



## THE ONLINE ALTERNATIVE: SUSTAINABILITY, JUSTICE, AND CONFERENCING IN PHILOSOPHY

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### ABSTRACT

*The recent global pandemic has led to a shift to online conferences in philosophy. In this paper we argue that online conferences, more than a temporary replacement, should be considered a sustainable alternative to in-person conferences well into the future. We present three arguments for more online conferences, including their reduced impact on the environment, their enhanced accessibility for groups that are minorities in philosophy, and their lower financial burdens, especially important given likely future reductions in university budgets. We also present results from two surveys of participants who attended one large and three small online philosophy conferences this year. We show that participants were in general very satisfied with presentations and discussions at the conferences, and that they reported greater accessibility. This indicates that online conferences can serve as a good alternative to in-person conferences. We also find that networking was less satisfactory in online conferences, indicating a point for improvement and further research. In general, we conclude that philosophers should continue to organize online conferences after the pandemic. We also provide some advice for those wishing to organize online conferences.*

**Keywords:** *Online conferences; accessibility; carbon footprint; carbon offsetting; inclusivity; minorities in philosophy*

## 1. A Natural Experiment

The pandemic has caused a collective re-think in the ways that many facets of academia traditionally proceed. The emergence of COVID-19 in early 2020 made it such that in-person conferencing, a regular part of most academics' yearly routine, was deemed too high risk and—given rapid closures of borders and universities—was soon practically impossible. Many conferences were cancelled in the early months of the pandemic; some were postponed (Philosophy of Science Association Biennial Meeting postponed one year until 2021, for example). Yet there were some conference organizers who shifted the meetings to an online format. And so arose a global groundswell of virtual conferences in philosophy.

Pre-corona, holding a conference online was not part of the mainstream. Whether large or small, local or international, conferences were just supposed to involve hotels, handshakes, and those little biscuits that inevitably come with filter coffee from an urn. Until recently, only a handful of philosophers had bucked the trend, convened online, and argued in favor of the virtual format.<sup>1</sup> The sudden increase in online conferencing in 2020 therefore represents a sort of natural experiment. Despite the confounding factors that a pandemic brings, we can start to look at whether online conferences in philosophy are an acceptable alternative to in-person conferences.

Assessing the suitability of online formats for conferences is especially pressing in light of a number of existing arguments in their favor. There have for some years been calls for academics to reduce their carbon footprints through limiting travel, for instance through online conference attendance. In addition, in-person conferences are often extremely financially demanding, and they present specific challenges for researchers outside North America and Europe, researchers with disabilities, and primary caregivers. The idea that these diverse challenges can be overcome

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<sup>1</sup> *Consciousness Online Conference* organized by Richard Brown from 2009 to 2013 was one of the first online philosophy conferences (<https://consciousnessonline.wordpress.com/program/>).

Buckner, Byrd and Schwenkler (2015) offered a model of online conferences and argued in their favor. Byrd (2020) significantly updated the argument with new data and reasons, and some useful advice can be found in St. Croix (2020) and Calzavarini and Viola (2020). Philosophers for Sustainability assembled resources on online conferences at <http://www.philosophersforsustainability.com/resources/>. We thank an anonymous reviewer for alerting us to some of these sources.

by taking a number of conferences online are often answered with a hand-wavy “but we just *have* to meet in person”.

If the pandemic has taught us anything, it’s that this answer is no longer good enough. In this paper we consider four philosophy conferences that were held online between April and August 2020, presenting empirical results showing that they are in many respects a suitable alternative to in-person conferences. In particular, presentations and discussions are experienced by participants and speakers as very satisfactory in an online format. Networking does suffer to a certain extent, though we suggest that this can be partly remedied through planning to provide networking opportunities with special attention to diverse needs of the audience.

We therefore argue that online conferences, rather than just a necessary measure during acute crises like a pandemic, are a sustainable and functional alternative to—but not wholesale replacement of—in-person conferences for the future of philosophy. Taking more conferences online is crucial to reduce the carbon footprint of philosophy, to address existing systematic inequalities in conference accessibility, and to cope with likely post-pandemic economic shortfalls and the consequent restrictions on university funding. Although some of these arguments for online conferences could also be addressed with hybrid conferences permitting online attendance, we focus on online-only conferences. Hybrid conferences have their own challenges and specificities that demand a separate treatment.

We begin by looking at three arguments for holding more conferences online: the environmental impact of traditional conferencing, the accessibility problems of many in-person conferences, and the likely increasing financial restrictions of scholars and universities to attend and host in-person conferences. We then introduce the four online conferences we organized and present the results of two post-conference surveys. Based on these results, we show that online conferences are a suitable alternative to both large and small in-person conferences and that pre-recorded and live lectures are both accepted formats, and we provide some suggestions for how to schedule and structure a successful online conference. Given the three arguments for and the suitability of online conferences, we conclude by suggesting that even after the pandemic online conferences should be the new default for academic meetings along with measures to decarbonize academic conventions and offset carbon emissions from both online and in-person meetings that cannot be avoided. In-person meetings should be rare and well justified departures from the default due to the inability of the online format to offer to academic practice what the in-person format affords. Networking opportunities are

the major shortcoming of online conventions and further work is required to design them so that scholars, especially early-career ones, benefit from this important experience.

## **2. Three Reasons for Online Conferences**

### **2.1. Environmental Issues**

We believe that it is roughly accurate that most philosophers are committed to social justice, inclusivity and have accepted the findings and recommendations of the IPCC (Intergovernmental Panel on Climate Change). A result of this commitment is that some philosophers have addressed the moral implications of greenhouse gas pollution and the responsibility of governments and of individuals to act toward preventing, reducing and eliminating this pollution that causes widespread harm. An example of such an argument for environmental action can be found in John Broome (2016, 161): “Justice requires you not to harm other people, at least not for your own benefit. Since emissions of greenhouse gas do harm, you should not make them”. Arguments like this speak in favor of online conferences.

The two models of online conferences that we present here are ways to effectively realize the moral argument for greenhouse gas reduction. In the absence of estimates for philosophy conferences, we can use those for science conventions to gauge their environmental impact. Burtscher et al. (2020) estimate the total carbon footprint of the virtual meeting of the European Astronomical Society to be 582 kg, roughly 3,000 times smaller than the carbon footprint of the 2019 in-person meeting in Lyon. Klöwer et al. (2020) estimate that travel to the 2019 meeting in San Francisco of the American Geophysical Union resulted in 80,000 tons of carbon emissions, whereas choosing a venue with the explicit goal to minimize transport emissions, increasing virtual attendance and meeting biannually in person instead of annually would have reduced about 90% of travel-related carbon emissions.

Despite the existence of philosophical arguments for reducing greenhouse gas emissions, professional organizations of philosophers have not implemented measures to effectively reduce and offset greenhouse gas emissions that result from their activities. And thirty years after the first

IPCC report, philosophers appear to do mostly business as usual.<sup>2</sup> This is despite the environmental impact of philosophers' research activities, and while forcefully objecting to politicians and businesspeople who advocate business as usual to ensure economic growth. Critics of philosophers would be right to label philosophers' talk not supported with substantial measures as a hypocritical and glaring departure from professed moral principles. The two models of online conferences described here allow professional organizations of philosophers to close the wide gap between their public defense of environmental causes and actual actions.

In addition to professional ethics, there is also an argument based on inclusivity towards personal preferences. Public statements of philosophical organizations show various efforts to be inclusive not just towards needs like childcare or accessibility, but also towards the preferences of those who have made principled decisions to be vegetarians and vegans. For several years, a number of philosophers have joined a

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<sup>2</sup> Here is a sample for illustration. The 2020 edition of the Good Practices Guide of the American Philosophical Association (Railton et al. 2020, 95-102) includes for the first time a section, the last one, on sustainability, containing comprehensive advice on preventing and reducing the environmental footprint of philosophical events. Funding and/or encouraging the use of carbon offsets and incorporating to various degrees digital conferencing are among the recommendations. Yet what forced APA to move its main meetings online was the pandemic, not the recommendations from its guide of good practices. APA plans to examine the issue of carbon offsets for travel to its meetings (Amy Ferrer, personal communication with VP on October 23, 2020).

The biannual meeting sites of the International Society for the History, Philosophy and Social Studies of Biology (ISHPSSB) oscillate between North America and Europe. The Site Selection Committee reports Milwaukee, WI, as the site for the 2021 meeting and that it has received an inquiry about hosting the 2023 meeting in Australia (sic!). Of the four points the Committee makes about future meetings, not one concerns the carbon footprint. Milwaukee site organizers are silent on this topic as well. The society plans to discuss the carbon footprint of its meetings at the upcoming Milwaukee conference, and the last meeting held in Oslo implemented measures to promote reusables and reduce single-use materials, such as plastic cups and bottles (Newsletter of ISHPSSB Fall 2019). The society has hosted a number of talks on problems related to sustainability.

The Philosophy of Science Association holds its meetings biannually in the USA and Canada, and its members have been examining philosophical problems of climate science. In the summer of 2020, it established a Sustainability & Climate Task Force. One of its goals is to reconceive "the format, frequency, and location of PSA meetings given the heavy carbon footprint of the existing conference model" (Sustainability & Climate Task Force), yet the decision to hold the regular meeting in Baltimore, MD, in 2021 so as to avoid a hefty hotel cancellation fee did not come with a request to association members to offset their carbon emissions nor information on how to do it (<https://psa2020.philsci.org/81-psa2020-2021-faqs>). Offsetting carbon emissions were not requested at the previous meetings either.

The sites of the European Philosophy of Science Association, the British Philosophical Association, the British Society for the Philosophy of Science, and the German Society for Philosophy of Science do not contain information about their efforts to address their carbon emissions.

growing number of scientists who object to flying to conferences. Some of them have self-reported on <https://noflyclimatesci.org/>. These academics are conscientious climate change objectors. The traditional model of in-person conferences is not inclusive toward them. To be inclusive toward these academics, and given the moral and justice principles to which philosophers are committed as well as the aforementioned precedents, virtual models of conference participation should be implemented.

## 2.2. Accessibility

In-person conferences are not as accessible to researchers outside the European Union and North America, to researchers with disabilities, and to primary caregivers (often women), all of whom are underrepresented groups in philosophy (Schwitzgebel and Jennings 2017; Humanities Indicators 2019a, 2019b). We think online conferences address many in-person accessibility issues and may thereby redress systematic limitations on conference attendance.

The first group benefited by online conferences are researchers outside the European Union and North America. For many of these researchers, in-person conferences require cumbersome, time-consuming and expensive visa application procedures, and visas are often denied or not granted in time (Khalid, Ardila-Gómez, and Scott 2016; Minai 2018; Albayrak-Aydemir 2020). Increased travel time, planning and expense present additional obstacles. Online conferences obviate the need to travel and obtain visas and thereby facilitate attendance from such countries.

Online conferences also offer advantages for researchers who have disabilities. Despite steps to improve accessibility of in-person conferences, many hurdles remain (Felappi, Gregory, and Beebee 2018; Fleming 2019; Railton et al. 2020, 70-76). In online conferences, participants can utilize their own systems, such as technological and physical aids. An online format might also help some participants with networking. For instance, using breakout rooms and written chats places less burden on individuals to approach strangers and reduces sensory input in comparison to crowded conference halls.

Finally, online conferences can benefit primary caregivers. Attending from home simplifies bottle- or breastfeeding, often challenging at in-person conferences (Calisi, Working Group Mothers in Science 2018; Felappi, Gregory, and Beebee 2018; Railton et al. 2020, 70-76). Muting or turning off the video also enables parents to remain in talks rather than having to leave the room when their child is crying. Depending on the conference schedule, parents can also often utilize their usual childcare arrangements.

Online conferences are however not without accessibility issues. First, not all researchers have access to adequate technology or internet connection, in particular working- or lower-class scholars (Minai 2018). Recording talks and using written chats might enable some participation, but these are likely sub-optimal for networking. Second, time zone differences reduce the wins for researchers outside traditional conferencing regions, though not entirely (researchers in South America can usually attend meetings in North America, and similarly for researchers in Africa and the Middle East for European meetings). Third, conference schedules should respect parents and people with disabilities. Breaks are especially important for these groups; a shorter day is often also necessary (Botterill 2020). Finally, conference-provided childcare funds remain important to ensure extra childcare can be arranged at no cost to participants.

If these steps are taken, we think online conferences are likely to enhance participation from minorities in philosophy. Increasing the availability of online conferences is not only fairer, it might also contribute to reducing inequalities in career outcomes for members of minority groups, especially given the importance of attending conferences for early-career researchers (Calisi, Working Group Mothers in Science 2018; Felappi, Gregory, and Beebe 2018; Railton et al. 2020).

### **2.3. Financial Issues**

One of the many impacts of the COVID-19 pandemic has been economic. The measures recommended to prevent transmission of infection—social distancing, reduced numbers in groups, wearing masks, isolating when exposed, restricted international travel, etc.—spell disaster for the normal maintenance of many businesses. This has had ramifications for the economy as a whole as many are not working (whether laid off or on leave) and businesses have closed, many not to open again. For the purposes of this paper, the impact that networks around universities have faced is most salient. This includes students, staff, and the institutions themselves. The online conference format, we argue, may provide some relief to the monetary strains placed on universities given the economic impact of the pandemic, and will also be worth considering even in times of relative normalcy. Further, even in times of non-acute crisis, online conferences provide those without the fiscal means to travel an opportunity to attend and be involved.

Many universities are reporting large budget shortfalls due to the recommended COVID-related changes in student activities. Just as one example, according to Lee Gardener (2020), “The University of Wisconsin system [...] has estimated it will lose \$170 million in the spring semester

alone from refunding room, dining, and parking fees to students, and other unexpected expenses”. While each university will be impacted differently, there is no doubt that many universities will be impacted in this or similar ways.

The impacts of these budget shortfalls are trickling down into the budgets of the individual departments, often resulting in the suspension of admissions to graduate programs. As of September 28, more than 50 humanities and social sciences departments in the US have suspended PhD admissions (Zahneis 2020). Largely, the justification to cut admissions has been to allocate what little resources remain to their existing students. While this paper is not about the larger effects of COVID-19 on universities, the point is that philosophy departments are likely going to be feeling a fiscal crunch for some time. This will potentially impact travel budgets: money allocated for both sending students out and bringing guest faculty in.

Even small conferences often require many thousands of dollars for flying and housing speakers, booking conference spaces, catering, software, staffing, and social events like day-trips or city tours depending on the location (De Cruz 2015). Online conferences offer a way to alleviate a lot of the spending, and associated risks, that accompanies an in-person conference. Nevertheless, some costs will remain, including for staff, technical support, software, and potentially also reimbursements for speakers.

To offset these kinds of costs, conference organizers will often require a registration fee which can be hundreds of dollars for larger conferences. For example, the 2019 Pacific American Philosophical Association meeting registration fee ranges from \$90 to \$290 depending on career status ([https://www.apaonline.org/page/2019P\\_RegInfo](https://www.apaonline.org/page/2019P_RegInfo)). Registration and travel costs are especially difficult for graduate students and early career researchers. Large proportions of doctoral students report feeling stressed about money on a regular basis (Kasia 2016). Even a domestic flight can be quite a burden for a graduate student, not to mention the costs of international travel, visas, hotels, and dining out. Attendance at conferences is thought to be a necessary component of career-advancement for early career scholars, so not attending has implications for career prospects later.

Virtual conferences alleviate much of the financial burden, enabling attendance by those affected by financial worries. In addition to students, the reduction in attendance cost promises to be especially beneficial for researchers from low-funded universities or countries with little public



funding for research, a condition that may increase in many post-pandemic economies, especially given the facts about university budgets discussed above.

Virtual formats promise to reduce many of the costs associated with organizing and attending conferences, and thereby reduce the required registration fee. Indeed, lower costs and avoiding travel were overwhelmingly recorded as positives in the survey responses (see below), suggesting that this mattered greatly to the attendees of online conferences.

### 3. Conference Models

In this section we introduce the online conferences that we organized. The European Congress for Analytic Philosophy (ECAP), and the colloquia *Doing Science in a Pluralistic Society* (DSPS), *Eco-Evo Mechanisms* (EEM), and *Philosophy of Biology at the Mountains* (POBAM) were planned as in-person. Because of lockdowns, organizers of all meetings, after having consulted conference participants, decided shortly before the planned events to switch to the virtual model. Here we describe some of the common aspects of and variations to their organization.

#### 3.1. Large Scale Event: ECAP10

Every three years the European Society for Analytic Philosophy (ESAP) organizes the ECAP. With about 800 participants at the 2017 congress, ECAP is one of the biggest philosophy conferences in Europe. Plans to hold the 2020 congress in Utrecht (Netherlands) at the end of August were scrapped in mid-March, and the move was made to switch the conference online.

##### *Background*

The conference was supposed to run for a whole week with several parallel sessions (ECAP had reservations for 13 rooms that could be used in parallel), keynote lectures, invited longer talks, and symposia. For each of the 450 contributed papers, 20 minutes were allocated in the programme plus about 5 minutes of discussion. The participation fee was set at 200 € (300 € after April 1) or 70 € for students (100 € after April 1).

##### *Conference Organization*

It took until June 5 to come up with a detailed plan to have the conference online. It was clear that one couldn't have 13 parallel live video group chats

for 8hrs a day (as we would have had for the in-person conference). It would be impossible to do the troubleshooting and tech support, and nobody would be able to follow so many talks online. It was also assumed that many people would no longer be able to attend during the (whole) week for which the conference was originally planned.

The ECAP organization thus opened a registration for the reduced fee of 30 € (to cover the costs for two student assistants and the EasyChair license that was used for the review process). Talks were to be pre-recorded, with two options for Q&A: offline/asynchronous or online live Q&A. The conference would be hosted in MS Teams (see [Supplementary Material Section 1](#) for details on the technical setup).

### *Registration and Participation*

Of the 450 accepted speakers for the physical conference, about 300 decided to participate in the online version. Eventually, over 400 people participated in the conference. The top 7 countries where participants came from were Germany, Italy, UK, the Netherlands, Poland, Spain and the Czech Republic, but the conference was also attended by philosophers outside Europe, such as the USA and India. In total, participants came from 32 different countries.

### *Contributed papers*

All talks (except for invited talks and keynotes) were accessible online from August 17, one week before the official start of the conference. This way conference participants had a week to watch the talks that they wanted to see. Participants could also comment directly on the pre-recorded videos.

Roughly 50% of speakers opted for a live Q&A, while the rest preferred a purely offline Q&A. On the basis of the registration, a program was made for the live Q&A talks, the invited talks and the keynote lectures. At most 4 parallel live Q&A sessions were scheduled, each with 6 papers for 1h. That way the conference programme was not too demanding on each day (see [Supplementary Material section 2](#)).

Each live Q&A session had a chair and participants were asked to watch all videos for a live Q&A meeting beforehand. At the live Q&A presenters were given a 2-minute spot to quickly remind everyone of the main thesis of their papers. For each paper there were roughly 10 minutes of discussion time allocated.

### *Invited talks and keynotes*

Invited talks and keynotes were streamed within MS Teams at specific times and then followed by a longer live Q&A. Invited talks were 40 minutes, followed by 20 minutes live discussion, keynotes were 60 minutes, with 60 minutes discussion. The keynote lectures were also simultaneously uploaded to YouTube for a wider audience. After the live event was over, the videos of the keynotes and invited talks were also available within MS Teams for participants who weren't able to attend the live event.

### *Networking*

In between events, participants were encouraged to use a dedicated environment within MS Teams for discussion and chats. On one evening during the conference, ECAP organized a pub quiz as a social event.

### *Local Team*

The local organization was a team of 6 colleagues, plus two student assistants for July and August. For a physical congress of that size, a much bigger team would have been necessary. In addition to the two student assistants, the only extra cost was for the EasyChair license (Utrecht University has a license for MS Teams). That way the conference could be organized for a fraction of the costs of a physical conference.

Since MS Teams is used at Utrecht University for teaching, the local organization team was already familiar with the software and Utrecht University could provide tech support. The tech support that was requested from participants, for entering MS Teams, creating and uploading videos, navigating the conference environment, etc. was minimal. The local organization team experienced the organization of the online conference as less stressful and demanding than the organization of comparable physical conferences.

## **3.2. Small to Medium Scale Conferences**

The other three online conferences we are comparing, all in philosophy of science, were comparatively smaller events. DSPTS, EEM, and POBAM used the conferencing software Zoom (see [Supplementary Material Section 1](#) for details on the technical set-up).

### *Conference Organization*

DSPS, EEM and POBAM were organized to be as close as possible to in-person events. All conferences involved live presentations and Q&A sessions, with each session (including Q&A) ranging from 40 minutes to 2 hours and 50 minutes, which included a 10-minute break. Talks of speakers who gave permission were recorded and access to recordings and slides was enabled for all participants after the conference was over.

The conference schedules varied from consecutive days to spread out over the course of a week. DSPS events took place on consecutive Fridays, POBAM activities occurred on Tuesday, Thursday and Monday, while EEM meetings took place on two consecutive days, Thursday and Friday. All meetings started at 9:00 local times of organizers and continued until 17:00, but 15:40 for POBAM.

For some of the conferences, their programs were entry points to conference activities, with zoom meeting rooms linked to the names and talk titles displayed in the program. This allowed participants to attend the talks of their choice just like in an in-person conference. Programs are attached in the supplementary material for illustration ([Supplementary Material Section 2](#)).

### *Registration and Participation*

Registration was free, yet required to prevent “zoombombing”, when an uninvited person joins a virtual meeting, often with the intention of being disruptive (Gunnel 2020). As a safety measure, a password to access the meetings was sent to registrants after they had registered. We adopted this measure because of media reports about occasional zoombombing, although we are yet to have experienced such incidents ourselves. Zoom also allows moderators to block possible disruptors, another way to deal with zoombombing without the hurdle of required registration. It is also possible to set up a zoom meeting so that participants have to request to be unmuted, which provides a certain level of security against unwanted disruptions.

Registration for the conferences was as follows: for DSPS, 127 persons from 16 countries (except for USA, India and South Korea, all countries were from Europe). Similarly, POBAM’s 136 registrants were mainly from the USA, Canada and Europe, but also from Mexico, Brazil, Egypt, India, Australia, and New Zealand. EMM had 100 registrations from 21 countries, primarily from Europe, but also from countries in North and South America, South-East Asia and the Middle East.

Conference participation was lower than registration. For DSPS, POBAM, and EEM participation varied between 30 and 70 participants.

### *Talks and Q&A Sessions*

At DSPS, POBAM, and EEM, talks were delivered live and were followed by live Q&A sessions. Keynote talks were between 40 and 50 minutes long, and regular talks were between 20 and 30 minutes, followed by 10 to 20 minutes of Q&A. Attendees could raise their hand (digitally) and ask their question *via* audio/video, or they could write a question in the chat, to be read out by the moderator.

### *Networking and other sessions*

All three conferences created opportunities for informal virtual social interaction. Separate Zoom meeting rooms were created for those events. DSPS had morning cafes, prior to the morning talks, and lunches. EEM included networking coffee breaks, a group-work session, and a happy hour at the end of the first day. EEM participants were asked for an additional registration for these sessions; registered participants and speakers were assigned to breakout rooms at random by a student assistant, though they also had the option to request to speak with a particular person which a few people did take up. POBAM's social rooms were largely unstructured. On the first day of the conference, only speakers and organizers were provided the passwords for lunchtime and post-talks happy hour social rooms. In the subsequent days the rooms were opened up to attendees to allow for more interaction. For all of the three colloquia, these virtual social events and group-work sessions were positively received; attendance fluctuated around 7-30 participants.

### *Poster session*

POBAM was the only colloquium to hold a poster session. The session occupied a normal session spot in which seven 5-minute back-to-back presentations were given over the 40 minutes with no Q&A time allotted. Each presentation was accompanied by a single poster slide that the speaker would reference if they wanted. The presenters were given the opportunity to share their poster on the POBAM website ahead of the conference to generate discussion beforehand (say, on Twitter or some other medium). The break-out rooms were partly designed with follow-up discussion in mind between presenters and attendees for that day.

## 4. Survey Design

### *Aims, Research Questions*

We conducted a survey to find out more about how participants and speakers experienced these four online conferences. Our aim was to answer the following general research questions:

1. Is the virtual format an acceptable *temporary replacement* for in person conferences?
2. Is the virtual format an acceptable *alternative* to in person conferences?
3. How do the two formats (live and pre-recorded) compare?
4. How should online conferences be organized?

As well as general attitudes towards and experience of the online conferences, we looked at evaluation of and preferences concerning the following elements of the conferences:

- A. content delivery
- B. feedback acquisition
- C. networking
- D. accessibility

### *Survey design and administration*

We use data from two surveys. One survey was developed for the ECAP10, here Survey A. The other survey was developed for the three smaller colloquia, here Survey B. Survey A was administered using Qualtrics at the beginning of September 2020 (right after the conference). Survey B was administered using SoSci Survey ([www.soscisurvey.de](http://www.soscisurvey.de)) in September 2020, between two and five months after the conferences. Both surveys consisted of multiple choice and open response questions. For simplicity, we focus on the quantitative results only.

### *Response rate and representativeness of sample*

All people who registered for the conferences were invited to participate in the survey. There was a total of 124 participants for Survey A, around a third of all participants to the ECAP. For Survey B, the total number of participants was 99; 33 had registered for EEM, 27 for POBAM, and 38 for DSPS. This represents roughly one quarter to one third of the total registered participants for each conference. Amongst the registered

participants were presenters: 12 presenters from DSPS, 11 from POBAM, and 7 from EEM.

In terms of demographics, the samples for both Survey A and Survey B were fairly equally spread across career stage (Survey A: 30 graduate students, 50 junior faculty members, 31 senior faculty members, and 13 missing responses; Survey B: 30 graduate students, 36 junior faculty members, 21 senior faculty members, and 12 missing responses). Survey B included some additional demographic questions, including gender, location, and disability status. The spread of genders was fairly even, and respondents were primarily located in Europe and North America. Few participants reported that they had a disability. As we note below, due to low sample sizes we cannot address questions about how online conferencing affects researchers with disabilities and researchers outside traditional conferencing countries (see [Supplementary Material Section 3](#) for full demographics).

#### *Instrument and data availability*

The items regarding participants' experiences in the workshop had a seven-point (survey A) or five-point (survey B) Likert scale response format and the items regarding the accessibility had a logical yes or no response format. Unless stated otherwise, the respondents are allowed to choose only one option for each item. The survey instruments and data from both surveys can be downloaded at <https://doi.org/10.17605/OSF.IO/D7QEZ>. A description of the results can be found in [Supplementary Material Section 3](#), Tables S3.1 and S3.2.

## **5. Survey Results**

### *General satisfaction*

We found that the conferences were evaluated positively overall. In particular, in Survey B, general satisfaction with the conferences was on average high to very high (Survey B: Mean [M] = 4.32, Standard Deviation [SD] = 0.82, Min-Max responses = 1 – 5), as was willingness to attend future online conferences (M = 4.28, SD = 1.03, Min-Max responses = 1 – 5). Survey B found no significant differences between presenters and regular participants in terms of their satisfaction with the conference ( $t(65.43) = -0.61, p = 0.54$ ), nor between participants at different career stages ( $F(2, 81) = 1.90, p = 0.16$ ).

In addition, the online format was not only seen as a temporary replacement during acute crises like pandemics but as a legitimate alternative to in-person conferences (see Figure 1).

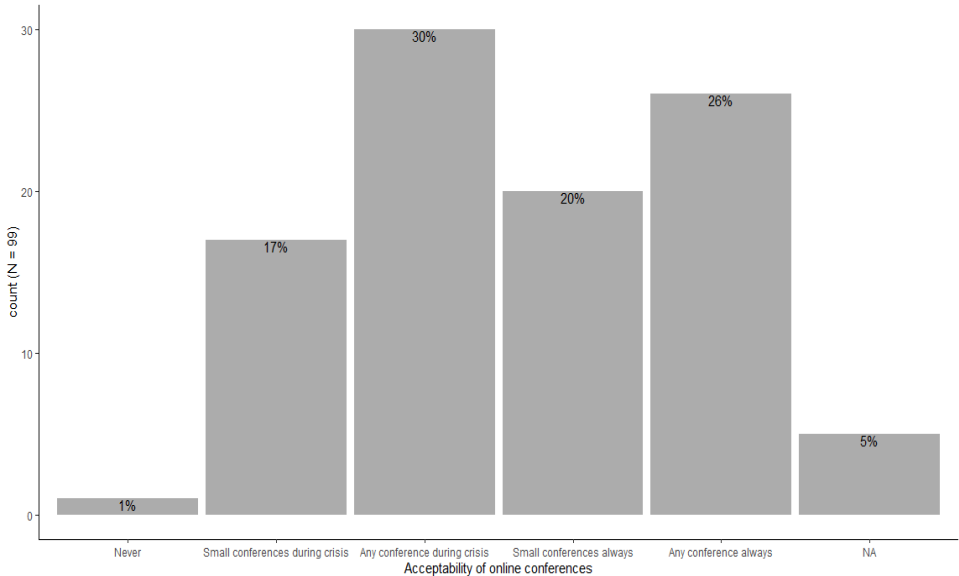


Figure 1. The frequency of participants in Survey B who agree with online conferences as an alternative format.

### *Experience of different aspects of the conferences*

In addition to general satisfaction, data show how respondents evaluated different aspects of the conferences. Respondents reported equal levels of very high satisfaction in both surveys (pre-recorded presentations in Survey A and live presentations in Survey B) with regards to presentations ( $M_A = 6.02$ ,  $SD_A = 0.99$ ,  $Min_A - Max_A = 1-7$ ;  $M_B = 4.38$ ,  $SD_B = 0.71$ ,  $Min_B - Max_B = 1-5$ ) and discussions ( $M_A = 5.75$ ,  $SD_A = 1.29$ ,  $Min_A - Max_A = 1-7$ ;  $M_B = 3.97$ ,  $SD_B = 0.98$ ,  $Min_B - Max_B = 1-5$ ). Given the difference in the response format, we rescaled the items from 0-10 to make sure they have comparable lower and upper scores and the result of a t-test showed that the satisfaction in both surveys were equally high with regards to presentation ( $t[df = 173] = -0.35$ ,  $p = 0.73$ ) and discussion ( $t[df = 177] = -1.44$ ,  $p = 0.15$ ).

Unsurprisingly, networking suffers in online conferences. Participants responded in Survey A that opportunities to network and chat with colleagues were worse or much worse than in physical conferences



( $M_{\text{Networking}} = 1.83$ ,  $SD_{\text{Networking}} = 1.23$ ;  $M_{\text{Chat}} = 1.59$ ,  $SD_{\text{Chat}} = 0.94$ , Min – Max = 1 (*much worse*) – 7 (*much better*)). This indicates that the written channels and the single pub quiz event at ECAP were not seen as sufficient for networking. The smaller conferences in Survey B included more targeted networking using break-out rooms, and it is positive to see that this seems to have improved participants' satisfaction with networking. Respondents to Survey B were not very dissatisfied, but they were still on average neither particularly satisfied nor particularly dissatisfied with the networking in the conferences ( $M = 2.75$ ,  $SD = 1.32$ , Min-Max = 1-5).<sup>3</sup> Noteworthy to mention that there were no differences between participants in the three workshops in terms of their networking experience in the Survey B ( $F(2, 90)=0.04$ ,  $p = 0.96$ ).

In addition to the experience of participants, it is important to look at how presenters evaluated the experience of presenting online. In Survey A, presenters responded that communicating their work to others and getting feedback was about the same as it is in physical conferences ( $M_{\text{communicating}} = 4.5$ ,  $SD_{\text{communicating}} = 1.16$   $M_{\text{feedback}} = 4.5$ ,  $SD_{\text{feedback}} = 1.24$ , Min-Max = 1 (*much worse*) – 7 (*much better*)). In Survey B we found that presenters were on average satisfied with how their presentations went when they were live ( $M = 4.2$ ,  $SD = 0.79$ , Min-Max = 1-5) but less so when their presentations were pre-recorded ( $M=2.67$ ,  $SD = 0.58$ ). However, this latter result is perhaps not indicative because only 3 presenters pre-recorded their presentations for the small conferences, and in general presenters were satisfied with their pre-recorded presentations at the ECAP, as seen in Survey A. Presenters were also fairly happy with the feedback they were able to get, especially for spoken feedback during Q&A sessions and in breakout rooms ( $M_{\text{spoken}} = 3.9$ ,  $SD_{\text{spoken}} = 1.03$ ,  $M_{\text{breakout}} = 3.7$ ,  $SD_{\text{breakout}} = 1.11$ , Min-Max = 1-5), and to a lesser extent, but still at the mid-point of the scale, with the written feedback through the chat function ( $M_{\text{written}} = 3$ ,  $SD_{\text{written}} = 1.00$ ).

### Accessibility

Another aspect to online conferences is their potential for enhanced accessibility (see subsection Accessibility). In Survey A, participants responded that the online conference accessibility was better than an in-person conference ( $M = 5.62$ ,  $SD = 1.20$ , Min-Max = 1(*much worse*) – 7(*much better*)). Similarly, in Survey B, we found that 87% of participants agreed or strongly agreed that making the conference online made it easier

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<sup>3</sup> Note that the questions about networking asked in the two surveys are not directly comparable, since Survey A asks about online networking in comparison to in-person networking, whereas Survey B asks only about satisfaction with online networking.

to attend. This positive result needs to be interpreted with caution because it was asked during a pandemic, meaning attending conferences in person would have been difficult if not impossible. Nevertheless, it is a positive indication that online conferences are accessible.

In Survey B we also asked about what factors impacted positively or negatively on participants' ability to attend the conference. Figure 2 shows the full list. Lower cost, reduced travel, and being able to attend from home were positive factors for many, whereas other work commitments, day length, and time zone hampered participation for many. It is also important to note the factors relevant to accessibility for minorities in philosophy, such as the positive impact of not having to worry about venue accessibility and the persisting negative impact of caring responsibilities. No significant differences were found between genders in terms of accessibility. As mentioned earlier, sample sizes were too low for people with disabilities and people outside North America and Europe to see if the conference being online had a positive impact for these groups.

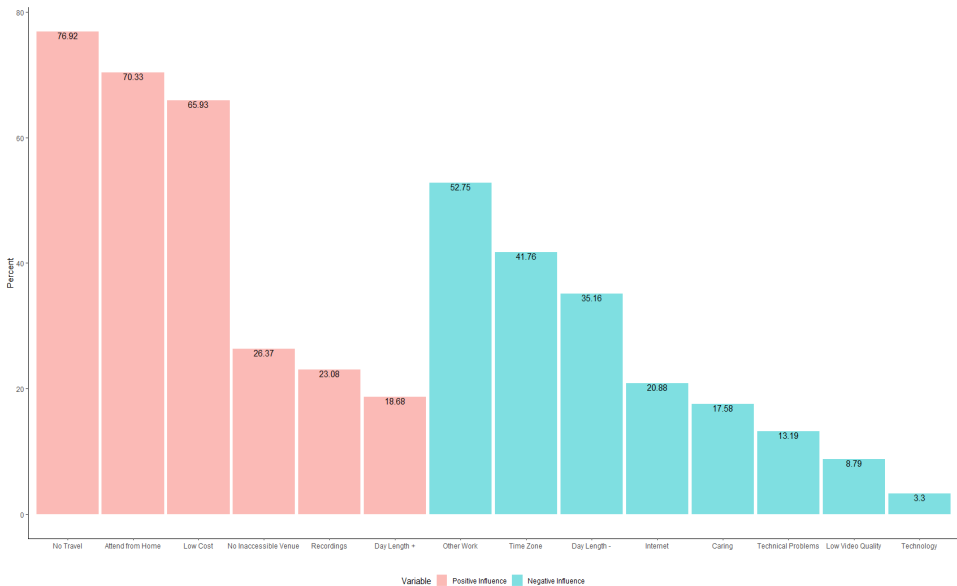


Figure 2. The percentage of participants that agree that the positive (left, pink bars) and negative (right, blue bars) factors affected their ability to participate in the conference.

### *Session format and scheduling*

Finally, online conferences offer a range of options for formats and schedules that aren't available for in-person conferences. In Survey B we found out about participants' preferences for these different options.

For Q&A, we found that 70% of participants prefer to have the option to ask questions either through the text-based chat function or spoken out loud; text-based only or spoken only formats were far less popular (5% and 20% respectively). For networking, the most favored format is digital coffee breaks using break-out rooms. This was the format employed in the colloquia, and it is a good sign that 70% of participants were happy with it after trying it out. Group work was also a fairly popular option (50% of respondents). In addition, the text-based chat function, speed dating, and participant organized events were moderately popular options (25-30% of respondents). Perhaps most importantly, only 10% of people preferred no networking in an online conference.

Finally, there is the question of length and scheduling of sessions. The general message from our results is that online conferences need shorter sessions and shorter days. Most people prefer a keynote of 40 minutes or less (90% of all participants), and a regular presentation of under 25 minutes (55% of all participants)—not including time dedicated for Q&A. For day length, participants preferred that the schedule runs for either 2-4 hours (47%) or 4-6 hours (42%), not including any scheduled breaks. Importantly, this is much shorter than a usual in-person conference day. In addition, whereas around half the participants prefer to have the conference held over consecutive days, the other half thinks that days spread out over a week or over multiple weeks is the better format.

## **6. Discussion**

*Addressing Q1. Is the virtual format an acceptable temporary replacement for in person conferences?*

Our results indicate that online conferences are in general very satisfactory and that they are accepted as a temporary replacement for in person conferences.

*Addressing Q2. Is the virtual format an acceptable alternative to in person conferences?*

The next step is to decide whether online conferences are acceptable not just as a temporary solution to the contact and travel restrictions during a pandemic, but as an alternative to in person conferences regardless of such acute crises. Answering this question is central to our argument that online conferences should be adopted in academic philosophy's post-corona future.

We found that online conferences seem to be a suitable alternative to in-person conferences when it comes to presentations, discussions and getting feedback, and accessibility. However, online conferences are less effective when it comes to networking, at least given current levels of familiarity with online networking using the formats we already have available. Given the importance of networking (e.g., in Survey B, networking was rated just as important as presentations and discussion), online conferences cannot be expected to totally replace all aspects of in-person conferencing.

*Addressing Q3. How do the two formats (live and pre-recorded) compare?*

No significant differences were found between the two data sets in terms of satisfaction with the presentations and discussions. This is perhaps a positive indication that both pre-recorded and live talks are suitable for online conferences.

Survey B did find that respondents overwhelmingly preferred live talks in comparison to pre-recorded talks (95% vs 18%; participants could choose more than one option). The preferences of participants should be taken into consideration when planning a conference. Nevertheless, it should be noted that the respondents to Survey B may not have seen any pre-recorded talks and may therefore be expressing an opinion not informed by experiences with the relevant medium.

*Addressing Q4. How should online conferences be organized?*

Our results indicate that online conferences should aim to have live Q&A sessions that permit both text-based and spoken contributions. Another clear indication is that days should be shorter with more frequent and longer breaks. This measure will potentially enhance accessibility, for instance for primary caregivers. In addition, shorter days and more breaks can help to combat a phenomenon known as “zoom fatigue,” attributable to the particularly draining effect of social interaction in video calls due to factors such as lack of eye contact, micro-delays in audio, and even 2D representation (Lee 2020; Nadler 2020).

Aside from shorter days, the key message seems to be that online conferences can be quite flexible in their scheduling. Consecutive days, multiple days in a week or over several weeks all seem to be accepted formats, allowing conference organizers greater freedom in how they choose to schedule sessions.

A number of options are available to organizers planning networking events. Digital coffee breaks and group work, when feasible, can be recommended. But other formats such as speed dating and making use of text-based chat functions may also work. Nevertheless, networking remains a sticking point for many online conferences. There may be other formats or ways of organizing networking that make it particularly effective, which is a point for further research.

### **6.1. Directions for Further Work**

Along with many disruptions, the pandemic created an overdue incentive for academics to experiment with online conferences. Yet they should not let this experience recede into history along with the pandemic. Because of their commitment to moral and justice principles and acceptance of the recommendations from IPCC, philosophers should lead the way to establish interdisciplinary teams with other academics from various sciences to improve the current models of online and in-person conferences with the goal of making them carbon-neutral, while preserving the desired features of conferences as mediums for exchanging and testing ideas, and forging relationships.

Regarding the result of our analysis, two cautionary remarks are warranted. First, out of those 450 participants initially registered for ECAP's physical conference, only 300 registered for the online conference. It may therefore be that those who registered for the online version of the conference and subsequently completed survey A already had a more positive attitude toward online conferencing in comparison to those who chose not to participate. Future studies might aim to conduct a more controlled survey of participants to ensure the result can be generalized to a wider circle of academics. Second, the sample size in our study was rather small. To improve explanatory power, future studies might aim for a larger sample size.

We should also note that the implicit assumption that online conferences are temporary because of the pandemic might have influenced their positive reception and the tolerance of their shortcomings. Making online conferences a permanent feature of academic life as well as incorporating online talks into traditional conferences might raise the bar for accepting

them. Interdisciplinary teams consisting of representatives of academic fields organizing conferences, psychologists, education, social and communication scientists, as well as other scientists as needed could adopt as a research project examination of extant practices of online conferences, articulation of improved models, their subsequent testing, and dissemination of best practices, which should facilitate widespread adoption of online conferences. In cooperation with those research teams, professional societies could establish platforms for communication of best practices. Furthermore, the interdisciplinary research teams and the boards of professional associations could work with specialized non-governmental and governmental organizations to identify effective ways to offset carbon emissions and to develop new ones if necessary.

For in-person conferences, professional organizations could build upon and further develop the suggestions proposed by Philosophers for Sustainability and contained in the Good Practices Guide of the American Philosophical Association, as well as those made by scientists to decrease the carbon footprint and increase the accessibility of conferences and of research (Bousema et al. 2020; Burtscher et al. 2020; Klöwer et al. 2020; Stevens et al. 2020). Several common proposals emerge from those suggestions: (1) replace in-person conferences with the online format; (2) alternate in-person with online conferences; (3) incorporate online talks in in-person conferences; (4) choose conference venues that are accessible and that would result in the lowest amount of carbon emissions, especially due to transportation; (5) mandatorily offset carbon emissions that cannot be avoided, including for online conferences. Mandatory offsetting could be achieved by incorporating it into conference registration fees.

## **7. Conclusion**

Online conferences are a worthy alternative to in-person conferences not only in times of acute crisis, but generally. That is not to say that online conferences should be adopted exclusively as a replacement. However, we do believe online conferences should become the new normal, with in-person conferences as an alternative that must be well-justified and responsibly carried out.

The COVID 19 pandemic created the conditions for a natural experiment, shifting conferences fully online. Our survey found that the online conferences that we organized offered participants an overwhelmingly positive experience to share and engage with research. Attendees reported that the online format was more than sufficient for presentations,

discussions, and feedback, with increased accessibility and affordability, allowing scholars from institutions less financially endowed to participate. We also acknowledge some shortfalls of online conferences. Our survey highlighted that online conferences fell short in the ability of the participants to network in a fully satisfactory way. This could be because the online format is new, and networking will develop as more conferences are run online or new technologies are developed. Alternatively, it may be that the online medium is not an adequate environment for networking.

When academics opt for an in-person format, they ought to be mindful of its environmental and financial costs and its implications for accessibility. They should resort to it only when the online version is not feasible for conference goals, while taking all the possible measures to decrease the environmental cost as well as to ensure accessibility. Given that most academics accept moral and justice principles and the recommendations of the IPCC, they should end the practice of externalizing the environmental costs of conferences and adopt mandatory carbon offset measures both for in-person and for online conferences; the latter are not entirely carbon free. In addition, we should continue to strive for accessible in-person conferences through measures like accessible venues and facilities, family-friendly scheduling and visa-friendly timing of decisions. Philosophers and other academics should take the natural experiment that the pandemic brought about as an opportunity to build interdisciplinary work groups to study and establish best practices for online conferences, environmentally friendly and accessible in-person conferences, and adequate ways to offset carbon emissions.

Administrators of universities and research institutions might take the shift to online conferences as simply a justification for reducing travel funding. However, they ought to view it as a motivation to reduce environmental costs of teaching and research done at their institutions, in-person conference participation being only a part of it. Teaching and research institutions are committed to a greater common good. Engaging in activities that pursue the common good while producing pollution that threatens the wellbeing of all and especially of the vulnerable creates an inconsistency between the deeds of institutions and their stated principles. It is incumbent on the administrators of teaching and research institutions to eliminate that inconsistency.

In-person conferences, externalization of environmental costs due to professional conventions and other aspects of research and teaching, as well as minimal and rare voluntary offsets of emissions have been the default of academic practice. The three reasons for online conferences we outlined, the models of conferences of different sizes we have organized

successfully, as well as the wider recognition among academics of the environmental footprint of their research activities suggest changing the default of academic practice to online meetings, denying the externalization of environmental costs, and ensuring mandatory offsetting of unavoidable carbon emissions. In-person conferences should become rare and well justified departures from the default of the online format.

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DC, VP, TJP, RT: Conception and design of the work, Data collection, Drafting the article, Critical revision of the article

AT, RT: Data analysis and interpretation

All: Critical revision of the article and final approval of the version to be published

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### **Ethical Approval**

The ethics boards at Utrecht University, Bielefeld University and the University of Dayton deemed that the surveys did not require ethical approval.



## REFERENCES

- Albayrak-Aydemir, N. 2020. The hidden costs of being a scholar from the global south. *Higher Education Across Borders (LSE Blog)*. Accessed 18<sup>th</sup> September 2020.  
<https://blogs.lse.ac.uk/highereducation/2020/02/20/the-hidden-costs-of-being-a-scholar-from-the-global-south/>
- Botterill, S. 2020. How to host an accessible online meeting. *Ability Net*. Accessed 18<sup>th</sup> September 2020.  
<https://abilitynet.org.uk/news-blogs/how-host-accessible-online-meeting>
- Bousema, T, P. Selvaraj, A. A. Djimde, D. Yakar, B. Hagedorn, A. Pratt, D. Barret, K. Whitfield, and J. M. Cohen. 2020. Reducing the carbon footprint of academic conferences: the example of the american society of tropical medicine and hygiene. *The American Journal of Tropical Medicine and Hygiene*, 1758-1761. doi: 10.4269/ajtmh.20-1013
- Broome, J. 2016, A reply to my critics. *Midwest Studies in Philosophy*, 40: 158-171. doi:10.1111/misp.12053
- Buckner, C., N. Byrd, and J. Schwenkler. 2015. *The Future of Online Conferences in Philosophy*. Accessed Dec. 3, 2020.  
<https://dailynous.com/2015/10/15/the-future-of-online-conferences-in-philosophy/>
- Burtscher, L., D. Barret, A. P. Borkar, V. Grinberg, K. Jahnke, S. Kendrew, G. Maffey, and M. J. McCaughrean. 2020. The carbon footprint of large astronomy meetings. *Nature Astronomy* 4 (9): 823-825.
- Byrd, N. 2020. Online conferences: Some history, methods, and benefits. forthcoming in *Right Research: Modelling Sustainable Research Practices in the Anthropocene*, eds. G. Rockwell, C. Miya and O. Rossier. Open Book Publishers.
- Calisi, R. M. and a Working Group Mothers in Science. 2018. Opinion: How to tackle the childcare–conference conundrum. *PNAS* 115 (12) 2845-2849.  
<https://doi.org/10.1073/pnas.1803153115>
- Calzavarini, F., and M. Viola. 2020. Socially distanced, yet virtually convened: neural mechanism online’s model of online conferencing. Accessed 28<sup>th</sup> August 2020.  
<https://dailynous.com/2020/03/20/socially-distanced-yet-virtually-convened-model-online-conferencing-guest-post/>
- De Cruz, H. 2015. How to organize a philosophy conference. *Philosophers Cocoon*. Accessed 9<sup>th</sup> October 2020.  
<https://philosopherscocoon.typepad.com/blog/2015/08/how-to-organize-a-philosophy-conference-or-workshop.html>

- Felappi, G., A. Gregory, and H. Beebee. 2018. Guidelines for accessible conferences: A guide by the British Philosophical Association and the Society for Women in Philosophy UK. <https://bpa.ac.uk/diversity/>
- Fleming, N. 2019. How to organize a conference that's open to everyone. *Nature* 571, S46-S47 doi: 10.1038/d41586-019-02253-9
- Gardner, L. 2020. How college leaders are planning for the fall. *The Chronicle of Higher Education*. Accessed 9th October 2020. <https://www.chronicle.com/article/how-college-leaders-are-planning-for-the-fall>
- Gunnel, M. 2020. What is Zoombombing, and how can you stop it? *How-to Geek*. Accessed 27th October 2020. <https://www.howtogeek.com/667183/what-is-zoombombing-and-how-can-you-stop-it/>
- Humanities Indicators. 2019a. Racial/Ethnic Distribution of Degrees in Philosophy. *American Academy of Arts & Sciences*. Accessed 5th October 2020. <https://www.amacad.org/humanities-indicators/higher-education/racialethnic-distribution-degrees-philosophy>
- Humanities Indicators. 2019b. Gender distribution of degrees in philosophy. *American Academy of Arts & Sciences*. Accessed 5th October 2020. <https://www.amacad.org/humanities-indicators/higher-education/gender-distribution-degrees-philosophy>
- Lee, J. 2020. A neuropsychological exploration of zoom fatigue. *Psychiatric Times*. Accessed 4th December 2020. <https://www.psychiatrictimes.com/view/psychological-exploration-zoom-fatigue>
- Khalid, F., S. Ardila-Gómez, and K. Scott. 2016. Visa headaches and inequalities in attending global health conferences. *The BMJ Opinion*. Accessed 5th October 2020. <https://blogs.bmj.com/bmj/2016/11/03/visa-headaches-and-inequalities-in-attending-global-health-conferences/>
- Klöwer, M., D. Hopkins, M. Allen, and J. Higham. 2020. An analysis of ways to decarbonize conference travel after COVID-19. *Nature*. 583: 356-359.
- Kovacs, K. 2016. Grad students' financial worries. *Inside Higher Ed*. Accessed 9th October 2020. <https://www.insidehighered.com/news/2016/11/17/report-finds-many-graduate-students-are-stressed-about-finances>
- Minai, N. Z. 2018. Guest post: Challenges for academics in the global south—resource constraints, institutional issues, and infrastructural problems. *The Scholarly Kitchen*. Accessed 25 September 2020.

- <https://scholarlykitchen.sspnet.org/2018/08/16/guest-post-challenges-academics-global-south-resource-constraints-institutional-issues-infrastructural-problems/>
- Nadler, R. 2020. Understanding “Zoom fatigue”: Theorizing spatial dynamics as third skins in computer-mediated communication. *Computers and Composition*, 58, 102613.
- Newsletter of ISHPSSB. 2019. Volume 30, No. 2. Issue 57. Accessed 22 October 2020.  
<https://www.ishpssb.org/news/newsletters/196-newsletter-volume-30-no-2-issue-57-fall-2019>
- Sustainability and Climate Task Force. Accessed 22 October 2020.  
<https://www.philsci.org/inclusion-outreach/sustainability-climate-task-force.html>
- Railton, P., M.-K. Lee, D. Michelfelder, and R. Zheng. 2020. *APA Good Practices Guide*, February 2020 Edition.  
<https://www.apaonline.org/page/goodpracticesguide>
- Schwitzgebel, E., and C. D. Jennings. 2017. Women in philosophy: quantitative analyses of specialization, prevalence, visibility, and generational change. *Public Affairs Quarterly*, 31, 83-105.
- St. Croix, C. 2020. The online-first model: On hosting an awesome online academic conference. Accessed 28th August 2020.  
<https://dailynous.com/2020/03/16/online-first-model-hosting-awesome-online-academic-conference-guest-post-catharine-st-croix/>
- Stevens, A. R. H., S. Bellstedt, P. J. Elahi, and M. T. Murphy. 2020. The imperative to reduce carbon emissions in astronomy. *Nature Astronomy* 4(9): 843-851.
- Zahneis, M. 2020. More doctoral programs suspend admissions. That could have lasting effects on graduate education. *The Chronicle of Higher Education*. Accessed 9th October 2020.  
<https://www.chronicle.com/article/more-doctoral-programs-suspend-admissions-that-could-have-lasting-effects-on-graduate-education>
- Zwart, S. P. 2020. The ecological impact of high-performance computing in astrophysics. *Nature Astronomy* 4(9): 819-822.

