

**Bayerische Staatsoper  
trial operation with increased number of visitors:  
Evaluation of the test operation with 500 visitors  
from 1 Sept. to 25 Oct. 2020**

**Final report of 3 Dec. 2020**

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## Summary

The State Government decided that performances at the Bayerische Staatsoper in Munich's Nationaltheater would be approved in September and October 2020 on a trial basis with up to 500 people. The objective of the pilot project was a differentiated risk assessment of cultural events from an infectiological, indoor climate and audience point of view. This will demonstrate ways and methods that enable cultural event organisers to achieve a logical highest number of visitors on the basis of on-site technical framework conditions with the aid of elaborated hygiene concepts, so the fixed highest number of visitors of 200 people previously approved in accordance with regulations on measures to prevent infection can be replaced.

The pilot phase was supervised and scientifically evaluated by a medical team from Munich's Klinikum rechts der Isar (MRI) and the Technical University of Munich (TUM), as well as representatives of the Bavarian State Office for Health and Food Safety (German abbreviation: LGL). Their expertise has been integrated into the concepts for both rehearsals and performances and for the procedures and processes in all audience areas. The additional findings determined in the pilot operation were continuously implemented. Scientific evidence provided by the Chair of Building Technology at the TUM on the ventilation issue was also incorporated.

These results of the pilot project show how the increase in the number of visitors neither has a negative effect on the processes in the audience area and the objective risk of infection nor on the visitors' satisfaction and perception of safety.

To illustrate paths forward for the future, in September the minimum distance of 1.5 m was reduced and a more relaxed version of the "chessboard seating" was tested in selected areas of the stalls. This further development was also proven to be positive, especially as the viewers are not turned towards each other during the performance and a complete air change in the Nationaltheater is guaranteed every 9.5 minutes; specific findings on flow behaviour were also delivered.

The expert teams examined and uncritically observed the processes in the stage area and in the audience area in particular (directing visitors to their seats, distance discipline, mask discipline). A visitor survey during the test run showed that the visitors considered their protection to be more than sufficient and did not think there is a higher risk during intermissions and in the catering areas when a well thought out hygiene concept is in place. And nor were any infections found with any visits to the Bayerische Staatsoper.

As part of this final report we can clearly draw a positive conclusion for the pilot project. From the Bayerische Staatsoper's point of view and on the basis of the opinions of the medical and technical experts involved, with the application of an elaborated individual hygiene concept and under the given conditions of the pilot project (7-day incidence, predominantly between 35 and 100 per 100,000 inhabitants), there is no increased probability of infection for the audience. Following the end of the partial lockdown in place since 2 November, the authors of the report therefore believe individual visitor limit numbers should be specified, and these should be oriented on the framework data provided (especially ventilation systems, available space in situ). The following criteria were applied as requirements:

**Distance indicator:** Max. audience number with **1.5 m** radial distance (mid-chair to mid-chair)

**Ventilation indicator:** Max. audience number with **fresh air change** of **60 m<sup>3</sup>** per person and hour

Application of an elaborated **individual hygiene concept**

# 1 Introduction

The limit for visitors to cultural events with assigned and identified seats in enclosed spaces stipulated in the Sixth and Seventh Bavarian Infection Protection Measures Ordinance (BayIfSMV) was 200 people (§ 21 II 1 No. 2 6. BayIfSMV and § 23 II 1 combined with § 5 III No. 2 7. BayIfSMV). This limited attendance figure made it significantly more difficult for cultural institutions and event organisers to perform and sustainably finance their cultural mission across the broader public sphere. Its actual impact was like a ban on events. The limit therefore was and still is criticised in public circles for both this reason, and also because it applies irrespective of the building system conditions of the respective venue. Big halls such as the Philharmonie am Gasteig or the Nationaltheater are consequently subject to the same rigid limit as small stages are.

In correspondence with the Bavarian State Ministry of Science and the Arts and the Bavarian State Ministry of Health and Care, the Bayerische Staatsoper was subsequently commissioned with a pilot project on 31 August 2020. This pilot project was intended to provide practical experiences with cultural events, with which the visitor numbers differed from the limit stipulated in § 21 II 1 No. 2, version 6 of the BayIfSMV. The pilot project was accompanied with advice and support from the Bavarian State Office for Health and Food Safety (LGL), representatives of Klinikum rechts der Isar (MRI), and the Technical University of Munich (TUM). As part of this pilot project, Bayerische Staatsoper performances in Munich's Nationaltheater were approved for trials with up to 500 visitors on identified seats, limited at first to the period from 1 September 2020 until 30 September 2020. The pilot project was extended twice into October, before it was suspended after the performance on 25 October 2020, when the 7-day incidence of 100 new infections per 100,000 inhabitants in Munich was exceeded.

The pilot project was designed to provide information to enable cultural events for a higher number of visitors. Stemming the spread of the betacoronavirus SARS-CoV-2 (hereinafter referred to as COVID-19) was a key requirement here. The Bayerische Staatsoper was chosen for the test run, as it started into the 2020/2021 season earlier than other institutions, and the main venue, the Nationaltheater in Munich, offers ideal test conditions due to its size and capacity (2,101 visitors).

The Bayerische Staatsoper already presented the first hygiene concept for performances with an audience at the beginning of May 2020, and consequently gathered first experiences with performances with a limited audience in June 2020 (first 20 visitors, then 50, then 100). Since the beginning of August it has been preparing for performances and regular daily work with extremely differentiated, constantly updated hygiene concepts. From the beginning of the 2020/2021 season, the TUM and MRI's scientists have been supporting the development and implementation of precautionary measures that aid safety at work. The key concern with the measures is regular COVID-19 testing in a continuous system of those employees that, according to the risk analysis, are exposed to a higher risk of infection in performing their duties. The tests are the subject matter of a scientific study by the TUM and the MRI. The information provided here will also benefit other cultural institutions. Ventilation tests in the Nationaltheater's auditorium with scientific support from the Chair of Building Technology at the TUM were also performed and evaluated.

The objective of the pilot project was to find methods, requirements and technical criteria, with which cultural events with visitor numbers above 200 people are considered responsible and safe. As always, the goal is to protect visitors against infection as best possible with smart operational procedures and additional protective measures. All involved are nevertheless aware that despite all measures, a "residual risk" of infection in the theatre or concert hall is just as difficult to avoid as it is in other areas of public life. The pilot project is also important for communication with visitors. Many of these will only find their way back to cultural events when it can be clearly stated that they are sufficiently protected against infection with diverse tried and tested measures.

## 2 Hygiene concept as part of the pilot project

The key points of the Bayerische Staatsoper's hygiene concept for audience movements are described in the following. Please see the hygiene concept for details (see BAYERISCHE STAATSOPER 2020A).

- **Anonymous ticket purchases** are not possible; ticket booking on a customer number with up-to-date contact information is compulsory. When passing on tickets to third parties, the purchaser of the tickets is bound by the additional restrictive conditions of use (see Bavarian State Theatres 2020 central ticket sales), where required to provide the contact details of visitors for COVID-19 infection tracing.
- **Visitor guidelines** are provided to each ticket purchaser in advance by handout or e-mail and online download. They include, for example, programme/cast information, admission point/time, hygiene information, no access if ill, food and drink may not be brought, cloakroom information, distance control, especially with admission and exit, mouth-nose covering control, no seat changing, obligations with passing on tickets etc. (see section 3.2.2). The **rights of the venue** are resolutely reserved for visitors that do not comply with the regulations.
- The concept of "**zoning**" similar to the concept applied by the Bundesliga (see DFL TASK FORCE 2020) basically applies in the Nationaltheater. The audience area is strictly separated from those participating on and behind the stage. Basically, there can be no zone changes without a good reason. As long as the orchestra pit is extended and the first four stall rows are expanded, the orchestra access to the auditorium will be exclusively via stalls door 1 on the left. This door is not permitted for audience movements.
- **Front-of-house staff** are regularly **trained** intensively (hygiene measures, infection symptoms, role model behaviour – see section 3.2.3).
- Wearing a **mouth-nose covering (MNC)** in the audience area is compulsory for all involved. The only exception to this rule is for the audience during the performance ("lights off" until final applause) in compliance with the Infection Protection Measures Ordinance. Implementing and informing about this obligation are ensured with advance information, supertitles, automated announcements and the front-of-house staff on duty. Visors instead of MNCs are only admitted in exceptional cases for good reasons. The front-of-house staff has replacement MNCs at the ready. With the performances from 19 September until 1 October and from 12 October onwards, because the 7-day incidence limit of 50 per 100,000 inhabitants in Munich was exceeded, an obligation to wear an MNC during the performance was also implemented.
- Visitors to the event **must be healthy**. With obvious symptoms (fever, sniffing, coughing or similar) the responsible staff on duty can deny access or terminate participation where symptoms appear during the performance, in accordance with the additional restrictive conditions of use (see Bavarian State Theatres 2020 central ticket sales). Nor may persons who have tested positive for infection with COVID-19 in the last 14 days attend the event. This shall also apply for persons who have been in contact with others infected with COVID-19 in the past 14 days (either proven or suspected). Claims for a refund of monies paid for admission shall also be excluded here.
- A **doctor** and at least two **paramedics** are present at every performance.

- Sufficient **parking spaces** are provided in the “Operngarage” car park; there are no narrow points on the way from the car park to the Nationaltheater.
- **Admission** to the Nationaltheater is via the main entrance (right-hand side of the auditorium) and the Freunde-Foyer (left-hand side of the auditorium); the box office has its own entrance (right-hand side entrance door). The respective access has already been communicated to the visitors with respect to the seat in print on the admission ticket. Further accesses are not planned for the moment in order to prevent audience crossovers. The admission time in September was 30 minutes (October: 60 minutes) before performance start, then handle-free access directly to the auditorium and seat; presence in the anterooms to the auditorium is kept short with regular early bell sounding. Admission tickets will only be controlled with scanners (so contactless). Disinfectant dispensers will be set up easy to see in the entrance area for visitors who, for example, do not have time to wash their hands before the performance begins; the importance of washing hands will be emphasised.
- Additional staff will be on duty in the **toilets area** to restrict access when capacities are reaching their limits; hygiene and distance notices are posted easy to see.
- In September at the request of many visitors, staff at first wore disposable gloves at **programme sales**, in the opera shop, with cast list handout and in the **cloakroom areas**, but this was later suspended at the recommendation of the LGL (“remove false safety”). Grouping and lingering for longer are prevented in the “Hausgöttersaal” (programme sales, access paths junction) by additional staff.
- When the season started on 1 September 2020, performances were at first staged **without intermissions** and **without theatre catering**. The first performance with an intermission and catering on offer was on 29 September 2020. Eating and drinking are only allowed at the table; only one household is permitted at one table. Visitors were asked to reserve a table via the theatre catering and to spread across all bars. The “Rheingold” on the right in the stalls, the “Sektbar” on the left in the stalls, the bar in the “Freunde-Foyer”, the two bars in the 1st tier and the “Aquarium” in the 3rd tier are open. The visitor details per table are recorded on a note and requested and collected by service staff. Additional staff will control and request compliance with passageways and distances.
- After the performance, it will be ensured that visitors do not linger in or directly in front of the building.
- Seating of 500 people in a way that always keeps one row free between the visitors and one or two seats free between single visitors and couples of visitors (“exam-type seating” with pairs of seats and single seats) was implemented as the **seating plan for September**. The “**Salzburg model**” was only tested and evaluated in the front stalls in two sections of three rows each. The visitors sit here in a type of relaxed chessboard pattern without empty row distance, but with one or two seats distance between single seats or pairs of seats. There are also pairs of seats in the first balcony row with just one empty seat of distance to the next party of people. As part of the pilot project, seats together were essentially only sold together to one purchaser. Compliance with seating was controlled by the admission staff. The additional 300 tickets were sold as preference per TicketDirekt option (online ticket), so collection at the box office was omitted.

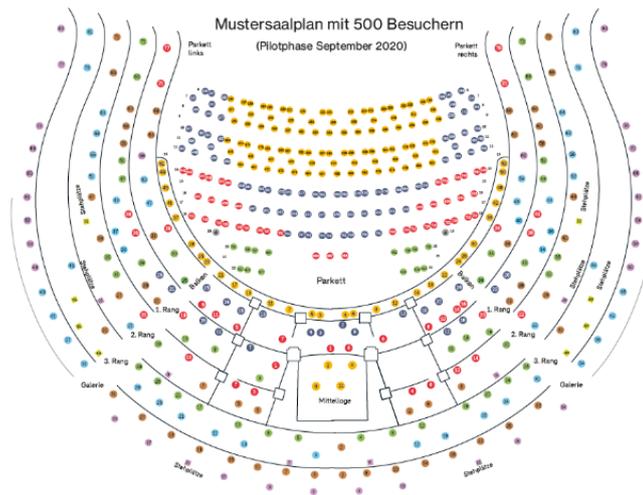


Figure 1: Seating plan pilot project for performances in September 2020 with 500 visitors

- As a **seating plan for October** the seating for 500 people was implemented in a way that also leaves at least one row free between the visitors in the stalls (“exam-type seating” with pairs of seats and single seats). This arrangement allows additional seats to be added with short-term seat increases in the form of a chessboard pattern, and especially in the empty rows.

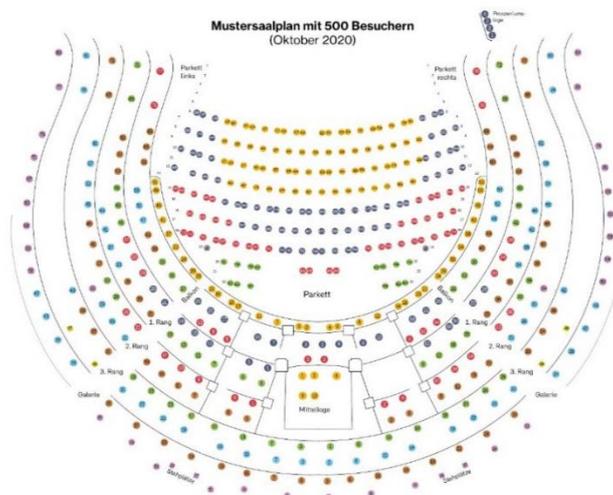


Figure 2: Seating plan pilot project for performances in October 2020 with 500 visitors

### 3 Pilot project three-components evaluation

The evaluation methodology (3.1) and the pilot project’s key results (3.2) are illustrated in this section. The optimisation of the visitor advance information and the processes in the audience area are very much to the fore here. Key data for the room volume and ventilation possibilities factors (3.3), which serve as indicators for a room usage that goes beyond the rigid highest attendance figure of 200 visitors, is also determined.

#### 3.1 Study design for evaluating the pilot project

The pilot project’s object of investigation is **how the audience behaves**. This includes access to the building, the situation with the cloakrooms, intermissions, catering and the toilets, exiting and seating, as well as behaviour in the auditorium itself with all performances in the Nationaltheater from 1 September to 25 October 2020. In September the 7-day incidence rate

reported daily by the city of Munich was predominantly below 50 (min: 30.58 | max: 56.13); in October up to and including 25 October predominantly below 100 (min: 32.48 | max: 114.5). Intermissions and catering were tested and evaluated from 29 September (separate sub-concepts were worked out for this). Information for internal service work was also gathered during the project, however this is not a key element of this report.

A **three-components evaluation** was chosen as the **methodical approach**. The experts' views, the internal analysis and the audience's opinion provide a 360° evaluation of the trial operation. The "live" method meant improvement measures could be identified and implemented directly in the trial operation.

### 3.1.1 External expert analyses

Case-related expert surveys and observational studies in performance areas were performed during the entire pilot project, from which improvement measures for the pilot project were then derived. The evaluation of the LGL and MRI external experts is based on inspections of the audience area, including the rooms for theatre catering, the interface area to the stage and to the cloakrooms, as well as performance visits to observe the processes in the audience area. Expert observations were made beginning with the first performance on 1 September 2020; a joint discussion together with a subsequent performance visit was held on 7 September 2020. A further inspection by the medical experts was made on 16 October 2020, whereby the focus was on ventilation analyses in the audience area and possibilities for orchestra set-ups.

The Bavarian State Office for Health and Food Safety contributed to the pilot project with input from Prof. Dr. Bernhard Liebl, Prof. Dr. Christiane Höller and Dr. Verena Lehner-Reindl. The TUM was represented by Prof. Dr. Ulrike Protzer (Director of the Virology Institute), Klinikum rechts der Isar was represented among others by private lecturer Dr. Christoph D. Spinner (the Klinikum's senior physician for infectiology and pandemic consultant), Dr. Friedemann Gebhardt (Head of the Hygiene Department) and Dr. Simone Graf (senior physician at the "Klinik und Poliklinik für Hals-, Nasen- und Ohrenheilkunde" and head of the test series at the Bayerische Staatsoper). The expertise of Prof. Dipl.-Ing. Thomas Auer from the Chair of Building Technology and Climate Responsive Design at the TUM was applied with technical questions relating to ventilation technology.

### 3.1.2 Internal analysis

All processes in the audience area were observed and evaluated daily during the entire project, from which ad-hoc measures were then derived. The evaluation team consisted, among others, of representatives from the offices of the

- General Manager (Nikolaus Bachler, Christoph Koch)
- Managing Directorate (Dr. Roland Schwab, Inka Albrecht)
- Technical Directorate (Karsten Mattereder),
- Front House Management (Charles Maxwell, Stefan Timmermann, Jörg Müller, Elias Ziakas),
- Visitor Communication and Management (Dr. Matthias Schloderer, Sophia Plodek, Julia Weyrauther, Eva Bergmann, Martina Zimmermann).

The evaluation of reports about the performance and evening and the feedback of colleagues working in the building, from the *VD Mayr* front house team, from the *Dallmayr* theatre catering team and the staff at central ticket sales (box offices), were also integrated into the assessment.

### 3.1.3 Audience analysis

The evaluation of the performance visit from the audience's point of view is also essential in assessing the pilot project. The perceived safety, the potential for improvement with hygiene and protection measures and the assessment of advance information were queried as part of online visitor surveys after the performances. As ticket sales are only possible personalised, e-mail addresses are provided by all ticket purchasers. All visitors generally received an invitation to the survey on the day after the performance, which was developed together with the Institute for Market-oriented Management (IMM) at the Ludwig Maximilian University under the guidance of Prof. Manfred Schwaiger. The questionnaire is attached to this report as an appendix.

The response to the visitor survey was high. A total of 6,566 assessments were provided, or on average 133 per performance, which at 27.9% is more than a quarter of all visitors. 95.3% of those providing an assessment finished the survey completely. Many KPIs indicate the study's representativeness: 76% of those surveyed only purchased their ticket when the seating capacity was increased on 31 August 2020, and the distribution according to seats taken is also proportional to the actual ticket offering. The demographic analysis of those surveyed indicates the usual composition of the opera audience (increased percentage of females, many visitors from Munich, average age just under 58). 28.4% of those surveyed say they are in a risk group, which is significantly below the population-representative average in Germany (approx. 37% – see STATISTA 2020). More than 99% of visitors say they always or almost always comply with the current regulations due to the COVID-19 pandemic.

Performance (max=500)	#	%
Tue, 01.09.2020 7 Deaths of Maria Callas	218	43,60%
Wed, 02.09.2020 Die Zauberflöte	155	31,00%
Thu, 03.09.2020 7 Deaths of Maria Callas	164	32,80%
Fri, 04.09.2020 Die Zauberflöte	89	17,80%
Sat, 05.09.2020 7 Deaths of Maria Callas (14.00)	167	33,40%
Sat, 05.09.2020 7 Deaths of Maria Callas (19.00)	124	24,80%
Sun, 06.09.2020 7 Deaths of Maria Callas	152	30,40%
Sun, 06.09.2020 Jonas Kaufmann & Helmut Deut	165	33,00%
Mon, 07.09.2020 Die Zauberflöte	141	28,20%
Wed, 09.09.2020 Schwanensee	173	34,60%
Thu, 10.09.2020 Die Zauberflöte	130	26,00%
Fri, 11.09.2020 Schwanensee	146	29,20%
Sat, 12.09.2020 Die Zauberflöte	116	23,20%
Sun, 13.09.2020 Così fan tutte	151	30,20%
Tue, 15.09.2020 Così fan tutte	113	22,60%
Wed, 16.09.2020 Christian Gerhaher & Gerold H	163	32,60%
Wed, 16.09.2020 Christian Gerhaher & Gerold H	146	29,20%
Sat, 19.09.2020 Giselle	133	26,60%
Sun, 20.09.2020 Così fan tutte	159	31,80%
Mon, 21.09.2020 Giselle	141	28,20%
Wed, 23.09.2020 Le nozze di Figaro	149	29,80%
Thu, 24.09.2020 Così fan tutte	134	26,80%
Fri, 25.09.2020 Le nozze di Figaro	128	25,60%
Sat, 26.09.2020 Giselle	131	26,20%
Sun, 27.09.2020 Così fan tutte	159	31,80%
Mon, 28.09.2020 Le nozze di Figaro	131	26,20%
Tue, 29.09.2020 L'elisir d'amore	127	25,40%
Thu, 01.10.2020 L'elisir d'amore	104	20,80%
Fri, 02.10.2020 Giselle	92	18,40%
Sat, 03.10.2020 Le nozze di Figaro	121	24,20%
Sun, 04.10.2020 L'elisir d'amore	99	19,80%
Mon, 05.10.2020 1. AKO: Jurowski	160	32,00%
Tue, 06.10.2020 1. AKO: Jurowski	125	25,00%
Wed, 07.10.2020 Tosca	114	22,80%
Fri, 09.10.2020 Schwanensee	99	19,80%
Sat, 10.10.2020 Tosca	126	25,20%
Sun, 11.10.2020 Schwanensee	100	20,00%
Tue, 13.10.2020 Tosca	148	29,60%
Wed, 14.10.2020 Wozzeck	158	31,60%
Fri, 16.10.2020 Madama Butterfly	112	22,40%
Sat, 17.10.2020 Wozzeck	114	22,80%
Sun, 18.10.2020 Premierenmatinee zu Die Vögel	101	20,20%
Sun, 18.10.2020 Madama Butterfly	126	25,20%
Wed, 21.10.2020 Wozzeck	152	30,40%
Fri, 23.10.2020 Madama Butterfly	71	14,20%
Sat, 24.10.2020 Macbeth	122	24,40%
Sun, 25.10.2020 Wozzeck	107	21,40%

Where did you sit?	#	%
<b>Front stalls (rows 6-12)</b>	<b>1263</b>	<b>20,65%</b>
Rear stalls (rows 14-20)	1051	17,19%
Balcony	1079	17,65%
1st tier	766	12,53%
2nd tier	700	11,45%
3rd tier	594	9,71%
Gallery	662	10,83%

Place of residence	#	%
<b>Munich</b>	<b>3600</b>	<b>60,47%</b>
Munich surrounding area (approx. 50 km radius)	1400	23,52%
Bavaria	546	9,17%
Germany	284	4,77%
Other state (please fill in):	123	2,07%

Age	#	%
<b>57,93</b>		
<b>Gender</b>	<b>#</b>	<b>%</b>
<b>Female</b>	<b>3618</b>	<b>60,78%</b>
Male	2329	39,12%
Other	6	0,10%

Figure 3: Descriptive analysis for representativeness evaluation

## 3.2 Pilot project evaluation results

The results of the three-component evaluation are presented in the following section. The visitors' perception of safety is described first, followed by a discussion of the possibilities for improving visitor information and the processes in the audience areas. The section closes with possible criteria for a capacity increase according to the room's conditions and ventilation.

### 3.2.1 Perceived safety with the audience

The audience survey shows a very high level of safety perceived by the audience: 94.5% of the respondents are happy with the measures the Bayerische Staatsoper has implemented to reduce the risk of infection with the COVID-19 virus during their visit. Only 3.2% are not satisfied with the measures (2.2% felt both). 96.5% of the respondents felt safe during their visit, and only 1.8% didn't (1.6% felt both). With the concierges and evening staff a very low level of complaints was recorded; only two pairs of visitors did not enter because of the conditions in the building.

97.9% of the respondents believe the obligation to wear an MNC in our buildings was complied with (apart from during the performance). Regular inspection walks by our front-of-house staff and direct, friendly reminders where MNCs were not worn or were worn incorrectly ensured the obligation to wear a mask was adhered to even more, and generated good perception of safety in the auditorium.

63.2% of the respondents say they also wear an MNC during the performance. Up until the obligation to also wear an MNC during the performance in September, just under 29% of the respondents wore an MNC continuously. In the compulsory period from 19 to 29 September this was 98.1% (missing percentage points presumably due to release for medical reasons); after the compulsory period from 1 to 11 October 57.7% and from the reintroduced compulsory period on 12 October 98.1% again. The perceived safety and satisfaction with the measures was at a very high level over the entire evaluation period; only with family performances is there a slight fall with regard to satisfaction, which can be attributed to the fact that with these performances, maintaining distance from one's own children with the seating is not very well understood.

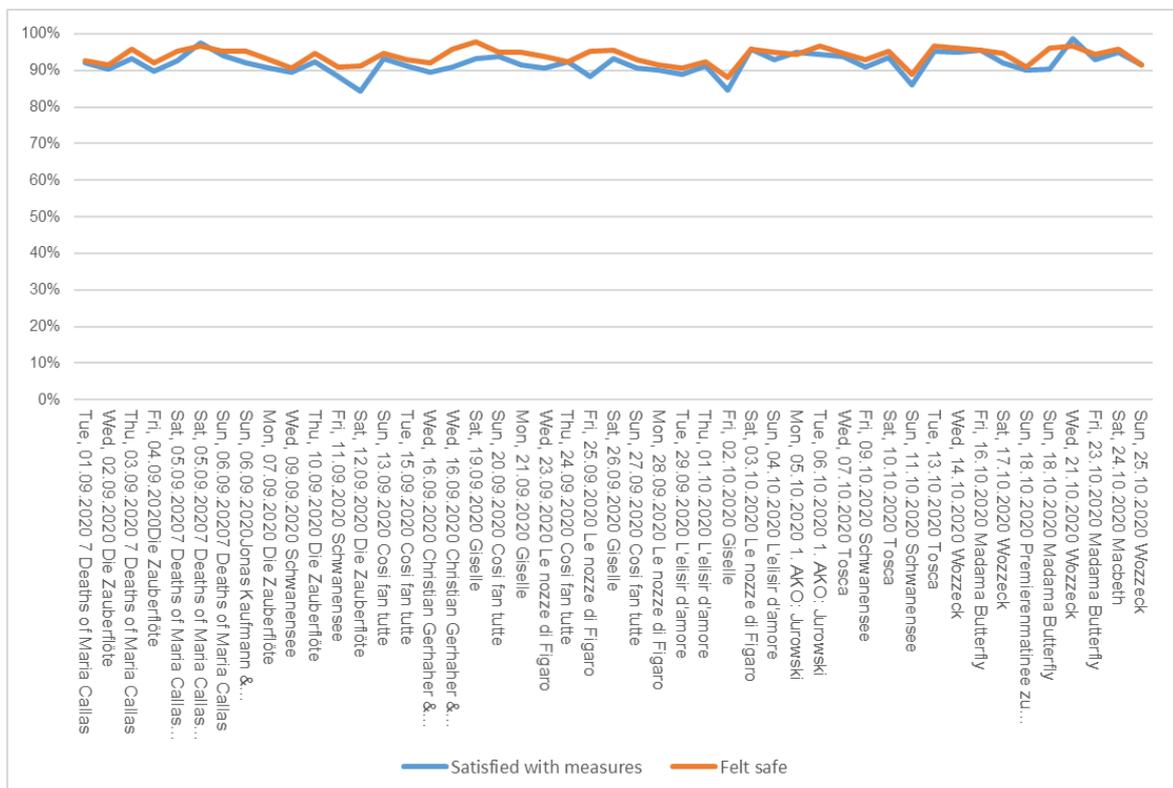


Figure 4: Satisfaction trend with measures implemented and feeling of safety over the months

On the whole a significant majority of the respondents (65.9%) believe 500 visitors is too cautious; 31.8% say it is “absolutely perfect” and only 2.3% say it is “too risky”:

500 visitors are	#	%
far too risky – considerably fewer visitors should be admitted	8	0,13%
rather risky – fewer visitors should be admitted	130	2,16%
absolutely perfect	1907	31,76%
<b>somewhat too cautious – more visitors could be admitted</b>	<b>2638</b>	<b>43,93%</b>
clearly too cautious – significantly more visitors could be admitted	1322	22,01%

Figure 5: 500 visitors risk assessment

The missing atmosphere and (before 29 September 2020) the suspended intermissions and theatre catering were mostly cited in the survey’s open commentaries; many visitors are extremely grateful that cultural life has returned just a little with this pilot project.

### 3.2.2 Visitor information optimisation

98.3% of the respondents say they have received the visit instructions. Of these, more than 99% have read the instructions entirely or partially. 99.3% of the respondents say the instructions are understandable (0.1% not understandable, 0.6% felt both). On the basis of the internal analysis (evaluation of reports about the evening, observations and checks in performance areas on the spot), but especially also on the basis of the on-site observations of the experts involved, it can be stated that the visitors follow the instructions very conscientiously.

With the aid of open comments in the survey, but also with the front-of-house team’s feedback and as part of the performance reporting system, improvement possibilities for communication were identified and worked directly into the instructions for visitors (e.g. the clarification that MNCs may only be replaced by visors in exceptional cases, or the clear statement that no catering at all will be offered). The following figure shows the visitor instructions at the time when it was not compulsory to wear an MNC during the performance.

**Instructions for your visit**

We look forward to welcoming you to an event of the Bayerische Staatsoper. Please observe the following instructions so you can enjoy your visit nice and relaxed, safe and secure. Contact us any time if you have any questions.

- The most important first – look forward to the time with us!
- **Admission to each event is 60 minutes before the start of the performance.** You can access the Nationaltheater via the entrance to the Freunde-Foyer (Alten-Goppel-Strasse) or via the main entrance. Please see your ticket for your entrance. The access to the Allerheiligen-Hofkirche is as usual (main entrance). During the admission and in the building please always maintain sufficient distance from other persons (at least 1.5 meters, but 2 meters are better).
- There are no personalised admission controls. Please note that as the purchaser of the tickets you are obliged to be able to name those attending the event at all times. Please also pass on these visitor instructions accordingly.
- Our **theater catering** has reopened and appears in new splendor. In the parquet floor on the right, our new bar „Rheingold“ welcomes you with considerably more selection. Please note that the consumption of food and drinks is only allowed at one table and that there is only one household at a table. Please reserve a table in advance via our **theatre catering**. We have set up more bar tables throughout the house for you. Please spread out over all bars. Open are the „Rheingold“ in the stalls on the right, the bar in the stalls on the left, the bar in the Freunde-Foyer, the two bars in the 1st tier as well as the so called „Aquarium“ in the 3rd tier.
- **Please only visit us if you are healthy.** If you feel symptoms or your immune system is weakened by a previous condition, we would ask you with a heavy heart to please stay at home – otherwise we very much look forward to seeing you! If you have had contact with a person with COVID-19 in the last two weeks or if you yourself have been tested positive for the virus, you may not attend either. Please use our ticket exchange (kartenboerse.staatsoper.de) if you cannot use your ticket for the reasons named above.
- **Please wear a mouth-nose covering continuously – at your seat as well.** We have to kindly ask you to also wear your mouth nose covering during the performance as protection for others. Please move only “back-to-back” in the rows past each other. If wearing a mouth-nose covering is not possible or tolerable because of a condition or for health-related reasons, please wear a visor during your visit. As a precaution, we would like to point out that wearing a visor does not provide the same level of protection as a mouth-nose cover. Unfortunately visitors that cannot wear a mouth-nose covering or a visor may not attend. Please do not use fans either, to keep the spread of aerosols as low as possible.
- **Please sit on your assigned seat.** You’ll find the seat number on your ticket. We would urgently ask you not to move to one of the free seats. Please also note that in the stalls and the balcony of the Nationaltheater other guests may sit directly in the rows in front of you and behind you; to the right and to the left there will be at least one free seat. You can find an exemplary seating plan for October [here](#); there might be daily variances due to production-related causes). At Allerheiligen-Hofkirche there is always one free row and three free seats between two parties.
- **Be a hygiene role model!** Needless to say you do of course know all the current hygiene rules, hygiene etiquette or similar advice providers. Thank you for acting as a role model; others will follow your example. And our front of house team will open the doors for you, so you get to your seat without touching any handles.
- **Enjoy your visit!** We’re delighted that you are here with us again. Let’s spend a relaxed and enriching time together!

Further questions are answered at [www.staatsoper.de/en/visit](http://www.staatsoper.de/en/visit).  
The Bayerische Staatsoper Team

Visitor Communication of the Bayerische Staatsoper  
T +49 (0)89 21 85 10 25 (Mo-Fr 10am-6pm), [besucher@staatsoper.de](mailto:besucher@staatsoper.de)

Figure 6: Instructions for visits to all visitors (as of 9 October 2020 – no MNC obligation at this time)

### 3.2.3 Optimisation of the processes in the audience area

The analysis of all observations shows that the instructions of the admission staff are followed very stringently. In just a few cases, this staff had to increase its instructions on complying with the regulations. To ensure the instructions were complied with even more extensively, at the recommendation of the experts a handout with the key regulations for the front-of-house staff was developed and continuously adjusted. The latest version of the handout is issued to staff before every use and was reproduced as follows at the time when there was no obligation to wear an MNC (changes to the respective previous version in red):

**BAYERISCHE  
STAATSOPER**

**Aktuelle Hinweise für das Vorderhauspersonal im Rahmen des Hygienekonzeptes  
(Stand: 2. Oktober 2020)**

Wir danken Ihnen sehr herzlich für Ihren Einsatz in dieser herausfordernden Zeit! Bitte beachten Sie nach wie vor die folgenden Hinweise:

- Bitte erscheinen Sie **nur gesund** zum Dienst. Sollten Sie sich unwohl fühlen, erkältet sein, Fieber haben oder Ihr Geschmackssinn beeinträchtigt sein, können wir Sie nicht einsetzen – bitte bedenken Sie Ihre große Verantwortung gegenüber dem Publikum und unserem Haus!
- Bitte tragen Sie konsequent im Vorderhaus eine **Mund-Nasen-Bedeckung** (nur bei Pausen an der frischen Luft abnehmen bei gegebenem Abstand). Bitte nehmen Sie die Mund-Nasen-Bedeckung auch nicht bei Ansagen bzw. zur besseren Verständlichkeit kurzfristig ab.
- **Auch das Publikum muss grundsätzlich über die gesamte Dauer des Aufenthalts im Nationaltheater eine Mund-Nasen-Bedeckung tragen. Lediglich während der Vorstellung darf die Mund-Nasen-Bedeckung wieder abgenommen werden (wir empfehlen allerdings, diese auch währenddessen aufzulassen).**
- Bitte **berühren Sie andere Besucher nicht** und halten Sie einen **Abstand von 1,5 Metern** ein. Sollten es doch zu Berührungen kommen, waschen oder desinfizieren Sie sich bitte anschließend die Hände.
- Bitte nehmen Sie beim Einlass möglichst keine Eintrittskarten in die Hand, sondern nutzen sie ausnahmslos die Scanner. Beim Einlass ist keine personalisierte Kartenkontrolle mehr erforderlich (Ausnahmen: Altersnachweis U30, SB-Merkzeichen o.ä.).
- **Der Einlass zum Haus ist wieder 60 Minuten vor Vorstellungsbeginn möglich. Die Türen zum Saal werden in der Regel 30 Minuten vor Vorstellungsbeginn geöffnet.**
- **Die Theatergastronomie hat wieder geöffnet. Besucher dürfen nur in den Räumlichkeiten der Gastronomie bzw. an den Stehtischen im Haus konsumieren. Ein Wandeln mit Getränk/Essen ohne Maske ist nicht möglich.**
- **Toiletten** sind aktuell erst ab Balkon aufwärts geöffnet; bitte darauf achten, dass sich nur **maximal 3 Personen** in einer Toilette befinden dürfen.
- **Es gilt für Garderobe und Programmbuchverkauf keine Handschuhpflicht mehr.**
- Bei **Traubenbildung** (z.B. im Hausgöttersaal) die Besucher bitten, **Abstand zu halten** bzw. den **Bereich freizumachen**.
- Bitte den Backstage-Bereich meiden, bitte keinen Kontakt zu Künstlerinnen und Künstlern suchen.
- Im Saal:
  - Bitte **kontrollieren Sie regelmäßig, dass alle Personen** beim Warten vor der Vorstellung ausnahmslos **Mund/Nase bedecken**. **Mit Beginn der Ansage vor der Vorstellung bis zum Einsetzen des Schlussapplauses darf die Mund-Nasen-Bedeckung abgesetzt werden.**
  - Bitte unterstützen Sie die Besucher insbesondere im Parkett darin, in einer Reihe **Rücken-an-Rücken** aneinander vorbeizugehen.
  - Bitte darauf achten, dass die Besucher auf den **zugewiesenen Plätzen** (laut Ticket) sitzen bleiben.
  - Besucher mit **Fächern** bitte freundlich proaktiv darauf ansprechen, dass dies zur Minimierung von Aerosolen derzeit nicht erlaubt ist.

Bei Rückfragen wenden Sie sich bitte gerne insbesondere auch an  
Charles Maxwell (+49 89 2185 2542)

Herzlichen Dank!

Matthias Schloderer  
Hygiene Task Force (+49 89 2185 1028)

Figure 7: Key points for admission staff (as of: 2 October 2020 – no obligation to wear an MNC at this time)

At any rate 29.9% of visitors use the entrance via the significantly further away Freunde-Foyer (north entrance foyer), which significantly frees up capacities in the main entrance area. There were no significant clusters in front of the building and in the cloakroom areas.

The evaluation of various situations by the audience is shown in the following table. How crowded or spacious the respective situation was considered to be was recorded on a seven-level Likert scale (1= very tight and crowded, no distances, up to 7= very relaxed, distances no problem at all; percent value represents the top and bottom 3).

Area	(quite) relaxed with distance	a bit of both	(quite) crowded without distance
<b>Building admission situation</b>	97,32%	1,57%	1,11%
<b>Auditorium admission situation</b>	98,13%	1,29%	0,58%
<b>Exit situation</b>	93,85%	3,52%	2,63%
<b>Cloakroom situation</b>	96,09%	2,60%	1,31%
<b>Toilet situation</b>	91,23%	6,80%	1,97%
<b>Intermission situation</b>	95,97%	2,71%	1,26%
<b>Catering situation</b>	95,04%	3,43%	1,53%
<b>Seating in the auditorium</b>	94,00%	3,40%	2,60%
Front stalls (rows 6-12) SEPTEMBER	89,73%	4,49%	5,79%
Front stalls (rows 6-12) OCTOBER	94,90%	3,57%	1,53%
Rear stalls (rows 14-20)	94,88%	2,61%	2,51%
Balcony	93,82%	3,43%	2,76%
1st tier	93,38%	4,64%	1,99%
2nd tier	94,89%	3,50%	1,61%
3rd tier	96,58%	1,54%	1,88%
Gallery	95,42%	3,21%	1,37%

Figure 8: Audience situations in survey after visit

An overwhelming majority (at least 89.5%) believe that the situation in the front-of-house area is quite relaxed with distance or very relaxed. Even with the seating in the front part of the stalls, where the “Salzburg model” was tested in September in the form of the more relaxed chessboard pattern, which was still unusual for the Munich audience, only 5.8% of the respondents thought the situation was quite crowded. It was also shown that a proactive communication of the seating plan helps to improve the perception of safety on-site, which was also incorporated into the visit instructions over the course of the pilot period. Furthermore, it is also clear that with a suitable hygiene concept in place, there is no reason why the offering of food and drinks and intermissions should not continue.

Based on the survey’s open comments, but also the performance observation analysis by Staatsoper representative’s and the named experts, further measures to prevent clusters of people and potential intensive contacts were implemented step-by-step. Additional staff was used at potential gathering points, to ask people to continue moving (e.g. foyer behind the portico/programme sales) and to coordinate queue formation (e.g. box office access, toilets area on the balcony).

**The audience’s experience was confirmed by the scientific evaluations/medical experts’ observations.** The general specification of maintaining distance from one another wherever possible was adhered to. Valuable findings on seating in the form of a chessboard pattern in the respective three selected stall rows were produced in September (7-day incidence, predominantly below 100 per 100,000 inhabitants) – this appears to be unproblematic, as it was in the “Salzburg model”, because all visitors face in the same direction here (not: face-to-face as with an intensive contact) and generally do not speak during the performance when they remove their masks. The use of fans is not permitted either, to prevent residual aerosols from spreading. The distance between the seats (axial dimension from mid-chair to mid-chair) was still also more than a metre here. Added to this is vertical ventilation, which quickly draws the visitor’s breath upwards, without causing any horizontal swirls (see section 3.3).

The committee of experts also suggested medical mouth-nose protection as an additional possible protective measure for the audience. This is better than convenient MNCs, on the whole is more effective and sits better on the face. Whether or not these are to be generally distributed in the building, can be purchased at an affordable price or will only be recommended as part of the visit instructions, will have to be examined when the cultural sector reopens. From the virology experts' point of view, with a fall of the 7-day incidence below 50 per 100,000 inhabitants, the removal of the obligation to wear a mask after taking your seat appears to be logically possible.

With regard to transmissions (virus transmissions) in the building, only theoretical statements can be made based on this pilot study. It should be noted, however, that no infections caused by a visit to performances in the Nationaltheater were recorded during the entire pilot period. This is not attributable to the low prevalence in the summer months alone, as performances went far into October, when a 7-day incidence of 100 per 100,000 inhabitants was even exceeded at times.

We were only informed by one person from the audience in September that they had tested positive in the days following their visit. Even though there was sufficient time between the visit and the appearance of the first symptoms and therefore according to the health authority's specifications, contact tracing in the Nationaltheater was not necessary, the case was nevertheless checked thoroughly. It was shown in the case analysis that the hygiene rules were adhered to with the visit and there were absolutely no intensive contacts with other visitors. According to the information provided, this person was neither infected in our building nor did they infect other people.

### **3.2.4 Prevention of intensive contacts**

To the best of the Bayerische Staatsoper's knowledge, there have not been any intensive contacts between people that do not know each other. In the visitor survey, 94 people answered the question as to whether they had an intensive contact during their visit for "longer than two minutes" (i.e. they stood face-to-face with another person that they did not know without the stipulated minimum distance), with "yes". With a more detailed analysis of these contacts we can however see that in these cases there was no intensive contact, but rather a brief contact. Some people, for example, said they had such a contact when passing by within the seat rows; another person had one for, "a few seconds outside the toilets"; another person said: "Someone had a question for me and can really quite close to ask it." Most of these contacts reported were experienced with pushing at programme sales, and according to those surveyed, other, careless people, were often the cause here, and not the spatial conditions. From the second performance on, additional staff ensured that a queue with sufficient minimum distance was maintained here.

### **3.3 Criteria for determining pandemic-related highest number of visitors**

The Bayerische Staatsoper's latest studies show that the figure of 500 visitors in the Nationaltheater is unproblematic. On the basis of technical factors (building ventilation systems, flow behaviour, air change rates, room geometry, distance rule), measurable criteria for calculating the pandemic-related highest visitor number help to minimise the risk of infection as much as possible.

The risk of infection comes on one hand from droplets – a risk that is significantly minimised by maintaining distance and MNCs. On the other hand the risk of infection also comes from aerosols in the breath, which are scattered in the room's air; if the air stays "standing", the risk of infection increases. To comprehensibly define a "pandemic-related maximum number of visitors", a room's specific technical data (area, volume and ventilation capacity) must be determined. The Assembly Area Ordinance (VStättV), which stipulates, among other criteria, that assembly rooms with more than 200 m<sup>2</sup> must have a ventilation system, applies for constructing and operating places of assembly. According to the ordinance the air change must be proven to be at least 20 m<sup>3</sup>/h per person. The air change rate in most cases is usually far

higher, especially in smoking areas (e.g. foyers, catering areas) before the smoking ban, when a minimum air change of 35 m<sup>3</sup>/h per person applied. Building ventilation systems are subject to strict maintenance intervals and regular approval by an expert (e.g. TÜV), which must be documented and verified accordingly in the inspection log book.

The air change that is beneficial with cultural events during a pandemic has yet to be scientifically determined. The recommendations of statutory accident insurance go beyond the criteria stipulated by VStättV (20 m<sup>3</sup> per hour and person) and state (also without scientific proof) that a fresh air supply of 50 m<sup>3</sup> per hour and person would be required for visitors older than the standard retirement age (see VGB 2020). Even if the recommendations of statutory accident insurance already constitute a conservative, robust standard, as part of these explanations following extensive discussion, an even higher fresh air change is proposed as the minimum value. To rule out any unnecessary risk, triple the legally stipulated air change, so 60 m<sup>3</sup> per hour and person is specified as the ventilation indicator – until scientific information on a lower required air change is provided.

In theatres and event spaces with built-in row seating **source air outlets** for air supply are built in under the seats and the exhaust air is suctioned in the ceiling area, so the **airflow is vertical**. With all other places of assembly the supply air and exhaust air by contrast are arranged in the opposing walls (or ceiling), so the airflow is horizontal. Several ventilation tests using artificial fog were performed in close consultation with the TUM's Prof. Thomas Auer (see [video](#), BAYERISCHE STAATSOPER 2020B) to examine and illustrate the vertical airflow in the Nationaltheater. During these examinations at different points in the auditorium it was proven that the fog in the stalls, in the boxes and in the tiers (also in the tiers' wall area) rises quickly; the same flow pattern also applies for the stage and the orchestra area, as the air is drawn up and not horizontally into the audience area. The addition of the audience causes a thermal effect, which significantly increases the vertical flow speed. There are no "ventilation rolls" or horizontal "swirls" that would take the aerosols back to the visitors. The findings with a fully filled house and in all sub-areas must still be verified for the Nationaltheater; comparable examinations must also be performed at other venues. This notwithstanding, for the TUM's ventilation experts involved, the risk of a superspreading event appears to be very low for three reasons, described in more detail in the following – the source air system, the air volume per person and the high room volume.

Fresh air is introduced from outside with all ventilation systems; for energy conservation reasons a smaller part of the room air is prepared for cooling and heating via a filter system. The volume flow of a ventilation system can be reduced or switched off with recirculated air, without changing the air change rate here. The degree to which the filtered air may still include a partial risk of infection, has yet to be conclusively clarified. Basically HEPA filters can be retrofitted, but this requires a construction work assessment, as the space requirement and the ventilation power must be adjusted.

There is an air change of 75,500 m<sup>3</sup> per hour in the Bayerische Staatsoper's Nationaltheater, which means that with a maximum visitor number of 2,101 there is an air change of 36 m<sup>3</sup> per hour per person. If the "pandemic-related maximum number of visitors" was to be set across the board at 1,000 visitors, this would be 75.5 m<sup>3</sup> per hour per person. The room volume in the auditorium is approx. 12,000 m<sup>3</sup>, which means the **entire room air is replaced approx. every 9.5 minutes**. The critical dwell time between people without MNCs or safety distance is given as 10 to 15 minutes. This confirms the pilot project's assumption that with a low 7-day incidence (e.g. <35 per 100,000 inhabitants) the "Salzburg model" with a "**chessboard arrangement**" of the visitors (**axial dimension from mid-chair to mid-chair 1 m**, as visitors' face away from each other) can be applied **with places of assembly with vertical airflow** (column) and **with horizontal airflow a radial distance of 1.5 m** is sufficient. A minimum distance of 1 m in the form of a chessboard arrangement, for example, appears to be beneficial as soon as the current high occurrence of infection slows. The 7-day incidence can be applied as criterion (<50 per 100,000 inhabitants, for example). The postulated calculation criteria for determining the pandemic-related highest number of visitors (hygiene distance and room air-related highest number of visitors *PAX (pan)*) are provided in the following table.

<b>Ventilation system with vertical airflow</b> (Event spaces with built-in row seating and separate stage block and auditorium)	<b>1 m</b> hygiene distance (radial) with a low 7-day incidence (e.g. <35 per 100,000 inhabitants), otherwise 1.5 m (radial)
<b>Pandemic-related air change per person</b>	<b>60 m<sup>3</sup>/h</b> (20 m <sup>3</sup> /h previously legally required)
<b>Room air-related highest number of visitors</b>	$PAX (pan) = \frac{x \frac{m^3}{h} [Raumluftwechsel vor Ort]}{60 \frac{m^3}{h} [Mindestluftwechsel je Person]}$
<b>Approved number of visitors</b>	Arrangement of the room air-related highest number of visitors with hygiene distance compliance. Depending on the combination of single seats and connected seats and the spatial design of the venue, the approved number of visitors is possibly below the computational highest number of visitors (according to ventilation criteria).
<b>Ventilation system with horizontal airflow</b> (Event spaces with variable auditorium and stage area)	<b>1.5 m</b> hygiene distance (radial)
<b>Event spaces with variable auditorium and stage area</b> (Stage block and auditorium not separated)	Highest number of visitors including participants (on the stage area)
<b>Room air change</b>	<b>Maximum 15 min</b> (if this value is exceeded for the respective venue, continuous MNC wearing applies)

Figure 9: Possible calculation criteria for determining the pandemic-related highest number of visitors

With a per person air change that is three times as high as that legally stipulated, regardless of the distance rule, in the **Nationaltheater there is a room air-related highest number of visitors of 1,258**, so more than six times the 200 visitors approved according to the Sixth and Seventh Infection Protection Measures Ordinance. Further room air-related highest numbers of visitors for selected venues in Munich are provided in the following table, whereby it should be remembered that the individual conditions on site (e.g. the visitors' viewing direction to one another) are always decisive in specifically determining the pandemic-related highest number of visitors.

	National-theater	Gärtnerplatz-theater	Prinzregenten-theater	Residenz-theater	Kammerspiele Schauspielhaus	Kammerspiele Theatersgasse-Halle	Philharmonie im Gasteig
Seats	2,101	900	1,083	881	690	268	2,400
Ventilation system airflow	vertical	vertical	vertical	vertical	vertical	horizontal	vertical
Fresh air supply (without circulated air) m <sup>3</sup> /h	75,500m <sup>3</sup> /h	30,000m <sup>3</sup> /h	40,000m <sup>3</sup> /h	24,300m <sup>3</sup> /h	14,000m <sup>3</sup> /h	8,000m <sup>3</sup> /h	120,000m <sup>3</sup> /h
Auditorium volume	12,000m <sup>3</sup> /h	3,680m <sup>3</sup> /h	7,500m <sup>3</sup> /h	3,850m <sup>3</sup> /h	2,490m <sup>3</sup> /h	3,190m <sup>3</sup> /h	30,000m <sup>3</sup> /h
Hygiene distance	1m	1m	1m	1m	1m	1.5m	1m
Complete room air change	9.5 min	7.4 min	11.3 min	9.5 min	10.7 min	23.9 min	15 min
Air change per person	60m <sup>3</sup> /h	60m <sup>3</sup> /h	60m <sup>3</sup> /h				
Highest number of visitors according to ventilation	1,258	500	666	405	233	133	2,000

Figure 10: Possible pandemic-related highest number of visitors according to venue and air change

The audience areas in the Nationaltheater's foyer are also ventilated with 55,000 m<sup>3</sup>/h, so there are no restrictions here either, even with the brief dwell time in the foyer. The following criteria for determining the pandemic-related highest number of visitors, which will have to be discussed as part of the development of an opening strategy for cultural institutions, possibly modified or discarded and finally specified, can therefore be defined as the result of the above statements.

**For discussion:**

**Distance indicator:** Max. audience number with 1.5 m radial distance (mid-chair to mid-chair)

**Ventilation indicator:** Max. audience number with fresh air change of 60 m<sup>3</sup> per person and hour

Application of an elaborated individual hygiene concept

**With lower 7-day incidence (e.g. <35 per 100,000 inhabitants):**

- **Distance indicator (vertical airflow):** Max. audience number with 1 m radial distance (mid-chair to mid-chair)
- **Distance indicator (horizontal airflow):** Max. audience number with 1.5 m radial distance (mid-chair to mid-chair)

An example of a schematic risk matrix is attached on page **Fehler! Textmarke nicht definiert.**

## 4 Conclusion and outlook

The experiences gained in the pilot project confirm that there is no increased risk of infection for the audience with a theatre or concert visit with the given study conditions. Within the scope of the pilot project it was also demonstrated that the audience typically behaves very responsibly, disciplined and carefully, and there is no increased risk with the continuation of intermissions and theatre catering either.

The results of this study suggest that a fixed highest visitor number of 200 is not justified with the venues' actual spatial conditions. Considerably higher visitor numbers can be responsibly permitted because of the higher ventilation capacities, stricter hygiene concepts and the audience's disciplined behaviour in the Nationaltheater. The individual highest visitor number should be defined while considering the individually specified conditions and technical criteria for ventilation and distances.

Pattern samples for visit instructions and for briefing front-of-house staff can be provided for use by other cultural event organisers and can be subsequently adjusted to the individual in-situ framework conditions. For continued progress, the exchange of all organisers of cultural events would be welcomed as a round table discussion or within the remit of the respective professional associations. Together with the medical and technical team of experts, with the reopening of the cultural sector the authors of the pilot report would also be able to develop strategic and operative recommendations for action together with the political decision makers and actively cooperate with the opening strategy. The transmission risk at cultural events can be addressed and minimised while considering the examined criteria to determine the pandemic-related individual highest number of visitors.

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## Special statutory provisions

Corona pandemic: Hygiene concept for cultural events and rehearsals of 2 July 2020

Sixth Bavarian Infection Protection Measures Ordinance, 19 June 2020, last change on 28 July 2020

Seventh Bavarian Infection Protection Measures Ordinance, 1 October 2020, last change on 22 October 2020

## Contact

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