

Organizing a Successful Artificial Intelligence Online Conference: Lessons from the 13th Symposium on Combinatorial Search

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The 13th Symposium on Combinatorial Search (SoCS) was held May 26 to 28, 2020. Originally scheduled to take place in Vienna, Austria, the symposium pivoted toward a fully online technical program in early March. As an in-person event, SoCS offers participants a diverse array of scholarly activities including technical talks (long and short), poster sessions, plenary sessions, a community meeting and, new for 2020, a Master Class tutorial program. This article describes challenges, approaches, and opportunities associated with adapting these many different activities to the online setting. We consider issues such as scheduling, dissemination, attendee interaction, and community engagement before, during, and after the event. In each case, we report on the approaches taken by SoCS, then give a post hoc analysis of their effectiveness and discuss how these decisions continue to impact the SoCS community in the days after SoCS 2020. This work will be of interest to organizers of similar conferences who may be considering the switch to an online format.

The Symposium on Combinatorial Search (SoCS) is an annual meeting of artificial intelligence (AI) researchers with an interest in the theory and practice of symbolic state-space search. Now in its 13th edition, SoCS 2020 took place entirely online during May 26 to 28. The decision to hold SoCS as a virtual conference was late-breaking and taken in response to the global Coronavirus-19 pandemic. It was a major departure for the SoCS series of symposia and also for the broader AI community, which values physical meetings as the primary method for disseminating new scientific results. On account of its early timing, SoCS 2020 was regarded by some in the community as an experiment, ahead of other larger AI meetings that decided to postpone or to move to a fully online format, such as the Principles and Practice of Constraint Programming Conference, the European Conference on Artificial Intelligence, the International Conference on Automated Planning and Scheduling (ICAPS), the International Joint Conference on Artificial Intelligence, and the International Conference on Principles of Knowledge Representation and Reasoning.

In this article, we report results from the SoCS 2020 experiment, widely regarded among participants and in the community as a success. We describe the organization of the symposium and our decision-making process regarding different aspects of the technical program. We were guided in this process by two important considerations: how to cater to the truly international community of SoCS attendees; and how to maintain the *SoCS community spirit*, wherein attendees spend several days at a secluded location, working and socializing together at every opportunity.

Beyond its immediate success, we also discuss how the now-proven online format adopted for SoCS 2020 is helping to shape the future of the community. These issues include the need for a broader digital footprint to help anchor and grow the community online, and the possibility for remote as well as physical participation during future editions of the symposium.

Background

In the field of AI, and in the broader field of computer science more generally, research moves extremely quickly. Progress is driven by a combination of extreme interest on the one hand and broad applicability on the other. For this reason, conference proceedings are the primary method of scientific communication. These areas contrast with other research disciplines, such as mathematics, science, and the humanities, where other methods of dissemination are preferred (for example, journal article or book monograph).

Since 2008, SoCS has brought together a diverse array of fifty to sixty AI researchers working on symbolic state-space search. The latest results from this area appear in the SoCS technical program and are preserved for future reference in archival proceedings. Differentiating SoCS from other similar events is the fact that each year the meeting takes place in a semi-remote retreat location, which fosters long periods of focused group discussion. Because of its smaller size, SoCS has usually taken place just before or just after another AI meeting. For 2020, SoCS was organized as a colocated event with the 17th International Conference on the Integration of Constraint Programming, Artificial Intelligence and Operations Research. Both the 17th International Conference on the Integration of Constraint Programming, Artificial Intelligence and Operations Research and SoCS were intended to be physical meetings in Vienna, Austria, with limited overlap to encourage cross fertilization.

With the rise of the Coronavirus-19 global pandemic, both SoCS and 17th International Conference on the Integration of Constraint Programming, Artificial Intelligence and Operations Research had to pivot. The preferred option for SoCS was to retain the originally announced dates (May 26 to 28) and to migrate the entire technical program to an online setting.

SoCS 2020 was not the first conference to grapple with these challenges. The International Conference on Autonomous Agents and Multi-Agent Systems, a related but substantially larger sister event, also pivoted toward fully online presentation and took place May 9 to 13, immediately preceding SoCS 2020. Other events that happened before SoCS 2020 included, among others, the International Conference on Performance Engineering (April 20 to 24, 2020; Iosup et al. 2020), the International Conference on Extending Database Technology (March 30 to April 2, 2020; Bonifati et al. 2020), the Neuro-match conference (March 30 to 31, 2020; Achakulvisut et al. 2020), and the Photonics Online Meetup (January 13, 2020; Reshef et al. 2020).

Decisions to Take

The originally announced format for SoCS 2020 featured a diverse number of activities, including paper talks (short and long), invited plenaries, poster sessions, a series of Master Classes (tutorials), and a community meeting. In this section, we discuss the main considerations and decisions taken to transfer this technical program to a fully online setting.

Format for Technical Talks

One of the pivotal aspects to consider when organizing a conference is how talks will be delivered. In an online setting, talks can be broadcast live, using tools for online meetings such as Zoom, Google Meet, and Microsoft Teams, or they can be delivered as prerecorded video, using platforms such as YouTube. Both approaches have advantages and disadvantages, and we considered these carefully for SoCS 2020:

Live Talks

Similar to an in-person meeting in terms of organization and interaction, the live talk format is well understood by speakers and organizers. It has the least overhead in terms of setup costs (choosing a platform, scheduling a time) and it allows speakers to work on the slides up to the time of their talk. One of the main disadvantages is scheduling: speakers must be available at fixed times and in a suitable environment for presenting. Another disadvantage is that the quality of the presentation depends on the quality of the network connection, not only for the speaker but also for participants. It has been documented, for example, that during the Coronavirus-19 lock-down period, internet usage dramatically increased (Candela, Luconi, and Vecchio 2020), which affects the quality and reliability of individual connections.

Prerecorded Talks

In this format, speakers record and submit their talk well in advance. The quality of the content is carefully controlled by the speaker and the quality of the delivery is guaranteed once the video is shared and downloaded. The main disadvantage of this format is an increased workload for organizers. Detailed instructions

must be provided for speakers before the event. Submitted videos must then be checked (for video and audio quality and for adherence to time limits) and possibly postprocessed, such as into a streaming session. The timing and release of videos is another area that requires careful consideration so that each talk can receive the attention of the community.

Impact on Question-and-Answer (Q&A) Interactions

The format of talks strongly influences the type of interactions possible between speakers and participants. Live talks must be carefully managed, and questions can only be taken at the end. Depending on the timing of the speaker, and the constraints of the schedule, discussion can even be cut short so that the next presentation can begin. By comparison, prerecorded talks have the advantage that discussion can take place also during the premiere time of each video, which gives participants and speakers more time to interact.

For SoCS 2020, we carefully considered the pros and cons of each format and opted for prerecorded talks. A few days after the acceptance notification, authors were provided with detailed instructions for recording their talks, using tools such as Screencast-o-matic, Kazam Screencaster, and OBS Studio. We requested each talk begin with a title card¹ showing photos of the speaker and possibly the authors. For keeping the talks engaging, we recommended strategies such as colorful slides and animations and using a picture-in-picture view to show the presenter alongside the content. We required authors to submit their videos three weeks before the conference. This allowed for some delays in the process (to be expected, given the exceptional circumstances) and enough time for us, the organizers, to check videos and prepare them. For Q&A, we used a combination of synchronous live chat and an asynchronous discussion forum.

Posters

Each year SoCS receives a substantial number of extended abstracts that are presented during a poster session. These sessions provide participants an opportunity to browse many works and to have longer, one-to-one discussions. Recent online conferences such as the International Conference on Extending Database Technology 2020 (Bonifati et al. 2020) suggest converting poster sessions into short talks, organized into a dedicated session without Q&A. At the Photonics Online Meetup 2020 (Reshef et al. 2020), posters were presented as a deck of four slides, each announced and discussed on Twitter. ICAPS 2020 exploited the gather.town² tool, where participants move an avatar into a two-dimensional map that mimics a conference center. In the specific case of poster session, participants can move their avatar from poster to poster, and discuss with authors, in a way that simulates the real-world corresponding interaction.

For SoCS 2020, we developed a specific microtalk format for poster presentations. Each talk was limited

to five minutes and a maximum of three slides (not including the title card). These talks were mixed into regular sessions. During, and immediately after, the premiere of each microtalk there was a live Q&A with opportunities for an asynchronous forum discussion thereafter.

Attendance and Registration

Online conferences have many benefits compared with in-person meetings and they are well positioned for attracting a wider audience. For participants, travel costs are eliminated, registration costs are reduced, and substantial amounts of time are saved. For organizers, online conferences are simpler to plan and less expensive. Many aspects of the physical conference, such as catering, rooms, receptions, badges, and welcome packs, are avoided. Another benefit for attendees and organizers is the reduction of the environmental impact, as compared with conventional meetings (Higham and Font 2020). Some new complications do arise, however, such as online hosting fees and software licenses, but these overheads tend to be smaller than those for an in-person meeting. The costs can be recovered by charging attendees a registration fee; however, this can act as a barrier to wider participation.

For SoCS 2020, we decided to charge one registration fee for each accepted paper, which covers the cost of the proceedings. Beyond that, participation was free for everyone. We asked authors, speakers, and interested participants to register for the SoCS forum, a dedicated bulletin board based on the phpBB system,³ which we used as a channel for communication and further announcements. The talks of the authors were free to watch, even anonymously, being streamed directly to YouTube at fixed premiere times. After their initial release, videos became freely available for viewing on-demand⁴ and we plan that they remain so in the foreseeable future.

Scheduling and Program

While the scheduling and the organization of a conference program is always a critical task, it becomes particularly challenging for online events. In the case of pre-recorded videos, one tempting option could be to release all talks at the same time. Indeed, this option was explored at the International Conference on Autonomous Agents and Multi-Agent Systems 2020, with only live keynotes and plenaries being scheduled at fixed times.

In the case of SoCS, we felt that releasing all videos simultaneously would undermine the spirit of the conference, which intends to bring together a tightly knit community for focused interaction. Instead, we opted for a conventional (to AI conferences) format, with talks being organized thematically into sessions. Each session ran for approximately sixty to ninety minutes and was scheduled for release on YouTube using the Premiere feature. In this setup, videos are played one after the other at fixed times, with some minutes of intermission in between.

Sessions encourage the community to gather at fixed times, which means each talk has a chance to be in the spotlight, and results in more vibrant Q&A with speakers and more robust interactions among participants. We scheduled five-minute breaks between talks in each session. These breaks signal the end of the live Q&A session (which begins while the video plays) and they provide a well-delimited time window for the community to resynchronize. Longer breaks, between sessions, simulate the lunchtimes and coffee breaks of a conventional meeting. They allow longer discussions and social gathering and we observed that many participants formed social circles during these times. Also, many participants met virtually in the evenings, after the end of the daily program.

This type of fixed scheduling requires one to select a reference time zone. However, attendees significantly out-of-sync with the reference time-zone will likely be unable to join for synchronous interaction. To solve this problem, a number of subsequent online conferences, including the International Conference on Machine Learning (July 12 to 18, 2020) and ICAPS 2020 (October 20 to 31), explored a dual delivery mechanism, where each talk is scheduled twice, thus ensuring that at least one presentation falls in a reasonable time window for all attendees. In the case of SoCS 2020, after some careful consideration, we opted for single delivery in the Central European Timezone. This was done for several reasons—because the in-person conference was supposed to happen in Austria; because Europe is the region where the largest number of community members live; and because the Central European Timezone provides a middle ground between people living in the Americas, and people living in Asia and Australia. To minimize the discomfort for them, where possible, talks involving authors from Asia and Australia were scheduled in the morning, while talks involving authors from the Americas were scheduled in the late afternoon.

Interaction between Participants

A major aspect of any AI conference is the interaction between participants. When moving to a virtual setting, it becomes crucially important to select the right tools and to leverage online advantages. At one end of the spectrum of possibilities we have asynchronous interaction. This method of communication is typified by e-mail correspondence and discussion forums. It does not require participants to be active at the same time and it allows for more elaborate and articulated exchanges. At the other end of the spectrum is synchronous interaction. This approach captures the spirit of face-to-face discussion: it is fast moving and requires participants to be online at the same time.

One possible tool for facilitating online interaction is *gather.town*.⁵ Explored at subsequent and larger online events, including ICAPS 2020 and the

International Conference on Principles of Knowledge Representation and Reasoning 2020, this is an application that allows participants to control an avatar moving in a two-dimensional space. Using avatars, participants can meet; when avatars are close together, video-calls are established between the corresponding users. This style of interaction is useful for organizing social events and for allowing participants to move between different sessions. At SoCS 2020 we explored two alternative methods of online participation, one synchronous and the other asynchronous.

For asynchronous interaction we used a dedicated forum.⁶ We created discussion threads for each keynote and session. We also posted announcements to the forum and we used it to provide instructions and information ahead of the symposium, such as advice for recording videos and instructions for participating. The forum was free, but registration was required to minimize the risk of trolls (Buckels, Trapnell, and Paulhus 2014). Trolls represent a critical risk for free online events, as they can disrupt any meaningful interaction and communication.

Synchronous interaction was achieved using Discord,⁷ a chat application that supports video, voice, and text. Instructions on accessing a dedicated SoCS Discord channel, and how to use Discord more generally, were provided via the forum — again to reduce the possibility of trolls. Authors of accepted papers were also asked to make themselves available for live Q&A on Discord at the time when their talk was scheduled for premiere. During longer breaks, public and private group discussions sprang up spontaneously, as happens during breaks at in-person conferences.

Moderation

Moderation requires significant effort for in-person AI conferences. A large number of session chairs and helpers are usually needed to make sure, for instance, that the schedule is followed, discussions do not degenerate, and participants are behaving according to a public and understood code of conduct. Our experience at SoCS 2020 is that moderation in a virtual setting is important but much less demanding. With regard to the forum, we used only very lightweight moderation, mostly for maintaining the organization and structure of the content. For the Discord, we found that two individuals (the organizers) were enough to moderate all the sessions. In all cases we relied on the ICAPS code of conduct⁸ to make clear the expected standard of all interactions.

Regarding Discord, we did not observe any abusive or aggressive behavior. Instead, we were pleasantly surprised by the fact that questions were more elaborated and more friendly in tone than might be expected at an in-person meeting. We assumed it was because, with text, it is hard to identify tones and that participants spent additional time to make sure their questions and their answers read well. We also noticed that customs quickly emerged in

Year	Location	Accepted Papers	Participants	Ratio
2015	Ein Gedi (Israel)	44	65	1.4
2016	Tarrytown, New York (USA)	41	41	1.0
2017	Pittsburgh, Pennsylvania (USA)	49	54	1.1
2018	Stockholm (Sweden)	27	65	2.4
2019	Napa, California (USA)	46	50	1.1
2020	Online	27	140	5.2

The number of papers is taken by reference to published proceedings. The number of participants is taken from data collected by previous organizers (2015 to 2019) and by counting user registrations on the SoCS forum (2020).

Table 1. Acceptance and Participation Rates for SoCS Conferences from 2015 to 2020.

the community — ways for clapping at the end of talks, for instance — and the best way to ask questions (by using the mentioning features of Discord) to make sure that they were noticed. Notably, such conventions evolved during the time of the conference, and were widely and promptly adopted by all the participants, with no enforcement from the moderators. In some cases, Q&A discussions went on for too long and overlapped with the start of the next talk. In such cases we asked the involved participants to move the discussion to a dedicated chat or to the forum. This is a very nice “plus” of online conferences, as one group of attendees can continue to interact while others can follow sessions without being disturbed.

Keeping Records

Discussion and Q&A for in-person conferences are highly valuable aspects, as they can lead to new collaborations and highlight potential developments of the presented works. Unfortunately, they are ephemeral in nature, as it is almost impossible to keep accurate public records during an in-person meeting. This is not the case for online conferences, where textual discussions and Q&A can be easily recorded for posterity. It is of course important to decide how to structure such minutes so that they are accessible and searchable by the community at a later point in time.

For SoCS 2020, we kept track of all the discussions that happened during Q&A sessions. The forum provided the ideal platform for recording such discussions, and for structuring them. In particular, one thread per session was created to maximize clarity and to make it easier to look at them. The main point was to make sure that the people who did not attend the specific session were provided with all the relevant and interesting discussion from the session. Being asynchronous, the forum allows these discussions to continue even after the conference is over, and provides links to relevant papers, tools, or websites mentioned during the meeting.

Beside discussions, videos of the talks are another way of documenting the conference, and they can

be likewise organized and stored. For SoCS 2020, we created playlists in a dedicated YouTube channel. The description of each video specifies its content and refers to the conference forum for additional information.⁹

Evaluation

To evaluate the success of SoCS 2020, we examine *participation rate*, which we define as the number of registered participants per accepted paper. As is typical for the field, SoCS requires at least one author per paper to register for the conference and to present the work as part of the technical program. In other words, the minimum participation rate expected in any given year is 1.0. The underlying hypothesis is that higher rates of participation indicate the technical program has attracted the attention of a broader community.

Table 1 compares SoCS 2020 with the previous five symposia (2015 to 2019), each of which were held as in-person meetings and without any online component. The data show that, as a physical event, SoCS is typically attended only by authors of accepted works. Higher rates of participation can be observed in years where the conference is held in a location with a strong community presence (Israel in 2015) or when the conference is co-located and concurrent with major AI meetings (such as the International Joint Conference on Artificial Intelligence in 2018). SoCS 2020 has by far the highest recorded participation rate, despite a smaller technical program. We attribute these gains to the online format and to the low cost. With free registration and no travel requirements, multiple authors per paper can register for the conference. There were one-hundred-and-forty registrations on the SoCS forum and one-hundred-and-seven unique users subsequently logging into the SoCS Discord server for live discussions (the address of our Discord server was made available only to forum members).

Although free, user registration can act as a disincentive for persons otherwise interested in online content (Li and Pavlou 2014). To mitigate this

issue, every session at SoCS 2020 was premiered on YouTube and made available afterward, as detailed above, and therefore, anyone with Internet access can enjoy them. User registration was therefore necessary only for Q&A with the speakers and for interacting with other participants from the SoCS community.

Figures 1 and 2 show statistics gathered from YouTube regarding views and viewers. We focus on the three days of the conference and the week immediately after. YouTube reports 1,957 unique views over this period, approximately two-thirds of which occur in the first three days. There were four-hundred-and-sixty-nine unique viewers in total, or approximately three times higher than the number of registered participants. Moreover, with all presentations being available online and in perpetuity, there exist further opportunities for interested persons to find and engage with the technical material. Here we focus on that period of time because, in our opinion, it provides the best angle to analyze the conference success. Videos on YouTube will still be watched in the coming months, but that is a different kind of evaluation, which looks more into the impact of the topic for the wider — and potentially nonacademic — community.

Discussion

SoCS 2020 received an extremely strong positive response from attendees and from the Search community more generally. We feel confident concluding that moving the conference to a fully online format, despite some risks and uncertainties, was ultimately the right decision. The core principles of our approach can be summarized as follows:

Prerecorded Videos

This approach allows speakers to carefully manage the quality of their material and delivery, while avoiding all technical issues typically associated with live presentations.

Streaming Sessions

This approach allows the community to meet online at times announced well in advance. Because sessions attract larger audiences, every video has an opportunity to be in the spotlight. After the session, videos were available for viewing on-demand.

Live Q&A

This approach has the advantage that discussions can take place during the video premiere, instead of only at the end as with a conventional format. We found that live chat works well for a smaller community such as SoCS but that it also has the potential to scale to larger events, where moderators can relay questions to the speaker.

Community Hub

We used a discussion forum for asynchronous discussion where participants and speakers can engage

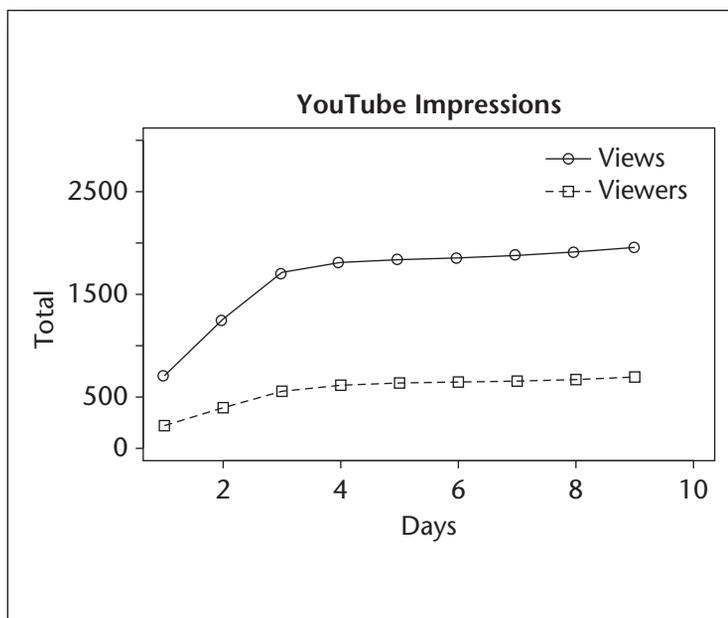


Figure 1. Cumulative Views and Viewers, According to YouTube.

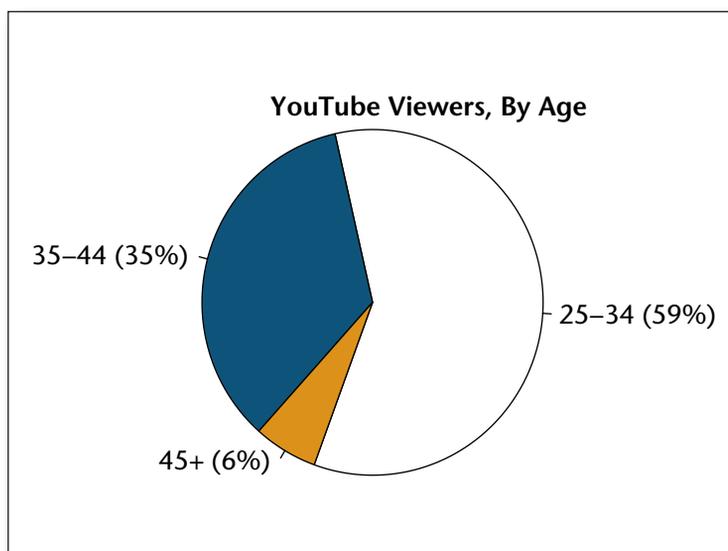


Figure 2. Viewers by Age, According to YouTube.

after a video premiere. The forum also served to coordinate the conference and for keeping a record of the meeting, with live discussions being summarized there.

Conclusion

By the time of the community meeting, which typically concludes every SoCS event, it was clear the online format had become a proven success. Among the many issues arising at the meeting was whether future editions of SoCS should continue as online meetings or at least retain some



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online aspects. Among the identified advantages are higher participation rates, reduced costs, and a much smaller environmental impact (Higham and Font 2020; Pacchioni 2020). Of course, this came at the cost of missing part of the *retreat feeling* that an in-presence conference in a remote location would have had. One possibility for a mixed format is to introduce a prerecorded microtalk that can serve as an advertisement for a longer in-person event but can still give an overview of the paper to people that are not able to attend the in-presence event. Another even more blended possibility is the addition of a virtual day that could precede the in-person meeting and include additional activities such as a Doctoral Consortium or further Master Class talks.

Other innovations from SoCS 2020 are already having an impact on the community. The discussion forum, for example, has been adopted as a general hub for the discussion of the SoCS series of symposia and for search-related topics more generally. Videos uploaded to the SoCS YouTube channel will form part of an upcoming library intended to bring students and newcomers up to the moment with research directions in the subject area.

Notes

1. tinyurl.com/txdphkm
2. gather.town
3. www.phpbb.com
4. Links to the session videos and individual talks appear on the SoCS 2020 website, socs20.search-conference.org/main.php?page=program
5. gather.town
6. forum.search-conference.org
7. discord.com
8. www.icaps-conference.org/index.php/Main/CodeOfConduct
9. The complete playlist is available at shorturl.at/jwIY5

References

Achakulvisut, T.; Ruangrong, T.; Bilgin, I.; van den Bossche, S.; Wyble, B.; Goodman, D. F.; and Kording, K. P. 2020.

Improving on Legacy Conferences by Moving Online. *eLife* 9: e57892. doi.org/10.7554/eLife.57892

Bonifati, A.; Guerrini, G.; Lutz, C.; Martens, W.; Mazilu, L.; Paton, N.; Salles, M. A. V.; Scholl, M. H.; and Zhou, Y. 2020. Holding a Conference Online and Live Due to COVID-19. arXiv preprint. arXiv:2004.07668[cs.DB]. Ithaca, NY: Cornell University Library.

Buckels, E. E.; Trapnell, P. D.; and Paulhus, D. L. 2014. Trolls Just Want to Have Fun. *Personality and Individual Differences* 67:97–102. doi.org/10.1016/j.paid.2014.01.016

Candela, M.; Luconi, V.; and Vecchio, A. 2020. Impact of the COVID-19 Pandemic on the Internet Latency: A Large-Scale Study. arXiv preprint arXiv:2005.06127[cs.NI]. Ithaca, NY: Cornell University Library.

Higham, J., and Font, X. 2020. Decarbonising Academia: Confronting our Climate Hypocrisy. *Journal of Sustainable Tourism* 28(1): 1–9. doi.org/10.1080/09669582.2019.1695132

Iosup, A.; Trubiani, C.; Koziolok, A.; Amaral, J. N.; Bondi, A. B.; and Brunner, A. 2020. Flexibility is Key in Organizing a Global Professional Conference Online: The ICPE 2020 Experience in the COVID-19 Era. arXiv preprint arXiv:2005.09085[cs.CY]. Ithaca, NY: Cornell University Library.

Li, T., and Pavlou, P. A. 2014. *What Drives Website Registration? Network Externalities versus Information Privacy Concerns*. Fox School of Business Research Paper No. 15-053. Temple University Research Paper Series. Philadelphia, PA: Temple University. <https://doi.org/10.2139/ssrn.2510116>

Pacchioni, G. 2020. Virtual Conferences Get Real. *Nature Reviews Materials* 5(3): 167–8. doi.org/10.1038/s41578-020-0187-z

Reshef, O.; Aharonovich, I.; Armani, A. M.; Gigan, S.; Grange, R.; Kats, M. A.; and Sapienza, R. 2020. How to Organize an Online Conference. *Nature Review Materials* 253–6.

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