



GC Insights: Enhancing inclusive engagement with the geosciences through art–science collaborations

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Abstract. Art–science partnerships offer valuable opportunities to enhance inclusive engagement with research through collaborative creative practice. Here, we present two case studies of interdisciplinary approaches to contextualising environmental science for wider audiences. We synthesise lessons learnt from these case studies and associated stakeholders to provide advice for conducting successful art–science collaborations that help to broaden interactions with environmental geoscience research.

1 Introduction

The adverse impacts of climate change and biodiversity loss are increasingly apparent, disproportionately affecting disadvantaged and socially vulnerable populations (Arkema et al., 2013). Now is consequently a timely opportunity for engaging wider audiences in environmental geoscience as public awareness of climate and biodiversity research has also intensified (Simis et al., 2016; Rossi et al., 2020; Lee, 2021). Art–science approaches offer an alternative to the traditional linear communication of research, providing a platform for participatory dialogue that may build trust in science outreach (Mach et al., 2021; Rask and Worthington, 2016).

Art–science partnerships have become increasingly popular and can take many forms (Tooth et al., 2019), ranging from more conventional “artist as the communicator” to truly collaborative initiatives whereby projects are co-conceived, conducted, and evaluated by cross-disciplinary participants. The latter supports knowledge co-production, whereby the

concept of “seeing double” (Mould, 2019) – through both an art and science lens – can help scientists to understand different perspectives and relations to their subject matter (Risner et al., 2019; Marlton and Robson, 2020). A recent *Geoscience Communication* Special Issue provided insight into the diversity of art–geoscience projects already occurring, demonstrating where geoscience and art have successfully collaborated to study topics such as climate change, geotourism, or cultural heritage (Lanza, 2020).

Art–geoscience projects may also capacitate audiences to “experience” landscapes and geographic concepts that they have not been exposed to (Gates, 2017). This has significant implications for inclusive outreach, as empowering viewers to (virtually or physically) interact with subjects allows for the individual interpretation of information, instead of acting as a recipient (Stewart and Lewis, 2017; Mould, 2019; Locritani et al., 2020). Emotional engagement with previously impalpable concepts is important in shifting public perceptions and responses to environmental change (Schneider and Simon, 2014; Lee, 2021).

Here, we share experience-based advice for conducting successful art–science collaborations that enabled wider public engagement within the environmental geosciences. Art is broadly defined to include many forms of creative expression, including painting, photography, film, poetry, and music (Tooth et al., 2016). We scoped environmental geoscience as the study of ecological and geophysical processes that influence our environment and the impacts of associated human activities. We provide two case studies of collaborative art–geoscience projects and the results of interviews with an

artist, artist–scientist, and an exhibition officer from these examples to synthesise experience-based recommendations for successful partnerships.

2 Methods

We sought to reveal enabling conditions for multi-stakeholder collaborations using an illustrative case study approach. The objective of this study was to retrospectively evaluate two case studies through a series of semi-structured interviews for in-depth analysis of factors contributing to successful art–science partnerships (Thomas, 2011). The case studies of outreach activities were selected from our networks for their collaborative nature. Representatives from the case studies were invited for interview to represent three common stakeholder groups in art–science partnership: an artist, scientist, and an exhibition officer. We conducted semi-structured interviews with the case study representatives using a set of preliminary questions which were pilot tested with two researchers in the team (Kallio et al., 2016). Interview results were thematically analysed and categorised according to establishing, conducting, and post-partnership stages. The results were summarised into key recommendations for building art–science partnerships, alongside contextual information on aims and motivations for partaking (the Supplement). This synthesis was iteratively co-developed with each stakeholder’s team to ensure that findings reflected a collective opinion.

Case study 1 – Connecting biodiversity and immersive art

An art–science exhibition hosted in 2022 at the Oxford University Museum of Natural History titled “Biodiversity” featured work by contemporary artist and environmentalist Kurt Jackson (<https://www.kurtjackson.com/about/>, last access: 1 October 2022). This exhibition displayed Jackson’s artworks amongst the Museum’s collections, showcasing interlinkages between art, science, and natural history. Selected works were accompanied by responses from Oxford University scientists to highlight connections with research and encourage viewers to consider what biodiversity means to them. Figure 1 features *Taxonomy of a Cornish Foreshore*, as displayed in the exhibition (see the Supplement for the researcher’s response). Integrating artwork with museum specimens and contemporary research created a unique environment in which visitors could connect with the natural world in their immediate environment whilst positively engaging with research that tackles the wider biodiversity crisis.

Case study 2 – Coupling art and climate negotiations

In order to share outcomes of the 2021 COP26 climate negotiations (<https://ukcop26.org/>, last access: 1 October 2022) in a more accessible and memorable format, artist and scientist Cécile Girardin collaborated with mural painter Lisa Curtis

and youth activist Arnaud Girardin-Potts to create a 4 m long mural within the COP26 negotiation zone (Fig. 1). The piece was intended to build bridges between the many activists and civil society representatives demonstrating in Glasgow and globally, as well as the thousands of negotiators debating within the conference centre. This mural captured the main takeaways of COP26, deploying a digestible combination of vibrant colours, shapes, and pithy statements. The dynamism of the artwork invites viewers to interpret the interconnectedness of nature, climate, and society; explore the complexities of the climate negotiations; and allude to key debates that shaped COP26 talks.

3 Results

These findings summarise key lessons learnt from interviews with stakeholders engaged in the case studies, specifically relating to the establishment and fulfilment of art–science partnerships for inclusive engagement. The interview participants (artist–scientist, artist, exhibition officer) each reported communicating to wider audiences as a primary motivation for partaking in these collaborations. To achieve this, interviewees highlighted the benefits of engaging other disciplines to connect multiple viewpoints, in addition to considering the contexts in which an art–science partnership is shared. For example, according to the exhibition officer, the Museum of Natural History setting for Case Study 1 attracted new audiences “who may be engaged with the arts but less likely to visit a science museum, by offering different perspectives on natural history.” Regarding Case Study 2, the artist–scientist reported that creating a mural during COP26 conference proceedings facilitated a piece that reflected the complexities of climate negotiations, as this allowed for dynamic incorporation of key debates and diverse perspectives in real time.

In terms of establishing art–science partnerships, interviewees recommended developing strong relationships between project stakeholders for collaborations that are founded on trust and respect. The artist from Case Study 1 highlighted the necessity of being well informed by those active in the relevant scientific field, as “only then can an artist facilitate the understanding of the environment. For the final work to have any profundity or agency, the creativity needs to be underpinned by genuine research and knowledge.” The artist–scientist interviewee from Case Study 2 similarly emphasised the importance of communicating research in digestible ways without oversimplifying the science, finding that “synthesising complex concepts into illustrations” helped to communicate their research better and to wider audiences. Further, strong partnerships allow for honest dialogue and consequently support the critical process of collectively evaluating and adapting art–science projects. The exhibition officer from Case Study 1 evidenced how impact should be monitored with specific metrics that evaluate both the process of



Figure 1. (a) *Taxonomy of a Cornish Foreshore* by Kurt Jackson, on display as part of the “Biodiversity” exhibition at the Oxford University Museum of Natural History. The piece shows how the beach, the foreshore, has a particular resonance to many whilst also being a biodiversity hotspot, a liminal zone, and the meeting point for ecosystems. This work was on display featuring a research response from authors Rosalie Wright and Lisa Wedding (see the Supplement). (Image credit: Museum of Natural History by Ian Wallman; <https://iwphotographic.pixieset.com/museumofnaturalhistorybyianwallman/>, last access: 20 March 2023.) (b) Cécile Girardin’s COP26 mural capturing the COP26 conference proceedings. This piece was created with her team to communicate and engage wider audiences in the outcomes of the COP26 climate negotiations. (Image credit: Cécile Girardin; <http://www.cecilegirardin.com/>, last access: 1 October 2022.)

collaboration and the short- and long-term impacts of an inclusive engagement project, contributing further to the evidence base on conducting art–science partnerships. A table of further recommendations along with additional data on the aims and motivations for collaborating can be found in the Supplement.

4 Discussion and conclusions

This work presented two case studies of interdisciplinary partnerships for wider engagement in the environmental geosciences. These examples demonstrated different approaches to facilitating knowledge exchange with communication tools co-developed through art–science partnerships. The stakeholder interviews corroborated that art–science collaborations can provide a platform for knowledge co-production, with each representative emphasising the value of cross-disciplinary partnerships for encouraging self-reflection and interacting with new viewpoints. The importance of mutual trust and respect in building these relationships has been reflected in other art–geoscience collaborations (Risner et al., 2019), allowing for the greater appreciation of other disci-

plines (Marlton and Robson, 2020). Significantly, interviews with the artist and artist–scientist revealed cautions against the oversimplification of science for communication purposes, emphasising the importance of taking time to foster collaborations based on a genuine understanding of the research, similarly highlighted by Locritani et al. (2020).

Our research activity revealed that each stakeholder representative was predominantly motivated by a common goal of engaging new audiences, a finding reported in a previous survey of participants in art–geoscience partnerships (Archer, 2020). An interesting result of the interview with the exhibition officer is the opportunity to situate art–science partnerships in varied contexts to enhance inclusive engagement, such as the Museum of Natural History exhibition, Case Study 1. By situating the exhibition amongst museum specimens, the art–science project connected visitors to both contemporary research and multiple perspectives on natural history. Visitors predominantly reported feeling inspired by the exhibition, commenting on how the artist made “the everyday and ordinary seem so extraordinary”, and provoked attendees to reflect on concepts of biodiversity and habitat loss. As explored by Van Loon et al. (2020), combining artistic practice with conventional methods for building resilience to

natural hazards may provide a more holistic understanding of social as well as ecological risks, leading to more comprehensive preparation for natural disasters (Van Loon et al., 2020). In responding to Kurt Jackson's work, the researchers in Case Study 2 were encouraged to situate their science and explain the social relevance. Such knowledge exchange is an asset in the development of effective solutions to the climate and biodiversity crises we are facing. In Case Study 2, the artist–scientist was able to co-create the mural with perspectives of those attending and speaking at the COP26 conference and found this to be a widely accessible and engaging format. This co-development of science communication is pertinent to publicly contested and politicised matters, such as biodiversity loss and climate change (Suldovsky, 2017).

In conclusion, enhancing inclusive engagement within the geosciences can be achieved through art–science partnerships. Our findings suggest that enabling conditions are important to create safe spaces for the knowledge exchange and reflective practice. Starting with relationship building based on mutual respect was found to support the successful development of equitable partnerships and co-production of ideas. Further, our case studies underscored that considering different contexts for sharing art–science partnerships (e.g., a museum) can contribute to the success of inclusive engagement initiatives. This work explored two case studies in which the team had been involved; the next step would be to increase the number of interviews with a wider group of stakeholders from a diverse range of case studies. These results are experience-based suggestions for practising a successful art–science partnership and represent a preliminary example of the value of investigating enabling conditions of interdisciplinary collaborations for inclusive knowledge exchange.

Data availability. This paper contains an overview of two art–science case studies and three interviews. Any additional information and data not included in the text can be found in the Supplement.

Supplement. The supplement related to this article is available online at: <https://doi.org/10.5194/gc-6-39-2023-supplement>.

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Competing interests. The contact author has declared that none of the authors has any competing interests.

Ethical statement. The interviews for this paper were conducted through voluntary participation and with informed consent to share the outcomes in an academic publication. Any data shared in this paper and the Supplement have first been approved for publication by the interviewees and associated teams. In addition, interviewees were involved in the iterative review and approval of the paper itself.

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References

- Archer, M. O.: Space Sound Effects Short Film Festival: using the film festival model to inspire creative art–science and reach new audiences, *Geosci. Commun.*, 3, 147–166, <https://doi.org/10.5194/gc-3-147-2020>, 2020.
- Arkema, K. K., Guannel, G., Verutes, G., Wood, S. A., Guerry, A., Ruckelshaus, M., Kareiva, P., Lacayo, M., and Silver, J. M.: Coastal habitats shield people and property from sea-level rise and storms, *Nat. Clim. Change*, 3, 913–918, <https://doi.org/10.1038/nclimate1944>, 2013.
- Gates, A. E.: Benefits of a STEAM Collaboration in Newark, New Jersey: Volcano Simulation Through a Glass-Making Experience, *J. Geosci. Educ.*, 65, 4–11, <https://doi.org/10.5408/16-188.1>, 2017.
- Kallio, H., Pietilä, A.-M., Johnson, M., and Kangasniemi, M.: Systematic methodological review: developing a framework for a qualitative semi-structured interview guide, *J. Adv. Nurs.*, 72, 2954–2965, <https://doi.org/10.1111/jan.13031>, 2016.
- Lanza, T.: Introduction: Five years of Earth sciences and art at the EGU General Assembly (2015–2019), *Geosci. Commun.*, 3, 127–128, <https://doi.org/10.5194/gc-3-127-2020>, 2020.
- Lee, K.: Urban Public Space as a Didactic Platform: Raising Awareness of Climate Change through Experiencing Arts, *Sustainability*, 13, 2915, <https://doi.org/10.3390/su13052915>, 2021.
- Locritani, M., Merlino, S., Garvani, S., and Di Laura, F.: Fun educational and artistic teaching tools for science outreach, *Geosci. Commun.*, 3, 179–190, <https://doi.org/10.5194/gc-3-179-2020>, 2020.
- Mach, K. J., Cortada, X. I., Mignanelli, N., Owley, J., and Wright, I. A.: Climate mobility and the pandemic: art–science lessons for societal resilience, *World Art*, 11, 277–287, <https://doi.org/10.1080/21500894.2021.1911839>, 2021.

- Marlton, G. J. and Robson, J.: Developing the hertz art-science project to allow inaudible sounds of the Earth and cosmos to be experienced, *Geosci. Commun.*, 3, 365–379, <https://doi.org/10.5194/gc-3-365-2020>, 2020.
- Mould, S. A.: Seeing double in art and geoscience: 3D aerial portraits of “lost” Anthropocene landscapes, *J. Maps*, 15, 92–101, <https://doi.org/10.1080/17445647.2018.1534142>, 2019.
- Rathwell, K. and Armitage, D.: Art and artistic processes bridge knowledge systems about social-ecological change: An empirical examination with Inuit artists from Nunavut, Canada, *Ecol. Soc.*, 21, <https://doi.org/10.5751/ES-08369-210221>, 2016.
- Rossi, G., Böhm, G., Saraò, A., Cotterle, D., Facchin, L., Giurco, P., Lucchi, R. G., Musco, M. E., Petrera, F., Picotti, S., and Salon, S.: Focus on glaciers: a geo-photo exposition of vanishing beauty, *Geosci. Commun.*, 3, 381–392, <https://doi.org/10.5194/gc-3-381-2020>, 2020.
- Schneider, S. and Simon, G.: Experience Our Planet—Interpreting Earth Sciences in a Museum Environment, in: *New Trends in Earth-Science Outreach and Engagement: The Nature of Communication*, edited by: Drake, J. L., Kontar, Y. Y., and Rife, G. S., Springer International Publishing, Cham, 121–135, https://doi.org/10.1007/978-3-319-01821-8_9, 2014.
- Simis, M. J., Madden, H., Cacciatore, M. A., and Yeo, S. K.: The lure of rationality: Why does the deficit model persist in science communication?, *Public Underst. Sci.*, 25, 400–414, <https://doi.org/10.1177/0963662516629749>, 2016.
- Stewart, I. S. and Lewis, D.: Communicating contested geoscience to the public: Moving from ‘matters of fact’ to ‘matters of concern,’ *Earth-Sci. Rev.*, 174, 122–133, <https://doi.org/10.1016/j.earscirev.2017.09.003>, 2017.
- Suldovsky, B.: The Information Deficit Model and Climate Change Communication, in: *Oxford Research Encyclopedia of Climate Science*, Oxford University Press, <https://doi.org/10.1093/acrefore/9780190228620.013.301>, 2017.
- Thomas, G.: A Typology for the Case Study in Social Science Following a Review of Definition, Discourse, and Structure, *Qual. Inq.*, 17, 511–521, <https://doi.org/10.1177/1077800411409884>, 2011.
- Tooth, S., Viles, H. A., Dickinson, A., Dixon, S. J., Falcini, A., Griffiths, H. M., Hawkins, H., Lloyd-Jones, J., Ruddock, J., Thorndy-craft, V. R., and Whalley, B.: Visualizing geomorphology: improving communication of data and concepts through engagement with the arts, *Earth Surf. Proc. Land.*, 41, 1793–1796, <https://doi.org/10.1002/esp.3990>, 2016.
- Tooth, S., Smith, M. J., Viles, H. A., and Parrott, F.: Editorial: Perspectives on the contemporary art-geoscience interface, *J. Maps*, 15, 1–8, <https://doi.org/10.1080/17445647.2019.1594032>, 2019.
- Van Loon, A. F., Lester-Moseley, I., Rohse, M., Jones, P., and Day, R.: Creative practice as a tool to build resilience to natural hazards in the Global South, *Geosci. Commun.*, 3, 453–474, <https://doi.org/10.5194/gc-3-453-2020>, 2020.