- Checks:
  - WIFI
  - SILENT MODE (Mac)
- Setup:
  - Open Quicktime (show iPhone screen)
  - Open developer.vuforia.com
BADGE PREPARATION

• Draw a picture (with lots of lines)
• Take a photo of it
• E-mail it to dominic@dominicmanley.com
  Subject: GLAMVR
  Include an interesting fact about yourself!
• Wear it as a badge!

- Ok so before we start I need your help...
- DEMO drawing a picture (a cat?).
  - Emphasise to include an interesting fact (something they don’t mind sharing!).
- Wear it as a badge.
- I’ll popup a reminder closer to the time.
- Hello, my name is Dominic Manley…
- IT consultant for DSBS specialising in mobile, VR and AR.
- Co-founder and committee member of AVRL, local initiative that helps accelerate VR and AR apps in academia and research.
- Software Developer for more than 20 years.
- Built many apps for the web, desktop computers, phones…
- Such this app, Elsie, the mobile companion for students at Curtin.
- I've made tablet apps, watch apps, VR apps...
- Like this one for the Plant Energy Biology Centre which recently launched at Perth Science Festival and at SciTech...
- And of course... I've done some AR apps, like the Kings Park Honour Avenues project.
- Which I'll discuss later in the workshop...
- **What is AR?**
  - How does it work?
  - How is it useful?
  - We'll look at some examples.

- Then we'll take a look at the Honour Avenues project which I think is a useful case study for learning what to look out for when developing an AR app.

- After that we'll go maximum risk and attempt to build a very simply AR app together, live coding, using Unity and Qualcomm’s Vuforia framework.
  - Fraught with danger... many things can go wrong!
  - The aim of that will be to open up the black box a bit as to how these apps are built.

- Then at the end we'll have questions and I'll leave some AR and VR demos out for people to try while we do a bit of networking.

The goals of today's workshop:

- **Are NOT to be** a detailed scientific explanation of augmented reality
  - There are cleverer people than me will explain the science behind the light rays, the optics, lens distortions, IMU offsets.
  - My skill set is as a developer and a technical/project manager of these kinds of apps...

- I'm hoping you'll go away thinking up new ideas for projects that involve VR and AR.
WHAT IS AR?
It's not VR.
It's a little bit MR.

- So what do I mean by that?
- Well… Michael has already shown us some VR today.
  - Virtual reality is entirely computer generated.
  - They attempt to immerse you in another virtual place, blocking out the real world.
  - VR headsets are very isolating.
- AR doesn't do that.
- AR lets you see the real world still.
- Then it layers over or “augments” (“supplements”) computer-generated virtual elements, like signs, text or even other 3d objects.
- Imagine an ordinary set of glasses that add some pictures over the top of the glass… you can still see through at your surroundings, but some areas are covered by the pictures.
- MR stands for “Mixed Reality” which is another term (somewhat controversially) floating around a bit lately. AR falls within the definition of MR. MR also includes AV (“Augmented Virtuality”).
- This will be the most complicated chart or graph you’ll see from me today :) 
- This is called the “Reality-Virtuality Continuum”. (Awesome… Q Continuum!)
- Explain it, give some examples.
Let’s play a game!

- No, not Pokemon Go.
- I call it “Is it VR, AR or AV?” (catchy title… thinking of pitching it to Hasbro)
- So notice this is a form of AR that doesn’t involve a headset or a pair of glasses.
- The augmented virtual information is actually projected onto the real world, rather that onto the eyes or wearable device.
(Game over!)
AR is not just about your eyes though (vision). It’s not just glasses and headsets.

As well as augmenting visual layers over the environment, sound can be augmented too to increase immersion, add additional information.

The direction of sound can be important, where it comes from spatially... imagine something happening in the augmented environment to one side, out of your view... something that’s trying to get your attention... well if you know which direction that’s coming from you can turn your head towards it.

And I’m sure some of you have been to art galleries and used headphones with the audio commentary, sometimes triggered by proximity to certain exhibits/paintings... That commentary is a form of augmented reality, providing you a layer of additional contextual information about your environment.

There are also some devices, ear-buds by Doppler Labs, that augment the live sounds around you, altering them, adjusting the frequency depending on the environment you’re in. So if you’re at a live music concert they can adjust the acoustics for you in real time. That’s an augmented reality.
Like VR, AR also needs some control mechanisms. We need something to interact with the virtual elements of the AR world. So we can activate buttons, move objects around, trigger things to happen.

Tactile vs non-tactile...

Non-tactile:
- Gaze
- Hands / gestures
- Voice recognition
- Proximity

Tactile:
- Wands, controllers, gloves
AR IN 2016

- Phones, tablets, Glass
- Early developer HMDs
- Pokemon Go!
- Not disrupting much (yet)

- A lot of AR right now is on phones and tablets…
  - Some good examples of data visualisation, some fun learning apps
  - You can download plenty of them by searching for AR in the app store
  - Demo the tattoo app?

Then there was Glass:
- Too early
- Limited release
- Cultural friction (forward facing cameras, privacy)
- Poor marketing, “Glassholes”

Hardware limitations:
- Field of view (Hololens)
- Size / form factor (too big)
  - Surprised how attractive some devices already are though
- Battery vs tethered
  - Out and about vs in the office/at home

- Pokemon Go (limited AR… no occlusion or real understanding of the environment… more GPS aware)
  - Imagination compensating (pokemon selfies)
- So you may of already seen some of the exciting technologies not that far away...
- Better hardware (hybrid VR/AR)
- Internet of Things (IoT)
- Artificial Intelligence (AI)
- The Metaverse
- Analysts: AR to be worth $billions

- Metaverse, IoT, cloud, AI
- Miniaturisation, smaller form factor
- Analyst expectations
- Apple will do it, Tango, Glass v2, t, Meta, MR... Intel's latest, (who else did a headset lately)
- Eventually hybrid devices that cater for all VR/AR/MR
- Higher field-of-views
- Great GPU and battery performance
- Losing the tethers
- Example of potential use cases
  - Kathryn's fridge scenario (milk weight, IoT)

Disruptions:
- Along with VR, expecting some significant disruptions
- Displacement of existing hardware
  - Cost effective... (fewer screens needed)
    - Microsoft Hololens robot, washing machines, think about all those screens on devices we use (what if they were all augmented)
- Displacement of existing HCI principles
  - How we interact with computers (e.g. Windows, scrollbars, mouse, keyboards)
  - Now gestures, spatial controllers etc.
- This is actually presented as a bit of a dystopian future, a negative outlook.
- But I actually think it has heaps of interesting examples in it... aspects of what we might see.

  (Hopefully you'll be able to filter out layers of the information bombarded at the user there...)}
HOW DOES AR WORK?
By understanding the environment

- As promised, not going to go into too much technical or scientific detail here...
- Simply put though... by understanding the environment
• Sensors (camera(s), mics, GPS, …)
• Clever algorithms (code)
• Targets (tracking)
• Data (local, cloud, persistent)
• 3d Objects / Scenes

- It does that using sensors.
  - Like us... needs sight and sound to understand things.
  - Like us... can be vulnerable/overwhelmed by noise (e.g. low light, snow/mist)
  - Some sensors humans don’t have, some we do.
  - Can maybe combine them together to get a better understanding.

- Sophisticated algorithms then translate that information into an understanding of natural environments.
  - Very difficult... e.g. Occlusion (one object passes in front of another).
  - I don’t envy the task the engineers at Microsoft, Magic, Meta etc... have.

- Targets (images, text, objects, surfaces, edges)
  - Can help lock-on to fixed/known areas to assist tracking
  - Framework variations: VuMarks
  - Better to NOT have them (can be messy... QR codes everywhere!)
    - But like humans... distinct elements of environments help us position ourselves, give us a sense of place

- Persistent data
  - Michael has demonstrated how cloud data e.g. from Trove and the state library can be pulled down into Unity
  - Multi-user environments
  - Returning to the same place (expecting it to be the same)
Remember to e-mail your badges to dominic@dominicmanley.com!
- Conceived by Julian Partridge, a professor in Animal Biology over at UWA who came over from the UK a few years and was visiting Kings Park.
- He saw these little plaques alongside many of the trees up there.
- It was clear they honoured fallen soldiers but he wondered what stories lie behind the individuals, those sacrifices, the families, the battles…
- Julian shared his curiosity and some ideas he had about using AR and citizen science…
- So before I tell you more let's take a look at the campaign video we did...
- It's a little rough in places but it gets the concept across...
PROCESS

• Find the skills/team
• Get partners/stakeholders on board
• Build the prototype
• Fund raising, crowd sourcing

- Julian
UWA campaigns
Don’t detail non-AR challenges (sensitivity, contacting families, etc)
Check it’s not a gimmick

Funding…
- Citizen Science
  - Crowd source data if possible to reduce energy
    - Introduces moderation though

- Environmental challenges
  - Weather, sunlight (time of day morning vs evening)
  - GPS assisting
  - Kings Park Anzac launch target… lots of people = cellular struggles?
  - “Contextual dynamacy” (changing environment)
  - Occlusion

Launch day cellular usage
- Tree cover (shadows, lighting)
- No ADDITIONAL targets allowed
  - Variations in targets viable? (use GPS/text-recog too)
    - Battalion badge not enough
    - Image recon variable enough (could we miss-match?)
Honour Avenues Demo
Done a number of VR and AR projects, many proofs, and a few like VPC has been taken further. Relevant to small-medium sized projects (under $100k)

Why use AR in your projects?
- Contextual HUDs, hands free
- Engaging, immersive
- Cheaper than real world sometimes
  - Can do things you can’t in the RW
- Genuinely unique possibilities waiting to be done
- Can you can align the use of AR in yours projects with strategic goals (student opportunities, campus infrastructure)
  - Some of my projects... getting students involved, engaging with local industry, generating awareness of these technologies and their potential... these are additive elements that sponsors/institutes are interested in beyond the scope
Do you need to make it yourself?

Adopt existing solutions
- Augment app
  - Let's you upload your own models, scan targets in
  - Constrained to their cloud service
- Enough for some scenarios e.g. spruce up classroom teaching
- The big players will be bringing many more more accessible tools in years to come
  - Unity's building a user-app for content creation, load into dev-mode after
  - Google has exhibitions etc. (expecting similar things for AR)

Or roll your own / DIY...
- Tools: Unity (recommended for prototyping), Native
- Development frameworks: Vuforia, Hololens SDK
- Explore new ideas
- Hook into your own cloud data silos e.g. library databases
- Control

Benefits of doing a project:
- Pioneering
- Don't do anything enormous right now (the Valley will take care of that)
- Can gain valuable insight to the processes though, knowledge and experience
PROJECT METHODOLOGY

- Agile
  - In my experience VR and AR projects desperately need to be agile... they need to be adaptive, iterative and evolve.
  - There are too many unknowns
  - Every situation is different
  - So many challenges
  - Not many examples, established practises/standards to adopt yet or point to/reference

- Sprinkle of Waterfall is ok
TEAM

- Project/Technical Manager
- Unity Developer
- 3d Modelling Artist
- Video (360) & Sound Production

- Local talent itching to get opportunities
DIY BUDGET

- Prototype: $15-20K
- Version 1: additional $30-50k

Prototype:
- Is it viable?
- Does it meet stakeholder expectations?
- Has it solved the core problem?
- Are there any big unknowns still? (If so, do another round of prototyping - maybe half the budget).
GROUP ACTIVITY:
LET’S BUILD AN AR APP!
Q&A
Downloads available soon at
http://dominicmanley.com/pb/glamvr/