



## Meeting the Viruses and Making them Visible

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**Abstract.** Recent years have seen, for obvious reasons, a massive increase in awareness of the impacts that viruses have on our lives – but have also seen a massive increase in misinformation and potentially harmful misconceptions. To help young and lay audiences engage with the science of viruses, and encourage an interest in virology as a discipline, we have created a range of applications and activities. A core feature of these applications and activities is an attempt to help with visualizing virus particles themselves – helping to ground understanding in a three-dimensional mental image of what a virus ‘looks’ like. In this extended abstract we outline the applications and activities that have been created. We also outline how we are supporting reuse by other educators who may wish to use them in their own teaching for high-school and entry level university studies.

**Keywords:** Virus, Medical Visualization, Augmented Reality.

### 1 Introduction

In the last few years, viruses have gained a significant level of interest due to the global SARS-CoV-2 (COVID-19) pandemic – although this is far from the only newsworthy virus outbreak of recent decades. At the same time, vaccine hesitancy in developed countries has been growing to the extent that outbreaks of preventable illnesses, such as measles, have again been emerging. In this context, tools to support public education on viruses are needed – both for general education, but also to help support interest in virology as a science. Accordingly, the MRC-University of Glasgow Centre for Virus Research (CVR) undertakes a wide range of public engagement activities [c.f. 1, 2].

In recent years, researchers from the CVR have collaborated with students from the MSc in Medical Visualisation & Human Anatomy (a joint programme offered by the University of Glasgow and The Glasgow School of Art) in the development of a range of digital 3D virus models and interactive applications. Building on this work, a Public Engagement Seed Fund grant from UKRI’s Medical Research Council supported the development and publication of an Augmented Reality application “Visualising Viruses”. This app is currently available for free download through both the Apple iOS App Store<sup>1</sup> and was also available on the Google Android Play Store (due to technical issues, at time of writing the app is not currently on the Android Play Store, but should be available again by the conference presentation). A companion application, a virtual gallery of viruses “Meet the Viruses” has also been developed, with an interactive web-based version available online, and a Virtual Reality version is available for download. All of these applications build on work initially developed as part of MSc research on the joint programme, in projects co-supervised by staff from the CVR and the GSA [3,4].

Here we present an outline of the mobile phone augmented-reality *Visualising Viruses* application and some of the companion resources that have been developed to accompany it, and some suggestions for use in lesson plans. The application itself contains a rich range of visual and textual information, aspects of which are highlighted in the following sections. The application itself is aimed more at supporting public engagement than intended for curriculum-based learning. Therefore, for effective learning, it should be used as part of – or companion to – classroom or homework activities. A sample classroom lesson plan has also been developed.

<sup>1</sup> <https://apps.apple.com/gb/app/visible-viruses/id1617295420>

## 2 Educational Resources

### 2.1 Visible Viruses

The Visible Viruses app allows users to learn about four notable viruses – some selected their notoriety and other for their prevalence in society. The viruses are: Influenza (Flu), Herpes Simplex, Zika, and SARS-CoV-2 (COVID-19).

The top level menu of the app has four main sections:

- Visible Viruses. This allows 3D visualisations of viruses, and virus sections, to be viewed in Augmented Reality. This view superimposes massively upscaled 3D models over a live camera view (Fig. 1a).
- Explore Viruses. View 3D visualisations on the mobile device, and allows users to read more detailed information about the viruses in sections covering: Overview, Transmission, Symptoms, and Prevention (Fig. 1b).
- More about viruses. Additional general information on what viruses are, vaccines, and different types of treatments. One subsection here presents information on ways that some viruses actually help us – ‘The Good Viruses’.
- Quiz. A set of short built in quizzes allow users to test their knowledge.

Finally, Additional Learning resources link to additional resources from the CVR, as well as to a paper describing this engagement work [1].



**Fig. 1.** Left (a) The augmented reality view allows users to see 3D models of viruses or virus sections superimposed over a live camera view. Right (b) The app provides a range of information on each featured virus.

### 2.2 Meet the Viruses

The companion online and VR *Meet the Viruses* gallery application provides less detail and information, being instead simply a gallery space where users can view a mixture of 3D virus visualisations and 2D illustrations and renderings of viruses. The inclusion of 2D renderings allows for a wider range of artistic interpretations and

display of more richly detailed models that would not be able to be shown in 3D in a real-time application. The gallery application also includes a 3D HIV model, courtesy of [5].

Classroom posters for each of the four featured viruses in the *Visible Viruses* app are available for download. A link to these is embedded in the app itself, and the posters in turn include a QR code that takes user to a web-page from where the app can be downloaded on a mobile device. The posters are themselves designed to be useful as standalone classroom resources.

Additional print resources have also been prepared. These include a *Visible Viruses* lesson plan, and a *Meet the Viruses* gallery guide. The lesson plan is aimed at school ages 11-14 approximately, though may be of use when using the apps with slightly older age groups. The Gallery Guide provides information on all five viruses featured in the gallery, with artwork from ViralZone ([www.expasy.org/viralzone](http://www.expasy.org/viralzone)). Resources linked here also include the *Co-Immunicate* app – a virus education app aimed at an even younger audience [6].

### 3 Summary

We have presented an overview of interactive Augmented and Virtual Reality applications and companion resources to support virus education and public engagement. These resources include posters, guides and lesson plans.

The lesson plans and guides serve as a support for teachers wishing to utilize these applications within their classes, providing scaffolded structure for using the applications and direction for students in exploring the apps in their investigations on the science of viruses. All resources are available for free online, to allow the widest distribution. A small amount of funding also allows some local schools are also able to contact the investigators to request printed posters be sent out. Together, the resources detailed here are just part of the rich range of resources and activities to support virus education provided by CVR, and represent a small part of the public engagement activities explored by students on the MSc in Medical Visualisation & Human Anatomy programme.

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