

PVRR

Pet Virtual Reality Research Technical Brief & Synopsis

A white paper by

isobar



The Ecology Global Network estimates that there are about **600 million** small cats in the world.

This includes pets, strays, homeless and feral cats. The wild cats alone number about 100 million. The sheer size of this feline audience is astounding, even when you subtract out the cats that are unable to join the population of cats that we believe to be active and willing consumers of content.

In order to determine the true potential audience of non-human immersive content experiences, we must subtract out the population of felines that are not aligned with our model of feline content consumers from the overall global cat population. This subtraction is necessary to account for felines that occupy areas in which there is no reliable power or internet access, as well as places where estimated technology spend per cat falls below normal thresholds.

This was a primary factor in our Pet Virtual Reality Research (PVRR) conception:

Creating a new form of content for the population of cats that have either owner-supported entertainment budgets or reside within a community that can effectively fund content. The PVRR platform has enabled the creation of CatVR, a first-of-its-kind initiative from Zoos Victoria, encouraging people to keep their pet cats indoors, and away from native wildlife.

In many cases, new hardware platforms fall victim to underwhelming content. While there is no silver bullet that serves as a solution to this, there are various tactics that we felt necessary to employ in both the creation and after-launch operations of the PVRR and CatVR platforms. These items include the ability to keep content fresh and entertaining, designed for cats and not other domestic pets (although canine VR and other products are soon to follow) and to ensure that there is an understanding of how to best design content that appeals to feline sensibilities. In addition our research has helped to lay out a strategy for ongoing revenue from content, helping to alleviate the challenges faced by human-centric VR devices and platforms. Ultimately, we see an ability for brands to directly build relationships with cats and for cats to be social and share with one another, creating a full ecosystem of content, experiences and multi-feline collaboration opportunities that are likely to forever change the way cats communicate with one another as well as consume content.

This paper will provide a high-level understanding of the strategy behind each of these items and help to clarify the approach that we have taken to make sure that PVRP/CatVR isn't just entertaining to our feline friends, but can be considered truly as the "digital" cat's pyjamas.

Addressing the content issue.

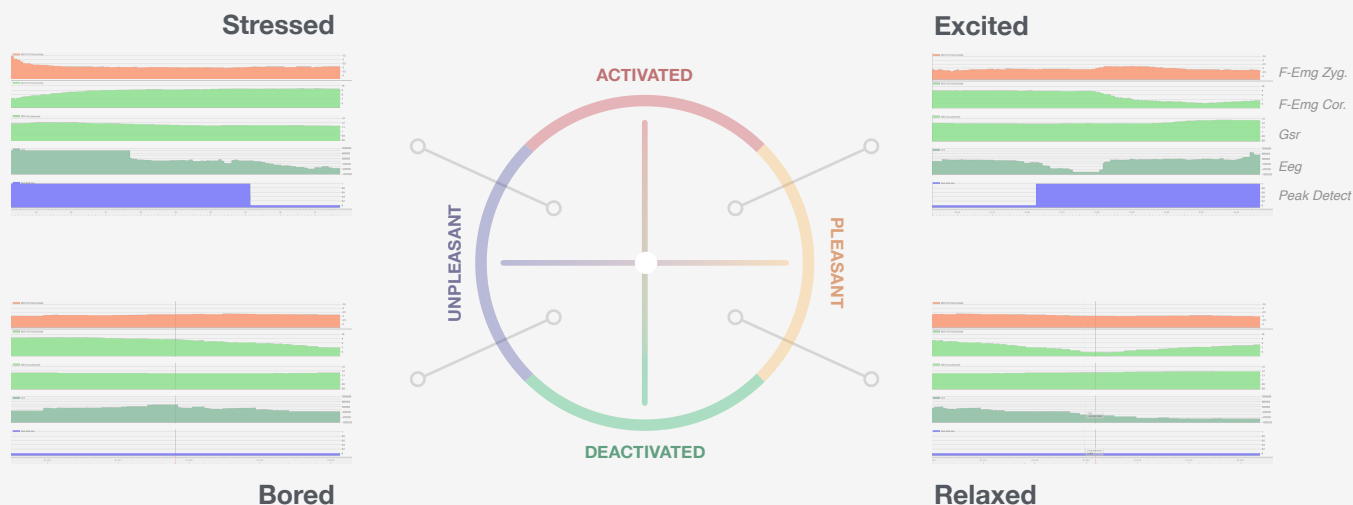
The biggest shortcoming and largest barrier to adoption of VR headsets in the marketplace is a lack of compelling content. This is absolutely true for human-centered VR content experiences, whether they be simple 360 degree video, 'on-rails' applications or more advanced real-time rendered applications that take full advantage of the various game engines, including Unreal Engine and Unity.

Creating good VR content is difficult and there are various elements that need to be done correctly in order to appeal to a mass market. Content needs to be optimised to run at high frame rates to avoid causing users to feel nausea. This requires a hybrid team that consists of visual artists, software developers, 3D artists that understand the myriad of 3D content pipeline and production workflows that can be used to create different types of content. In addition, technical specialists that can bring ideas to life aren't just enough. Great content that is displayed in VR headsets must be usable.

To validate PVRP and the strategy behind CatVR we leveraged biometric-monitoring and services provided by our own Isobar Marketing Intelligence team's patented MindSight platform to analyse the effectiveness of content, experiences and cat-interfaces. These processes were put to use across our conceptual and detailed design processes in order to ensure maximum acceptance of the product in the marketplace.

Prior to performing research our team had to create a validation framework and a series of metrics that could be used to understand the feline response to mixed reality content, with an emphasis on head mounted display based VR content.

One of the primary challenges when performing MindSight studies on cats was their inability to accurately control the computer mouse or other readily available forms of input. Without opposable thumbs, using a computer mouse or variations such as the "air mouse", proved ineffective. In addition, verbalising the word "mouse" or "mice" in the laboratory while test panels were present caused false positives in the biometric monitoring equipment, especially when measuring arousal and valence through EEG, EKG and GSR monitoring devices.



To help our team more effectively perform testing without mentioning the common name for small rodents, our engineers inside of Isobar NowLab leveraged an array of depth-sensing cameras situated within the testing environment. These cameras were able to detect both visible and invisible light. With custom software algorithms, we were able to detect and analyse each feline subject's facial expressions to understand their perception of the content being tested.

This included being able to overcome several challenges, including the inability to do standard facial coding due to the necessity for each cat to be wearing the CatVR headset. To get around this limitation, we pioneered a patent-pending process that is referred to as "W.A.H.T" - Whisker Attenuation and Haptic Telemetry. This groundbreaking addition to the computer vision and sensor platform has allowed us to leverage software algorithms to understand the 'tells' each feline has related to their whiskers and be able to accurately understand when a cat experiences one of the following states:

- **Totally disinterested (TD)**
- **Disinterested (D)**
- **Mildly disinterested (MD)**
- **Cat-nipped (CNP)** – a term we've been using to express the same brain activity seen in highly stimulated cats when under the effects of catnip

This included being able to overcome several challenges, including the inability to do standard facial coding due to the necessity for each cat to be wearing the CatVR headset.

In most cases, cats would consume content, but have a relatively high TD/m (totally disinterested expression per minute) as well as in some cases even seeing Y/m (Yawns per minute). Cats yawn to take in more oxygen, allowing their brains to become more active and awake.

We can see this spike in brain activity post-yawn and had to do a lot of work to ensure that the cats in our test groups were not polluting the data capture with yawns, essentially creating a lot of false-positives in our analysis of their preferences for content types, device form-factor, and audio playback techniques.

All of these elements are amplified in a world where cats are now part of the audience. While initial attempts were to simply repurpose human VR content for felines, initial testing in Isobar's NowLabs quickly concluded that the TD/m and Y/m rates for cat-centric content were far beyond acceptable thresholds.

This outcome provided the necessary information to devise a new strategy that would be central to the creation of CatVR and would subsequently mean drastic changes were needed to the production workflow to create content appealing to cats and to be able to reliably reduce TD/m and Y/m rates for the felines in on our research panels.

The biggest difference between human vision and cat vision is in the retina, which can be broken into 3 main factors:

- **Cats can't detect colours as well as humans**
- **Cats can't see far objects as well as humans**
- **Cats have a superior ability to see in the dark compared to humans**

Additional research led to the validation of previous findings around feline vision and the ability to process images running at >40 FPS on backlit screen VR hardware that we had tested. Of particular source was found to be especially useful in the design of the PVRR headset and lens technology. Not only did the form factor of the headset need to change to support the cranial structure of most felines, but lighting and display luminance had to take various factors into account, including ultraviolet sensitivity.

According to a paper published in the Proceedings of the Royal Society of Biological Sciences (R. H. Douglas, G. Jeffery, "*The spectral transmission of ocular media suggests ultraviolet sensitivity is widespread among mammals*"), there were some documented unknowns that would require additional R&D and investment to ensure that the experiences brought to felines on the CatVR platform would be visible to all of the intended audience.



This was especially true in households where felines lived among other mammals that may borrow or occasionally be permitted to use the CatVR headset. This multi-user use-case has been a critical stumbling block for human VR headsets and something we wanted to be sure to address in the design of the PVRR/CatVR ecosystem. Douglas and Jeffery state:

“Although ultraviolet (UV) sensitivity is widespread among animals it is considered rare in mammals, being restricted to the few species that have a visual pigment maximally sensitive (λ_{max}) below 400 nm. However, even animals without such a pigment will be UV-sensitive if they have ocular media that transmit these wavelengths, as all visual pigments absorb significant amounts of UV if the energy level is sufficient. Although it is known that lenses of diurnal sciurid rodents, tree shrews and primates prevent UV from reaching the retina, the degree of UV transmission by ocular media of most other mammals without a visual pigment with λ_{max} in the UV is unknown.”

As one can imagine, it took considerable time, energy and the participation of many cats in our product development cycles to overcome this.

From performing to performance.

Once our team was able to work through all of the technical issues related to feline-friendly content rendering and as validated by positive results and scoring from feline test panels, the true challenge for content became evident. Cats were not satisfied with content produced with any sort of flavour of human bias evidenced in the content itself.

This distaste for human influence in content included storylines, character development, interaction patterns, or other production elements that feline test subjects perceived as “inauthentic”.

We found that, through both simple observation and traditional methods as well as the use of Isobar’s Mixed Reality Behaviour and Emotion Analytics Platform that top contents of interest to cats included the following:

- **Scenes featuring fish/aquatic wildlife**
- **Fast moving, light-variant content, regardless of subject matter**
- **Motion graphic content featuring rodents in their natural habitat**

These three primary types of content scored highly among the test panels as expected. Favourable content ratings increased as adjustments were made by our team for the lighting and perception differences created by the instruments outlined in our R&D findings related to spectral transmission of ocular media.

Having expertise in both enterprise and consumer facing Augmented Reality, Virtual Reality and Mixed Reality platform creation, app production and content design and delivery, our team at Isobar felt strongly that relit and colour transformed content would not be enough to maintain interest among felines. While functional content (content designed for training, education or other easily described functions) was of interest to cats, entertainment content scored very high on the scale that was created to benchmark PVRR experiences.

While initial tests reported a 47.4 CNP rating, we were able to increase the aggregate feline response to 67.2 when human bias was effectively removed from the content experiences. The removal of illustrated versions of animals (primarily mammals) as well as taking away any scenes of canines giving chase to, or otherwise tormenting felines gave way to much higher ratings, incrementally increasing CNP ratings with each edit and re-test.

Perhaps the most interesting fact revealed during the testing panels for PVRR was the 94.7 CNP score and TD, D and MD scores in the low single-digits for some content. The variance was so drastic it caused concern that the testing had been invalidated in some way. After a careful review of the testing process, it became clear that the feline test subjects had a disproportional interest and attraction to several of the PVRR test content experiences.

This discovery was of great interest to our team as it led to a key insight related to feline content preferences.

After much analysis, some performed by colour shifting and re-lighting the PVRR rendered content inside the headset, it was discovered that content that scored the highest contained imagery/subject matter that cats identified in the range of human/non-human mammal submissive.

This content descriptor essentially points to contents within the content that cats felt put humans in a position of submission to other mammals, not limited to cats. Of most interest, feline biometric readings spiked when situations played out where humans were subservient to the same “cat enemies” as played out in content with a great deal of human bias.

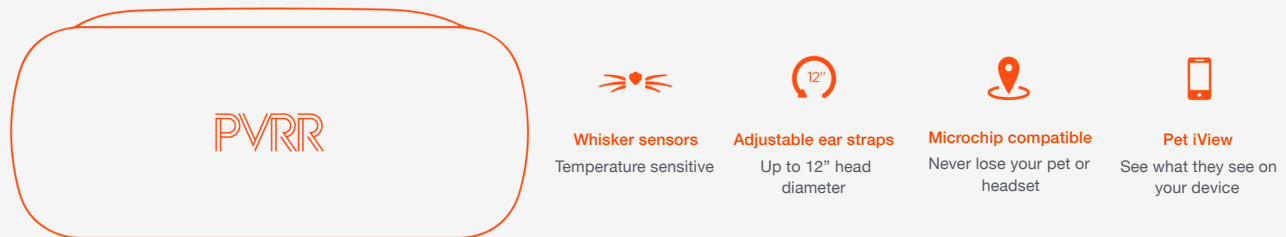
Examples primarily included rodents and canines, such as a scene where a man jumped onto a stool to avoid being attacked by a small mouse.

Another scene that scored dramatically high on the CNP scale included a man sleeping in a bed while his dog jumped onto the bed, biting the pillows, sheets and disrupting the man while he was sleeping. When these test subjects witnessed the mouse leave the kitchen scene and the dog retreat from the human’s bedroom, the feline CNP score dropped to D (Disinterested) 26%, MD (Mostly Disinterested) 45% and TD (Totally Disinterested) at 29%.

Revenue models.

With a firm understanding of content preference and reaction, a long-term strategy related to hardware and software for PVRR and industry partnerships in place across content creation and deployment technology companies, our team recognised that the final piece necessary to successfully launch a pilot of the PVRR in the Australian market would require a program that made it easy for content producers to monetise their content.

Through PVRR-based advertising, sponsored applications and also branded content experiences, we intend CatVR to become the leading platform for feline digital content experiences, regardless of market. Originally only designed for single-cat experiences primarily at home, the research we were able to do has influenced that strategy to broaden, now including an equal focus on out-of-home (location-based) experiences in retail pet establishments, parks, and even cinemas.



To help partners be successful, the technology has been greatly simplified through the creation of an SDK, currently in a private beta, but due to be released in Q3 of 2018. The SDK includes:

Faceplate meow-o-metrics: Custom implementation of cat-friendly biometric sensing to provide bespoke experiences for each individual animal.

RFID capable neck support: The inclusion of an animal "chip" reader into the PVRR platform allows for instant identification of cats upon their very first use of the CatVR headset. This provides a simple process for identification and integrates with our cloud platform for user authentication as well as storing of preferences for each animal.

Ad-Matic: A single line of code can be inserted into content creators' Unity or Unreal Engine projects that will provide feline-tested content that has achieved CNP scores of higher than 80%. This will ensure that cats are always engaged and stay focused on what is happening inside their PVRR headsets.

Conclusion.

Times are changing and with the advent of modern innovations like more powerful and long-lasting batteries, faster and smaller processors that radically out-perform their ancestors in terms of cycles and heat generation and brighter, higher pixel density, more energy efficient screens, new types of content is being experienced on a myriad of new devices... for humans.

We have one simple belief – great content should not be for only those fortunate enough to be considered bipedal. There are hundreds of millions of cats in this world, many of whom have the same sensibilities, tastes, deep level of interest in entertainment and who may also benefit from the amazing capabilities of virtual reality to create empathy, educate and display content that we haven't yet thought of.



We've used hard science to validate the strategy behind PVRR platform and we are exceptionally proud of our partnership with Zoos Victoria to launch our flagship product: CatVR.

No more sitting by the window watching native wildlife. No more laser pointers. No more hiding under beds while the owner's dog rules the roost. Felines are special and we've proven it. Better yet, we've brought to life what they once only imagined to be possible. The first VR headset designed solely for cats. It's CatVR, based on the PVRR platform and it's going to take the word by storm as "the digital cat's pyjamas".

Author



David E Meeker

Global Director Emerging Technology
and Head of Isobar NowLab

Collaborators



Jeremy Pincus

Ph.D., Director, Research & Strategy
Isobar Marketing Intelligence



Dave Budge

Director of Isobar NowLab
Australia

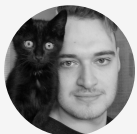
Human Contributors



Ric Dube, Ph.D.



Brian Thomas

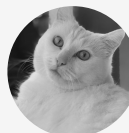


Benjamin Pincus

Feline Contributors



Jack



Princess Moonbeam



Nesta



Douglas

isobar