A MUSEUM IN YOUR POCKET

Alan O'Donohoe explains how to recreate the magic of a school trip at home

In the year 1834, Ada Lovelace, widely recognised as the first computer programmer, visited factories and mills in the north of England under the guidance of her mother, Annabella Milbanke, as part of her education. If we close our eyes, we can try to imagine a young Ada gasping at the noise and clatter of a Jacquard loom mechanism as she witnessed the extraordinary force of steam powering the machinery used to manufacture textiles on an industrial scale. History books tell us that young Ada did not have a conventional school-based education; she was largely homeschooled. Ada's mother must have known the potential of an educational visit to expose Ada to learning experiences beyond traditional learning.

■ Nintendo's Game Boy was released in 1989

Educational trips that take place outside the normal learning environment offer enormous potential to inspire and engage young minds. However, the organisation involved in such trips has become overwhelming. Enhanced levels of preparation, risk management, and hazard controls can mean that as more energy is diverted into organising the trips, the actual content or experience may suffer, and as a result, become less stimulating.

It's also possible that in broadening the appeal of a trip to a wider audience, the unique opportunities of the visit may be diminished. If you're planning an educational trip in England, computing teachers can choose to visit museums in London, Cambridge, Manchester, Sheffield, Bradford, or Bletchley—but these locations are not easily accessible to all. The idea of having a museum literally close to home does have a certain appeal and many practical advantages. So, rather than making our homes castles, let's make them our local computing museums.

Learning during lockdown

At the time of writing, in common with my friends, family, and colleagues, I'm confined to working from home in a lockdown situation with no exit date in sight as yet. We're currently in the second month, and while we know that this enforced isolation at home is temporary and necessary to save lives and protect our health service, it's become increasingly challenging for teachers and parents to continue to provide rich experiences for learners confined to home. As school closures were announced, museums also closed their doors, thereby cancelling opportunities for future visits or trips. The unique nature of this lockdown period has prompted me to explore alternative methods to unlock the potential that museums, exhibitions, and objects still have to educate, engage, and inspire learners.

■ Museums have huge potential to educate, engage, and inspire

If you try out any of the resources suggested below, or have shared computing artefacts with your students, why not share your experiences by using the hashtag #MuseumFromHome on Twitter?

For home or school use

While writing this guide, I have considered how it might help children, parents, and families interested in hosting a museum from home during current or future enforced periods of home confinement. I have also included thoughts on how teachers and students might additionally curate a computing museum in their classrooms outside of a lockdown period.

> ## " HAVING A MUSEUM AT HOME DOES HAVE SOME PRACTICAL ADVANTAGES

In the rest of this guide, I will share with you some ideas that I have tried and tested, as well as some ideas still in development around the theme of a computing museum at home or in school. All of these ideas should work equally well in a classroom situation beyond the current period of isolation and social distancing.
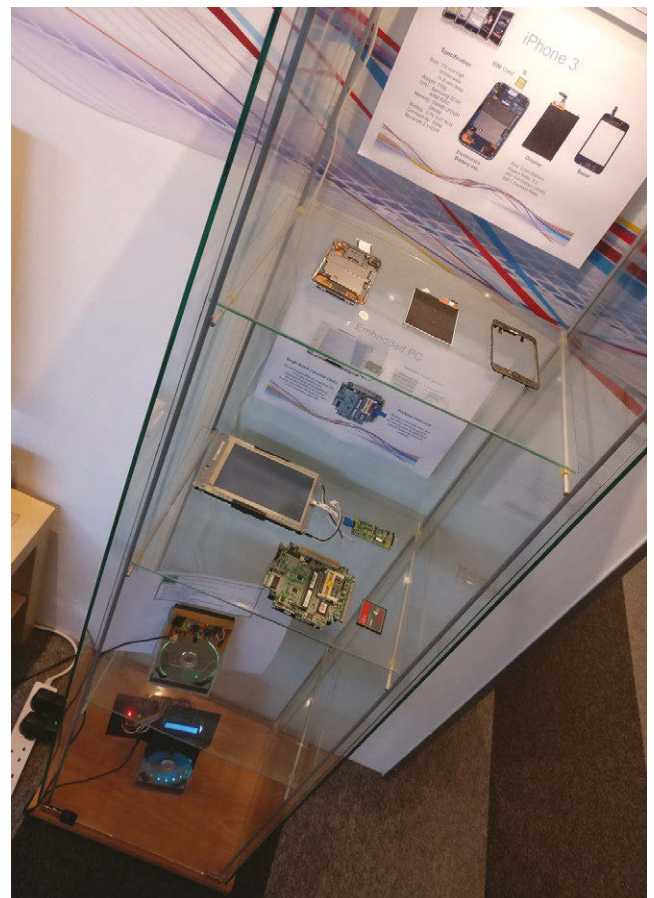
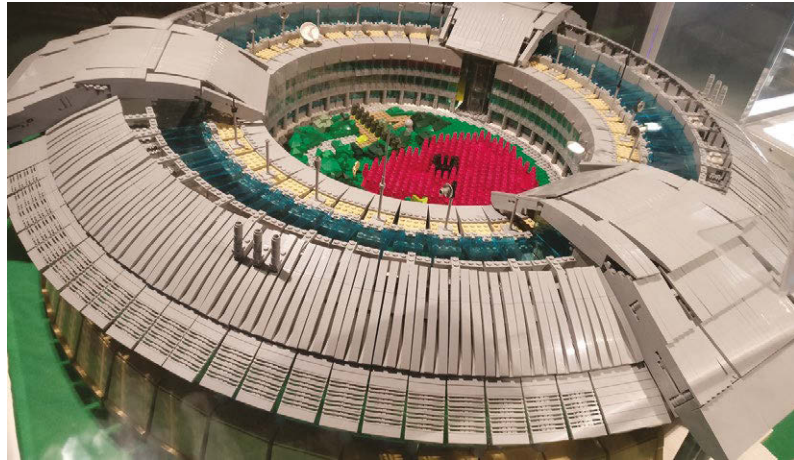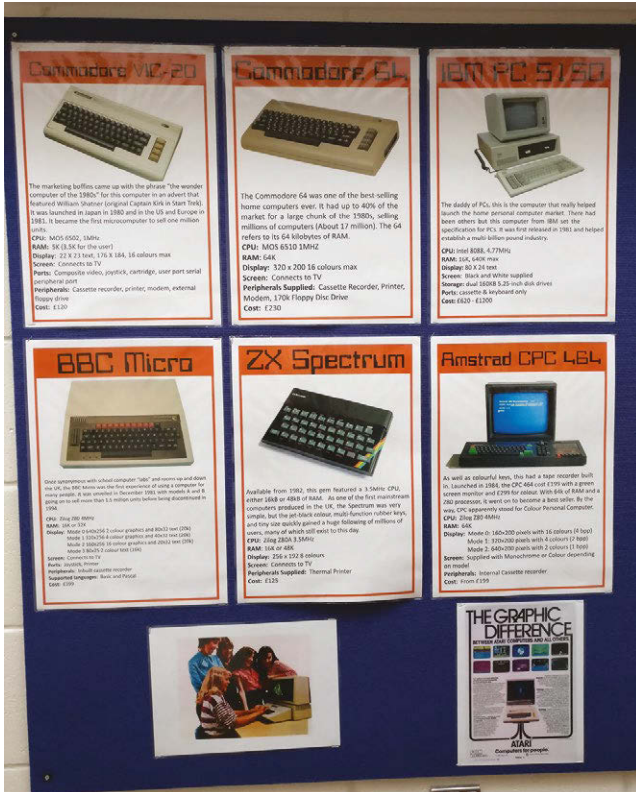We're going to start with objects (individual items) and collections (groups of objects).

A pocket museum of computing

Quite simply, this is a museum small enough to fit in your pocket containing tiny objects to stimulate conversation. The museum opens the moment you retrieve it from your pocket, and only closes when you put it away again.

There's a huge range of objects that you could house in your museum

The compact size and portability mean that you can carry this museum around with you. When an opportunity presents itself, you simply open the museum and unleash the collection of objects and the stories that accompany them. Pockets vary in size, and so will these miniature museums. You might design a museum with a specific pocket in mind. An upcycled mint tin containing some surface mount components, for example, may be no larger than a few centimetres.

Another pocket museum might be an assortment of information cards or images. A pencil case museum could contain a glass valve, a floppy disk, a punched card, a CPU, RAM, a micro:bit, an Arduino, and a Raspberry Pi. Granted, not all of these objects are going to easy to acquire immediately, but it's fun trying to source objects for your collection. Many of the objects I've collected for my own pocket museums have cost me around £1 on online auction sites. You may be surprised to find you already have some objects lurking in the bottom of an old drawer, cupboard, or garage, or salvaged from devices that are beyond economical repair. Your pocket museum could have a theme; for example, 'The Memory Box' might contain only objects related to data storage and computer memory, e.g. RAM, ROM, and disks.
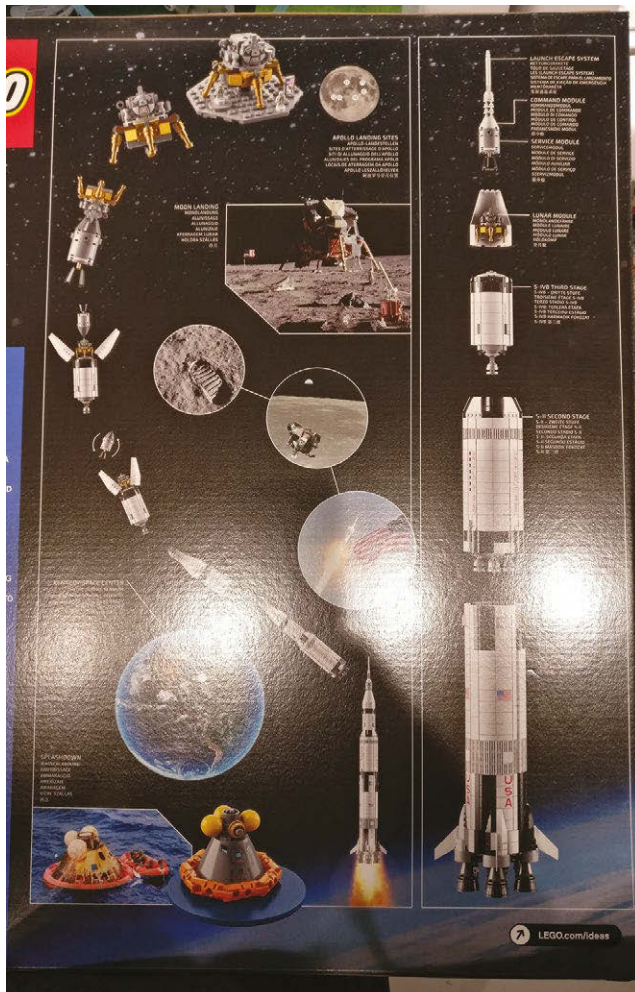
#exabition

This is a freely downloadable, printable resource I created to help you start your own pocket museum of computing. Once it's printed out, you simply cut along the dotted lines, and hey presto! If you're particularly skilful with a pair of scissors, you can cut out the profiles of the objects, and there you have the beginnings of your very own pocket museum. This museum is so small it will fit in an envelope, so you could design your own wallet from paper or card and expand the collection to include other items.

Computing cards

A set of cards is really just an alternative version of a pocket museum of computing. I have been struck by the beauty and simplicity of Giles Booth's cards, which he designed when he was just 13. Giles was inspired to make the cards because he loved window shopping for computers in magazines and dreamed of designing his own one day. He made these computer trump cards in the early 1980s; around that time he had a Commodore PET at home. He had access to a dot matrix printer, so it made sense to him to use it to generate the text descriptions. A former computing

A pocket museum provides a focus for discussion

RESOURCES TO GET YOUR POCKET MUSEUM STARTED

- **#exabition:** Print at home version **helloworld.cc/exa**
- **Home Computer Cards:** Dominic Pajak has shared for free his print-and-play version of the Home Computers retro collectible cards/trumps card game **helloworld.cc/trumps**
- **Computer Combat Cards:** Available to purchase to cover printing costs, or as a digital download under a Free Creative Commons BY-SA 4.0 licence; find a sample pack here **helloworld.cc/combat**
- **The Internet Archive:** A vast repository of PC/MS-DOS computer games that you can play in your web browser **helloworld.cc/classic**
- **RetroPie:** Software for the Raspberry Pi to enable you to install and run vintage computer games **retropie.org.uk**
- **Enigma machine:** From the Science Museum's collection **helloworld.cc/enigma**
- **Apollo 11 command module:** At the Smithsonian **helloworld.cc/smith**
- **From Lisa to Windows:** The Science Museum tells how the computer mouse, desktop, and graphics we're so familiar with are relatively recent inventions that have defined our experience of home computing **helloworld.cc/lisa**
- **The Little Museum:** Designed as a HyperDuino project that was shown at ISTE 2015. Touching sensors on the panels activates additional information shown on a computer **thelittlemuseum.net**
- **Rocky Bergen:** Has created a print at home set of retro computers including a ZX Spectrum **helloworld.cc/rocky**

teacher, Giles now works for the Micro:bit Educational Foundation. Perhaps creating those cards set the young Giles on a path towards a career in computing?

William Lau, a computing teacher and author of *Teaching Computing in Secondary Schools,* was inspired to create Computer Combat Cards when his five-year-old son came home with some Top Trumps cards from a friend at school. Kirstie, a home educator, is a fan of the Computer Combat Cards, and has found that they have motivated her home-educated learners

> ## " THE DEEPEST ENGAGEMENT TAKES PLACE WHEN STUDENTS DEVELOP THEIR OWN CARDS AND RESOURCES

to research more about the technologies that appear on them. Enthusiast Dominic Pajak designed and created a Computing History Collection for printing at home. You can also order a high-quality printed version from the Cambridge Centre for Computing History.

Whether the activity takes place at home or in school, learners could start their collection using some of these packs as a basis. I'd suggest that the deepest engagement occurs when they begin to develop their own versions based around these examples. They can
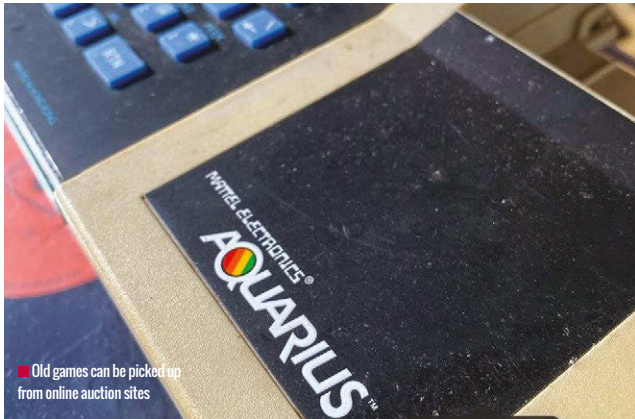
■ Old games can be picked up from online auction sites

select the theme for their own card collections, for example, classic Nintendo games, mobile phones, handheld games consoles, or social media networks.

Vintage computers, games, and consoles

Some households still have vintage games consoles, personal computers from bygone ages, and accessories, books, and software titles in their possession. These items may be buried away in a box in the garage, the loft, or the spare room, just waiting to be relocated to their new museum home.

From time to time, you can pick up these things from online auction sites and charity shops. I recently bought an early 1980s game for £10 and there are others available at the time of writing. During a period of lockdown, when only essential travel is allowed, it's best to find other ways of reliving the experience of vintage computer games. Enthusiasts have shared footage from these games for watching on video sharing sites, as well as an archive of original TV programmes such as *BBC Micro Live* and *Tomorrow's World* that featured developments in technology.

The Internet Archive hosts thousands of vintage MS-DOS and PC games that can be played in a web browser from the comfort and safety of your home. Using a piece of free software called RetroPie that allows you to install 16-bit and 8-bit games on Raspberry Pi, some teachers have built versions of their own arcade games cabinet, including a tabletop game housed in a low-cost IKEA table.

Reproductions and representations

As a computing teacher, I've regularly set an extended holiday homework project for my students to build a 3D representation or reproduction of an object from computing history, using materials that are available to them. I've had students use a whole variety of skills to represent difficult concepts. Courtney, a Year 10 (14–15) GCSE Computer Science student, baked a cake with coloured layers to demonstrate the layers of the TCP/IP model! Students have used LEGO to build conceptual models of Turing machines or CPU system architecture. Plasticine, cardboard, and paper are easily pliable materials for creating reproductions of objects from history. Teacher Paul Jones has in his classroom plasticine models of storage devices, made by students. In my home, I've enjoyed making a Raspberry Pi, a Nintendo Game Boy, and Mario artwork from Perler or Hama beads with my children.
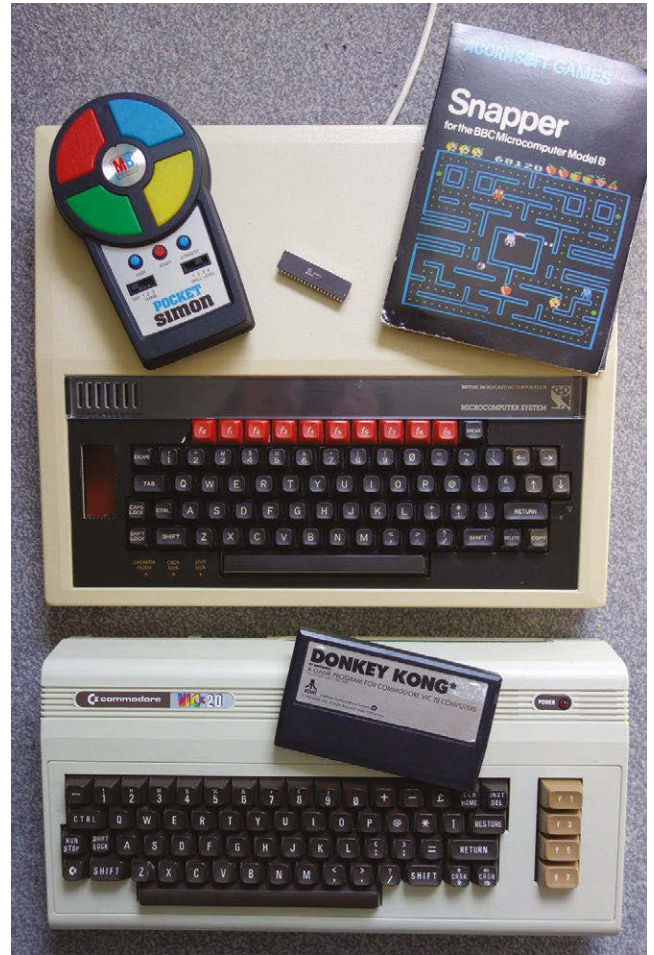
■ Many households can find some vintage games consoles hidden away

Virtual museums

There is a plethora of online resources that in one way or other allow you to explore museums and objects from your browser, or even better when combining a mobile phone with a VR headset. My personal favourites are the Enigma machine in the Science Museum's collection and the interior of the Apollo 11 command module at the Smithsonian. It's easy for these activities to become passive experiences, so I'd recommend you ask learners to act as curators and plan a virtual trip during which they lead the visitor on a trip with interesting insights, anecdotes, and factual details provided by the curator while the visitor wears the headset. (HW)

ALAN O'DONOHOE
Alan has over 20 years' experience teaching and leading technology, ICT, and computing in schools in England. He runs exa.foundation, delivering professional development to engage digital makers, supporting computing teaching, and promoting the appropriate use of technology (**@teknoteacher**).