Planning virtual and hybrid events: steps to improve inclusion and accessibility

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Abstract.

The past decade has seen a global transformation in how we communicate and connect with one another, making it easier to network and collaborate with colleagues worldwide. The COVID-19 pandemic led to a rapid and unplanned shift toward virtual platforms, resulting in several accessibility challenges that have excluded many people during virtual events. Virtual and hybrid conferences have the potential to present opportunities and collaborations to groups previously excluded from purely in-person conference formats. This can only be achieved through thoughtful and careful planning with inclusion and accessibility in mind, learning lessons from previous events' successes and failures. Without effective planning, virtual and hybrid events will replicate many biases and exclusions inherent to in-person events. This article provides guidance on best practices for making online/virtual and hybrid events more accessible based on the combined experiences of diverse groups and individuals who have planned and run such events.

Our suggestions focus on the accessibility considerations of three event planning stages: 1) pPre-event planning, 2) on the day/during the event, and 3) after the event. Ensuring accessibility and inclusivity in designing and running virtual events can help everyone engage more meaningfully, resulting in more impactful discussions that will more fully include contributions from the many groups with limited access to in-person events. However, while this article is intended to act as a starting place

for inclusion and accessibility in online and hybrid event planning, it is not a fully comprehensive guide. As more events are run, it is expected that new insights and experiences will be gained, helping to continually update standards.

1 Introduction

Diversity leads to better research and work outputs, helping to generate novel findings and perspectives (e.g., Beilock, 2019; Gomez and Bernet, 2019; Swartz et al., 2019; Hundschell et al., 2021). While diversity movements have historically focused on gender (typically binary) and ethnic background (see Golden, 2024), the more recent move to virtual platforms in 2020, have facilitated people connecting in a way never possible before. This also led to discussions on barriers to inclusion within geoscience, including consideration of ffieldwork accessibility (Giles et al., 2020; Stokes et al., 2019; Greene et al., 2021; Pickering and Khosa, 2023), financial barriers (Abeyta et al., 2021), and parachute science-, where international scientists conduct research without meaningfully engaging local communities and researchers (Ekandjo and Belgrano, 2022; Stefanoudis et al., 2021). These discussions have helped create new ideas and actions to overcome geosciences' historical lack of diversity (Dowey et al., 2021; Huntoon et al., 2015; Marin-Spiotta et al., 2020), creating a more inclusive and equitable field. However, one persistent challenge, impacting many people from different countries and backgrounds,~~Geoscience has long been considered one of the least diverse scientific fields (Dowey et al., 2021; Huntoon et al., 2015; Marin-Spiotta et al., 2020). Many barriers to inclusion exist for researchers from historically marginalized groups, including fieldwork accessibility (Giles et al., 2020; Stokes et al., 2019; Greene et al., 2021; Pickering and Khosa, 2023), financial barriers (Abeyta et al., 2021), and parachute science (where international scientists typically from higher-income countries conduct research without meaningfully engaging local communities and researchers (Ekandjo and Belgrano, 2022; Stefanoudis et al., 2021). A significant challenge for many marginalised researchers~~ has been accessing and attending international in-person conferences, which are fundamental opportunities to network and connect with other researchers from beyond typical geographic and disciplinary boundaries (Fleming, 2020). The dominance of purely in-person events has often resulted in the exclusion of historically marginalized groups from these spaces. As such, the recent evolution in virtual, online, and hybrid (events with both in-person and online elements) conferencing, and its impact upon accessibility and inclusivity in geoscience, merits renewed discussion.

~~The dominance of purely in-person events has often resulted in the exclusion of historically marginalized groups from these spaces.~~ While t~~T~~raditional in-person conferences offer many opportunities, they often present physical and mental challenges to participation for a wide range of people, including, but not limited to, those who are neurodivergent, have disabilities or chronic conditions, ~~or~~ caring responsibilities or /family commitments (Chautard, 2019). For many researchers, events are too expensive to attend in-person when registration fees, ~~and~~ accommodation, transport and other costs are taken into consideration (Sang, 2017; Vasquez, 2021; Wu et al., 2022; Amarante and Haag, 2024). The predominance of in-person events ~~to be~~ held in the Global North also increases the costs for many from the Global South, and reduces ~~and reduces~~ opportunities and career progression options for many marginalized groups (Talavera-Soza, 2023). Researchers from the

Global South often require visas to attend in-person conferences, which are often difficult and costly to obtain and require significant time in advance to arrange. Indeed, there have been numerous reported cases of researchers who were unable to attend in-person conferences to present their work simply because a request for a visa was either rejected or ignored completely (Chatterjee, 2022). Furthermore, cultural and political factors can also act to make in-person conferences inaccessible for minoritized researchers. Transgender and gender non-binary researchers may have problems traveling with a passport that does not align with their gender-expression (Savage and Banerji, 2022). Additionally, using a passport with a neutral gender-marker (e.g., 'X' on U.S. passports) may cause issues if they are not accepted in the conference host country (Quinan, 2022). The political and cultural climate of many countries is not one of inclusion for LGBTQIA+ people~~members~~, with lack of legal support creating unsafe environments for the community (Gibson, 2021; Olcott and Downen, 2020). In-person events may also lead to experiences of isolation, discrimination, and sexual harassment (EDIG, 2020). Alcohol-focused social events may further exclude people from full participation and cause increased occurrences of sexual harassment and other inappropriate behaviours in professional settings (GRL, 2020). Consequently, virtual~~/~~ and hybrid events can provide advantages to foster more inclusive and accessible environments, encouraging participation from more diverse audiences and promoting a greater sense of belonging for all (Foramitti, 2021; Wu et al., 2022). Further, as many geoscientists are striving to travel less for environmental reasons, virtual options offer a potential alternative to reduce high carbon footprints associated with in-person attendance (Allen, 1996; Tao et al., 2021; Periyasamy et al., 2022).

In the last 10 years or so, but especially since the forced virtualisation of many research activities during the COVID-19 pandemic, the number of virtual academic events has increased very rapidly (Graham, 2023), yet equity, diversity, inclusivity and accessibility have to a large extent not featured in discussions around this virtualisation. Indeed, many events previously hosted online (as a result of the pandemic) are now returning to fully in-person, often resulting in the exclusion of historically marginalized groups~~,~~ and many others~~,~~ who benefited from the previous change (Fraser, 2017; Niner, 2021). It is our view that for global, interconnected networks to continue to grow, and to provide a more inclusive and accessible experience for a wider audience, virtual or hybrid events must continue to play a role in geoscience. Including virtual access to events makes them more inclusive and accessible, helping to share the content with more people, including those who are unable or unwilling to travel or are otherwise unavailable to attend physically. However, while virtual alternatives can be very positive, several challenges remain, with common technological fatigue (Wiederhold, 2020; Gain, 2024), a lack of networking opportunities (King and Kovács, 2021), poor inclusion of the online audience in hybrid events (Eventforce, 2024), or a lack of access to a reliable internet connection (due to remote locations, poor infrastructure or a lack of finances to purchase internet services; Signé, 2023). To counter these challenges, advanced discussion and consideration of accessibility during the pre-event, event, and post-event planning stages is crucial to avoid the inadvertent exclusion of people. It is not sufficient to simply include a virtual component as an add-on at the end. If we wish to make sure that online and hybrid events are truly inclusive and accessible, structures should be put in place early to ensure equitable experiences between virtual and in-person participants.

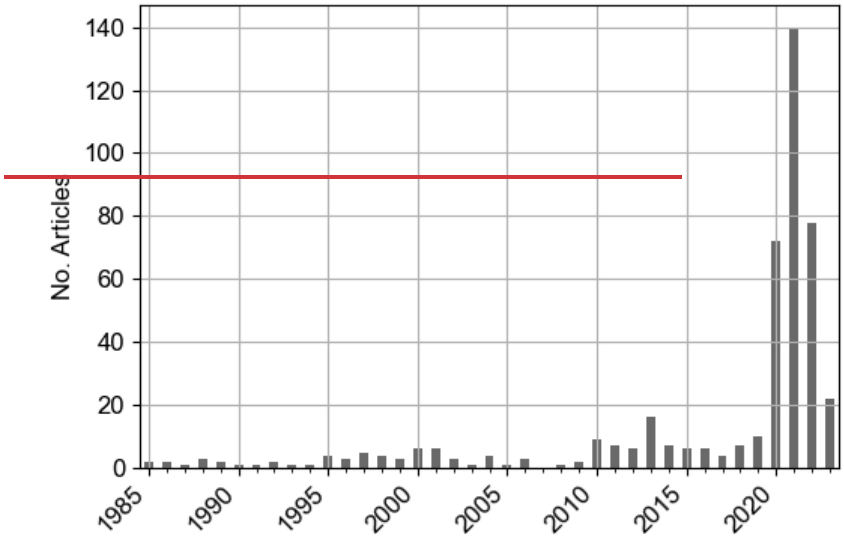
Here, we outline suggestions to help make online and hybrid events more accessible to a wider audience, based on the experiences of several groups and people involved with event planning for the virtual landscape, as well as from a wider search of the literature surrounding virtual events. This article is structured as follows: we first provide a summary of the existing literature surrounding accessibility, inclusion and online or hybrid conferences, and then provide some guidance for each stage of running an accessible and equitable event including Stage 1 (pre-event), Stage 2 (during the event) and Stage 3 (after the event). Some of these suggestions will depend on the size and type of event being organised, but they have been merged here to ensure that all elements are considered. While this article focuses on virtual and hybrid conferences specifically, our suggestions may be applicable to other events like seminars, workshops and panel discussions. Many of us will be involved in organising a virtual or hybrid event at some point in our careers, and ensuring it is accessible and inclusive for all requires some thought and planning. We acknowledge that this paper cannot give a full and finite description of making online and hybrid events more accessible and inclusive, as new techniques and strategies will evolve. As such, this article is only intended to act as a starting place, and does not represent an ultimate guide to the accessibility needs of an event. Let's remember that we are all learning and striving to continually improve accessibility and inclusion, so let's be patient, listen, learn and act together to ensure equitable experiences for all participants.

2 Review of previous literature

When did the shift to virtual events begin, and how has this change manifested over time?

To quantitatively demonstrate ~~the~~ change ~~ing~~increased academic interest in virtual conferences ~~as of~~prior to, and following, 2020, we analysed records of literature indexed by Web of Science (https://www.webofscience.com/wos/). We chose to limit our search to articles with the words 'virtual', 'online' and 'conference' specifically in the title rather than in the abstract text, as these articles are more likely to deal with the specifics of virtual conferencing. We constructed searches by using the 'NEAR' query term to eliminate articles which do not directly relate to virtual conferences (see Ssupplementary Table 1). This strategy was not entirely successful: for example, several papers were found concerning a 'virtual geoscience conference' which was an in-person event whose subject matter was photogrammetry and other virtual techniques for collecting and presenting geoscience data (Chandler, 2016); these data were removed manually from the analysis. Nevertheless, the search yielded a total of 452 unique publications, which when plotted by year (***Fig. 1***) clearly show an increase in publications as of March 2020: a total of 312 articles within the search were published in 2020 - 2023, almost 70% of the total dataset. We additionally performed searches of the Directory of Open Access Journals (https://doaj.org/), which allows less detailed search queries to be constructed and does not allow article metadata to be easily downloaded. A search for the words 'virtual' and 'conference' in the title of articles produced 71 results, of which 63 (89%) were published since March 2020, while a search for 'online conference' yielded 56 results, of which 46 (82%) were published since March 2020. Indeed, many articles published from 2020 onwards explicitly state that their rationale for considering virtual event organisation was driven by the pandemic (e.g., Busse, 2020: Fulcher, 2020; Gottlieb, 2020; Jain, 2022). In line with this change in interest, there has also been a huge shift in

the type of literature published, with grey literature (blogs, social media, websites, etc) becoming an important body of work for several academic fields during the pandemic (Kousha et al., 2022).



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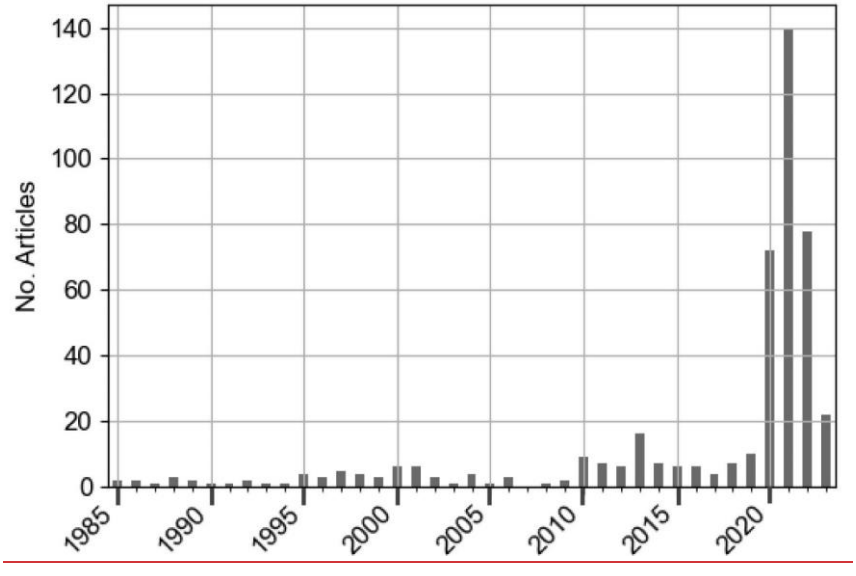

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Figure 1: *Plot of Web of Science search results for articles with the words 'virtual' or 'online' and 'conference' in their title, within two words of each other (total dataset = 452). A very sharp uptick in publications is visible from 2020 (312 were published from 2020 onwards), coincident with the onset of the COVID-19 pandemic which precipitated a necessary rise in virtual conferencing.*

To assess the interest in virtual conferencing outside of a purely academic sphere, we analysed search data from Google Trends (https://trends.google.com/), aggregating hits for searches for six terms related to virtual conferencing from the last five years (***Fig. 2;*** *see Supplementary Table 2 for a list of all aggregated search terms*). These data demonstrate a very sharp increase during the first wave of the COVID-19 pandemic, with interest tailing off from the summer of 2020 to the present, albeit the interest remains higher than before the start of the pandemic.

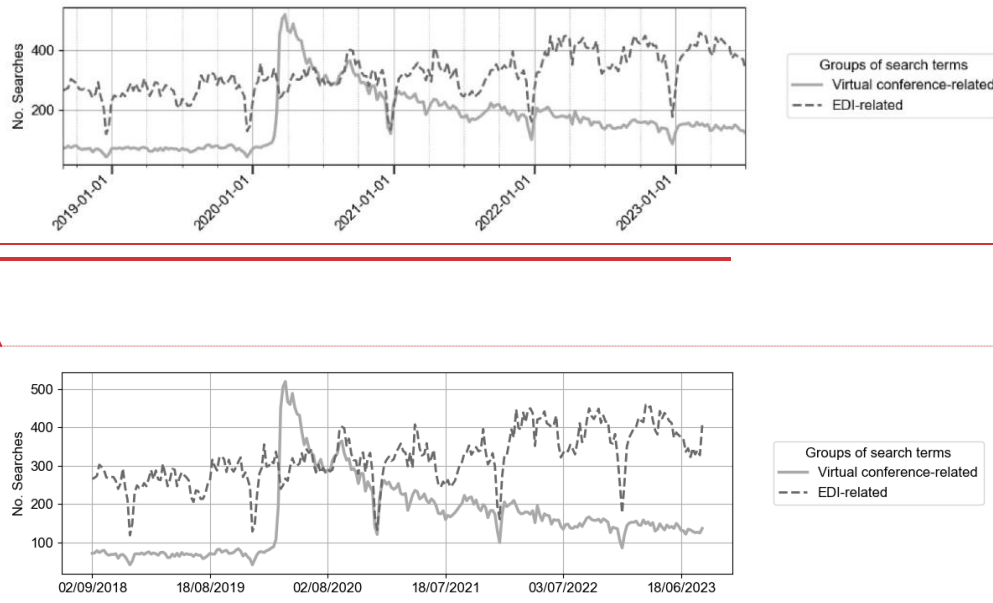

Figure 2: *Plot of Google Trends data, across all search categories over the 5-year period 02/09/2018 - 29/08/2023, for search terms related to (a) virtual academic conferences and (b) related to equity, diversity, and inclusion (EDI). Co-located troughs in ~~There is a~~are several areas of overlap, with ~~both~~ search categories~~categoeries dipping,~~ can be seen each December which correspond~~ing~~ to winter breaks, with other dips aligning with holiday terms in many countries. Generally,~~lack of correlation~~*

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~~*between the two datasets:*~~ *interest in EDI* ~~*is, on average,*~~ *gently increas*~~*ed*~~*ing with time, whereas that in virtual conferencing spiked during the COVID-19 pandemic but declined shortly after*~~*.*~~.

What motivations were given for increased 'virtualisation' of conferences at the time?

Conferences are efficient tools for facilitating academic discussion, career development, networking, and collaboration, but present several inherent inaccessibility and inequality challenges. While traditional conferences have typically been held in-person, the existence of virtual alternatives have long been recognised: the concept of virtual conferences and the use of virtual spaces to network has been discussed in the literature as early as 1986 (Heim). Much of the earlier literature is primarily concerned with addressing technological developments in virtual conferencing, which facilitate increased opportunities for networking and professional development if an appropriate physical meeting is not feasible (e.g., Anderson, 1996; Blow, 2011; Thatcher, 2006).

As the virtual conference management and participation landscape developed further, articles began to identify communities for whom traditional, in-person conferences fail to cater, and to suggest innovative virtual solutions to these specific hurdles. For example, Gichora (2010) described a series of conferences run virtually via regional hubs across Africa, facilitating access to a conference without the need for the time and money required for travel. Black et al. (2020) outlined the benefits of virtual interactions over in-person conferences from a feminist perspective, drawing on the experiences of organising a fully virtual, interdisciplinary conference (Lewis et al., 2019). Although the urgency of the COVID-19 pandemic led to comparatively little questioning of the status quo, pre-pandemic literature identified numerous ethical and EDI issues with in-person conferences (Spinellis and Louridas, 2013; Fraser, 2017), and reported results and surveys of virtual conference participation (Gunawardena et al., 2001; Gichora, 2010; Erickson, 2011). It should further be noted that many smaller-scale conferences and seminars have been run virtually in previous decades without a published record of having occurred and would therefore have been missed here.

What challenges are associated with virtual conferences and how have these been addressed?

The appropriate use of time zones is a common issue faced by virtual meetings, with significant planning required to ensure time zones are accessible to as many people as possible. Clear communication (e.g., time zone specific programs) is vital to ensure full inclusion (Gichora, 2010; Niner, 2020; Gibson, 2021). Virtual events often use a range of technologies, with many of these rapidly changing or being replaced. Consequently, it is vital to provide extra time in the schedule to account for technical glitches and to give presenters time to practice, and if choosing to facilitate live presentations, encourage pre-recordings as a backup in case of technical issues on the day ~~ideally to have pre-recorded videos as a fall back if using live talks~~ (Gichora, 2010; Raby and Madden, 2021). Communication through other platforms (such as running social media campaigns or the use of mailing lists) prior to and during the event will also help ensure the smooth running of a meeting, as

will having clear information on an online form such as a website (Gottlieb, 2020; Raby and Madden, 2021). The use of conference apps as the main communication platformform may not be fully accessible as they may not be compatible with all phones, tablets or other devices and this assumes as well as the assumption all that everyone hasparticipants have access to to such a device which can host apps (Niner, 2021). The use of apps may also present problems for, and digital accessibility needs (colour palettes, font, ease of reading, screen readers etc.) which may not be considered in the design of such platforms (e.g., Kohler, 2023). Providing clear instructions on how to submit questions or how to attend any virtual activities or networking opportunities, with detailed explanations or access to help pages for any new technologies being implemented is crucial to avoid inadvertent exclusion (Raby and Madden, 2021).

Many event reviews discuss the challenges in creating effective networking environments and fostering participant engagement during online meetings (e.g., Fulcher, 2020; Correia, 2021; Gibson, 2021; Raby and Madden, 2021). In particular, virtual poster sessions have often been difficult to design with limited success in promoting engaging networking. While there have been virtual poster sessions prior to COVID (e.g., the AGU Virtual Poster Showcase; (AGU, 2024 - ; although note that this has been discontinued and we could not find any review of how this session went from an attendee point of view), but, introducing the inclusion of other media (e.g., videos, QR codes) canould enhance engagement (Raby and Madden, 2021). There may be multiple reasons why online engagement is hindered, with some people finding it more difficult to interpret social cues in virtual spaces making communication more challenging, or with people experiencing or expecting to experience more hostile interactions online than in person (Niner, 2021). While more structured virtual activities have been used to make online networking more successful (Fulcher, 2020), other reports suggest using alternative ways to engage that allow flexibility (Raby and Madden, 2021). The use of engagement platforms will depend on the scale of the event, with break-out rooms often working well in small meetings to promote participant engagement (Gottlieb, 2020), but including features such as networking pages could help participants engage more easily (Raby and Madden, 2021). Experimenting with different types of platforms and engagement methods will help in future event planning for specific events (Niner, 2020).

The financial barriers that in-person events may create for people, often enhanced by geography, is commonly discussed (e.g., Sarabipour, 2020; Raby and Madden, 2021; Rowe, 2019). Many international conferences are hosted in the Gglobal Nnorth, creating additional barriers to participation such as difficulty obtaining visas, leading to biased demographics of attendees (Waruru, 2018). While there are still several challenges to overcome for virtual events (as discussed herein), fully online conferences online conferences often reduce financial and geographical barriers to attendance (Wu et al., 2022). Hybrid events may have additional costs for arranging a virtual component as opposed to hosting the same event exclusively in person, depending on the type of event planned. THowever, including a virtual element to an event his can lead to an increase in representation from traditionally underrepresented groups and foster new innovation and networking opportunities between new groups (Sarabipour, 2020). The potential accessibility of virtual events for low-income attendees is hindered if the conference fees are high, and adds another barrier to inclusion (Niner, 2020; Raby and Madden, 2021).

Is EDI a focus of ~~How can we~~Despite the increasing awareness of the benefits and challenges of virtual conferences, there is a need to better incorporate EDI issues into virtual conference design?~~.

Our literature review shows that the shift to virtual events was not specifically motivated by EDI issues, and that to better cater to these issues we should frame an appraisal of virtual conferences by their ~~considerable~~ potential EDI benefits. This is borne out in the data analysed in Fig. 1. Of the 452 articles in the dataset, only three titles (<1 %) contained the strings *'inclusiv'* (contained in *'inclusive'* and *'inclusivity'*) or *'accessib'* (contained in *'accessible'* and *'accessibility'*). This quantitatively demonstrates that inclusivity and accessibility are not at the forefront of discussions around virtual conferencing, despite the increasing public interest in EDI issues, shown in Fig. 2. Several recent studies have highlighted the benefits to online conferences when EDI considerations are incorporated~~incoporated~~ into conference design, including how virtual components can be used to create space and opportunities for minoritized groups by looking at audience engagement from a gendered point of view (Zhang et al., 2023). They

~~The need for virtual conferences to actively create space and opportunities for minoritized groups of researchers to participate was highlighted by a recent study examining the effects of gender on participation in an online conference from 2021 (Zhang et al., 2023). The authors~~ demonstrated that, even though women composed an equal number of participants to men, they asked half as many questions as their male colleagues. A study of a different virtual conference from 2021 (de las Heras et al., 2023) provided an example of what can be achieved when the needs of minoriti~~z~~sed groups, in this case women and early-career researchers, are kept in mind during the planning stages of a conference. By curating an event which centred the inclusion of these groups in the design of the conference (such as round-table events with quotas for the participation of these groups), the organisers received very positive feedback from the researchers involved.~~c~~can

~~Ma~~Many people prefer in-person events for a variety of reasons including technology fatigue during online events and better social cues when meeting in person. Thus, hybrid events seem to be a good way to incorporate the needs of a broad spectrum of people. However, the organisation of~~zing~~ hybrid events needs to carefully consider the needs of both in-person and virtual attendees~~,~~ in order to be inclusive.

Historically, EDI initiatives have not been the central theme of the published virtual conference literature, meaning that the implications of these types of events for EDI have often been overlooked. Many of these publications are reports of an individual virtual conference or series of conferences, written by the organisers of said conference, and therefore are not framed by an EDI agenda despite indirectly addressing many issues related to EDI (e.g., cost of travel, adhering to social distancing regulations). Reviews of virtual conferences are often but not always evaluated using feedback from participants, usually in the form of a post-event survey (e.g., Fulcher, 2020; Erickson, 2011; Busse, 2020; Moreira et al., 2022), and often but not always give practical advice for the future running of online conferences (e.g., Achalkulvisut, 2021; Reshef, 2020; Gottlieb, 2020; Harabor and Vallati, 2020; Li et al., 2021; Fu and Mahony, 2023; Margetis et al., 2007). Specific advice given can apply

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both to running an online conference smoothly, without specific consideration of EDI (e.g., Pedaste and Kasemats, 2021; Seery and Flaharty, 2020; Reshef, 2020) and give advice specifically tailored toward increasing EDI (e.g., Fraser, 2017; Gichora, 2010). While review articles cover a wide range of topics (such as survey feedback, online engagement, communication), it is important to note that these reviews are not fully representative of everyone and may not capture all perspectives, especially if someone is not able to attend in the first place due to lack of accessibility. Similarly, having a virtual component does not automatically result in equitable inclusion (Niner, 2020). Virtual events may still present barriers to inclusion. These include socio-economic challenges, with the cost of internet access varying widely across countries (Raby and Madden, 2021). Additionally, not all people can engage with virtual events in the same way, with some attendees including many neurodivergent or disabled participants often facing additional focus and fatigue challenges (e.g., Nahass, 2022; Kukoyi, 2023), resulting in lower engagement and their inadvertent exclusion. As accessibility~~accessibiloty~~ is not frequently~~freutenytly~~ a consideration in review articles~~arteiles~~ of virtual events, there are several

~~Often, inclusion of accessibility considerations for virtual events is not a priority of review articles, with many~~ elements missing from the current literature. For example, live closed~~-~~ captions or subtitles for virtual, and in-person, events are rarely mentioned, as these may not have been considered far enough in advance for effective implementation (Gibson et al., 2021) but, these are crucial for the inclusion of those with certain disabilities and participants with different first languages to the conference (Seery and Flaharty, 2020; Wu et al., 2022). The benefits of effective subtitles and transcriptions in online environments are clear, with higher engagement from people with hearing and motion impairments in online lessons (Federico and Furini, 2012). In order to produce effective subtitles or closed captions, a clear audio connection is required, which may be restricted by poor microphones or acoustic environments, which may generate additional costs that should be considered early (Federico and Furini, 2012).

In-person academic conferences have existed since at least the eighteenth century (Bigg et al., 2023) but have often lacked meaningful consideration of EDI in their planning. In recent years, virtual conferences have increased in popularity, with the COVID-19 pandemic showing that increased use of virtual and online platforms leads to a huge increase in collective experiences, regardless of the limited experience of hosting virtual events many people had prior to the pandemic (Eventcube, 2023). As virtual and hybrid conferences continue to be utilized, it is vital that the academic community incorporates accessibility and inclusion into their planning. With this in mind, in the section below we collate and combine recommendations from across both the literature and the authors' experiences running and participating in virtual/hybrid conferences and give concrete advice in the running of future events. As the breadth of the literature shows, each online conference will have different audiences, goals, and ways of planning (e.g., Gichora, 2010; Niner, 2020; Gibson, 2021; Raby and Madden, 2021). However, by utilizing diverse mechanisms for running conferences, novel and inclusive experiences can be had by all participants of a virtual or hybrid conference, both technologically and socially. As virtual conferences continue

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to take place, with hybrid- events becoming more frequent, the ways of ensuring inclusion and accessibility will grow, with new ideas and technologies always emerging. Therefore, the below guidance should be taken as advice rather than as rules.

3 Stages in event planning

3.1 Stage 1: Pre-event planning and event design

3.1.1 Who?

Often ~~an~~ event planning begins ~~will start before any official planning begins,~~ when several people come together to discuss ideas, before the formation of an official planning committee. During these early discussions, several steps should be thought about (e.g., target audience(s), title/theme, organisational roles, timelines, communication strategies). Early decision on the precise event theme and target audience is important for every other step, and will be used as a foundation for communication and accessibility planning. During these early stages, ensuring diversity and inclusivity of those involved is crucial. Be proactive in inviting early-career colleagues and those from historically marginalized groups who might not otherwise become involved. Consider ways for marginalized groups to amplify~~aplufy~~ their voices during the design stage of an event, and consider compensation for any time given to volunteers (e.g., discounted registrations, society membership, or monetary compensation).~~, and provide opportunities for individuals to suggest themselves as volunteer~~s. It is important that volunteers are valued and not invited to tick a diversity box. Everyone's opinions and ideas need to be listened to and discussed. Furthermore, involving a broad range of people means that specific considerations for different marginalized groups are less likely to be overlooked. In the presence of a team of organisers from a diverse range of backgrounds who are treated equitably, organisers and attendees alike will feel more able to raise any foreseen issues before the event, thus reducing the likelihood of negative experiences.

Target audience: Work out who the target audience(s) is for your event and how best to reach them. Different audiences may be more familiar with different platforms or have different needs or expectations of an event. Different approaches or structures of an event (or event series) may be required depending on your audience because people engage in different ways (e.g., lecture-style, panels, open dialogue discussions, audience participation)~~.~~.

Presenters: If inviting/reviewing applications for speakers or other event roles, try and ensure a broad and diverse range of presenters to ensure wide representation. Inclusion statements and codes of conduct can help, but still many events fail to provide a diverse line up, restricting ~~reducing the~~the range of perspectives and worldviews availabl.~~e diversity of conversation.~~. If running an event with invited speakers, consider fee waivers for speakers at your event. This is particularly important for EDI-related events, where many speakers often carry out their work on a voluntary basis. Depending on the scope of your

event, it can be a good idea to encourage ~~give~~ people ~~the opportunity~~ to talk about both their research and EDI-related concepts during the same presentation.

Avoiding tokenism and ensuring the most appropriate people are selected for the event you are organizing is crucial. Inviting someone because of their gender, socio-economic status, ethnic background or other characteristic to meet quotas does more harm than good to EDI work (Kamalnath, 2020). Tokenism undermines equity movements and reduces the benefits of a truly diverse community in terms of diverse perspectives and ideas (Kamalnath, 2020). If it proves difficult to identify diverse experts or speakers, rather than assuming there are none, re-evaluate it from a different perspective and consider alternative ways (e.g., connecting with specialized groups) to reach people outside of the committee's network. This may require more pre-planning in order to find the best people for a topic or talk, but meaningful diversity and inclusion take time and effort from everyone.

When potential speakers for an event have been decided upon, make sure to email and communicate clearly with them at an early stage. The exact format, purpose and length of a talk should be shared, along with any deadlines~~ue dates~~ (e.g., for pre-recorded talks) as soon as is feasible. Similarly, if inviting a speaker, it can be a good idea to explain why you feel they would be a good fit for the talk, and ask for suggestions of alternative/additional speakers to try and reach new networks. Share any accessibility information (see Section 3.1.6) and format requirements with speakers and panellists early in order to help them with the preparation of talks. If a panel discussion is planned, communicating any planned questions before the event can ensure the event is more accessible to many people ~~, including neurodiverse participants~~ (Nocon, 2021). A pre-event session or 'dress rehearsal' can give volunteers, invited speakers or panellists the opportunity to familiarise themselves with the platform, ask any questions and reduce uncertainty of how the event will run on the day (Nocon, 2021).

3.1.2 When?

During this stage, there are several decisions that need to be made to help streamline the rest of the event planning: When should we run the event? Is there a cycle for events like this? What permissions need to be sought? Can we tag onto a larger event which will increase our audience or should we do it alone?

Time zones: In which time zones are your target audience and speakers? Will you need to rerun certain sessions to facilitate reaching a wider audience? If you are working across multiple time zones, what steps can be taken to ensure accessibility? Providing pre-recorded talks before the event can allow people to submit questions and become more involved, while providing a recording of the event afterwards can allow it to be shared with people who could not attend live. Furthermore, consider providing a platform for continued discussions after the event to allow participants unable to attend live to share their opinions and ideas.

Dates for the event: When choosing dates for the event, researching possible time clashes early is important to avoid any issues later. This should include identification of national holidays, religious and holy days or times, and any other events that may

restrict attendance for some people. Avoid clashing with other conferences in similar or adjacent fields. The timing of an event may limit participation from particular groups and reduce diversity of participants.

3.1.3 Budget

Online conferences do not have many of the associated costs of an in-person event, such as room hire, catering and printing, but there are still likely to be some, particularly for technical support and accessibility planning as many free virtual platforms have limited capabilities (Barrows et al., 2021). Thoroughly research the various options to decide what mix of platforms and tools is most suitable for your event (see Section~~.~~ 2.6). If you do decide to charge attendance, try to minimise the fees and consider waivers for attendees from middle- and low-income countries. Be transparent to participants about where the money is being spent.

If running a hybrid event, the fees for those attending virtually should be considered carefully. Clearly, many of the costs associated with in-person attendance do not apply to someone attending remotely, but some costs remain, such as~~e.g.,~~ speaker expenses and running the online platform. The geoscience community is still trying to figure out how to charge for virtual attendance at hybrid conferences, but for example, the Mineralogical Society of the UK and Ireland typically charge virtual attendees fees 40–60% of those for in-person attendance. Other conferences, such as~~, and~~ the European Geophysical Union (EGU) have~~also~~ charged a slightly~~-~~ reduced registration fee for virtual attendees of their General Assembly. However, many events, such as the American Geophysical Union (AGU) Fall Meeting 2023 (AGU, 2023) still charged registration rates for virtual attendance ~~comparable~~ at the same rate as ~~to~~ in-person participation, without clear explanation of why virtual costs were so high, reducing accessibility to participants with limited funding.

However, there is a concerning trend of events not considering a virtual component due to potential high costs or fear of the unknown. When asking event organizers why there is no virtual element to an in-person event, the authors have frequently been told that this would require a full AV set up, which would be very costly and outside the budget of many smaller events. Alternatively, the authors have been told of dwindling attendance online as a reason for dropping virtual components, but this may be more linked to lack of true engagement opportunities online or high costs for virtual attendance as mentioned above. There are several simple steps that can be taken to include virtual components, including the use of microphones by in-person attendees for questions/talks (which are generally used at most in-person events as a norm) or sharing presentations through the virtual platform software so it's not a camera pointing at an angle to a screen. A lot can be achieved with low to no budget, by asking attendees in advance, asking for sponsorship, doing some research and a bit of creativity! Virtual components should not be dismissed before true consideration of how they can be included.

3.1.4 Technology and event format

Virtual events can offer much more flexibility than in-person events. Common virtual-event structures include a one-hour panel discussion or webinar, or a more extensive series of short talks and discussions. With no need for the audience to travel to the location of the event, sessions need not be consecutive or run on subsequent days. Talks may also be made available on

demand, allowing participants to pre-watch and share questions in advance to allow engagement beyondpast the live presentationswith or without the participant having previously attended a session. There are many approaches to running virtual events and new methods are continuously emerging which change how we engage online. There are opportunities to combine multiple formats through virtual events, with a level of flexibility not previously available. The format used should be adjusted to reflect the specific goals of the event (dissemination of research results, /audience, participation, feedback, networking, etc.). A good approach is to make fundamental decisions about structure (e.g., platform, talk availability through recordings/live presentations, poster session formats, hybrid or fully virtual format) as far in advance as possible, announcing details early in a clear, accessible and transparent way. Similarly, many people are not familiar or comfortable with some technologies and can get overwhelmed by new platforms and software and overly complex instructions, resulting in their exclusion from participation. Consider ways to overcome this such as making instructions as clear as possible, including annotated screenshots to help guide participants, or offering support through correspondence with participants and speakers.

There are several types of platforms and technologies which can be used for online events, each of which have different features and capabilities. As well as standard video-conferencing platforms such as Zoom and, Microsoft Teams, additional live streaming services such as YouTube, Streamyard or Twitch may be used to reach a wider audience. Ancillary services may be used alongside the main event platform in order to increase audience participation and inclusion (e.g., AhaSlides, Slideo) or to facilitate networking (e.g., Gather Town). Consider that many platforms or services may be unavailable in some countries, and consequently alternative ways of engagement may be needed to ensure full accessibility, depending on the target audience of the event- (such as using additional live streaming services and uploading gagreeing to upload recordings and transcriptions to alternative video hosting platforms afterward). Similarly, different platforms have different accessibility features; consider whether it offers options for reliable captions and screen-reader compatibility when deciding where to host your event. When choosing a platform or technology for your event, ensure they support the needs of your event.. If possible, ask the providers of the platforms you are using or find information online, for aspects such as; streaming capabilities and limitations, design options of events, reporting metrics, plugin options, customer support, and other accessibility features. Importantly, test the application of any platform or tool in advance of running the event to ensure it works in the way that you had desired.

3.1.5 Promotion and communication strategy

The promotional strategy will depend on your target audience. Different target audiences mean different ways of communication need to be considered. How will you ensure that event information is shared with all target audiences? How will you reach audiences outside of your network and engage people who are not traditionally involved? If your event is open to everyone, consider how your promotional strategy will make it clear that all people are welcome. For communication with speakers and other participants, announce deadlines early and remind people when they are approaching.

Social media platforms can be a great tool for spreading the word about an event, along with disseminating a registration link. Consider using social media platforms like Facebook, LinkedIn, X, Instagram, YouTube, TikTok, or any

other platforms you may be able to engage with potential participants. However, other methods should not be forgotten as many people do not engage with social media. Consider targeted email campaigns, printed posters for notice boards, and inclusion in newsletters and mailing lists. When utilising these methods, consider the accessibility of the content being distributed. Ensure the use of alternative (alt) text for online content and accessible design in the generation of any graphics (Section ~~5~~3.1.6; Chiarella et al., 2020; Jackson, 2020~~CHIARELLA REF~~). A social media campaign may help gain momentum and get the most interaction with other stakeholder groups. Plan several posts before the event, such as a save the date, speaker introductions, description of themes and registration links in the run up to the event to help increase engagement. Ensure adequate time to share the details as it can take a while for details to be circulated. Accessibility of social media plans should be discussed in advance to avoid inadvertent exclusion. Working with other groups to share event details can also help to reach a wider audience. Similarly, these groups could be used to discuss ideas and gain feedback on plans.

A word of caution: even for free events, it is a good idea to require prior registration by the participants. Unfortunately, there have been instances~~,~~ where meeting links w~~h~~ere shared publicly on social media, resulting in so-called 'Zoom bombings', where individuals shared inappropriate content or otherwise disrupted the session. Prior registration minimizes the risk of such disruptions. Additionally, a designated person should be ~~in~~ charged with handling such situations promptly by blocking and removing that individual.

3.1.6 Specific tips for accessibility and inclusion

~~There are several accessibility challenges to be considered for event planning, e.g., screen-sharing means screen readers cannot describe images as they are being presented. There are some straightforward solutions to address these challenges, including sharing of presentations prior to the event, with some more specific examples outlined below.~~

Closed captions/subtitles: Closed captions or subtitles are critical to maximise engagement with any event for a variety of reasons. For example, people with hearing impairments and people whose first language is different from that of the conference may depend on these to fully engage with the material being presented (Cooke et al., 2022; Dello Stritto and Linder, 2017). Captions or subtitles may help people from all backgrounds to keep focused on the materials being presented, or if they are in a noisy area, as not everyone has access to quiet working spaces. ~~Further, they can also help people overcome screen fatigue for virtual events and help participants to stay more engaged overall.~~ It is important to highlight that closed captions (assumes audio cannot be heard, includes sound effects) and subtitles (dialogue transcriptions only, assumes other audio can be heard) offer different benefits, and for any event~~,~~ the more relevant form should be selected (Rev, 2021).

Closed captions/subtitles can be deployed in a number of ways: many virtual event platforms offer in-built auto-generation options and third-party artificial intelligence (AI) services are also available, though there may be issues with accuracy if using auto-generated captions (Besner, 2019; Leduc, 2020). Other services, such as Communication Access Realtime Translation (CART, 2024) have reviewed positive reviews, but if going with auto-captioning, research on the accuracy and reliability of the service should be undertaken. Human transcription services are often more accurate than auto-

generated and so are preferable, but they will typically cost more and may not be possible live. Research before the event is needed to see what options are available and which service is available in your region or meets your audience's needs. Legal requirements for closed captions during virtual events vary with geography and institution so check those relevant to you before making any decisions. However, if the event is hybrid, it is crucial to ensure in-person attendees use a microphone so all, including virtual attendees, can clearly hear the comment/questions/talk. Online attendees also need to use good audio connections, but the traditional 'shouting a question to the speaker' approach of many in-person events, will exclude online attendees completely, and consequently result in inaccurate captions and transcriptions.

~~*Transcriptions:*~~~~*Transcripts*~~*Transcriptions:* Transcripts can be helpful in keeping a record of discussions and debates that take place during an event, and can consequently be used as a resource to write up conference papers or blogs to share outcomes after the event. ~~Plan to provide a written record of the session after it has taken place.~~ These can be auto-generated by most video conferencing platforms or provided by a third-party AI service. Check the quality of any transcripts before providing them to attendees, particularly if auto-generated by software. However, the use of third-party transcription services comes with a potential breach of privacy: all captioning services require access to speakers' content, and depending on terms of service associated with individual services may claim exclusive rights to processed user content. As well as a potential privacy violation for the individuals affected, this could be counter to institutional protocol on data protection, and can potentially violate the EU's General Data Protection Regulation (Distelmeyer, 2023). Choice of an AI closed captioning service should therefore consider data usage, and informed consent must be obtained from all speakers before a captioning service is used. Data protection is also something that should be considered for use of all online platforms, especially those that collect user information (e.g., emails), but more discussion on data protection needs to be had to fully understand the potential impact.

~~Transcripts can be helpful in keeping a record of discussions and debates that take place during an event, and can consequently be used as a resource to write up conference papers or blogs to share outcomes after the event.~~ Before the event, a person should be assigned transcription reviewing, as this can be a time consuming process. Also consider the availability and accessibility of these resources: Can anyone access them? Will they be shared in a follow up email or linked with recordings? Do people need to contact the organizing committee for them? Whatever the decision, this needs to be communicated clearly to participants before and during the event.

Languages: Many people may be presenting and participating in their second or third language. Be patient and respectful of the fact that people may be more accustomed to a different language than that which the event is held in. Consider running parts of the event, including social events, in a language other than the main language, depending on the demographic of participants. Similarly, providing support for speakers that may not be presenting in their native language may help ensure people are comfortable while presenting. These could include mentorship opportunities, practice runs or feedback services, and could significantly help people's confidence in taking part in an event. As with transcripts and closed captions, AI can offer the possibility of live translation, partially circumventing language barriers and improving accessibility, although this is

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still an emerging ~~this~~ technology and has limitations. ~~again does not provide as good quality a service as a trained human professional. As with closed captions, AI offers the possibility of live translation, partially circumventing language barriers and improving accessibility. However, the use of third-party transcription services comes with a potential breach of privacy: all captioning services require access to speakers' content, and depending on terms of service associated with individual services may claim exclusive rights to processed user content [source]. As well as a potential privacy violation for the individuals affected, this could be counter to institutional protocol on data protection, and can potentially violate the EU's General Data Protection Regulation (Distelmeyer, 2023). Choice of an AI closed captioning service should therefore data usage, and informed consent must be obtained from all speakers before a captioning service is used.~~ Sign

~~*Sign language:* Sign~~ language interpreters offer another way for people with hearing difficulties to engage with content. However, forms of sign languages vary globally, and consideration needs to be given to what is most relevant to your event, whether including sign language options would be appropriate, and if not, what alternatives can be utilised to ensure accessible content.

Accessibility in presentations: Issue guidelines to participants about how to make slides accessible (AHEAD, 2023a; b). In particular, be mindful of colour schemes and typefaces which may cause legibility problems for participants with colour vision deficiency, dyslexia or similar (Wickline, 2000; De Paor et al., 2016). There are several resources available to check accessibility (e.g., Colour Oracle, Coblis - Color Blindness Simulator). Further, the amount of text on a single slide, the colour of the text and the contrast between text and background are all important considerations. Avoid placing important information at the bottom of the screen where it may be covered by subtitles/captions. Marks (2018) is one example of a comprehensive guide on how to make and deliver an accessible and inclusive presentation which could be shared in advance to help presentation planning, however, there are numerous options available to utilise.

Social media: If planning a social media campaign (as described in Section~~.~~ 2.1.6), the accessibility of posted content needs to be thought about in advance. Each platform offers different accessibility features that should be researched in advance. Ensure the use of alt text if using graphics, and that graphics are designed in an accessible way (e.g., fonts, colour schemes). There are many other considerations, such as avoiding the overuse of emojis or ensuring the use of capital letters in hashtags (i.e., camel case) to help screen readers engage more meaningfully with content. Consider assigning dedicated people to research social media accessibility to ensure your content is accessible to everyone.

Other considerations: The inclusion of breaks during an event to allow rest is a crucial step to allow people to recover from screen-time and prevent overstimulation. For online conferences, this could take the form of ensuring a conference's schedule is well staggered to allow breaks and rest periods. For in-person elements of hybrid events, follow best practice for in-person events (e.g., separate spaces for different needs). There are several extensive reviews of in-person accessibility needs which

can be explored, but which are not the focus of this paper, including, EOWG (2022), Council of Ontario Universities (2016) and Felappi et al. (2017).~~, such as outlined i~~ ~~conferences, have quiet spaces in place e.g., for people to de-compress, breast-feed or pump breast milk, but it is important to ensure separate~~eperate spaces are provided for different purposes~~. Also, consider providing sensorysesnsory room(s) and fidget toys for in-person attendees to utilise. Having water refill stations and food (including dietary specific options)~~

~~for sale or for free available for the participants on-site is another helpful consideration so people do not have to go too far, which may be an access barrier. Similarly, if serving coffee and tea, have decaffeinated options available, or alcohol-free beverages if serving alcohol.~~

~~3.1.7 Presentation format~~

3.1.7 Presentation format

Virtual events offer a unique opportunity to have various styles of presentation. Talks within a conference session (or similar) may be either live (given on the day), pre-recorded (recorded in advance, with the recording shared during the event), or a combination of the two. There are many benefits to both styles, but pre-recorded talks allow for more accessibility options, and they will ensure exact timings are maintained during the event. This is particularly useful if running a larger-scale conference with multiple short talks or with multiple parallel sessions. However, care should be given to what your choice means in terms of accessibility as screen readers may not be able to engage with presentations shared through a pre-recorded video (Vasquez, 2021), so this should be made available beforehand to allow people to engage more meaningfully. There are several pros and cons to both formats, with some summarised below:

Live talks during fully virtual and hybrid events:

Pros:

- Less preparation time for both speakers and organisers when talks are presented live, as no re-recording is needed to change any mistakes and organisers do not need to assign someone to review videos prior to an event.
- More familiar to speakers, less likelihood of technology problems. However, the use of microphones for clear communication is important to ensure full accessibility, or headsets with clear microphones/are in a quiet spoca with reduced background noise.
- Makes live ~~question:/response~~question: response more seamless.

Cons:

- Requires steady internet with no unexpected outages.
- Requires presence at the computer at a certain time which can create~~-~~ difficulties with time zones, childcare, balancing with other work obligations etc.
- Only live captions are possible, whether from AI or live transcription services, which may not be perfect and require additional funding.

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Pre-recorded talks:

Pros:

- May decrease the potential for stage fright or anxiety as the speaker can remove errors. However, this is something of a double-edged sword, as the lack of specific timelines can cause people to devote excessive time to preparation and recording, leading to undue stress, whereas live talks do not have the option of ~~re-recording~~ multiple do-overs~~times~~.
- Allows flexibility for recording time as the presentation is submitted in advance, and it allows organizers to plan for effectively as they will know the exact time for each talk.
- Presence at the time of the event is not essential, although it is still useful/important to be present to answer questions (see below) and to avail of possible networking opportunities.
- Potential for talks to be watched "on demand", although consent should be sought from participants for talks to be hosted online in a way that facilitates this.
- If videos are clearly recorded, the audience would likely not be aware of it being pre-recorded unless told in advance and could help avoid technical issues with speaker internet connection.
- Crucially, allows time for preparation of accurate subtitle files rather than relying on AI. Subtitles can be checked against the video in advance and corrected if necessary. Transcripts can be prepared in advance and distributed prior to, or on the day of, the conference, allowing people to follow along with the talks on-screen.
- Participants can choose to watch the video at a faster or slower speed, according to their needs.

Cons:

- The presentation may take longer to prepare. If mistakes (in content or accessibility) are noticed after submission, correcting this and re-recording creates an additional burden and can cause significant delays.
- Who is responsible for providing captions of the video? Not everyone has experience or awareness on how to do this – will you be providing guidance or assigning someone to produce the captions? Presenters could be given guidance on how to create captions using different platforms, or if pre-recording, some technologies provide auto captioning (e.g., google slides). This needs to be discussed and decided in the early planning stages, ensuring transparency at all levels.
- Video recording tools are not necessarily intuitive; at the very least this requires recommendations from organizers about which software are available to use. Additional resources may be required for people to be able to produce their own videos.
- If people are not familiar with sharing videos, technology challenges may cause delays to schedules, so practice runs are needed to avoid any glitches on the day of events. Provide recordings if participants are not able to attend a practice session.

- Not suitable for all kinds of sessions. Although they can be recorded and rewatched afterwards, panel sessions are generally delivered live. Other options are possible for panel sessions to make them more inclusive to a wider range of people, including consideration of recording the session and using predetermined questions and post event discussion platforms ~~must originally be live as all panellists and audience need to be present at the same time~~.
- Some~~Many~~ people do not like watching pre-recorded talks as it seems less personal.

There is room for a combination of these two categories: for example, pre-recorded talks could be made available as a backup in case of internet connection issues, or pre-recorded videos could be livestreamed as if given live but with pre-prepared subtitle files. A willingness to be flexible in your approach to accommodate the different needs of your presenters and attendees will go a long way, though it is also important to be mindful of going too far the other way and creating too much of a logistical burden for the event organisers.

3.1.8 Other considerations for the pre-event organising stage

Code of conduct, etc: An equity, diversity and accessibility statement should be prepared and shared in advance of the event through promotional materials, social media postings, website pages and any other platforms available. This should be shared again during the event introduction. Take time before the event to come up with a code of conduct and other housekeeping information and provide this document to both speakers and attendees before the event. A code of conduct should include a list of what is/is not permitted, and also any consequences there may be for those who choose not to abide by it. Consider having a way for people to signify they need assistance from a member of the conference team, such as using ~~the~~ a ~~"raised hand~~specific~~" feature or a particular~~ emoji reaction included in most video conferencing software, ensuring explanation during the event. Give clear guidance on how violations will be reported and dealt with (e.g., email, private chat function, removal of participants). Consider where participants will go ~~to~~ for assistance during both fully virtual and hybrid events in advance to ensure help is given in an effective manner.

Planning document: ~~Before the event~~, Cereat~~e~~ing a central document or record with all details that may be needed on the day before the event~~should be generated~~. This can act as a central database for all relevant information and help address any challenges that arise during the event. This should contain any prepared statements (e.g., code of conduct, Q&A process, information on recordings if available, follow up statement) along with logistics information (speaker lists and contact details, access links, announcements). All volunteers should have access to this resource before the event. A similar document should be designed for presenters to give all relevant information, links, pre-planned questions, and other logistics and help ensure smooth running on the day.

Pre-event accessibility questionnaire: To help ensure the needs of participants are met for your event, a pre-event questionnaire should be thought about and distributed to gain insights into the accessibility needs of your participants. This form could be

linked with registration, depending on the platform being used (e.g., EventBrite) or circulated through social media/email lists. This will greatly help planning, and ensure that people's needs are met for full inclusion during the event.

Networking Features: Consider innovative networking features as a way to help foster new engagement during online events. This is particularly important for hybrid events which may not have large online engagement from in-person attendees who fear missing out on other opportunities. Restrictive networking opportunities may reduce online engagement, so consider what your platforms offer to increase connectivity (e.g., group chats, roundtables, matchmaking). Consider gamifying online elements to promote wider engagement and networking.

3.2 Stage 2: During the event

Much of the work for the actual running of the event will have been done in Stage 1, and this is why it is such a crucial step in (virtual) event planning. This section discusses how some of the more specific features may run on the day, with accessibility in mind, and includes elements that should be defined in the pre-event stage.

Volunteers and staff: What volunteers or staff are needed for during the event? While many events will need volunteers and staff to host sessions or run discussions, there are many other roles that should be considered beforehand to ensure the smooth running of an event, including technical support. All volunteers and staff should be confirmed before the event with expectations clearly outlined and know what their role is. A plan for communication during the event should be considered, to deal with daily communication and any issues that arise (e.g., messaging platform, emails).

Questions from the audience: Make sure the audience has the option to ask questions either verbally or in text (e.g., through a chat box function) and clearly explain how questions can be asked at the start of the event to ensure full inclusion. Many platforms offer a 'raised hand' feature that can be used to avoid disruption to a presenter and if audience members have the option of ~~live~~ asking a question in real time. If the event is also being streamed to another platform (e.g., YouTube), ensure someone is responsible for monitoring for questions on the second platform to allow all audiences to engage. Consider not recording the questions and answers part~~,~~ to lower the hurdle of asking a question. During both online and hybrid events (particularly during the in-person part of a hybrid event), make sure all people asking questions use a microphone as some assistive technologies are dependent on their use.

Introductions: When introducing and ~~/~~talking to people, use gender-neutral language, do not assume pronouns, and if possible, ask people their pronouns before the event. This can form part of the introduction package that should be developed before the event (Section 2.1.9). If a mistake happens, there are a lot of resources that can help to learn the correct way to respond (e.g., Pronouns.org, 2023). Avoid binary turns of phrase like 'Ladies and Gentlemen' or gendered terms such as 'Welcome Guys!', which may inadvertently exclude people with non-binary gender identities. Encourage people to include their pronouns in their

online tag. However, there are many reasons why people might not want to publicly declare their pronouns, so this should always be optional. When speakers introduce themselves, it can be helpful for people with visual impairments for them to give a short visual description (e.g., I have brown shoulder-length hair and today I am wearing a stripy white and yellow jumper) but do not force this as not everyone will be comfortable with carrying out self-descriptions (see IDEA, 2021 for other examples).

Camera etiquette: Do not insist that cameras be switched on, as this may not be possible for every attendee, and people may request not to be on camera. Streaming attendees' videos can be problematic for people with a poor internet connection. Video fatigue (Bailenson, 2021) is also a reality, and if an event is going on for several hours, people need a break from being watched. Request participants not have moving backgrounds, as these use excessive bandwidth and may be distracting for other participants.

Event etiquette: Remind people of the code of conduct at the start of every session including how/to whom to raise any concerns. If parts of the session are being recorded, let the audience know this at the start of the session.

Data and analytics: If the chosen platforms allow access to data and analytical tools to measure online engagement, make sure to avail of them during the event and use them during~~use during~~ post-conference review.

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Social media activity: Using social media during an event, to share discussions, ideas and outcomes can be a great way to encourage participation from a wider audience. Permission should be obtained for sharing anyone's research or image, and contents should be shared with accessibility in mind (e.g., alt text).

3.3 Stage 3: After the event

Any activities for the post-conference phase (e.g., follow-up emails) should be planned in advance because people often need to take time away after event planning and there may be limited volunteers and staff help for carrying out any after-the-event plans. There are several aspects that should be considered, with some examples below.

Recordings and Transcripts: If providing recordings, ensure that full, accurate transcripts are available and that any subtitles/captions uploaded are correct. Reviewing captions and transcripts can be a time-consuming process, so ensure that enough volunteers and time are available for this. Decide in advance how soon after the conference you expect these to be available, communicate this to participants and keep to this deadline.

Follow-up email: Whilst this is optional, it can be helpful to direct attendees (or those who registered but could not attend) to any available recordings and relevant links~~/~~ and information and should be planned in advance~~.~~ This also provides an

opportunity for people to give feedback if requested through questionnaires or polls (see below). Make sure to provide a way for participants to share their experiences and thoughts which can be used to build on for future events.~~.~~

Feedback: Measuring feedback can be difficult, but a short questionnaire (or equivalent) could be included in the follow-up email. This will require additional support to review and analyse the feedback, but it can be a great way to learn how to improve accessibility for future events, which will be particularly useful if running an event for the first time. Consider asking for feedback related to session engagement, diversity, technology experiences and overall attendee enjoyment and accessibility. However, be mindful of overwhelming the audience with surveys. There are different ways to collect feedback (e.g., polls on virtual platforms, interactive presentations, message boards), so consider what works best for your event and research what other events have done to maximise feedback collection. Additionally, feedback should be something people have the opportunity to provide throughout an event, not just afterward. Consider using QR codes and~~or~~ posting links regularly for attendees to access feedback forms.

Communication channels: How can people get in touch with you/the organising team post-event? If using an email, someone will need to monitor this and answer any questions. Some events may also have corresponding Slack/Discord/other platform channels to help participants network and discuss more between themselves. If this is something to be launched for the event, it will need consideration at an early stage to ensure engagement and accessibility. Also consider how long after the event this will continue to be live, and communicate this to participants early.

Certificate of attendance: Some participants may be required by their workplaces or university to produce a certificate of attendance for the event. Appoint a volunteer to respond to such requests.

4 Conclusions & Summary of Lessons Learned

The global COVID-19 pandemic caused a drastic shift in the way people communicate with each other. Many people were forced into working from home due to lockdowns, causing working groups and research teams to utilise video conferencing technologies far more frequently to ensure continued collaboration and connectivity. The restrictions on travel both locally and internationally also had a drastic impact on geoscience events. As the pandemic progressed, many planned in-person events began to be redesigned for a virtual platform, with novel and innovative ways created for participants to communicate and network with each other. This virtual network has led to many new collaborations between people who may have never met in-person, and it has also helped to strengthen relationships already in place, allowing for a more diverse, interconnected, and effective research community across the world.

However, this move to a virtual landscape was sudden and consequently consideration has not always given to the accessibility of these virtual platforms and events. Whilst we are currently seeing a resurgence in the number of purely in-person events, the use of virtual and hybrid platforms is likely to continue, with many virtually-based groups now in existence, and flexible and remote working options having been established. The move to a virtual and hybrid landscape also highlighted the geographical and socio-economic disparities of in-person event accessibility, with the financial and logistical burden of travel to events being felt by some researchers more than others. This has led to inequalities of opportunity and to biased attendances at international in-person conferences which do not represent the entire spectrum of researchers. Consequently, moving back ~~Further, moving back~~ to purely in-person events would dismiss the lessons learned in event accessibility over the past several years, and lead to the renewed exclusion of many people ~~progress in accessibility and inclusion they have provided~~.

In cases where virtual components of an event have not been successful, future virtual elements should not be dismissed to avoid future exclusion (Niner, 2021). Reflection on why an event (or a component of one) was not successful, asking for feedback where possible, and learning from other examples~~,~~ is suggested to create recommendations for how to try and make future events more inclusive and engaging. It is important to discuss and plan accessibility and inclusion early in event planning to ensure a safe and engaging environment for all potential participants (Gibson, 2021). Virtual conferences will only become truly accessible and inclusive if the entire community actively works towards it (Niner, 2020), with active consideration and discussion of best practices for different people. This includes consideration of which communities are best served by best practice guidelines, and continual re-examination of procedure as technology and expertise develop new methodologies for increasing success of conferences for everyone. As new ways of interacting with each other continue to be established, we need to remember the lessons learned from the initial move to virtual events. If thought and consideration are not put into the virtual part of future online and hybrid events, then these will not be effective and may exclude most ~~some~~ participants.

In summary, there are some key considerations identified that can help with event planning to act as a starting place for planning an inclusive and accessible virtual event:

- Accessibility needs to be part of the planning phase, not an afterthought.
- Decide early on the dates, length, purpose and title of the event, and communicate this information early and clearly.
- Ensure diversity of the planning committee and speakers to ensure different ideas and viewpoints are considered. Different perspectives are needed from the people that will be most impacted by the choices being made (e.g., Kingsbury et al., 2020).
- Ask participants about their virtual access needs before the event and then ensure these needs are met throughout the event. Consider providing a way for people to communicate real time needs during the event and have a plan in place to address any challenges that arise.
- Clearly outline planning/time commitment involved for volunteers/organisers and decide on roles (and associated responsibilities) before the event, so everyone knows what they're doing and when they are needed (feeds into

communication). Ensure enough volunteers or staff for the event being organized. It can be quite overwhelming to try to do multiple things (e.g., monitor chat and feed panel questions).

- Evaluation of the event can be achieved through a short survey (prepare this during the pre-planning phase) sent to participants shortly after the event. Asking about location/career stage/etc.~~.~~ can help monitor and evaluate where your network reaches and help in future event planning.
- Accessible and open c~~C~~ommunication is key! Ensure opportunities for people to provide and receive information on all aspects of the event.

While there are doubtless many other considerations around virtual accessibility not covered here, we hope that this article can provide a checklist for those who wish to curate more inclusive and accessible virtual events going forward.

5 Author contribution

ALD, VRD and BW contributed equally to the formation of the article, including the initial draft development. KM, RAW, AA, IC, CC, DY, MD, and LK all contributed to writing, reviewing and editing of drafts, and adding their experiences and ideas, leading to the submitted version.

6 Competing interests

No competing interests are known at the time of submission.

7 Ethical statement

This article was produced during volunteered time by the authors and was not funded by any external group or award. As no humans or animals were included in this work, and no personal information has been shared, no ethical review was required.

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References

Abeyta, A. & Fernandes, A., & Mahon, R., & Swanson, T.: The True Cost of Field Education is a Barrier to Diversifying Geosciences. DOI: 10.31223/X5BG70, 2021.

Accessible U - Social Media Guide for online accessibility: accessibility.umn.edu/what-you-can-do/create-accessible-content/social-media, last access: 23 January 2023.

Achakulvisut, T., Ruangrong, T., Mineault, P., Vogels, T.P., Peters, M.A.K., Poirazi, P., Rozell, C., Wyble, B., Goodman, D.F.M., Kording, K.P.: Towards Democratizing and Automating Online Conferences: Lessons from the Neuromatch Conferences. Trends Cogn Sci. 2021 Apr;25(4):265-268. doi: 10.1016/j.tics.2021.01.007 Feb 16. PMID: 33608214. 2021.

AGU Register & Attend webpage for the AGU23: https://www.agu.org/fall-meeting/pages/attend/register, last access: 1st December 2023.

AHEAD, 2023a, Creating Inclusive Environments in Education and Employment for People with Disabilities: Accessible PowerPoint Presentations: https://ahead.ie/wam-remoteworking-resources-powerpoint, last access: 17 February 2023.

AHEAD, 2023b, Creating Inclusive Environments in Education and Employment for People with Disabilities: PowerPoint Presentation Accessibility Guidelines: https://www.ahead.ie/allyship-accessible-comms-presentation, last access: 17 February 2023

Allen, M.: Virtual conferences are more inclusive and greener, Phys. World 35 (2) 11i, 2022.

Anderson, T.: The Virtual Conference: Extending Professional Education in Cyberspace. International Journal of Educational Telecommunications, 2, 121-135, 1996.

Amarante, F. B. D. and Haag, M. B.: Earth Science for all? The economic barrier to Geoscience conferences, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-1653, 2024.

Bailenson, J. N.: Nonverbal Overload: A Theoretical Argument for the Causes of Zoom Fatigue. Technology, Mind, and Behavior, Technology, Mind, and Behavior, 2, 1-6, https://doi.org/10.1037/tmb0000030, 2021.

Barrows, A. S., Sukhai, M. A., and Coe, I. R.: So, you want to host an inclusive and accessible conference? FACETS, 6, 131-138. https://doi.org/10.1139/facets-2020-0017, 2021.

Besner, L.: When Is a Caption Close Enough? The Atlantic: https://www.theatlantic.com/health/archive/2019/08/youtube-captions/595831/, last access: 10 August 2022, 2019.

Bigg, C., Reinisch, J., Somsen, G., and Widmalm, S: The art of gathering: histories of international scientific conferences, *The British Journal for the History of Science*, 56(4), 423–433. https://doi.org/10.1017/S0007087423000638. 2023.

Black, A. L., Crimmins, G., Dwyer, R., & Lister, V.: Engendering belonging: thoughtful gatherings with/in online and virtual spaces, Gender and Education, 32:1, 115-129, DOI: 10.1080/09540253.2019.1680808, 2020.

Blow, N. S.: Making the conference scene virtual. *Biotechniques*, *50* (4), 203. https://doi.org/10.2144/000113642, 2011.

Busse, B., & Kleiber, I.: Realizing an online conference: Organization, management, tools, communication, and co-creation. International Journal of Corpus Linguistics. 25. 10.1075/ijcl.00028.bus, 2020.

CART: Communication Access Realtime Translation. Online webpage, National Association of the Deaf, https://www.nad.org/resources/technology/captioning-for-access/communication-access-realtime-translation/, last accessed June 20th 2024, 2024.

Chandler, J.: VGC 2016: Second Virtual Geoscience Conference. Photogrammetric Record, 21(156): 469–470, 2016.

Chatterjee, D.: How international conferences fail scholars from the global South: International Affairs Blog. Available at:medium.com/international-affairs-blog/how-international-conferences-fail-scholars-from-the-global-south-fbde14e5d1f1,last accessed 31/08/2023, 2022.

Chautard, A.: Inclusive conferences? We can and must do better – here's how. Available at: https://blogs.lse.ac.uk/impactofsocialsciences/2019/06/06/inclusive-conferences-we-can-and-must-do-better-heres-how/#:~:text=Many%20minorities%20also%20experience%20challenges,diversity%20should%20span%20beyond%20panels, last accessed 01 November 2023, 2019.

Chiarella, D., Yarbrough, J., and Jackson, C. A. L. Using alt text to make science Twitter more accessible for people with visual impairments. Nature communications, 11(1), 5803, 2020.

Cooke, M., Child, C. R., Sibert, E. C., von Hagke, C. and Zihms, S. G.: Caption This! Best Practices for Live Captioning Presentations, Eos, 101, https://doi.org/10.1029/2020EO1502462, 2022

Correia, S., Disadvantages of Online Events, Available at: blog.digitalnexa.com/disadvantages-of-online-events, last accessed: 31 August 2023, 2021.

Formatted: Superscript

Council of Ontario Universities: A Planning Guide for Accessible Conferences. How to organize and inclusive and accessible event. Online guide, available at: https://www.accessiblecampus.ca/wp-content/uploads/2016/12/A-Planning-Guide-for-Accessible-Conferences.pdf, ISBN: 0-88799-489-X, 2016.

de las Heras, A., Gómez-Varela, A.I., Tomás, M.-B., Perez-Herrera, R.A., Alberto Sánchez, L., Gallazzi, F., Santamaría Fernández, B., Garcia-Lechuga, M., Vinas-Pena, M., Delgado-Pinar, M., González-Fernández, V.: Innovative Approaches for Organizing an Inclusive Optics and Photonics Conference in Virtual Format. Optics, 4, 156–170. https://doi.org/10.3390/opt4010012, 2023.

Dello Stritto, M. E. and Linder, K.: A Rising Tide: How Closed Captions Can Benefit All Students: https://er.educause.edu/articles/2017/8/a-rising-tide-how-closed-captions-can-benefit-all-students, last access 10 August 2022, 2017.

De Paor, D., Karabinos, P., Dickens, G., Atchison, C.: Color Vision Deficiency and the Geosciences. GSA Today, 27, 6, 42-43, doi: 10.1130/GSATG322GW.1, 2016.

Distelmeyer, J: Video conferencing as programmatic relations: conditions, consequences and mediality of Zoom & co. In: *Video Conferencing: Infrastructures, Practices, Aesthetics.* Volmar, A., Moskatova, O. and Distelmeyer, J. (eds). 1st edition. Bielefeld, Germany: transcript Verlag (Digitale Gesellschaft). https://doi.org/10.14361/9783839462287**,** 2023

Dowey, N., Barclay, J., Fernando, B., Giles, S., Houghton, J., Jackson, C., Khatwa, A., Lawrence, A., Mills, K., Newton, A., Rogers, S., and Williams, R.: A UK perspective on tackling the geoscience racial diversity crisis in the Global North. Nature Geoscience 14, 256–259. https://doi.org/10.1038/s41561-021-00737-w, 2021.

EDIG, Franklin, J.: Equity, diversity and inclusion in Geoscience (EDIG) survey results. EDIG 2020 Conference, Online, 14-16 December, 2020, www.youtube.com/EDIGConference, 2020.

Ekandjo, H., and Belgrano, T.: Value for Value: End the Parachute Science Era. SEG Discovery 2022; (128): 1–76. doi: https://doi.org/10.5382/SEGnews.2022-128, 2022.

Erickson, T, Shami, S.N., Kellogg, W.A., and Levine, D.L.: Synchronous interaction among hundreds: an evaluation of a conference in an avatar-based virtual environment. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI' 11). Association for Computing Machinery, New York, NY, USA, 503–512. https://doi.org/10.1145/1978942.1979013, 2011.

EOWG, Making Events Accessible: Checklist for meetings, conferences, training, and presentations that are remote/virtual, in-person, or hybrid , Education and Outreach Working Group (EOWG) online webpage developed with the WAI-AGE Project, available at: https://www.w3.org/WAI/teach-advocate/accessible-presentations/, last accessed: 21st June 2024, 2022.

Formatted: Superscript

Eventcube:, How The Events Industry Has Adapted to COVID19 By Going Virtual (A Study). Online blog available at: www.eventcube.io/blog/how-the-events-industry-has-adapted-to-covid19-by-going-virtual, last accessed: 31 August 2023.

Eventforce: 8 Key Mistakes to Avoid When Planning Hybrid Events. Blog, available at: https://www.eventsforce.com/blog/8-key-mistakes-to-avoid-when-planning-hybrid-events/, last accessed: 30th May 2024, 2024.

Federico, M., and Furini, M.: Enhancing Learning Accessibility through fully automatic captioning: Conference: International Cross-Disciplinary Conference on Web Accessibility (W4A 2012), DOI:10.1145/2207016.2207053, 2012.

Felappi, G., Gregory, A., and Beebee, H.: Guidelines for Accessible Conferences - A guide by the British Philosophical Association and the Society for Women in Philosophy UK. British Philosophical Association, Online guide, available at: https://bpa.ac.uk/wp-content/uploads/2018/11/BPA_SWIP-Guidelines-for-Accessible-Conferences.pdf, 2017.

Fleming, N.: What's on the agenda for post-pandemic meetings?: Nature Career Feature article, DOI: https://doi.org/10.1038/d41586-020-02254-z, 2020.

Foramitti, J., Drews, S., Klein, F., & Konc, T.: The virtues of virtual conferences, Journal of Cleaner Production, 294, 126287. https://doi.org/10.1016/j.jclepro.2021.126287, 2021.

Fraser, H., Soanes, K., Jones, S.A., Jones, C.S., Malishev, M.: The value of virtual conferencing for ecology and conservation. Conserv Biol., 31(3):540-546. doi: 10.1111/cobi.12837. Epub 2017 Feb 2. PMID: 27624673, 2017.

Fu, Y., and Mahony, S.: Toward implementing equality, diversity, and inclusion for virtual conferences within the LIS professions. Journal of Librarianship and Information Science 1–15, https://doi.org/10.1177/09610006231164145, 2023.

Fulcher, M.R., Bolton, M.L., Millican, M.D., Michalska-Smith, M.J., Dundore-Arias, J.P., Handelsman, J., Klassen, J.L., Milligan-Myhre, K.C., Shade, A., Wolfe, B.E., Kinkel, L.L.: Broadening Participation in Scientific Conferences during the Era of Social Distancing. Trends Microbiol. 2020 Dec;28(12):949-952. doi: 10.1016/j.tim.2020.08.004. Epub. PMID: 32978058; PMCID: PMC7507981,1, 2020.

Gibson, H., Illingworth, S., and Buiter, S.: The future of conferences: lessons from Europe's largest online geoscience conference, Geosci. Commun., 4, 437–451, https://doi.org/10.5194/gc-4-437-2021, 2021.

Gichora, N.N., Fatumo, S.A., Ngara, M.V., Chelbat, N., Ramdayal, K., Opap, K.B., et al., Ten Simple Rules for Organizing a Virtual Conference—Anywhere. PLoS Comput Biol 6(2): e1000650. https://doi.org/10.1371/journal.pcbi.1000650, 2010.

Giles, S., Jackson, C. & Stephen, N.: Barriers to fieldwork in undergraduate geoscience degrees. Nat Rev Earth Environ 1, 77–78, https://doi.org/10.1038/s43017-020-0022-52, 2020.

Formatted: Superscript

Gottlieb, M., Egan, D.J., Krzyzaniak, S.M., Wagner, J., Weizberg, M., Chan, T.: Rethinking the Approach to Continuing Professional Development Conferences in the Era of COVID-19. J Contin Educ Health Prof. Summer; 40(3):187-191. doi: 10.1097/CEH.0000000000000310. PMID: 32658014, 2020.

Greene, S, Antell, G, Atterby, J, Bhatia, R, Dunne, E, Giles, S, Groh, S, Hanson, E, Hilton, J, Knight, H, Kraftl, P, Morgan, E, Rhodes, I, Rockey, F, Singh, S, Stevenson, C, Sun, S, Warren, B, Wheeley, J & Yamoah, K.: Safety and belonging in the field: a checklist for educators: EarthArXiv. https://doi.org/10.31223/x53p6h, 2021.

Graham, S.: How COVID-19 Is Changing the Future of Virtual Events. Online blog available at: www.g2.com/articles/how-covid-19-is-changing-virtual-events, last accessed: 31 August 2023, 2023.

GRL: Limiting alcohol during professional events, Geocognition Research Laboratory: geocognitionresearchlaboratory.com/2020/07/02/limiting-alcohol-during-professional-events/, last access 17 February 2023, 2022.

Gunawardena , C.N., Nolla,A.C., Wilson, P.L., Lopez-Islas, J.R., Ramirez-Angel, N., Megchun-Alpizar, R.M.: A cross-cultural study of group process and development in online conferences, Distance Education, 22:1, 85-121, DOI: 10.1080/0158791010220106, 2001.

Harabor, D., and Vallati, M.: Organising a Successful AI Online Conference: Lessons from SoCS 2020., 2020.

Heim, M.: Humanistic Discussion and the Online Conference Heim, Michael Philosophy Today; Winter 1986; 30, 4; ProQuest pg. 278, 1986.

Huntoon, J. E., Tanenbaum, C., and Hodges, J.: Increasing Diversity in the Geosciences: https://eos.org/science-updates/increasing-diversity-in-the-geosciences, last access 24 February, 2023, 2015.

IDEA Inclusive AD Forum: Self-description for inclusive meetings, Royal Holloway University of London and VocalEyes:vocaleyes.co.uk/services/resources/digital-accessibility-and-inclusion/self-description-for-inclusive-meetings/, last access 17 February 2023, 2021.

Jackson, C. A. L.: Using alt text to make science Twitter more accessible for people with visual impairments. Nature communications, 11(1), 5803, 2020.

Jain, V.: Virtual And Hybrid Events Are More Than Just A Covid-Era Fix: Forbes Council Blog. Available at: https://www.forbes.com/sites/forbesbusinesscouncil/2022/12/20/virtual-and-hybrid-events-are-more-than-just-a-covid-era-fix/, last accessed: 31 August 2023, 2022.

Kamalnath, A.: Diversity quotas will only lead to token appointments, doing more harm than good. Online article, the Conversation. Available at: theconversation.com/diversity-quotas-will-only-lead-to-token-appointments-doing-more-harm-than-good-132244, last accessed: 31 August 2023, 2020.

King, M., and Kovács, B.: Research: We're Losing Touch with Our Networks. Online article, available at: https://hbr.org/2021/02/research-were-losing-touch-with-our-networks, last accessed 31st May 2024.

Kohler, T.: Accessibility and Inclusivity: Study Guide. Online blog, available at: https://www.nngroup.com/articles/accessibility-inclusivity-study-guide/, last accessed 331st May 2024, 2023.

Formatted: Superscript

Formatted: Superscript

925 Kousha, K., Thelwall, M., Bickley, M.: The high scholarly value of grey literature before and during Covid-19.
926 Scientometrics. 127(6):3489-3504. doi: 10.1007/s11192-022-04398-3. Epub 2022 May 21. PMID: 35615527;
927 PMCID: PMC9122808, 2022.
928 Kukoyi, S., Zoom Fatigue and Neurodiversity. Online blog available at: lexxic.com/blog/zoom-fatigue-and-neurodiversity.
929 Last accessed: 31 August 2023.
930 Leduc, J.: The Problem with Using Auto-Captions in Education, 3PlayMedia: https://www.3playmedia.com/blog/problem-
931 using-auto-captions-
932 education/#:~:text=At%20its%20best%2C%20ASR%20can,mispronunciations%2C%20and%20excellent%20audio
933 %20quality, last access 10 August 2022, 2020.
934 Lewis, M., Grimmett, H., Lipton, B., Walsh, S. C., Bickel, B., Elsom, S., ... & Walker, A.: A Tapestried Review of the Fully-
935 virtual, Non-traditional (Un) conference 'MAKING shiFt HAPPEN: Female Academics Creating Personal and
936 Professional Alchemy in the Academy', Co-convened by Alison Black and Rachael Dwyer. *Art/Research*
937 *International: A Transdisciplinary Journal*, *4*(2), 695-711. https://doi.org/10.18432/ari29504, 2019.
938 Li, L.M., Bourke, N.J., Lai, H.H.L., May, H.G., Zimmerman, K.A., Bell, J., Riches, E., Abu-Sway, S., Sharp, D.J.:
939 Conferences in the time of COVID: notes on organizing and delivering the first Brain Conference. Brain Commun.,
940 3(3):fcab142. doi: 10.1093/braincomms/fcab142. PMID: 34755106; PMCID: PMC8570146, 2021.
941 Marín-Spiotta, E., Barnes, R.T., Berhe, A.A., Hastings, M.G., Mattheis, A., Schneider, B., and Williams, B.M.: Hostile
942 climates are barriers to diversifying the geosciences: EGU Advances in Geoscience, 53, 117–127.
943 https://doi.org/10.5194/adgeo-53-117-2020, 2020.
944 Margetis, G., Ntoa, S., Bouhli, M., Stephanidis, C.: An Accessible Platform for Conference Administration and
945 Management. In: Stephanidis, C. (eds) Universal Access in Human-Computer Interaction. Applications and
946 Services. UAHCI 2007. Lecture Notes in Computer Science, vol 4556. Springer, Berlin, Heidelberg.
947 https://doi.org/10.1007/978-3-540-73283-9_102, 2007.
948 Marks, G., S.: How to Make Professional Conferences More Accessible for Disabled People: Guidance from Actual
949 Disabled Scientists. Online article, available at: https://blog.ucsusa.org/science-blogger/how-to-make-professional-
950 conferences-more-accessible-for-disabled-people-guidance-from-actual-disabled-scientists/, last accessed, 31st May
951 2024, 2018.
952 Moreira, C., SIMÕES, F.P.M., Lee, M.J.W., Zorzal, E.R., Lindeman, R.W., Pereira, J.M., Johnsen, K., and Jorge, J.: Toward
953 VR in VR: Assessing Engagement and Social Interaction in a Virtual Conference, in IEEE Access, 11, p. 1906-
954 1922. DOI: 10.1109/ACCESS.2022.3233312, 2022.
955 Nahass, E., Zoom vs. Neurodivergency. Online blog available at: swarthmorephoenix.com/2022/02/10/zoom-vs-
956 neurodivergency/, last accessed: 31 August 2023, 2022.

Formatted: Superscript

Niner, H.J., Johri, S., Meyer, J., and Wasswemann, S.N.: The pandemic push: can COVID-19 reinvent conferences to models rooted in sustainability, equitability and inclusion?. Socio Ecol Pract Res 2, 253–256. https://doi.org/10.1007/s42532-020-00059-y, 2020.

Niner, H.J., and Wassermann, S.N.: Better for Whom? Leveling the Injustices of International Conferences by Moving Online: frontiers in Marine Science: doi: 10.3389/fmars.2021.638025, 2021.

Nocon, A.: How to Make your Panel Event Neuroinclusive for Speakers. Available at: https://www.expandthecircle.co.uk/neurodiversity-blog/make-your-panel-neuroinclusive, last accessed 02 November 2023, 2021.

Olcott, A.N., and Downen, M. R.: The Challenges of Fieldwork for LGBTQ+ Geoscientists, Eos, 101, https://doi.org/10.1029/2020EO148200, 2020

Pedaste, M., & Kasemets, M.: Challenges in Organizing Online Conferences: Lessons of the COVID-19 Era. Educational Technology & Society, 24 (1), 92–104, 2021.

Periyasamy, A.G., Singh, A., Ravindra, K.: Carbon Emissions from Virtual and Physical Modes of Conference and Prospects for Carbon Neutrality: An Analysis From India. Air, Soil and Water Research, 15. doi:10.1177/11786221221093298, 2022.

Pickering, R., and Khosa, R.: The geological period that no one talks about: menstruation in the field: EGU Blog: https://blogs.egu.eu/geolog/2023/05/12/the-geological-period-that-no-one-talks-about-menstruation-in-the-field/, last access 31 August 2023, 2023.

Pronouns.org: Mistakes - what if someone makes mistake and mispronouns someone else?: https://pronouns.org/mistakes, last access 1st December 2023.

Raby, C., and Madden, J.: Moving academic conferences online: Aids and barriers to delegate participation. Ecology and Evolution. 11. 10.1002/ece3.7376, 2021.

Reshef, O., Aharonovich, I., Armani, A.M., Gigan, S., Grange, R., Kats, M.A., and Sapienza, R.: How to organize an online conference. Nat Rev Mater 5, 253–256 (2020). https://doi.org/10.1038/s41578-020-0194-0, 2020.

Rev: Closed Captions vs. Subtitles: Differences & Which to Use: https://www.rev.com/blog/subtitles-vs-captions, last access 10 February 2023, 2021.

Rowe: The Economic Cost of Attending Educational Conferences. International Journal on Social and Education Sciences, 1,1, 2019.

Sang, K.: Without accessible conferences, we lose the voices of disabled academics, The Guardian: www.theguardian.com/higher-education-network/2017/aug/31/without-accessible-conferences-we-lose-the-voices-of-disabled-academics last access 18 May 2022, 2017.

Sarabipour, S.: Research Culture: Virtual conferences raise standards for accessibility and interactions eLife 9:e62668. https://doi.org/10.7554/eLife.62668, 2020.

Savage, R., and Banerji, A.: Passport to acceptance? LGBTQ+ travellers wary about gender-neutral IDs. Available from: https://www.openlynews.com/i/?id=612e0cd6-55e7-4369-9c1d-6966bf525864, last accessed 6th December 2023, 2022.

Seery, M.K., and Flaharty, A.A.: Ten Tips for Running an Online Conference: Journal of Chemical Education 2020 97 (9), 2779-2782. DOI: 10.1021/acs.jchemed.0c00833, 2020.

Signé, L.: Fixing the global digital divide and digital access gap. Online blog, available at: https://www.brookings.edu/articles/fixing-the-global-digital-divide-and-digital-access-gap/, last accessed 31st May 2024, 2023.

Spinellis, D., Louridas P.: The Carbon Footprint of Conference Papers. PLoS ONE 8(6): e66508. https://doi.org/10.1371/journal.pone.0066508, 2013.

Stefanoudis, P.V., Licuanan, W.Y., Morrison, T.H., Talma, S., Veitayaki, J., and Woodall, L.C.: Turning the tide of parachute science. Current Biology 31, R161–R185, 2021.

Stokes, A., Feig, A. D., Atchison, C. L., Gilley, B.: Making geoscience fieldwork inclusive and accessible for students with disabilities: Geosphere, 15 (6): 1809–1825. doi: https://doi.org/10.1130/GES02006.1, 2019.

Talavera-Soza, S. Citizenship a determining factor in a geoscientist's career. Nat. Geosci. 16, 550–551, https://doi.org/10.1038/s41561-023-01221-3, 2023.

Tao, Y., Steckel, D., Klemeš, J.J. *et al.*: Trend towards virtual and hybrid conferences may be an effective climate change mitigation strategy. *Nat Commun* **12**, 7324, doi.org/10.1038/s41467-021-27251-2, 2021.

Thatcher, A.: Building and maintaining an online academic conference series. International Journal of Industrial, 26, p1081-1088. doi:10.1016/j.ergon.2006.09.009, 2006.

Vasquez, K.: Virtual Conferences Aren't as Accessible as You Might Think. Scientific American: https://www.scientificamerican.com/article/virtual-conferences-arent-as-accessible-as-you-might-think/, last access 23 June 2022, 2021.

Waruru, M.: African and Asian researchers are hampered by visa problems. Nature. https://doi.org/10.1038/d41586-018-06750-1, 2018.

Wickline, M.: Coblis - Color Blindness Simulator: Online tool by Colblinder: https://www.color-blindness.com/coblis-color-blindness-simulator/, last access 10 February 2023, 2001.

Wiederhold B. K.: Connecting through technology during the Coronavirus disease 2019 pandemic: Avoiding "Zoom fatigue.", Cyberpsychology, Behavior, and Social Networking, 23 (7), 437–438. 10.1089/cyber.2020.29188.bkw, 2020.

Wu, J., Rajesh, A., Huang, YN. et al.: Virtual meetings promise to eliminate geographical and administrative barriers and increase accessibility, diversity and inclusivity, Nat. Biotechnol, 40, 133–137, https://doi.org/10.1038/s41587-021-01176-z., 2022.

Formatted: Superscript

Zhang, J., Torchet, R., and Julienne, H.: Gender-based disparities and biases in science: An observational study of a virtual conference PLoS ONE 18(6): e0286811. https://doi.org/10.1371/journal.pone.0286811, 2023.

Zoom: Basic user meeting duration changes: https://support.zoom.us/hc/en-us/articles/5809097508109-Basic-user-meeting-duration-%20changes#:~:text=On%20July%2015%2C%202022%2C%20Zoom,users%20on%20all%20account%20types, last access 10 August 2022.