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Online conferences as an opportunity to enhance inclusiveness in animal behaviour and welfare research: A case study of the ISAE 2020 virtual meeting☆

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ABSTRACT

The COVID-19 pandemic caused worldwide disruptions and changes, including in the way research was conducted. One aspect was the cancellation of in-person scientific conferences and the rapid replacement of some into virtual conferences. The aim of this study is to highlight the opportunities that virtual conferences can bring to animal behaviour and welfare research, with a focus on regional diversity and early career researchers (ECRs). The ISAE 2020 virtual meeting was used as a case study. Firstly, conference attendance was compared to the ISAE 2019 in-person international congress. Secondly, a post-conference survey was conducted (n = 142 responses). Data were analysed quantitatively (multinomial models) and qualitatively (word classifications). The organisation by geographical region attracted many non-local attendees and positive feedback was received on the global perspective. The participation from the ISAE developing regions AFRICA (Africa/Central Asia/Middle East), ASIA (South/East/Southeast Asia) and LATAM (Latin America) was higher as compared to the in-person conference (p < 0.001). The most valued advantage for the virtual conference was the reduced cost, followed by the increased ability to participate and the reduced environmental footprint. The most valued advantages did not differ between regions or attendees of different career stages, but an interaction showed that the ability to participate was more appreciated by ECRs in developing regions (p < 0.05). Over 75% of the respondents ranked the absence of social interaction as the most important disadvantage. Respondents from developed regions were more likely to attend a future virtual conference with a registration fee as compared to those from developing regions (p < 0.05). Respondents most enjoyed the organisation, flexibility, quality of presentations and regional diversity from their virtual experience. This study showed that within applied animal behaviour and welfare science, the virtual format of an international conference can promote participation from diverse regions, especially from less financially privileged groups, but attention should be paid to enhance the social element of a virtual conference.

1. Introduction

The year of 2020 was historically marked by the SARS-COV-2, or COVID-19 global pandemic. Large scale lockdowns and restrictions took place in many countries. This also severely disrupted scientific research (Corbera et al., 2020) and especially research that included animal trials (Myers et al., 2020). The long-lasting restrictions on social contact and mobility led to a cancellation of in-person conferences (Niner et al., 2020). Scientific conferences are an important format for sharing research work, exchanging ideas, learning and networking, and they thus have an important role in strengthening the scientific community (Zierath, 2016). In-person conferences are also crucial for early career researchers (ECRs, i.e., within 5 years after obtaining a PhD degree, including undergraduate students) to present their work through oral or poster presentations as part of their career development training (King, 2013; Zierath, 2016) and to expose their profiles and network with others. Scientific conferences provide a platform for early career researchers to establish their position in the scientific community by presenting their research work and receiving feedback from experts in the field (Corbera et al., 2020).
possible future collaborators. In addition, for the relatively small societies within animal behaviour and welfare science, conferences present a moment of reunion with friends and former colleagues and enhance the sense of community. As a result of the COVID-19 pandemic, however, several major organisations in animal sciences cancelled or postponed their annual conferences, such as the British Society of Animal Science (BSAS), the European Federation of Animal Science (EAAP) and the Welfare Assessment at Farm Level (WAFL), with the latter only taking place every three years. Some societies instead held their conferences in an online format, i.e., as virtual conferences, such as the Association for the Study of Animal Behaviour (ASAB; Raby and Madden, 2021a, 2021b) and the Universities Federation for Animal Welfare (UFAW), and this move is generally welcomed, as demonstrated by a greater number of global participants (Sohrabi et al., 2021; UFAW, 2020).

The change to a virtual format has been identified as a potential opportunity for increased research collaboration (Niner et al., 2020; Sohrabi et al., 2021), especially for those who are normally less likely to join a congress due to financial, travel and/or time constraints (Pulcher et al., 2020; Zierath, 2016). These opportunities particularly benefit researchers in developing countries as well as ECRs and students. Increasing engagement in animal behaviour and welfare science can have a direct impact on the development of this yet young and burgeoning academic field and on public perception of animals and their status quo (Mellor and Beyvel, 2004). This can, in particular, be achieved through conference attendance from a wider geographical area and diversity (e.g., participants from different career stages in academia, industry and non-government organisations). The wider reach has the potential to improve animal welfare, especially in areas where currently limited knowledge on animal behaviour and welfare exists. It is therefore important to understand whether an online meeting format can increase further outreach, without losing the benefits of an in-person conference.

The International Society for Applied Ethology (ISAE) decided in April 2020 to organise a virtual meeting for members and non-members, without a registration fee. To facilitate international participation, the conference was organised in two 12 h continuous sessions spanning the various ISAE regions. This enabled attendees in all time zones to participate in talks that were hosted by their local and neighbouring regions. In conjunction, ISAE made a firm statement to its members on its recognition of “the importance of supporting and promoting diversity in its membership and the wider community, in gender, age, race and ethnicity, geographical representation and other factors”, and began the process of forming a dedicated committee to support inclusiveness and to promote BAME (Black, Asian, minority ethnic) representation in the society (ISAE Council, 2020b).

The aim of this study was to investigate the change in conference attendance and the perception of the attendees from the ISAE 2020 virtual meeting. The meeting was used as a case study to better understand how a virtual conference can contribute to increased inclusiveness and to assess the opportunities for the applied animal behaviour research community. We hypothesised that the virtual conference would improve the diversity of engagement, and that attendees would differ in their perceived advantages and disadvantages of a virtual format depending on geographical region and career stage, with more benefits for developing countries and early career researchers. Although this study does not involve the behaviour of non-human animals, it has profound implications on the application of animal behaviour and welfare research and the future direction of knowledge exchange that needs to be considered.

2. Materials and methods

2.1. The ISAE 2020 virtual meeting

The decision to postpone the 2020 ISAE international congress (originally planned to take place in India) was made in March 2020, when an agreement was reached between the ISAE Council and the organisers that the pandemic was destined to prevent the possibility of an in-person meeting. The organisation for the virtual meeting began in late April 2020 by the efforts of the ISAE council members, regional secretaries and country liaison officers.

Conference registration was open for five weeks and was announced among members (through e-mail and ISAE website) and on social media (Twitter, Facebook). The conference was free to register and attend. Within less than three weeks of announcement, 136 abstract submissions were received. Conference abstracts went through the peer-review process. From the selected abstracts, 48 were from ECRs. The conference was held through Zoom (Zoom Video Communications, Inc., San Jose, USA) and included eight invited talks (of 20–30 min each), 45 talks of 10 or 15 min and 11 short talks of 5-minute length. Talks were pre-recorded and were followed by live online questions and answers (Q&A), whereby the attendees could type their questions in an on-screen Q&A box and were recited by the session moderator. There were no parallel sessions or poster sessions. The conference took place on 6–7 August 2020 and was organised by region to account for the different time zones, extending a global coverage. The programme was divided into ten regional sessions: Australia/New Zealand (AU/NZ), South-East/South-East Asia (2 separate sessions, hereafter abbreviated as ASIA), Africa/Central Asia/Middle East (2 separate sessions, hereafter abbreviated as AFRICA), Europe (2 separate sessions), Latin America (2 separate sessions, LATAM), and Canada and the USA (NA) and spanned two 12 h continuous runs. The categorisation of the regions was based on the proximity of geographical locations to mainly accommodate time zone differences and groupings of similar cultural backgrounds.

2.2. Conference registration and attendance

Data were collected about the registrants and the attendees. The conference pre-registration was collected using Google Forms (Google LLC., Mountain View, USA), and included pre-registrants’ full name, email address, membership and sessions selected to attend. As the conference was held via the Zoom platform, participants needed to enter their name, email address and their ISAE membership status to register again and obtain a link to join in each session. Zoom also recorded the attendees’ country, membership and session attendance. Data were obtained under general user consent and were anonymised after an initial check for duplicate entries based on unique email addresses.

2.3. Post-conference survey

After the conference, an anonymous post-conference survey was hosted on SurveyMonkey (SVMK Inc., San Mateo, USA) and distributed to all conference attendees (society members and non-members) who had accessed the Zoom link to any of the sessions (confirmed attendance, n = 311). Before starting the survey, respondents were asked to give their consent on whether they agreed with the following statements: 1) You voluntarily agree to participate, 2) You are at least 18 years of age, 3) You agree that your responses will be used by ISAE for the purposes of understanding the participants’ feedback and improving future organisation, 4) You agree that you have not filled in this survey previously. Human ethics approval was not required, as the survey was anonymous and did not obtain personal data. Ten questions were asked on basic demographics and their experience of the virtual conference (survey questions in Table 1). In total, 142 surveys were received, all with valid answers, and used for the analyses.

2.4. The 2019 ISAE international congress in Bergen, Norway

Data from the previous ISAE International Congress was collected to serve as a comparison to the 2020 conference. The 2019 ISAE International Congress was organised by the Norwegian University of Life
Table 1
Post-conference survey questions.

| No. | Question | Answer type |
|-----|----------|-------------|
| Q1  | In which country are you living? | Single selection from a drop-down list |
| Q2  | Where did you learn of the opportunity to join the ISAE virtual meeting? | Multiple choice: ISAE website; ISAE social media; Other social media; ISAE members (including regional secretaries); The ISAE development programmes (e.g. DCCAF, travel scheme for regional meeting, promotion by the country liaisons, etc.); Colleague; Other (please specify) |
| Q3  | What is your current job / position? | Multiple choice: Undergraduate; Graduate Student; Postgraduate student; Technicians; Early Career Researcher (within 5 years of completion of PhD); Academic/researcher; Industry/NGO representative; Other (please specify) |
| Q4  | Are you an ISAE member? | Multiple choice: Yes; No |
| Q5  | Have you attended an ISAE international conference previously? | Multiple choice: Yes, in regional meeting; Yes, in both International Congress and regional meeting; No |
| Q6  | Please rank the important advantages of a virtual conference for you? | Ranking of 9 choices from the most important to the least important (skipping a choice is possible) |
| Q7  | Please rank the disadvantages of a virtual conference over a physical conference for you? | Reduced cost compared to a physical conference; No costs at all; Reduced environmental footprint; Better able to manage other tasks alongside the conference; No travel needed; More able to participate due to a health issue or disability; More flexibility in which talks to watch; Possibility to watch recorded talks later; Pre-recorded talks are less stressful to contribute |
| Q8  | Would participation in a future ISAE conference for you depend on the option for virtual participation? | Multiple choice: Yes, I would participate virtually if the registration fee is the same as the in-person conference; Yes, I would participate virtually if the registration fee is lower than the in-person conference; Yes, but I would only participate virtually if there is no registration fee; Depending on whether my abstract gets accepted; Depending on travel restrictions (e.g. Covid-19 or other issues...); No, I would just participate the in-person conference; No opinion |
| Q9  | What are the aspects that you particularly liked/enjoyed during this virtual meeting? | [Open answer] |
| Q10 | Do you have suggestions on how to improve future ISAE (regional/ international) virtual meetings or any other feedback regarding this meeting? | [Open answer] |

Sciences and took place in Bergen, Norway. The Congress was announced in December 2018 with the early bird registration deadline in May 2019. The early bird registration fees for members and non-members were 4,750 NOK (Norwegian Krone, the average exchange rate in 2019 was 1 NOK = £0.09/€0.10/USD$0.11) and 5,700 NOK, respectively. For PhD students the conference registration fee was 2,650 NOK with ISAE membership and 3,200 NOK without. The conference was advertised by the organiser’s dedicated website and through ISAE networks. Travelling scholarships were available for selected ISAE members (11 awarded) and developing countries fellows (14 awarded). In total, 375 abstracts were submitted. There were 416 attendees from 38 countries and 104 oral and 183 poster presentations (Newberry and Braastad, 2019). The programme was structured into main conference themes and sub-themes on different scientific topics, held in two parallel sessions except for the plenary lectures. Free social programmes were available (e.g., welcome reception, farewell party, six themed workshops, lunch discussion roundtables and a ‘lunch with ethologists’ organised by the student representatives). Additional social dinners and excursions were available at additional charges.

2.5. Quantitative data analysis

The responses to questions Q1, Q3 and Q6-Q8 were reduced to create variables with fewer categories in order to facilitate better analyses (descriptive statistics to the original categories are shown in Table S1). Q1 received the variable name ‘Region’ and countries were categorised under their ISAE region: AFRICA, ASIA, AU/NZ, Europe, LATAM and NA (descriptive statistics shown in Table S2). For analysis by ‘development’, regions were combined into developed (AU/NZ, Europe, NA) and developing regions (AFRICA, ASIA, LATAM) based on the classification by the ISAE development strategy, i.e., “promotes applied ethology and ISAE activity in countries where the ISAE is unrepresented or under-represented, particularly in Eastern Europe, Africa, the Middle East, Asia (apart from Japan) and Latin America” (ISAE Council, 2020a). Q3, which was renamed ‘ECR’, was categorised as ECR or not (yes/no). For Q6, ‘Advantages’, answers were categorised into 4 categories: reduced costs, increased ability to participate, reduced environmental footprint and reduced stress (details of the classification are in Table S3). For Q7, ‘Disadvantages’, answers were categorised as reduced social contact, less opportunity to acquire skills, technical issues and reduced cultural experience (Table S3). Q6 and Q7 were rankings involving 9 or 8 items to rank, respectively. In Q8, due to the low occurrences of choosing ‘Yes, I would participate virtually even if the registration fee is the same as the in-person conference’ it was combined with ‘Yes, I would participate virtually if the registration fee is lower than the in-person conference’ as the likelihood to attend virtual conferences with a fee and compared with only attending virtually without a fee or only in-person conferences. The other options, except for ‘No’ and ‘No opinion’ were not chosen by the respondents, and therefore this variable was categorised as yes/no (no opinion was discarded).

For the survey data, the respondent was the unit of analysis. Data were analysed using Statistical Analyses System (SAS, version 9.4, SAS Institute Inc., Cary, NC, USA). The likelihood to participate in future virtual conferences (Q8) was compared between ECRs and other respondents (researchers and other career types), and between respondents from the developed and developing regions using Chi-square test. Respondents who selected no opinion (n = 6) or omitted this question (n = 1) were not included in the analysis (n = 135 analysed). Comparison of region and membership between the attendees to the conference in 2019 and 2020 was done by Chi-square test.

For ‘advantages’ and ‘disadvantages’ (nominal data) only the highest ranked choice was analysed, after inspection of the data which revealed very little variation in the ranking of the choices beyond the first one (for details see Table S3). The highest ranked choice was analysed in a generalized linear model using maximum likelihood estimation (GENMOD procedure) with a multinomial distribution and cumulative logit (cumlogit) function and without random variable. The variables ‘advantages’ and ‘disadvantages’ were used as response variables, whereas ‘region’ (6 levels), ‘ECR’ (yes/no), ‘member’ (yes / no) and the interaction between ‘region’ and ‘ECR’ were the predictor variables in each
model. Membership correlated with previous ISAE conference attendance ($r = 0.63$, $p < 0.001$) and only membership was included in the models to avoid confounding between these two variables. In a second model, ‘region’ was substituted by ‘development’ (yes / no).

### 2.6. Qualitative data analysis

The two open questions in the survey (Table 1, Q9 and Q10) yielded 139 and 138 text answers respectively. From the answers, themes were extracted based on repetitions of relevant words. The sentences were then labelled according to the emerging themes. Occurrence of the themes was counted and presented as descriptive statistics by the respondent’s career stage and region. The word cloud for Q9 was generated with DisplayR (https://app.display.com/). Similar words were combined (e.g., ‘quality of talks’ included talks, quality and presenter; ‘Global’ included world, region, countries, continent and international, etc.). The same noun in singular or plural forms, and verbs in different tenses, were considered the same. Prepositions, conjunctions, and some generic verbs (e.g., go, make, work, can, etc.), adjectives (e.g., same, more, good, nice, important, etc.) and adverbs (e.g., well, very, really, etc.) were omitted.

### 3. Results

#### 3.1. Virtual participation

In total, 781 people pre-registered their interest in attending the ISAE virtual conference (for breakdown by regional sessions registered, see Supplementary files Table S4). Most pre-registrants (65.6 %) self-reported to not hold ISAE membership. In the second phase of registration for the Zoom meeting links, 785 individuals registered for various sessions (Table S4). In total, 311 individuals from 43 different countries attended the conference (Table 2). The attendance rate for various sessions (Table S4). In total, 311 individuals from 43 different countries attended the conference (Table 2). The attendance rate for various sessions (Table S4). In total, 311 individuals from 43 different countries attended the conference (Table 2).

#### Table 2

| Region    | Attendance 2019 (% of total 2019) | Attendance 2020 (% of total 2020) | % difference 2019-2020 | Attendance by country 2020 (n) |
|-----------|-----------------------------------|-----------------------------------|-------------------------|--------------------------------|
| AFRICA    | 4 (0.96)                          | 22 (7.10)                         | +638.06 %               | Israel (1), Jordan (1), Ghana (1), Morocco (2), Nigeria (15), Rwanda (1), South Africa (1) Bangladesh (2), India (22), Japan (11), South Korea (1), Philippines (1), Singapore (1) Australia (14), New Zealand (3) |
| ASIA      | 23 (5.53)                         | 38 (12.26)                        | +121.71 %               | Austria (9), Belgium (5), Bulgaria (1), Czechia (3), Denmark (5), France (3), Germany (14), Ireland (2), Italy (6), Netherlands (18), North Macedonia (1), Norway (1), Poland (1), Portugal (4), Slovenia (2), Spain (8), Sweden (3), United Kingdom (49) Argentina (7), Brazil (18), Chile (4), Colombia (2), Costa Rica (1), Ecuador (1), Mexico (5), Uruguay (4) Canada (22), USA (36) |
| AU/NZ     | 13 (3.12)                         | 17 (5.48)                         | +75.48 %                |                                  |
| Europe    | 264 (63.46)                       | 133 (42.90)                       | -32.39 %                |                                  |
| Total     | 419 (100.00)                      | 310 (100.00)                      |                          |                                  |

* (% of 2020 attendance – % of 2019 attendance) divided by % of 2019 attendance.

#### 3.2. Post-conference survey

All regions were represented in the survey, similar to the distribution of conference participation: AFRICA (n = 13, 9.2 %), ASIA (n = 16, 11.3 %), AU/NZ (n = 5, 3.5 %), Europe (n = 69, 48.6 %), LATAM (n = 24, 16.9 %) and NA (n = 15, 10.6 %, for country breakdown see Table S2). The responses to the five multiple choice questions (Q2-5, Q8), showing the respondent demographics, are given in the supplementary files Table S1. In summary, 51.4 % of the respondents were ECRs (n = 73), 12.0 % (n = 17) did not work in academia, 57.0 % (n = 81) had...
previously participated in an international and/or regional ISAE conference, and 49.3 % (n = 70) were ISAE members.

3.2.1. Advantages and disadvantages of an online conference

The most highly ranked advantage was the reduced cost of participating in the conference (47.9 %, n = 68), including the choice for no registration fee at all or a reduced fee. For 32.4 % (n = 46) the increased ability to participate was the most important advantage, whereas 17.6 % (n = 25) ranked the reduced environmental footprint as most important (Fig. 1). Three respondents (2 %), of which two were ECRs, indicated that they mostly appreciated that the online presentation format was less stressful than presenting at an in-person conference. The highest ranked advantage did not significantly differ between ‘region’, ‘ECR’ as compared to other respondents, and members as compared to non-members (all p > 0.05). An interaction between ‘region’ and ‘ECR’ indicated that ECR participants from AFRICA perceived different advantages (ability n = 4, and costs n = 2) than non-ECR in this region (costs n = 5, ability n = 1 and stress n = 1) (p = 0.049). When ‘region’ was substituted by ‘development’ there was an interaction between ‘development’ and ‘ECR’ (p = 0.013). Within developing regions relatively more ECRs as compared to non-ECRs (9 vs. 3, respectively) indicated the ability to participate as the most important advantage, whereas in developed regions relatively fewer ECRs chose this option as compared to non-ECRs (11 vs. 23) (Fig. 2).

The clearly highest ranked disadvantage was the reduced social contact (75.4 %, n = 107), with 70 % of the respondents choosing ‘Less contact with fellow colleagues’ as the most important disadvantage. The next most chosen disadvantage was not having the possibility to travel (i.e., cultural experience, 9.7 %, n = 14), the reduced opportunity for acquiring presentation skills (8.5 %, n = 12) and technical difficulties (6.3 %, n = 9). For a detailed breakdown of each response see Fig. S1. The highest ranked disadvantage did not differ between ‘region’ or ‘ECR’ as compared to other respondents, members as compared to non-members, and there was no interaction between ‘region’ and ‘ECR’ (all p > 0.05). The highest ranked disadvantage also did not differ depending on ‘development’, or the interaction between ‘development’ and ‘ECR’ (both p > 0.05).

3.2.2. Likelihood to participate in future virtual conferences

Most respondents indicated they would participate in future virtual conferences with a lower registration fee (53.9 %, n = 76). There was no difference between ECRs and other respondents in terms of the likelihood to attend the future conferences virtually or in-person. However, more respondents from developed regions indicated they would attend virtual conferences in the future with a fee as compared to developing ones (X² (2, N = 135) = 8.35, p = 0.02, Fig. 3).

3.3. Qualitative analyses

Based on the respondent’s open answers to Q9 on the aspects that they liked about the virtual meeting, six main themes were derived: organisation of the virtual conference (38.7 %, n = 55, related to the format, execution and technical functionality of the meeting), flexibility (31.0 %, n = 44, related to better adjustment to their daily routine, no need to travel, no cost involved, accessibility and the possibility to watch the talks later via recordings), quality of the talks (24.6 %, n = 35, related to the content, variety of topics and the delivery of the talks), diversity (21.8 %, n = 31, related to the representation of different regions, global perspectives, and the opportunity to learn from different countries), advantages for less experienced groups (14.8 %, n = 21, related to more students’ and ECRs’ participation, lower demand for language ability and less stress about asking questions), and networking (7.0 %, n = 10, related to the possibility to interact with others and the sense of community). A word cloud generated from the responses on Q9 is visualised as a graphical abstract in the online version of this paper. The themes mentioned by respondents from different career categories were similar, but more ECRs mentioned advantages for the less experienced groups, and non-academic respondents more often emphasised the quality of the talks (Table 4). Between regions, respondents from developing regions focused more on the quality of talks and the organisation of the virtual conference, whereas those from developed regions put more emphases on flexibility of attending a conference virtually as well as organisation (Table S5). The main themes for Q10 are included in Table S5.

![Fig. 1. Responses to the original categories of Q6, advantages of the virtual conference. Each choice was ranked from 1 to 9 (1 as the most important advantage, depicted in dark green; and 9 as the least, in light green). If the respondent did not find a choice important, it was ranked as N/A.](image-url)
Fig. 2. The percentages of respondents (n = 142) for the four categories of advantages (Q6), by ECR (ECR or not) and Development (Developed regions: AU/NZ, Europe, NA; Developing regions: AFRICA, ASIA, LATAM).

Fig. 3. Respondent's future likelihood to participate in an ISAE virtual conference (Q8) by their career stages and by regions (Developing regions: AFRICA, ASIA, LATAM; Developed regions: AU/NZ, Europe, NA). The two responses were under two separate questions and therefore were independent of each other, each with n = 142.

Table 4
Main theme from Q9 by respondent's career stage/type and region. Numbers are percentages and the number of responses in the brackets. (Q9: What are the aspects that you particularly liked/enjoyed during this virtual meeting?) ECR stands for early career researcher. Abbreviations for the regions: AFRICA – Africa/Central Asia/Middle East; ASIA – South/East/Southeast Asia; AU/NZ – Australia/New Zealand; LATAM - Latin America; NA – Canada and the USA.

| Theme/respondents' demographics | Organisation | Flexibility | Quality | Diversity | Less experienced | Networking |
|---------------------------------|--------------|-------------|---------|-----------|-----------------|------------|
| Career stages                   |              |             |         |           |                 |            |
| ECR (n = 73)                    | 39.7 (29)    | 28.8 (21)   | 21.9 (16)| 21.9 (16)| 20.5 (15)       | 6.8 (5)    |
| Researcher (n = 52)             | 42.3 (22)    | 36.5 (19)   | 21.2 (11)| 17.3 (9)  | 9.6 (5)         | 7.7 (4)    |
| Other (n = 17)                  | 23.5 (4)     | 23.5 (4)    | 47.1 (8) | 35.3 (6)  | 5.9 (1)         | 5.9 (1)    |
| Region                          |              |             |         |           |                 |            |
| AFRICA (n = 13)                 | 38.5 (5)     | 0.0 (0)     | 61.5 (8) | 7.7 (1)   | 7.7 (1)         | 0.0 (0)    |
| ASIA (n = 16)                   | 18.8 (3)     | 18.8 (3)    | 37.5 (6)| 31.3 (5)  | 6.3 (1)         | 12.5 (2)   |
| AU/NZ (n = 5)                   | 20.0 (1)     | 60.0 (3)    | 0.0 (0) | 20.0 (1)  | 0.0 (0)         | 20.0 (1)   |
| Europe (n = 69)                 | 42.0 (29)    | 36.2 (25)   | 23.2 (16)| 26.1 (18)| 18.8 (13)       | 7.2 (5)    |
| LATAM (n = 24)                  | 38 (9)       | 33 (8)      | 17 (4)  | 17 (4)    | 17 (4)          | 4 (1)      |
| NA (n = 15)                     | 53.3 (8)     | 33.3 (5)    | 6.7 (1) | 13.3 (2)  | 13.3 (2)        | 6.7 (1)    |
4. Discussion

A unique opportunity emerged in 2020 due to the COVID-19 pandemic, and as a result the ISAE held its first ever virtual conference. More attendees from developing regions and non-ISAE members attended the virtual conference as compared to the 2019 in-person conference. Most attendees considered the reduced cost to be the greatest advantage of a virtual format, but the lack of social contact to be the most prominent disadvantage. Attendees from developing regions indicated that they were less likely to attend future (virtual) conferences with a registration fee. Overall ECRs only marginally differed in their responses as compared to other respondents. The open answers revealed that attendees’ positive experiences of the conference related to the organisation, flexibility, quality and diversity of the ISAE 2020 virtual meeting.

4.1. Increased inclusiveness, geographical outreach and inter-region exchange

The number of attendees from the less represented regions, namely AFRICA, ASIA and LATAM, was higher than in the previous conference, with a five-fold increase in attendees from the AFRICA region. Increased participation from geographical areas where animal behaviour and welfare research is still growing is crucial for research outreach, and the global attendance provides the opportunity for animal welfare science to find its momentum to become better integrated in other issues that share a more universal concern, such as food security and sustainability (Marchant-Forde, 2015). The increased inclusiveness thus has the opportunity to expand this field of science that is usually considered Europe/Western-centric (Buller et al., 2018). On the other hand, most attendees to the sessions of AFRICA and ASIA were non-local, which demonstrates an inter-regional interest. The global representation and the opportunity to learn from different countries was indeed mentioned as one of the main themes that attendees valued about the virtual meeting.

In the wake of the 2020 demonstrations for inclusiveness (Gibson et al., 2020), many research societies gave new attention and priority to addressing issues of diversity and inclusion (Tzovara et al., 2020). As this was also true for animal science societies (Raby and Madden, 2021a), this was the main focus in this study. The 2019 congress in Norway naturally attracted more European attendees given their reduced need for travel as compared to attendees from other continents. Costs of registration and travel may have also discouraged less financially eligible attendees, although several travel scholarships were granted. Offering conference travel awards is one way to generate a more inclusive research environment within an association (Segarra et al., 2020). Although participation of developing regions increased with this virtual conference, it should be taken into consideration that access to internet is not a standard commodity for all countries (Rallet and Rochelandet, 2007; Niner et al., 2020).

In addition to geographical inclusiveness, the 2020 virtual meeting attracted more attendance from non-ISAE members as compared to the 2019 conference. This is most likely due to the reduced cost and the regional format with a global time zone coverage, which also highlights the benefit of the virtual format to reach out to a wider audience more easily. Surprisingly, there was a reduced member attendance, which may be due to the members-only benefit to (re)watch video recordings later.

4.2. Early career researchers (ECRs)

ECRs, especially PhD students, in animal behaviour research have been most impacted by the COVID-19 pandemic (Kappel et al., 2021; Camerlink et al., 2021). ECRs often have yet to establish their scientific network and to gain essential academic skills (Sohrabi et al., 2021), such as giving an on-stage oral presentation and engaging in a panel discussion, whereas in-person conferences provide an ideal arena for such training (King, 2013; Segarra et al., 2020; Zierath, 2016). Many of the in-person conference features that are specifically organised and most attended by ECRs were absent in the current virtual conference. Virtual accessibility and no cost barrier may have encouraged more ECRs to submit their abstracts and attend the conference (86 % of the accepted abstracts were from ECRs). ECRs in developing regions found the ability to participate in the conference more often a main advantage of a virtual conference than non-ECRs, whereas in developed regions this was not the case, thus showing an interaction between ‘ECR’ and ‘region.’ For all other parameters, however, ECRs did not respond differently as compared to other attendees. They did mention in the open answer more often to have benefitted from the lower threshold of engaging in questions and increased language ability, similar to what a previous study suggested (Milic et al., 2020). Overall, priorities to support ECRs should be incorporated during the conference organisation, for example through dedicated ECR-moderated and themed sessions and social events.

4.3. Advantages and disadvantages of a virtual conference

The highest ranked advantage of the virtual conference was the reduced costs, or free participation. Previous studies also found the cost of conference registration, transport and accommodation was the major barrier for in-person conference attendance (Houston, 2020; Mair et al., 2018; Niner et al., 2020). The next most valued advantage was the attendees’ ability to participate, which was similarly expressed in other studies (Houston, 2020; Misa et al., 2020). One aspect of the ability to participate was the availability of video recordings. Video recordings can further improve outreach and overcome difficulties with different time zones (Houston, 2020). The reduced environmental footprint of a virtual conference was the third highest ranked advantage (17.6 % of the respondents ranked it as the most important advantage). Researchers are called to set an example when it comes to reducing our environmental footprint (Spinellis and Louridas, 2013), and this is especially true for researchers working in related sciences (Neugebauer et al., 2020; Raby and Madden, 2021a). Virtual conferences have been estimated to reduce the carbon footprint between 44 % (Achten et al., 2013) and 75–90 % (Jäckle, 2019). Raby and Madden (2021a) estimated that the online ASAB meeting had only 6 % of the footprint of one of the previous in-person meetings. Animal welfare is an integral part of sustainability (Broom, 2010, 2019), and as such it is likely that researchers in this field have a higher environmental awareness.

The missing social element in a virtual conference was considered the biggest disadvantage by over 75 percent of the respondents, similar to other case studies (Fulcher et al., 2020; Kopec and Stolbach, 2020; Speirs, 2020). A more recent study explored the outcome of a virtual conference that was organised to replicate an in-person conference experience, with all similar elements except for being held online (Raby and Madden, 2021b). The authors found that the engagement for a variety of available social events was still low. They concluded that it may take more considerations to make virtual networking events successful, which could require a more bottom-up approach (activities arising from initiatives by delegates, like socializing in the pub) rather than top-down (e.g., activities being initiated and coordinated by conference organisers) (Raby and Madden, 2021b). As the pandemic continues, the demand for more innovations in virtual communication tools keeps growing. A greater variety of virtual conferencing tools may be available to accommodate more socially dynamic online conferences (Hacker et al., 2020; Welch et al., 2010) and include activities such as virtual mentoring, networking meetings and more structured social workshops and discussion boards (e.g., Slack, Discord, etc.). For example, some reported successfully using Gather (https://gather.town/, Gather Presence Inc., San Francisco, USA) as a more organic meet-up mechanism in a virtual environment (Maier et al., 2020), while others used Mozilla Hubs (https://hubs.mozilla.com/), Mozilla Corporation, San Francisco,
USA) for enhanced online interactions (Le et al., 2020). A relatively smaller proportion of respondents expressed the drawbacks of not being able to travel or to improve presentation skills, and technical issues. Respondents from developing regions did not select technical issues as a top disadvantage, which is in contrast to the suggested influence of the digital divide between countries (Niner et al., 2020). This discrepancy may be due to researchers, especially online survey respondents, in developing countries having a privileged access to internet resources (e.g., through their university) and higher socioeconomic status as compared to the general public in those countries (Scheerder et al., 2017; Okunola et al., 2017).

4.4. Conference quality and organisation

The open answers revealed that scientific quality and smooth organisation of the virtual conference were the most mentioned aspects by the attendees. Other conferences which moved to a virtual format received similar audience feedback (Ruiz-Barrera et al., 2021). This highlights the importance of balancing scientific quality and regional diversity to engage a more diverse audience. On the other hand, although many expressed the preference not to pay a fee to attend a virtual conference, the organisation of an online meeting is still labour-intensive, especially when the quality of science and the variety of programme are to be guaranteed (Misa et al., 2020; Speirs, 2020). For a virtual format to be more inclusive, a balance should also be struck between a reasonable registration fee and greater accessibility.

4.5. Limitations of the study

It is worth noting that at the time of organising the ISAE 2020 virtual meeting, the idea was to provide an opportunity for researchers in this field to present their studies, in the absence of the in-person annual conference. It was not meant to completely replace the in-person congress, and thus did not include social events. The here reported results thus not only relate to a different conference format (in-person versus online) but also to a different conference programme (with versus without social events). Future virtual meetings with more social elements, many of such are already scheduled for 2021, will provide insight in the contribution of these specific aspects of a conference.

The attendees’ prior experience in attending other online conferences could be affecting their opinions on virtual participation, especially under the on-going impact of COVID-19, with the increasingly common occurrences of virtual conferences in all different formats. We did not know which prior experiences the attendees of ISAE 2020 virtual meeting had in our case study, so we could not assert if the responses were based on this specific virtual experience or not. It would be interesting for future qualitative studies to understand the effect of prior experience on participants’ perception of virtual meetings and the consequences of virtual as compared to in-person conferences (for example in terms of network development and social engagement).

4.6. Future perspective

The adaptation to virtual conferences due to the COVID-19 pandemic’s restriction on movement comes at a time when the format of scientific conferences was already questioned due to reasons of inclusiveness and the carbon footprint generated by international conferences (Spinellis and Louridas, 2015; Klöwer et al., 2020). Whether the opportunities of improved inclusiveness and reduced carbon footprint weigh up to disadvantages of virtual conferences may not be generalised across societies. Hybrid conferences (which offer both in-person attendance and online participation) as well as other novel models (e.g., conferences through Twitter and other technological aids; Fulcher et al., 2020; Milić et al., 2020; Ruiz-Barrera et al., 2021), are worth exploring given the current results. Inclusiveness encompasses more than inclusion of people from diverse geographical locations and career stages, such as gender and BAME communities (Bentley, 2020; Malisch et al., 2020; Niner et al., 2020). As a first step, the positive experience of holding the first ISAE virtual meeting brought insights already into a more inclusive future. Moving towards the option of a (partly) online conference format has the potential to increase sustainability through increased diversity, reduced carbon footprint, and an opportunity to raise global awareness of animal welfare issues by a more inclusive conference attendance.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at https://doi.org/10.1016/j.applanim.2021.105369.

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