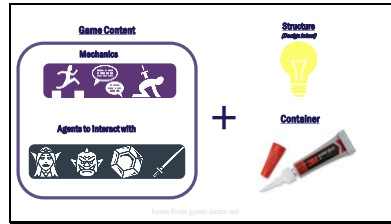
That is to say, if I take my game mechanics – jumping, talking, stabbing at things – and maybe some agents I can interact with - NPCs / AI, objects – if I combine these into a realised structure that conveys both the context and intent of how I want the player to interact with these parts, then I get a level.

Slide 15
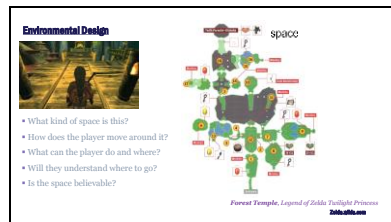
Level Design traditionally covers two spheres of influence. On the one hand, there is Environmental Design. This is the planning and construction of a physical space that contains all the elements the player can interact with.
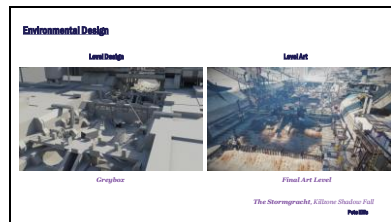
It can communicate to the player where they should go and sell the thematic and narrative of the space.

Zelda Temples traditionally have this "Metroidvania" style of design to them – you confront paths you can't take, you acquire a new ability which enables you backtrack and take those paths and slowly you're taught more advanced control of your ability until you face the Temple's boss. It's here where the key to defeating the boss is to use the new ability you've been being taught this whole time. You realise the entire level has been a tutorial to introduce a new mechanic, and the boss is simply a final test to ensure you were taking notes.

(http://zelda.wikia.com/wiki/File:Fores

t_Temple_Map_(Twilight_Princess).png)

Slide 16

Environmental Design
Level Design   Level Art
Greybox   Final Art Level
The Stormgracht, Killzone Shadow Fall
Pete Ellis

In AAA development, The Environment is usually built up by both Level Designers and Level Artists.

Level Designers will build with broad strokes in what is called Greybox, planning out a functional space in a style that is lacking finish and definition but supports the gameplay.

Level Artists will then break these shapes down into fully realised assets, eventually ending with a finalized, believable space.
http://pete-ellis.com/kzsf/

Slide 17

Scripting

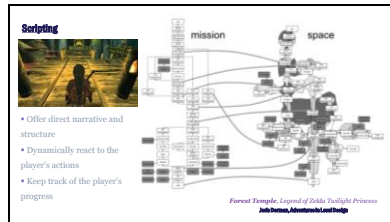*"Defeat the Bot and Find the Key to Open the Gate", Kismet*

Jesse R. Walter
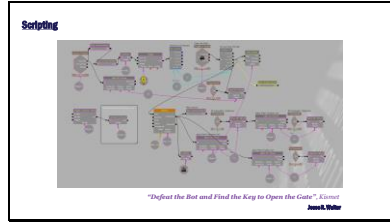
If we want to provide a mission, narrative hook or some other reactive element into the level its done through **scripting**.

A Scripter will program the logical flow of what conditions need to be met for what reactions to occur.

http://waltergallery.com/category/udk-rephaim/

Slide 18

Scripting

mission   space

▪ Offer direct narrative and structure
▪ Dynamically react to the player's actions
▪ Keep track of the player's progress

Forest Temple, Legend of Zelda Twilight Princess

Joris Dormans, Adventures in Level Design

Back in Zelda's Forest Temple, scripting provides Link with the structure and gated progression of the Temple's mission: he is guided step by step through the temple by monkeys, presented with puzzles and camera cues that hint their solutions to the player and eventually, picking up keys and unlocking doors later is led all the way to the boss fight at the end.
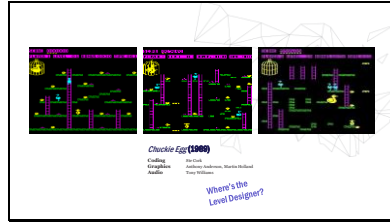
http://www.jorisdormans.nl/pdf/dormans2010_AdventuresInLevelDesign.pdf

Slide 19

"LEVEL DESIGNER" AS A ROLE

?
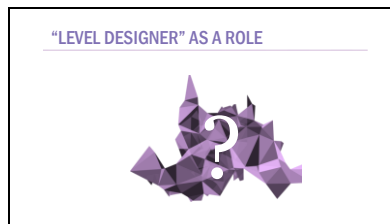
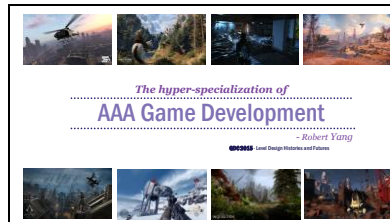So what about Level Designers as a role?

Slide 20

Well let's be clear (I'm gonna show my age here) - before Level Designers there was Level Design and there were Levels (in Chuckie Egg there were 40 of them).

(article on the making of Chuckie Egg, if you're interested: http://www.nowgamer.com/the-making-of-chuckie-egg/)

Slide 21

The job title "Level Designer" is really the creation of needed specialization within the AAA games industry.

Because modern AAA games are so incredibly complex to create, and involve a huge spectrum of technical and creative roles to build them, increasingly developers become specialists dedicated to one particular area.

(http://www.gdcvault.com/play/1022109/Level-Design-in-a-Day)

Slide 22
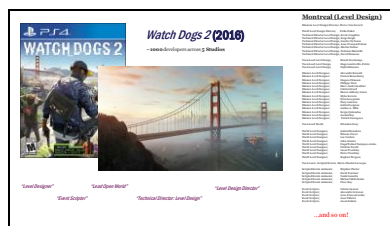
Watch Dogs 2 shipped last year and as you can see there were a lot of Level Designers working on it. This is only showing 1 of the 5 main development studios that worked on it, with a total team size just shy of 1000 developers – which sounds huge but its not uncommon to find in AAA development.
Looking at the titles developers were credited with, even within the Level Design family itself, there is a wide gamut of specialization available.
There's a distinction between Open

World LDs (those who focus more on Environmental Design) and Mission Scripters (those who focus on Scripting) – as well as Leads, Directors and Technical roles at all possible junctions.

Slide 23

Well what about "no level design" then? Procedural Generation, or as I like to call it "The P Word". Even when creating procedurally generated levels, there's plenty of Level Design at work.

Levels might be broken down into authored tiles which are then reconfigured like a jigsaw into a new level, like Spelunky.

In other cases code entirely drives the forms that should be present, and algorithms can be picked and tweaked which give the right sort of results, as in games like Minecraft.

Procedural Generation anyway is used as a tool in most AAA games now, as it has been for many years. If there's a lot of landscape in a level, chances are someone used a procedural terrain tool like World Machine to help create it all. Games like Far Cry and The Witcher 3 all use this software.

http://tinysubversions.com/spelunkyGen/
https://www.spigotmc.org/resources/biomegenerator.1663/

Slide 24

So what does a Level Designer typically do, and what are some of the design tools used to actually build levels?

Slide 25
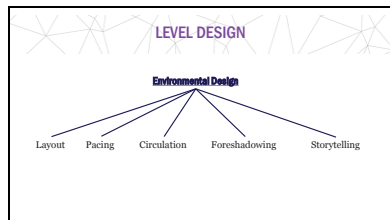
We can break down Environmental Design into a series of overlapping skills, which I'll explore in more detail.

Slide 26

Layout is how the key elements of your level are arranged, in addition to the planning required to "realise" the space – that is, to make it seem as an actual place.

That's not necessarily "making it realistic" – games are full of make believe spaces. It's making sure the level is something that the player can imagine how it might function contextually.
Dust2 might be a Counterstrike map specifically designed with player pathing, bomb site placement and chokepoints as its primary focus, yet it still manages to evoke that "in the real world" this could be a place with a very understandable purpose – a section of streets and walled courtyards in some imaginary city, that doesn't just exist as an area for people to shoot each other.

Slide 27
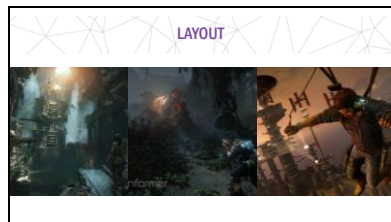
The mechanics of the game, the characters who use your level's space and the abilities they have – hell, just the movement speed alone, will dramatically drive the way in which you design your layout.

Think of how the varied climbing mechanics of Tomb Raider, or the presence of oversized Monster players in Evolve, or the high-speed wing suiting freeform action of Just Cause 3 impact how content is arranged in their respective levels, what language is used to inform players what is content and what is just set dressing, and what impact their varied

mechanics have on Environmental Design as a whole.

Slide 28
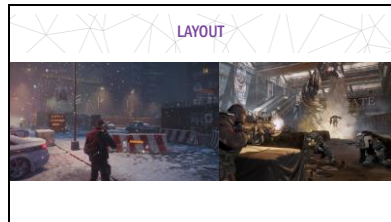
A classic design language for cover based shooters is to have a very clear distinction between what is low cover (something you crouch behind and peek **up** from) and what is high cover (something you stand behind and peek **out** from).

Because this needs to be clear to the player from a distance, there's strict rules (or **metrics**) forbidding the creation of assets that are in-between these two heights. The prevalence of chest high walls in these games is a direct consequence of this.

Slide 29

The rate and intensity at which the player encounters content in the level is **Pacing** and its crucial to ensure a player doesn't get too bored or too frustrated.

Typically points of **low** intensity are best to teach a new mechanic or deliver story content to the player as you'll have more of their attention.

The graph on the right is an actual design document used for the development of a map in **Splinter Cell: Blacklist** – it tracks Story and Combat intensity as it changes through each beat of the level.

http://www.gamasutra.com/view/feature/184783/the_metrics_of_space_molecule_.php

Slide 30
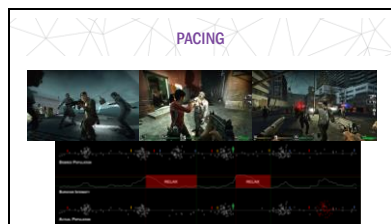
If you've played any of the Left 4 Dead games you'll be familiar with its AI Director – a series of systems that would monitor the intensity of the player's experience (based on their current health and when they were last in combat) and spawn more or less enemies depending on whether it thinks the intensity needs to go up or go down. Definitely check out Mike Booth from Valve's talk on this system, its super interesting.

(paper on it here: http://www.valvesoftware.com/publications/2009/ai_systems_of_l4d_mike_booth.pdf)
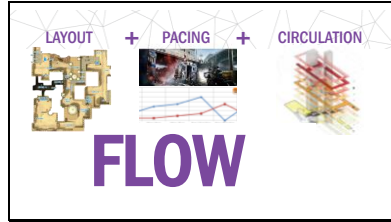
Slide 31
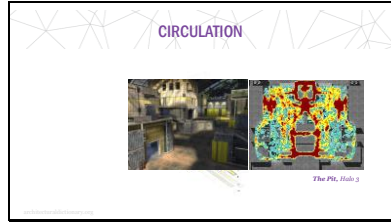
One aspect of architecture that crosses over with Level Design is Circulation. Not only does it describe the paths people take to move through a space, it can also describe rates of movement flow in different areas – moving through a confined space tends to feel faster than moving through an open one.

Level Designers quite often evaluate AI and player circulation by using a **heatmap**.

The example on the right, the multiplayer level **The Pit** from Halo 3, plots player deaths over the course of a match, with **red** areas being **hotter** due to a greater number of occurrences. These most likely indicate choke points in the map, or areas of high activity (maybe there's a good pickup there). As a Level Designer, I can investigate what might be causing player deaths to be concentrated so much, and take steps to ensure a more even spread of map usage, if that's something I want to change.
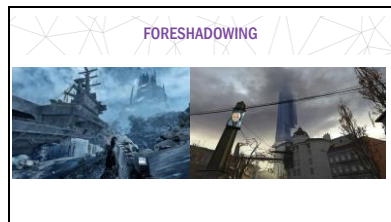
(http://architecturaldictionary.org/dictionary/)

Slide 32

Layout, pacing and circulation are all tightly related and are often described together as **Flow**.
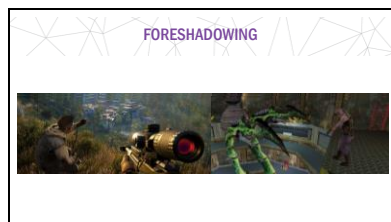
(http://architecturaldictionary.org/dictionary/)

Slide 33

Foreshadowing is usually encountered in a narrative context – I see a distant landmark, I start to draw conclusions as to what I might find when I get there, and I also use it to work out where I am in the level.

Slide 34

But there's also a gameplay context to it. Having an overview of the layout of a base I'm about to attack lets me plan my strategy based on entry points, how many guards there are and of what types. The Far Cry games almost always lead you to an overlook where you can plan the assault of an outpost below.

Foreshadowing is also often used to teach the player. Half Life uses a series of unfortunate NPCs to demonstrate different dangers the player might not have encountered yet - like new enemies or environmental hazards.

Slide 35
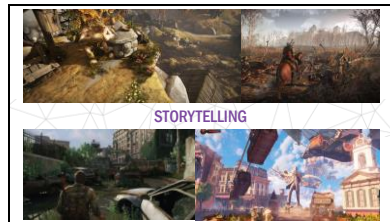
Whilst a lot of narrative content is delivered to the player via speech or text, Environmental Storytelling is still a powerful part of it.

In each of the games above, without knowing anything of the actual story or setting, you can infer a lot of knowledge just through the environment. We can read the signs, the cultural symbols, the compounded ideas and draw our own conclusions about what these places are.

Slide 36

So how might we go about building levels? There's two real extremes to the process spectrum, and both are used extensively in AAA development.

Slide 37

FORMALIST LEVEL DESIGN

Rational Design / RLD
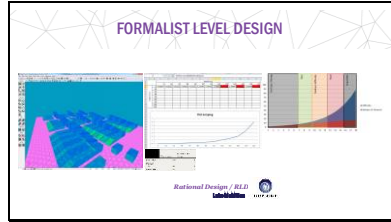
On the one hand, there are several recent movements towards more formalist approaches.

Rational Level Design or RLD is a tool we use at Ubisoft.

It's a method by which you score the intensity of each individual atom of gameplay, then you may determine your pacing spatially and on much more granular level than you normally have control over. This has been used on everything from Splinter Cell to Assassins Creed and Rayman Legends. There's a lot of resources published on this too.

(http://www.gamasutra.com/blogs/LukeMcMillan/20130806/197147/The_Rational_Design_Handbook_An_Intro_to_RLD.php)
(http://www.gamasutra.com/blogs/LukeMcMillan/20131014/202289/The_Rational_Design_Handbook_Four_Primary_Metrics.php)
(another overview of RLD, from Rayman Origins: http://www.gamasutra.com/view/feature/167214/rational_design_the_core_of_.php)

Slide 38

On the other side are freer, more artistic forms of expressing and developing spatial designs.

Wild, freeform design and "kitbashing" have been staples of Level Design since the first Designer was given a single cube and told to make a level. Caves in games are traditionally kitbashed because their organic forms can be difficult to achieve with usually a small amount of fixed pieces. Halo Forge and the like are good places to see people being super creative with a limited palette of objects.

On the bottom right we have Ferdinand Cheval's outsider art masterpiece, Le Palais Ideal – kitbashing in the real world. Definitely worth looking up!

(https://en.wikipedia.org/wiki/Ferdinand_Cheval)
(http://www.winchestermysteryhouse.com/)

Slide 39
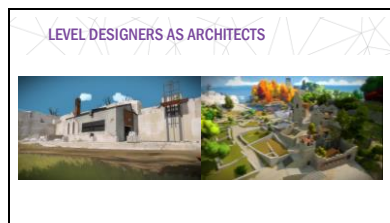
There's an analogy of the Level Designer being like an Architect, and it has a lot of convenient similarities.

For anyone not aware, the screenshots from The Witness are examples of the opposite – that is, Architects as Level Designers. There's a great article on Gamasutra that breaks their process down, well worth a read.

(writeup on The Witness architectural

process:
http://www.gamasutra.com/blogs/DeannaVanBuren/20151012/254238/Architecture_in_Video_Games_Designing_for_Impact.php)

Slide 40

Both design spaces, of varying sizes, designs and intentions, that are often navigable and useable.

And both are built to the metrics of the user.

Architects quite often design spaces specifically for human use. Doorways, rooms and corridors comfortably accommodate the human frame and we find elements at the right height for us to use.

A Level Designer on the other hand builds based on the player avatar, their camera and the requirements of the game's mechanics and AI – one level is built for a 6 foot tall human, another is intended for cars, or spaceships, or all 3 at once.

However, I think that's where the similarities end.

Slide 41

Levels often have far less rules governing how they are built – they're not constrained by zoning or building regulations, let alone even physical laws. Monument Valley and Antichamber tout MC Escher-like perspective relativity, the Portal games let you play with bending gravity and inertia through player created warpholes and Miegakure has you puzzle solving by traversing a new 4th physical dimension in a 3 dimensional world.
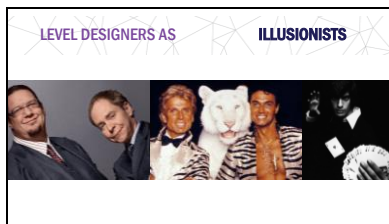
Slide 42

The Architect on the other hand only has to deal with the intent and execution of their design – they don't have to plan exactly how people will act in it.

Level Designers do – they are architects, builders and theatre directors all in one.

Slide 43

There's a, ok, rather bizzare analogy which I prefer, which also helps describe a lot of what my work on a project tends to be….and that's that quite often Level Designers….are Illusionists. It's ok, you can laugh.
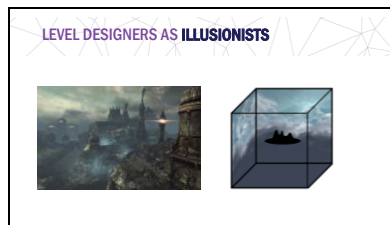
Slide 44

Ok, bare with me.

Often the Level Designer presents an experience which gives the impression of something far more complex than is actually being done behind the scenes.

The player perceives something great, unaware of the relatively simple trick being performed via the design's implementation.

Slide 45

Level Design trickery is present in every level you've ever played. 3D games now almost always have a standardized implementation of a Skydome or Sphere with a scrolling texture on it (though the more modern option would be some multi-faceted, multi layered shader) – a few years back it would have been just a cube. In some engines, skies and background objects are rendered to a texture from a camera placed in another physical space and projected onto the bounds of the actual level, making it seem much bigger than it actually is.

(icon from - http://blog.simonrodriguez.fr/)

Slide 46

Physics simulation is probably the widest implemented strategies of illusory design. Whilst the player sees a beautifully rendered, high resolution 3D space around them, they perform pretty much all their interactions within the **physics world** – an underlying simulation of low poly shapes, physics layers, simulation models and general affordances that make it actually possible to simulate the visual complexities the player is seeing.

Slide 47
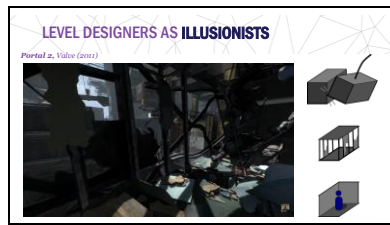
The opening sequence of Portal 2 is a brilliant set piece combining 2 huge pre-baked physics simulations: the first that simulates the journey of the room as its carried on rails smashing through the superstructure, and the second that simulates the skeleton of the room deforming and collapsing around the player. This in turn drives the real-time simulation of the wall's hundreds of pieces of debris as they fall off and clutter the room. The player's movement within the space is simulated in a completely separate but largely identical room which isn't moving or breaking apart, and the results of this control are mapped onto player's camera moving around the actual room they see. Yes, it's pretty complicated.

Slide 48
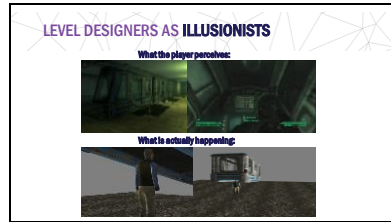
Getting on the metro in Fallout 3's Broken Steel DLC seems believable enough as a player.

Under the hood though, the player actually puts on the Metro car "glove" and is animated along the train's path themselves. They carry the train along the line to the station, not the other way around. This workaround that was discovered by players a year or so ago and did the rounds on the Internet – the funny thing is, this is more common place than you'd realise.

http://www.pcgamer.com/heres-whats-happening-inside-fallout-3s-metro-train/
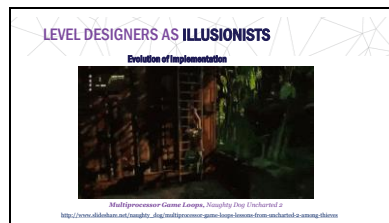
Slide 49
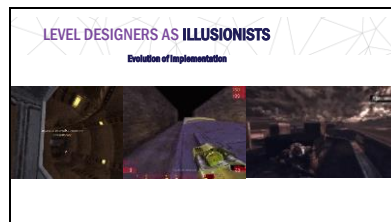
So lets stick with trains for a minute, because its really cool that you can track the evolution of implementing a given design idea, like train levels, throughout the history of 3D games.

Half-life 1 classically starts with a train ride. I can look out the windows at the facility I am moving through. I'm clearly moving through a space, but I can't really do much on the train itself.

Unreal Tournament had an Assault Map – AS-Train - that took place on a moving train. Except – it wasn't moving. The train is static, sat inside a rectangular box. Blurry textures move past on the sides and floor, giving the impression I'm flying along. Really though, myself and the other players are the only things moving.

Gears Of War's Train Wreck level is the same concept, only with a slightly more advanced setup. The structures and props that whizz by the side of the train – they're moving. The train is static, and the objects in the world are moving past. There's a joke Einstein supposedly made about the station finally arriving at the train he was on – well this is it in action.

Slide 50

LEVEL DESIGNERS AS **ILLUSIONISTS**
Evolution of Implementation

Multiprocessor Game Loops, Naughty Dog Uncharted 2
http://www.slideshare.net/naughty_dog/multiprocessor-game-loops-lessons-from-uncharted-2-among-thieves

Which brings us to Uncharted 2's train level, and why it's so important.

Because the reason Gears and Unreal Tournament had to contend with moving the world instead of the train is that it's extremely complex to get AI pathfinding, shooting, complex player navigation and such working on top of a fast moving object. The cost in programmer time to solve these issues for the "token train level" in your game just isn't worth it.

But Naughty Dog planned from the start to undertake this challenge – it was a core pillar of Uncharted 2's development from the start. And so yes, this train is **actually** moving through a space, and all the game's systems just work with it. This time, it's not an illusion.

I highly recommend reading the tech breakdown Multiprocessor Game Loops from Naughty Dog if you want to bombard your head with maths, it's a fantastic insight.

(lots of maths, but how Naughty Dog got the trains working: http://www.slideshare.net/naughty_dog/multiprocessor-game-loops-lessons-from-uncharted-2-among-thieves)

Slide 51

Ok, then, so that's all the problems solved right? Not so fast!

The train starts off in the Jungle. It goes through a tunnel, ends up climbing through some mountains and after a boss fight it ends up hanging off a cliff, ready for the next level.

The train is moving at a constant speed and we know we're physically moving through a space, then what happens if I just sit down and wait? Will I end up skipping the level, because the train will run its course up the mountain and right towards its own end? Nope – there's still more at work here.

Slide 52
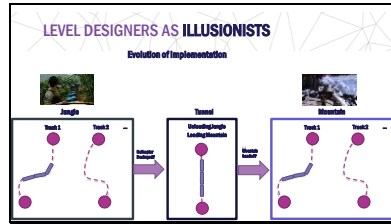
There's not 1 long single track that the train follows, but a collection of little sections of track that the train gets teleported between, like toy track pieces randomly linked together endlessly.

Moving from the Jungle to the tunnel only happens once you defeat a helicopter part way through the level. So during the helicopter fight, you're teleported between generic sets of tracks until the fight is over. Then you're moved outside the looping sections and onto a track that transitions from Jungle to Tunnel.

The tunnel then masks the unloading of the jungle section and the loading of the snowy mountains. Once you reach the boss fight here, the cycle continues – you loop around generic mountain sections until the boss is defeated and the level can end.

Slide 53
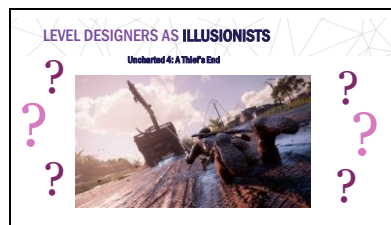
Maybe you've played the convoy section in Uncharted 4, which is based on the same Train tech from Uncharted 2. How did they do it? There's been no talk on it just yet. I'm trying to find time to sit down and analyse it, but as of now – I have no idea, it's just so incredibly complex. But once you know what to look for, given the time anything can be broken down and analysed.

Slide 54
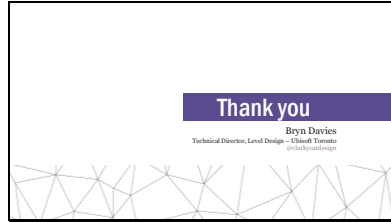
Thanks for your time, I hope you enjoyed the talk.

Any questions?

****

(Further Reference)

(http://www.gamasutra.com/blogs/JoelBurgess/20130501/191514/Skyrims_Modular_Approach_to_Level_Design.php) – a classic!
(http://www.gdcvault.com/play/1305/Everything-I-Learned-About-Level) – another classic!
Designing For Exploration & Choice In Firewatch (GDC 2015) - https://www.youtube.com/watch?v=8_kL_RVMGbg
Worldofleveldesign.com
Books:
Introduction to Landscape Design - John L. Motloch
Space & Place – Yi-Fu Tuan