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One Earth one future: A new approach to inspiring biodiversity, through artwork, digital technology and museum specimens

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Abstract

21st century technology offers a powerful way to virtually explore the great diversity of habitats and landscapes of our planet, including its most remote regions. However, natural science collections provide a unique connection to the organisms themselves that live within those habitats and complex ecosystems. This paper describes a novel approach through using a combination of collections, digital technology and artwork to inspire an understanding of biodiversity, and in particular pollinators such as bees. We worked with Suffolk Family Carers clients, aged 9-12. We explored a range of habitats using satellite images, focusing on the local agricultural landscapes of Suffolk and which aspects of these environments would be most conducive to bee diversity. The young people created individual two-dimensional artworks and then a three-dimensional group artwork of their ideal bee environment. Much of their understanding of the key concept, biodiversity, however, seemed to stem from their physical experience through the main natural science gallery where they could explore the diversity of nature through taxonomic and diorama displays. This study highlights that even though digital technology offers a powerful vehicle for engaging young people, we should not forget the importance of using museum specimens to connect with the natural world.

Keywords: Collections, specimens, biodiversity, digital, satellite, bees, artwork, community, co-creation

Introduction

Just over 50 years ago, the Apollo Moon missions allowed humanity to see our home, Earth, for the first time as a fragile blue planet, surrounded by the vast blackness of space (Our Planet, 2019). Since this time, our detrimental impacts on the planet through habitat loss, pollution, introduction of invasive species and climate change have become incontrovertible through multiple lines of evidence, including recent IPCC reports (e.g. Pörtner *et al.*, 2002) and being able to visually see signs of environmental changes from space. An

unprecedented task lies ahead in not only mitigating these impacts but also reversing them to save our natural world.

Museums constitute a wide network across many regions of the world and are ideally situated to help promote an awareness of environmental sustainability, and more specifically they can help to achieve the UN's Transforming Our World: the 2030 Agenda for Sustainable Development (United Nations, 2015). This role was recognised in the



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2019 ICOM Kyoto meeting “Curating Sustainable Futures”. In order to achieve a more sustainable planet, through for instance engaging the public in initiatives around environmental protection, it was recommended that museums must draw on their unique collections and work with local and global communities to foster community engagement and education to explore and proactively generate a sustainable future (ICOM, 2019).

To date, museums have communicated on these topics through exhibitions - for example, Wade (2022) explores a novel way of using the display of contemporary art in natural history collections to engage audiences about the environmental crisis, and also talks, workshops and other engagement activities - for instance, Freedman *et al.* (2010) detailed how during a science week, visitors investigated the miniature world of oceans using live specimens under a microscope and models of plankton. Digital technology is a more recent form of engagement which museums are using to reach new audiences, including younger people (e.g. Mujtaba *et al.*, 2018, Jackson, 2020). This project reports a novel approach to using digital technology, namely satellite images, to develop an understanding of biodiversity, and as inspiration for 2D and 3D artworks in a museum setting. The NHM has displayed a huge, 7 m diameter 3D Earth artwork created from detailed NASA images of our planet taken from space (Zhongming, 2018) but in our project we are using satellite images as an inspiration for the artworks rather than as part of the artworks directly. Also, the project Inspace (University of Edinburgh), have announced 5 artists in residence who will be focusing on the theme of Space and Satellites data. For example, one of the artists is using remote sensing data from Scottish wildlife conservation organisations to use animals’ movements as a source of inspiration for various artworks. However, the novel approach of our project is that it took place within the museum environment, using collections to provide a key role in underpinning the understanding of biodiversity.

Rationale and background to the project

Ipswich Museum audience surveys (Mather *et al.*, 2021) demonstrate that people who visit this Museum are interested in biodiversity and environmental sustainability. However, participants are unable to clearly articulate why. This project introduced themes around biodiversity in a non-scientific way, framed through artistic and creative activities, to convey key concepts more simply.

It was decided from the outset that we would use

digital technology and in particular satellite images to inspire the artworks. The use of data from digital satellites can help to further our understanding of Earth’s changing complex environments and ecosystems. Specifically, Satellite Remote Sensing (SRS) permits researchers to address questions on scales inaccessible to ground-based methods alone, providing variable information on long-term-trends in biodiversity observing large-scale areas (Pettorelli *et al.*, 2014). This includes, for instance, monitoring species distributions such as mapping wildlife in open savannas to estimate population size, being less “invasive”, time-consuming, costly and labour-intensive compared to more traditional surveying methods (Zheng, 2012). Satellite images can also be used to study human-induced changes to landscapes such as deforestation, and can be combined with powerful “deep learning” algorithms to more accurately estimate the extent of deforestation (Lee *et al.*, 2020). This powerful technology also provides an excellent means to communicate concepts of biodiversity and to quickly navigate, observe and study even the most remote places on the planet using satellite images. The variety of different habitats and ecosystems across the globe, and shapes, forms and colours, from which they are composed, provides an almost infinite source of inspiration for artworks, changing at the height the “observer” views Earth from space. A key benefit of this technology is that it is visual so that the viewer can immediately see any changes to landscapes over time, which can then have a big impact on their understanding of biodiversity, which could even change the way they think about their own lifestyles.

The Museum selected the charity Suffolk Family Carers (SFC) to collaborate with on this community project. For 30 years, SFC has assisted family carers of all ages across Suffolk to get the support they need to live fuller lives. As the Museum has an established relationship with this charity, this made it an ideal group to try out this new project. Previously, the Museum has collaborated with SFC to co-create events that explore Black history and African cultures, offered respite activities inspired by Ipswich Museum’s collections, and provided venues for regular SFC club meet-ups.

The aims and objectives of the project were then developed in discussions between the Museum and SFC and then, after funding had been secured, a freelance artist with a specialism in biodiversity was sought out, using a known network of existing contacts.

The Museum recruited installation artist and

contemporary composer, Lily Hunter Green (LHG). LHG has extensive experience of making artworks around bees, for example, converting redundant pianos into working beehives (Green, 2014). This led to the project's focus on bees and discussions around pollinators more generally. With their vital role in maintaining healthy ecosystems for global food security, with crops pollinated by bees contributing to about one third of total human food (Khalifa *et al.*, 2021), it makes them an ideal 'flagship' group of species to communicate principles of biodiversity.

The workshop content was then finalised in discussion between the Museum and LHG, and SFC were consulted throughout the process. LHG had a certain amount of flexibility in how these workshops could be delivered and the type of artworks which could be done, but working within the framework of the aims and objectives i.e. using satellite technology to inspire the artworks.

The workshops

Two workshops were delivered at the Museum, led by two Ipswich Museum Collections and Learning Curators (SJ and Eleanor Root) with LHG for a group of nine young people aged 9-12 from SFC. These were delivered within a dedicated education room, allocated for school groups and community groups. Each workshop was 2 hours in length although it included breaks for the young people.

The purpose of the first workshop was to introduce the young people to the concept of biodiversity and why it is important. This was achieved through watching a short 5 minute Sir David Attenborough video (Attenborough, 2021) followed by a question and answer session. The group was then taken to the Victorian Natural History Gallery where they explored concepts of biodiversity, referring to the natural science displays. These Victorian displays consist mainly of specimens in display cabinets stretching around the galleries with invertebrates, fish, reptiles and mammals arranged clockwise respectively, reflecting the progressive nature of how the Victorians saw the natural world and tried to make sense of it (Figure 1). The middle of the gallery is occupied by cased and un-cased large mammal taxidermy including the Museum's iconic Rosie the Rhino - which featured in Rowland Ward's 'Records of Big Game' in 1903 and had the second largest horn of any Indian rhino shot at that time - and French explorer Paul du Chaillu's gorillas. This gorilla group was shot around 1862 and was part of the first group of gorilla specimens seen in Britain. A large cabinet, at the back, includes a set-piece collection of African mammal taxidermy.

The young people were encouraged to look closely at the objects and choose their favourite, and in so doing encountering a vast number of species across the animal kingdom. During this part of the



Figure 1. Photograph of Victorian Natural History Gallery, reflecting the gallery prior to the museum redevelopment 2022-25 showing taxonomic arrangement of cases around central cases and exhibits. © Colchester and Ipswich Museums.



Figure 2. A key part of the young people's learning about biodiversity was through the Victorian Natural History Gallery's displays. Display case shown prior to the museum development 2022-25. © Colchester and Ipswich Museums.

workshop it was noted that some of the young people displayed curiosity to the various displays particularly with regard to the diversity of species (Figure 2). Some were also drawn to the Victorian depictions of animals, such as the group of gorillas and it was explained to those enquiring that this is how Victorians saw them at the time. Some of these displays will remain as key objects in the Museum's redevelopment and will be central to discussions around collecting practice and decolonisation. At the end of the exploration, there was a follow-up discussion to reflect on the range of animals they had seen and why biodiversity in nature was important.

The next phase of the workshop introduced the group to how we can explore biodiversity through digital technology and was facilitated by the freelancer, LHG. We focused on how we can use satellite technology to explore different habitats from space using Google Earth. Google Earth allowed the young people to easily explore areas of interest through the search function. The Geographic Information System (GIS) - a computer system that captures, analyses and displays information attached to unique geographically referenced locations or sites - data means that names of various sites can be easily identified just by clicking on areas of interest. Firstly, we looked on a global scale at the importance of rainforests and the group virtually explored the Amazon rainforest, including its vastness, drawing attention to the variety of tree types evident from the pictures.

Whilst it was important to communicate the importance of biodiversity on a global scale, it was invaluable to bring the subject to the local scale and environments which the young people could see in Suffolk. LHG showed the group satellite images of local agricultural habitats, drawing attention to the patchwork quilt-like nature of the landscape. The main objective was to communicate which of these habitats, used for agriculture, were most conducive to pollinators such as bees. For instance, LHG drew attention to the function of hedgerows as wildlife corridors, wildflower strips around fields for foraging, and the presence of water for drinking. This information would be the basis of the later artworks. As recorded in the evaluation, the young people were surprised by the varied colours of the landscapes and by the importance of local pollinators including the fact that bees need different species of flowers for foraging. LHG expanded on this discussing the vital role that bees have in pollination, providing food for other animals including ourselves. The workshop culminated with the group of young people creating individual drawings of their ideal environments for bee diversity, consolidating their learning from the satellite images (Figure 3).

The second workshop took place a week later and started with a summary of the importance of biodiversity and ecology. The group then worked together to create a 'bee-friendly' 3D landscape, using recycled materials such as redundant carpet tiles, old pieces of clothing and recycled coloured paper. The young people were encouraged to use



Figure 3. The young people created their own individual two-dimensional drawings of their ideal bee habitats, based on agricultural landscapes in Suffolk reproduced with permission of Suffolk Family Carers .
© Colchester and Ipswich Museums.

their artworks from session one as inspiration for the 3D landscape although this led them to work individually rather than as a group (Figure 4). To encourage collaboration, young people were delegated particular responsibilities e.g. one young person encouraged to recreate water, another hedgerows, which facilitated more effective group working.

LHG created a 3D virtual model of the reimagined landscape designed by the group - a digital output which could find its way into a future Museum display. A flying drone was flown over the artwork, creating aerial photographs from several different views. 3D models were created using photogrammetry, which involves taking

overlapping photos of an environment and converting them into a 3D model using algorithms on a computer or tablet. The 3D models were actually made during the workshop and processed on the tablet - some of the group even had a turn at taking some of the pictures which were stitched into the model (Figure 5).

The second workshop culminated in a short presentation from SJ about some of the actions that we can take to preserve biodiversity and mitigate climate change. Young people created individual environmental pledges that they would take home with them, for instance, walking to school or eating less meat The creativity and thoughtfulness seen in the pledges demonstrated



Figure 4. The young people worked as a group to create a three-dimensional artwork of their ideal bee habitats based on local agricultural landscapes reproduced with permission of Suffolk Family Carers.
© Colchester and Ipswich Museums.



Figure 5. 3D model of the young people's collective artwork created by artist, Lily Hunter Green.
© Lily Hunter Green.
Reproduced with kind permission by Lily Hunter Green.

that the young people want to make a difference in preserving biodiversity and tackling climate change (although being aged 9-12 meant that they would have had limited control over their lifestyles and diets).

Results

To capture learning from the group of young people, a Microsoft Forms survey was completed before and after the two workshops (see Appendix I), which asked them what they knew about biodiversity and climate change and to reflect on their learning. The survey consisted of seven questions with five possible responses arranged in a Likert scale, e.g. from “not important at all” to “of extreme importance”.

There was a considerable increase in knowledge around biodiversity and environmental sustainability. For instance, when asked ‘How much do you know about looking after your planet?’, the combined responses “a lot” and “a huge amount” increased from 17.6% to 78% before and after the workshops, respectively.

Another significant increase was around knowledge of the use of satellite images for looking after our planet. For instance, in response to ‘How much do you know about using satellite images to study this topic?’ none of the young people selected “a lot” or “a huge amount” before the workshops. After the workshops, the combined response in these

categories was 22.2%. Moderate understanding increased from 29.4% to 66.7% before and afterwards.

However, in response to the first question “How important is looking after the planet?” the number of responses in the “extreme importance” category decreased slightly from 64.7% to 55.6% although responses in the “very important” category increased a little from 29.4% to 33.3%. This might be caused by little subjective variation between the two surveys.

The survey results demonstrate success of the study in communicating the importance of bees as pollinators. In response to “Is there anything about the environment that now particularly concerns you?” before the workshops, participants answered with responses including: animals, Earth and climate change. Understandably, after the second workshop 33% answered with responses that included bees or other pollinators.

The young people's enthusiasm increased after the exploration of the Victorian Natural History Gallery, although this was not quantitatively measured. However, at the end of the workshops their enthusiasm for biodiversity and the environment was demonstrated by the majority (7) of the young people engaging with the “make a pledge activity” to create a variety of actions (Appendix II).

Conclusions

This project was undertaken as a funded pilot project and, so therefore, the number of sessions was limited. As discussed above in the rationale section, we chose to work with a community group that we had an established relationship with but following the success of the project there is no reason why the project cannot be expanded on for other age groups and community groups. For the particular format of the sessions, the size of the group (9 young people) seemed to be an optimum number - fewer would have reduced the “buzz” of enthusiasm with the group and more would have been harder to manage in the workspaces selected.

In formulating the project, including its aims and objectives, it proved invaluable to bring on board the proposed community group that we intended to work with from the outset. This meant that the content would sufficiently meet the needs of their clients, the young people. The project worked well in combining both the in-house expertise through the experience of the Collections and Learning Curators, with the more specialist knowledge and artistic abilities of the freelancer, LHG. This multi-disciplinary approach enabled a degree of depth which the project would not have otherwise had.

The different elements to the project: collections, 2D and 3D physical artworks, digital technology including the 3D modelling, and environmental pledges (Appendix II) over the 2 workshops proved a successful way of keeping the young people engaged and maintaining their focus and enthusiasm. The artworks proved to be successful in their combination of individual 2D creations followed by a collaborative effort to create the 3D artwork. Splitting the content over two two-hour workshops, with only a week in between also proved to be effective and allowed the young people to reflect on their knowledge and learning between the workshops and at the start of the second workshop.

The results clearly show that the project successfully engaged the audience, measured through increased understanding around biodiversity and the use of satellite technology to study the topic. Most of the young people made pledges to preserve biodiversity or mitigate climate change, which demonstrates their concern for the environment.

Biodiversity is a complex topic to communicate, however. The physical journey through the Victorian Natural History Gallery allowed the young people to grasp the enormity of biodiversity.

The Museum used its displays to provide a connection with the natural world, something which videos and images would not have been able to reproduce so successfully. Whilst the taxonomic arrangement of objects around the sides of the gallery allowed the young people to understand the variety of life and how species are classified into different groups, the dioramas allowed them to visualise the animals in their natural habitats as part of complex ecosystems. Their enthusiasm and vibrance was considerably greater after the gallery exercise had been completed. Therefore, if the session was repeated in the future, starting with the physical gallery exercise might prove a more efficient way of gauging their interest from the outset. The exercises in the gallery could also be expanded slightly and also undertaken at the beginning of the second workshop. Gallery exercises would, however, need to be modified slightly in line with the modifications to the gallery as part of the Museum’s redevelopment project. There was also greater scope for using the collections in addition to just the gallery visit. For instance, the entomology collections could have been used to showcase a large number of bee species to demonstrate biodiversity. These could be made more engaging with the introduction of magnifying glasses for the young people to look through.

The project focused on agricultural landscapes around Suffolk as ideal bee landscapes. It was important to study local landscapes so that the young people could relate to these environments. However, there is a vast potential to digitally explore other habitats both global e.g. Great Barrier Reef or local habitats in East Anglia e.g. the internationally significant Norfolk and Suffolk Broads – indeed, focusing more on local habitats has a greater potential of fostering ownership or environmental stewardship, “looking after our planet”. In addition to the satellite images, there is also the potential to enrich the understanding of biodiversity from these landscapes through the natural science collections. For instance, for the reefs, different coral types could be showcased and for the wetland environments, taxidermy vertebrate specimens or entomology specimens could be used. Funding permitting, investigation of the local wetland habitats could also incorporate field-based investigations.

There is also the potential in future workshops for some of the artworks to be displayed in museum displays or on social media. 3D models would lend themselves particularly well to digital displays. This would allow a larger audience to see the work of the community groups.

This project demonstrates a novel way of combining digital technology, artwork and natural science collections to inspire an understanding of biodiversity. It shows that although digital technology is a powerful way of 'exploring' the globe and engaging youngsters, natural science collections have a unique ability to connect with reality and provide a physical journey of exploration. In a digital age, we should not forget the unique selling point of museums, their collections and their power to engage.

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Appendix I. Microsoft Forms survey used before and after workshops.
 "Pre" = before workshops, "post" = after workshops. All figures are percentages.
 The asterisk denotes responses which include concern over bees.

Question	Not important at all		A little im- portant		Moderately important		Very im- portant		Of extreme importance	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
How important is looking after our planet to you?	0	0	0	0	5.9	11.1	29.4	33.3	64.7	55.6
How much do you know about looking after our planet?	0	0	23.5	0	58.8	22.2	17.6	55.6	0	22.2
How much do you know about using satellite images to study the topic?	17.6	0	52.9	11.1	29.4	66.7	0	11.1	0	11.1
Please write below why you think this topic is important	Most common response									
	Pre Planet (47)	Post Bees* (33)								
Is there anything about the environment that particularly concerns you?	Most common response									
	Pre Animals (29)	Post Bees* (33)								
What experience would you like to get from these workshops?	Most common response									
	Pre Knowledge (19)	Post N/A								
Is there anything in particular you have learnt from these workshops?	Most common response									
	Pre N/A	Post Bees* (67)								
Is there anything else you would particularly like to learn?	Most common response									
	Pre Planet (23)	Post N/A								
Is there anything that surprised you?	Most common response									
	Pre N/A	Post Bees* (33)								

Appendix II. Environmental Pledges Made by the Young People and Staff.

These pledges have been transcribed as accurately as possible from photographs of pledges (in all but one case which has been interpreted). Names of pledgers have not been included for data protection purposes.

Don't put garbage in the ocean because the world [small picture of Earth] isn't a massive BIN but you are if you put rubbish in the ocean!

I will walk to as many places as I can. I will keep using my reusable thing (bags, bottles) insted [sic] of buying bags and bottle [sic] (one use bottles). I will try buy local food.

I will try to plant more flower [sic] for the bees.

Next year I'll be walking to school and walking back from school so we will sell 1 car out of our 2 cars :-)

The way I will help the environment is by not using my car to go to school but when I have to go far away I can use it but I'll use it less [use if less?]. And recycle what I can.

I think that to improve the environment we can all make a difference, but I will try to always bring my metal water bottle.[Water bottle picture]

I already walk to school so therefore I am reduceing [sic] the carbon dioxide by not using a car. [Car picture].

I have started eating less meat and the other day I made [?]-chill [chilli?] with Quorn insted [sic] of meat.

You should help with pollution (limit ?) and start eating less meat and more vegetables and start riding bikes. [Picture of a bike].
[The above pledge was interpreted from the original rather than being verbatim due to spelling errors].

And pledges from the staff:

I will try to buy more food locally.

I will try to always remember my reusable coffee cup [small picture of coffee cup].

I will drive less and walk more.