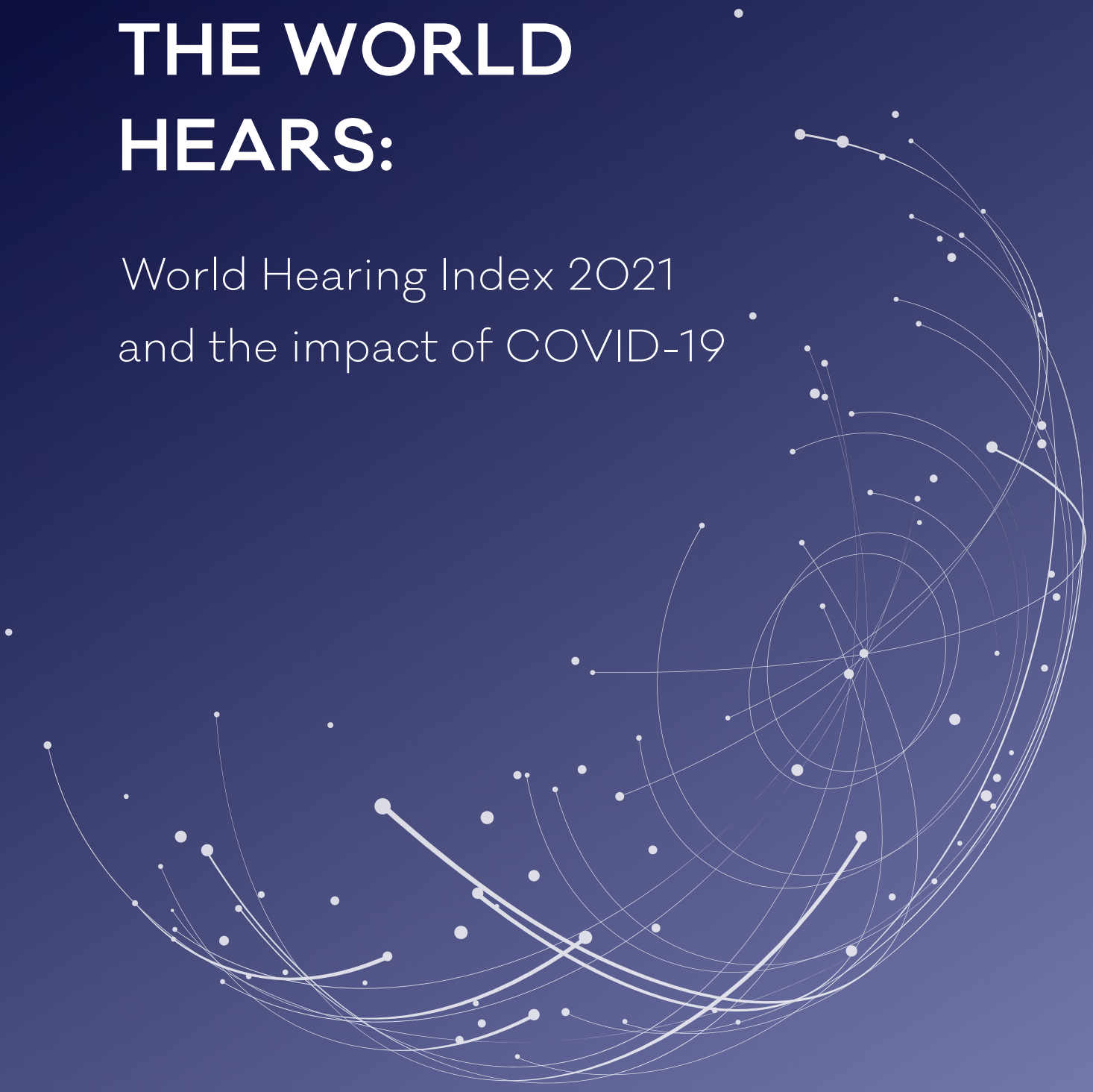
HOW THE WORLD HEARS:

World Hearing Index 2021 and the impact of COVID-19



Executive summary

Since 2017, Mimi Hearing Technologies has mapped how the world hears, with data from over 1.5 million digital hearing tests. 2020 saw the world grappling with COVID-19, shifting from the physical to the virtual for many pursuits from remote-first work and Zoom meetings to virtual happy hours. Our ability to hear became critical to our ability to communicate. We saw the opportunity to explore our own data and position in the context of the massive social shift of the last year. This whitepaper is an opportunity to not only look at what our hearing tests reveal but also place this data in the broader social context. This includes:

- The rise of digital-first
- The impact of in-home media
- Noise pollution and its effects on our hearing health and fight for quiet

Some of the significant findings from our data and broader research:

Hearing loss is affecting young people, and there's no cure

Our research found that hearing loss is increasingly present in young people. This trend shows no sign of abating due to a combination of factors, including environmental noise pollution and listening to headphones at an excessive volume for extended periods.

Sound personalization creates an opportunity for early intervention

By the time people realise their hearing is declining, they may have lost the opportunity to prevent future damage. Mimi Hearing Technologies Sound Personalization creates a bridge between sound calibration to ameliorate declining hearing and the motivation to access professional medical assistance. Further, earphones and other audio equipment calibrated to the specific sound personalization of their user provide greater clarity at a lower volume reducing the need to listen to audio at ear damaging levels.

The time is ripe for OEMs to embrace sound personalization

The last year has cemented the value of high quality personalized audio experiences as people embraced the companionship of audio outlets like podcasts and music. Soundtracks create significant value to mediums such as gaming and in-car audio. MimiSDK and API make it easy to provide advanced audio personalization to various apps with scope for use cases as nascent technologies become mainstream.

Introduction

The last year and a half fundamentally changed how we connect and communicate with others. Seemingly overnight, we saw businesses and schools close, restrictions, social distancing, and curfews imposed and other protective methods in a bid to curb the spread of COVID-19. This resulted in a massive shift for most of the world's population, in terms of work, study, and social life.

For some, working from home was a wonderful novelty; for others juggling the pressures (and noise) of competing demands of a life with other people and noisy neighbours, the appeal was less compelling. Add the combination of in-person communication limited to those wearing masks, and a new found reliance on communication channels such as zoom calls and virtual conferences. The challenge of struggling to understand what others are saying clearly became more critical than ever before. People also relied on entertainment such as audiobooks, music, and movies for respite.

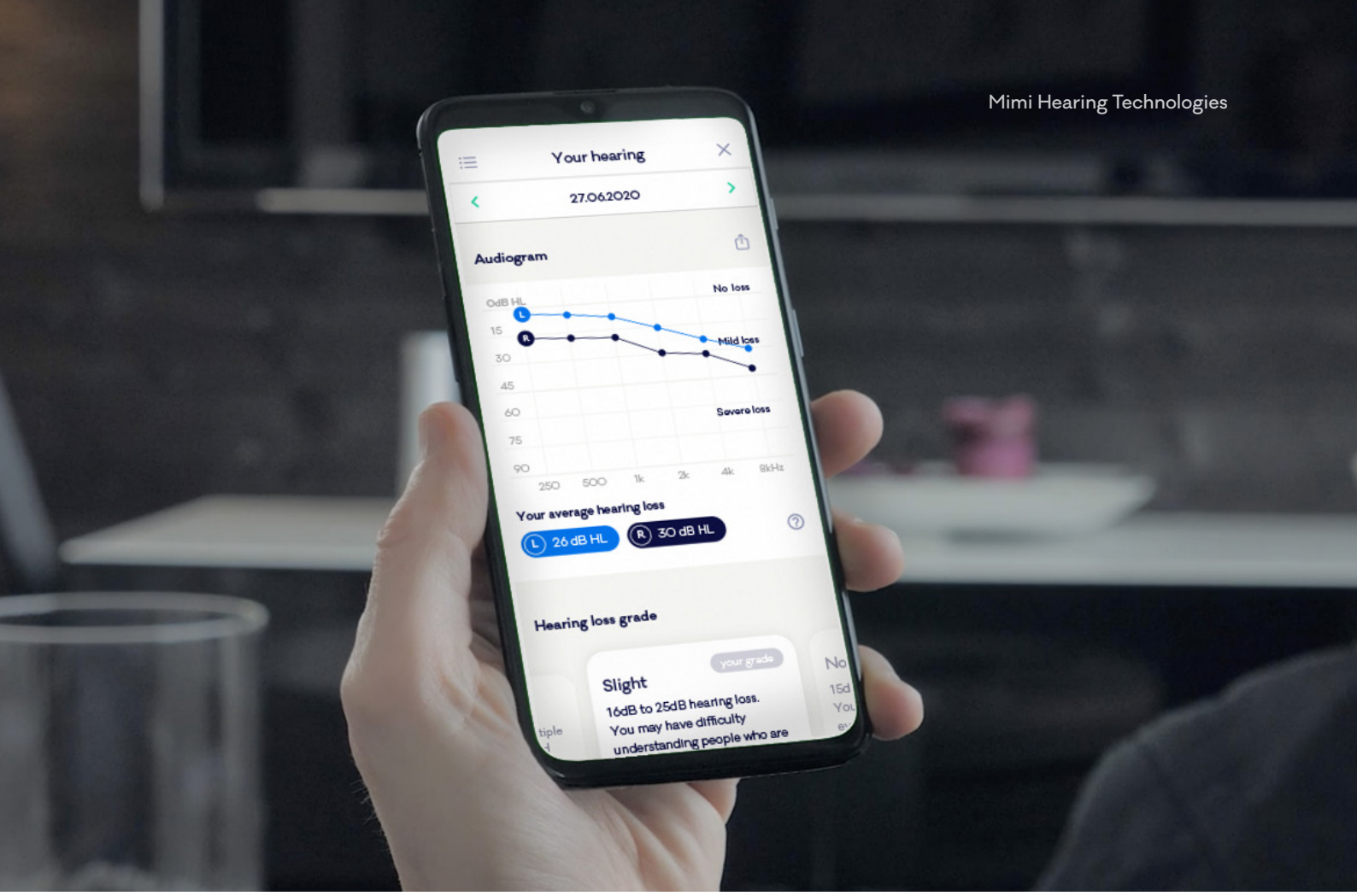
In a world where we all hear differently, and based on Mimi's 2019 hearing data [1], 55% of the adult population has some type of hearing loss, it still goes unrecognised and untreated for the vast majority of the population. And while wearing glasses and contact lenses is the common way to deal with vision problems, hearing difficulties are not equally addressed. Since 2017 Mimi has conducted The World Hearing Index, providing a deep dive into how the world hears, based on over 1.5 million hearing tests. This whitepaper looks at our most recent results and explores them in the broader context of the pandemic including the challenge of noise pollution and the opportunity of emerging audio tech across all connected devices.

[1] https://www.mimi.io/en/blog/world-hearing-map-2020

COVID-19 and hearing isolation

COVID-19 compounded the experience of isolation for those with hearing challenges. The pandemic brought increased attention to the importance of hearing in remaining connected with friends and families, with the necessary use of face masks making communication more challenging for those suffering from hearing loss.

According to the World Health Organization (WHO) , many with hearing loss have recognised hearing difficulties during the pandemic due to masks. These are people who have been overcompensating through lip-reading, which was made more difficult by the advent of mask-wearing.



Mimi Hearing Technologies

COVID-19 and the nexus between hearing loss and hearing tests

Many non-urgent and routine healthcare operators closed their doors for all but essential appointments in an effort to reduce the spread of COVID-19. The American Academy of Audiology reported a drop in patient intake comparing 2020 to 2019 - of over 90% in April, although this number dropped to a reduction of 6.3% in November.[2]

McKinsey research found consumer adoption in telemedicine grew from 11% of US consumers, amongst those surveyed using telehealth in 2019, to 46% of consumers using telehealth to replace cancelled healthcare visits in 2020.[3]

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[2] https://www.audiology.org/news-and-publications/audiology-today/articles/on-trend-the-pandemics-impact-on-clinics-some-datapoints/

[3] https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/telehealth-a-quarter-trillion-dollar-post-covid-19-reality

However, COVID also saw a shift in the mainstreaming of telemedicine in countries like Germany where adoption had been previously nascent compared to other countries. In the spring of 2020, a survey of 2000 doctors conducted by the Stiftung Gesundheit and HIS (health innovation hub) found that 52% of doctors surveyed were offering video consultations—a 50% -point increase from the end of 2017. [4]

At the recent EFAS online conference hosted by the European Federation of Audiology Societies, De Wet Swanepel, PHD shared the use of digital solutions to address the barriers of traditional hearing care and COVID-19 challenges. A survey was conducted from June 23rd to August 13th 2020, of 337 audiologists from 44 countries. It found a rise in the importance of telehealth, rated as important by 44.3% of respondents before the pandemic, a number that grew to 87.2%, as audiologists were looking for low and no-touch testing opportunities. [5]

De Wet asserts that COVID-19 presents an opportunity to rethink how services are provided in an otherwise very traditional sector. He gave the example of the use of pure tone audiometric calibrated headphones and a rapid automated self-test to detect hearing loss. A binaural DIN test was used to detect speech in noise, with 'red flag' questions to track hearing challenges or changes over time.

De Wet also suggests the optional use of digital AI otoscopy. An example is a product like hearScope[6], a digital otoscope that captures high-quality images and videos from a smartphone or desktop. This innovative product includes the world's first AI image classification feature to support categorizing eardrum images. It shows the increased value the digital product offerings are bringing to hearing services.

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[4] https://www.stiftung-gesundheit.de/pdf/studien/aerzte-im-zukunftsmarkt-gesundheit_2020_1.pdf

[5] https://efas-virtual.org/

[6] https://www.hearxgroup.com/hearscope/

Going digital-first

Along with the challenges of masks, the shift from in-office to remote work has increased the need for improved hearing; as people shifted from the physical to virtual: board meetings were replaced by digital meetings, conferences pivoted to online offerings, which at the beginning of the pandemic lacked basic accessibility, such as closed captioning.

Even in people's social lives, we saw all-digital entertainment proliferate, ranging from online theatre, DJ sets from bedrooms, zoom 'pub' quizzes and happy hours, and the development of new offerings like invite-only chat app Clubhouse.

Going digital-first meant not only connectivity challenges and juggling various platforms but the need for optimal sound quality and accessibility for everybody. The ability to focus became a fundamental challenge for many. Working from home was lauded by those with adequate quiet, space, and comfort, but a chronic pain point for those contending with housemates and partners. Therefore, the desire to be able to control our audio quality became more important than ever before.

Digital-first brings a global increase in the demand for sound personalization

2020 saw Mimi used in more countries than ever before. Our users increased across the globe, highlighting the demand for sound personalization.

- India: +275%
- Canada: +250%
- Romania: +239%
- Greece: +203%
- Iran: + 178%

Overall, we saw a 50% increase in test numbers from 2019 to 2020, strengthening the demand for, and validity of, sound personalization.

2020 saw significant increases in the consumption of at-home media for work and leisure:

Live Streaming and Audio/Web Conferencing

Livestreaming and gaming platform Twitch[7] had a phenomenal year in 2020 with downloads reaching 80.6 million – a rise of 134% over the previous year (34.5 million). Originally a gaming platform, Twitch became a popular option to deliver low cost webinars and conferences online.

Data collected by On24[8] shows that the use of webinars increased 162% and attendance nearly quadrupled to more than 60 million people. Audiences engaged with over 61 million hours of content, an increase of nearly 300%. In 2020, Zoom's daily participants[9] jumped from 10 million to a massive 200 million in just three months. But Zoom fatigue became real a few months into the pandemic. Many meeting and conference attendees requested cameras off meetings, a scenario causing an even greater need for stellar audio.

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[7] https://www.businessofapps.com/data/twitch-statistics/

[8] https://www.on24.com/blog/how-covid-19-is-changing-webinars/

[9] https://venturebeat.com/2020/04/02/zooms-daily-active-users-jumped-from-10-million-to-over-200-million-in-3-months/

Film/Television

Research[10] in October 2020 for Variety intelligent platform found that 54% of those surveyed watched more movies and TV shows. 49% were watching more online videos, online gaming had increased by 36%, and news listening by 35%. Interest in over the top consumption (film and television content provided via a high-speed Internet connection rather than a cable or satellite provider) grew substantially, with Disney Plus streaming service one of the winners of the pandemic. In April 2020, Phone Arena reported[11] "it took Netflix seven years to hit 50 million paying subscribers while Disney needed just five months." The streaming service has gained[12] an 8.7 million increase in its subscriber count since the start of 2021, totalling 103.6 million users around the world.

It follows that with the increase in audio interaction, listeners are demanding a greater quality of sound, something which has been at odds with show creators. Over the last few years, efforts to make actors speak in their natural voice in UK productions have led to complaints about inaudible dialogue and backlash from TV show viewers unable to hear dialogue clearly. One show Jamaica Inn resulted in 2,200 viewer complaints about mumbling. It's a problem not limited to British TV, with last year's blockbuster Tenet criticised for poor sound quality, with some even turning on the subtitles to compensate. Personalized sound quality is one tool to help rectify the problem, for both in-air audio and smart TV speakers.

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[10] https://variety.com/vip/more-time-at-home-during-the-pandemic-means-more-content-consumption-survey-1234883629/#!

[11] https://www.phonearena.com/news/disney-plus-reaches-50-million-subscribers-worldwide_id123686

[12] https://www.techradar.com/news/disney-plus-creeps-closer-to-netflix-after-hitting-100m-subscriber-milestone

Streaming/Podcasts

Research[13] by Nielsen found that streaming audio consumption increased by 39% on computer/mobile between May 2020 and January 2021. Spotify gained 6 million followers in the first quarter of 2020. Even without daily commutes for many, podcasts continue garnering increased listenership, with particular growth among multicultural listeners[14]. There was an increase of 8 million more people in the 18+ age category listening to podcasts in 2020, compared to 2019. Interestingly, podcast listening is also strong among kids: 89% of kids who listen to podcasts are under the age of 9. While it's easy to focus on screen-based digital experiences, many people are seeking audio-first, a phenomenon platforms are predicting - in May 2021 Spotify announced that it would add audiobooks to its platform by the end of the year. [15]

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[13] https://www.nielsen.com/wp-content/uploads/sites/3/2021/04/2020-2021-Nielsen-National-TV-COVID-Evaluation.pdf

[14] https://www.nielsen.com/us/en/insights/report/2021/podcasting-today/

[15] https://newsroom.spotify.com/2021-05-20/storytel-audiobooks-will-be-available-on-spotify-later-this-year/

Why hearing health

The World Health Organization (WHO) hosts World Hearing Day annually on March 3rd. Their recent World Health on Hearing reports that nearly 2.5 billion people worldwide —— or 1 in 4 people —— will be living with some degree of hearing loss by 2050[16].

With the current rate of prevalence, WHO asserts that nearly $1 trillion internationally is lost from unaddressed hearing loss. Without action, the coming decades will see this figure rise further.

[16] https://cdn.who.int/media/docs/default-source/documents/health-topics/deafness-and-hearing-loss/world-report-on-hearing/wrh-executive-summary.en.pdf

Noise pollution and hearing

If there's one thing the last year has brought to a head, it's the impact of noise pollution. Noise pollution is a term used to describe the propagation of noise with ranging impacts on the activity of human or animal life. Its causes are multiple and complex and include rail, traffic, aircraft, and industry noise such as construction and manufacturing. It's linked to health problems such as sleep disruption, increased stress, annoyance, and distraction; and long-term effects such as hypertension, heart disease, and hearing loss. In addition, there is evidence of impact on educational performance, with numerous studies showing that noise pollution produces learning and cognitive impairment in children, resulting in decreased memory, reading skills, and lower test scores. The World Health Organization (WHO) rates noise pollution as the second most dangerous environmental risk factor for humans after air pollution.

Hearing loss exacerbates noise exposure[17] and contributes to damage as we turn up the volume in an effort to increase audio clarity.

[17] https://www.who.int/pbd/deafness/activities/MLS_Brochure_English_lowres_for_web.pdf

People on mobile devices typically consume audio content at 17% higher levels when listening in background noise. Noise-induced hearing loss is irreversible, and hearing loss is a growing global problem.

At least 20% of the EU population lives in areas where traffic noise levels are harmful to health[18]. Average noise on some lines of and the New York subway[19] and the London Underground[20] regularly exceeds 90 decibels. According to the CDC, damage to hearing in the 90 decibels range is possible after about 50 minutes of exposure.[21] Cars without a muffler and gas-powered lawnmowers sit in the 90 to 100-decibel range. 100-decibels is also equivalent to the volume of a high power lawnmower or a jet taking off at 305 metres.

In 2020, the countries with the most hearing difficulties, according to our research, were:

- India
- Pakistan
- Iraq
- Saudi Arabia
- Philippines

Saudi Arabia was the highest in this category in 2019, where the top 5 also included India and the United Arab Emirates. It's worth considering these numbers in the context of COVID-19. Overall, COVID-19 lockdown and lower levels of travel and economic activity, such as manufacturing, reduced the noise pollution around the globe. However, this was short term, especially in service-driven cultures, similar to the 5 mentioned with the most hearing difficulties. In these countries, businesses and factories opened sooner, offering little respite. Further, mass migration to cities means people typically work in urban areas, which usually includes travel by car or public transport, providing a louder soundscape than countries where people worked from home. A case example is India who has been grappling with the problem of noise pollution for decades.

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[18] https://www.eea.europa.eu/publications/environmental-noise-in-europe

[19] https://www.theguardian.com/lifeandstyle/2016/aug/31/new-york-city-subway-trains-noise-pollution-jet-engine

[20] https://www.wired.co.uk/article/london-tube-underground-noise

[21] https://www.cdc.gov/nceh/hearing_loss/what_noises_cause_hearing_loss.html#:~:text=Noise%20above%2070%20dB%20over,immediate%20harm%20to%20your%20ears

India and noise pollution

In 2020, the highest increase in Mimi users (+275%) came from India suggesting increased interest in sound quality and hearing health. India also was found to have the highest level of hearing difficulties in the world, according to our data.

India imposed one of the world's strictest lockdowns in March 2020, although restrictions eased as the months went on. Noise pollution research found that noise levels of Delhi, the capital of India, reduced by around 40–50% during the lockdown period in March 2020. Due to the reduction of vehicle movement, the noise levels of Delhi's Govindpuri metro station reduced 50–60 dB, from 100 dB[22]. City dwellers had the opportunity to enjoy the chirping of birds, which usually ranges from 40-50 dB.

A particular challenge in India is the cultural practice of car horn honking. A study conducted by Indraprastha Institute of Information Technology (IIIT Delhi) for 30 days in February and March 2019 found that the honking of vehicles is a bigger noise polluter than firecrackers. Times Of India reported that "While the crackers emit short-term noise up to 90 decibels, honking vehicles can emit over 100 decibels of noise in many cases. The honking is even more problematic as it continuously occurs for hours daily."[23]

In 2020 the Mumbai police conducted a trial in response to car honking[24]. Called "The punishing signal" drivers who honked their horns were made to wait longer at the traffic lights. The city connected decibel meters to traffic light poles, and if the meters registered noise levels of 85 decibels or over, the lights were reset and stayed red for longer. They deemed the trial a success but it's unclear if it will continue or be rolled out to other cities.

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[22] https://timesofindia.indiatimes.com/india/covid-19-noise-pollution-falls-as-lockdown-rings-in-sound-of-silence/articleshow/75309318.cms

[23] https://timesofindia.indiatimes.com/city/delhi/bursting-a-myth-honking-is-noisier-than-firecrackers/articleshow/71495698.cms

[24] https://www.youtube.com/watch?v=RTMkHvCKb9k

The use of sound technology in the fight against noise pollution

City planning plays an essential part in reducing noise impact and preventing its increase through efforts such as traffic rerouting, underground tunnels, and changes to flight paths and flight curfews.

According to the WHO, using carefully fitted, and if possible, noise-cancelling earphones/ headphones suited to the individual user allows music to be heard clearly at lower volume levels[25]. Earphones that are calibrated to the specific sound personalization of their user, provide greater clarity at a lower volume. In addition, noise-cancelling earphones and headphones cut down the background noise so that users can hear sounds at lower volumes than otherwise needed. For example, frequent users of personal audio devices on trains or planes should consider using noise-cancelling earphones or headphones in these settings.

Technological advancements such as the electrification of cars and other vehicles can help[26]. Researchers from Nanyang Technological University in Singapore are working on noise-cancelling windows where speakers set on bars inside the windows cancel out unwanted noise. They fixed 24 loudspeakers, each 4.5 centimetres wide in a grid pattern to bars attached to the inside of a window, plus a microphone outside the window. If the microphone detects noise from outside the building, the loudspeakers immediately emit "anti-noise" — sound waves with an inverted pattern of peaks and troughs compared with the incoming noise. This anti-noise cancels out the incoming sounds, reducing the volume of noise pollution entering the room, even when the window is open.

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[25] https://www.who.int/pbd/deafness/activities/MLS_Brochure_English_lowres_for_web.pdf

[26] http://www.auto-decibel-db.com/Top10_Quietest.html

The value of quiet

As urban density increases, the need to find respite from noisy spaces grows. Last year Mimi joined forces with the Good Hearing Initiative to launch a nationwide campaign called #silenceforfuture to raise awareness of the impact of daily noise. Researchers at New York University (NYU) are leading a research project called SONYC[27], to understand how noisy outdoor environments are in the city, and train a computer algorithm to identify the sources of sound contributing to these environments. The NYU project records audio clips that have monitored noise pollution patterns in the city for more than three years. They provide a fascinating insight into the shift in citywide rhythm over time.

Coinciding with the issue of noise pollution is an awareness of the value of intentional quiet. Over the last year, reductions in traffic, commuters, and businesses closed for service have not only reduced carbon emissions but

[27] https://wp.nyu.edu/sonyc/

profoundly shifted the sound of the outdoors. This is exemplified in a sound map created by Pete Stollery on Google Earth to capture sonic environments that have changed due to governments' actions worldwide to curb the spread of the virus[28]. Crowdsourced submissions to the map have included bird songs, recording of 'clap for carers', markets, and airports.

There's also numerous not for profits and projects dedicated to celebrating quiet and eradicating noise pollution. Created in Berlin, the Hush City phone app[29] is a free, citizen science mobile app. It empowers people to identify and assess quiet areas in cities to create an open-access, web-based map of quiet areas, with the potential of orientating plans and policies for healthier living. Hush City is adopted by the City Councils of Berlin (2018) and Limerick (2020-2021) within the context of the creation of the Quiet Areas Plans. In Germany, the Berliner Morgenpost published an interactive sound map mapping the volume of public transport and car sounds across the city[30].

In the US, Quiet Parks International is a not for profit committed to the preservation of quiet for the benefit of all life. They've set up international standards which define the data set collected onsite by field technicians for certification assessment using a GPS, pair of high sensitivity low-noise omnidirectional microphones, digital recorder, and sound level meter. Additional qualitative information, including land history and use is gathered through conversations with land managers. They aim to certify over 50 locations as Quiet Parks by 2030.

[28] https://sound-scotland.co.uk/news/covid-19-sound-map

[29] http://www.opensourcesoundscapes.org/hush-city/

[30] https://interaktiv.morgenpost.de/laermkarte-berlin/

The opportunity for hardware OEMs

Audio hardware OEMs are increasingly looking for ways to differentiate themselves in the competitive hearable tech market. Sound personalization and the ability to create custom audio profiles enable providers to create a full, rich listening experience for the end-user across multiple devices from in-ear audio devices, to smart speakers, to VR/AR gaming devices, smart voice translators and voice-recognition enabled tech. Audio devices are continually updated with new features and functionalities such as head tracking, biometric monitoring, surround sound, active noise cancelling (ANC), and gesture recognition and control, along with connectivity to other smart IoT devices. Binaural recording (aka 8D audio), layered hearing and speech amplification.

Further, retailers are looking to create long-term subscription-based service models with consumers across different life points, and sound personalization can be part of a broader aim to build brand loyalty over an extended period as people get older and their hearing challenges increase. While hearing loss over time is not inevitable, there's a nexus between those in the early stages and those formally diagnosed.

In 2020, due to the outbreak of COVID-19, many manufacturers of consumer electronics experienced a temporary setback with disruption in component manufacturing and supply management as well as the closure of assembly lines across major and emerging markets. However, the market revived by June/July 2020 due to the rise in demand for headphones and home entertainment devices. Germany alone sold 20% more smart TVs in 2020 than the previous year[31].

Research by Reportlinker.com suggests that the global smart true wireless headphone market by unit shipment expects to touch 83 million units by 2026 with a revenue of 8 billion USD[32]. This is attributed to ease of use, streaming, price and innovations in Bluetooth technology. The active noise cancellation (ANC) headphones market by revenue is expected to cross USD 9 billion by 2026, growing at a CAGR of approx. 22% during 2020–2026.

Further, sound tech is evolving exponentially not only in terms of audio quality but use cases. An example is in-car audio. Cars bring forth an enormous service economy to provide in-car services. We're preparing for a time when we ride as passengers, not drivers, leading to a growth of in-car communication and entertainment. It's a huge economic opportunity for car manufacturers, service providers, virtual assistants, streaming services, platform providers and payment companies.

Concept cars such as Sony Vision-S are embedded 360 Reality Audio enabling each passenger to enjoy their favourite music in their seats with a personalized sound configuration[33]. A few years ago Tesla added a "Caraoke" library to a number of their vehicles. Owners can connect and watch videos on their Netflix, Hulu and YouTube accounts via the centre console (when the car is parked).

In-car gaming is also evolving. In Germany Holoride is a startup co-founded by Audi Electronics Venture GmbH[34]. They create a virtual experience combining virtual reality headsets with real-time physical feedback of the car in motion. The headsets are wired into the car. When the vehicle accelerates, brakes, or turns, the same happens in the game, so the player feels everything happening on the screen. Holoride says the technology could also apply to movies and TV shows. They call the content elastic as it can adapt to the route length and type, driving styles, and location for experiences tailored to your journey.

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[31] https://www.broadbandtvnews.com/2021/01/25/smart-tv-sales-continue-to-rise-in-germany-in-2020/

[32] https://www.benzinga.com/pressreleases/21/04/g20533649/the-global-true-wireless-headphones-market-by-revenue-is-expected-to-grow-at-a-cagr-of-over-20-dur

[33] https://www.sony.com/en/SonyInfo/vision-s/

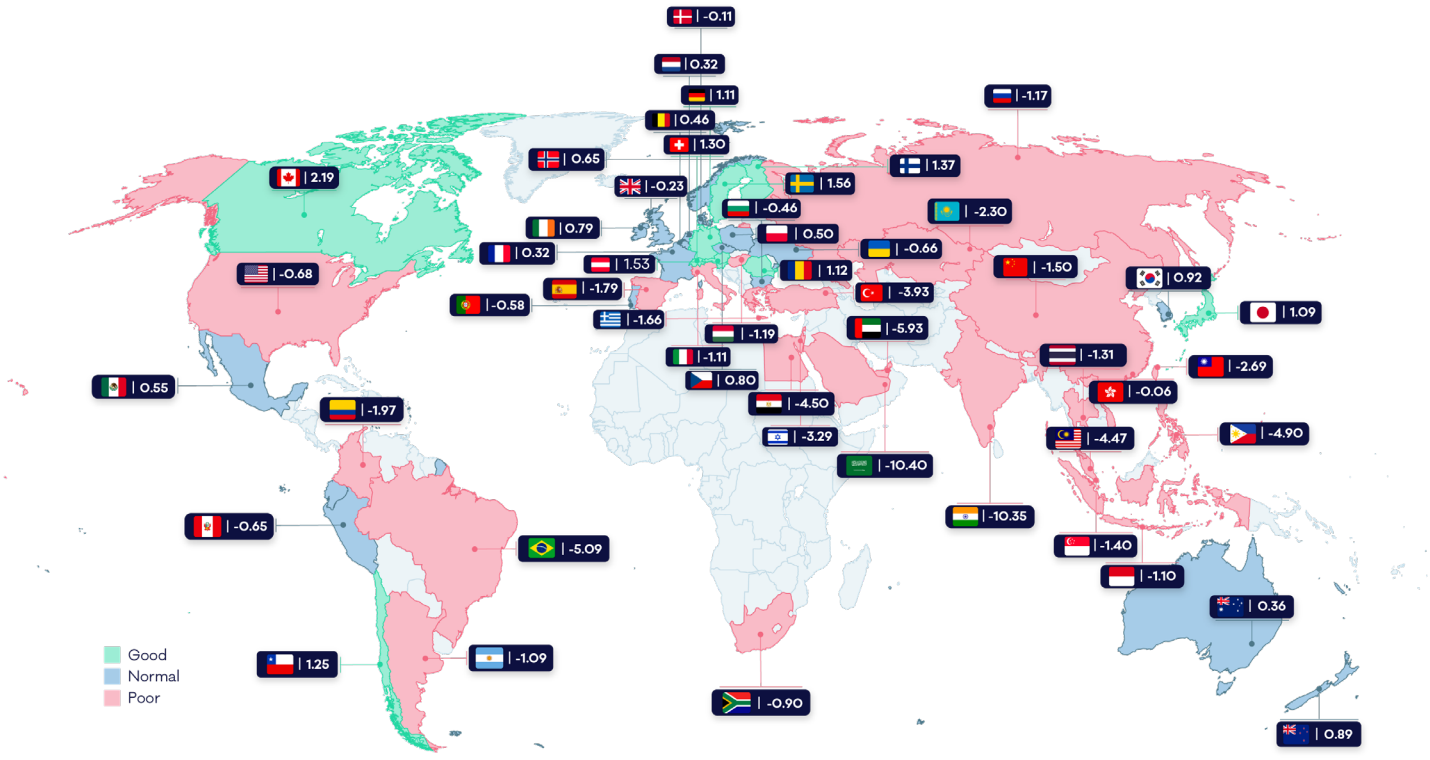
[34] https://www.holoride.com/

It's also anticipated that we'll see the creation of multiplayer in-car gaming where players can play with others via vehicle-to-vehicle communication. Sound personalization is an integral part of this.

Mimi's technologies are ready to implement for a number of platforms. MimiSDK makes it easy to provide advanced audio personalization to your app with Hearing ID and Mimi Sound Personalization. It provides an intuitive, highly customisable UI built on a powerful audio core to provide advanced Hearing Tests and personalized audio for your users. A comprehensive API provides the ability to create everything from complex custom integrations to advanced sound personalization with a few lines of code.

A deep dive into Mimi's digital hearing profiles database

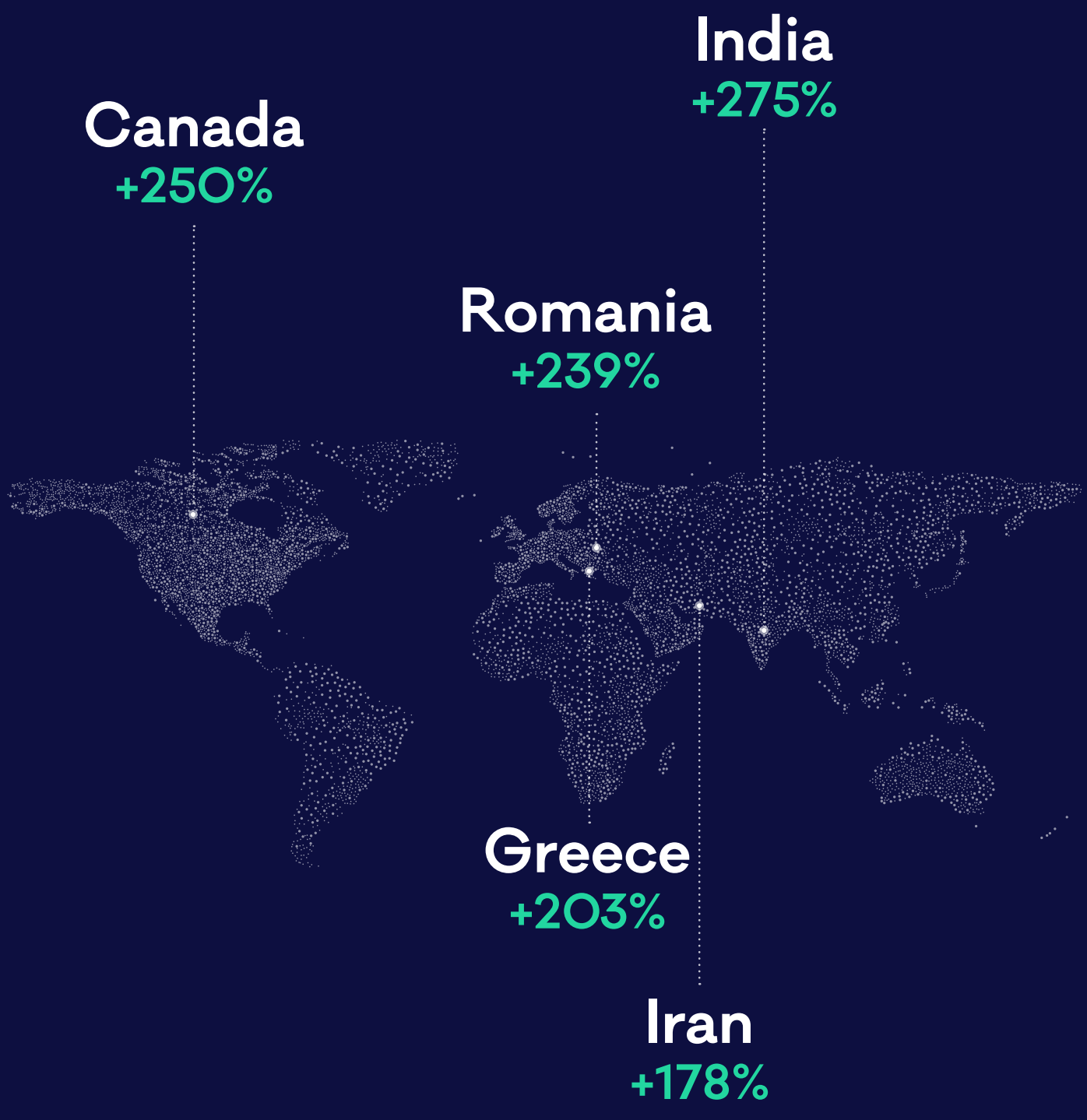
The World Hearing Index is based on data collected with Mimi's Hearing Test in the last 4 years (2017 to 2020), informed by the results of over 1.5 million tests completed in the Mimi Hearing Test app.



Mimi World Hearing Map 2021

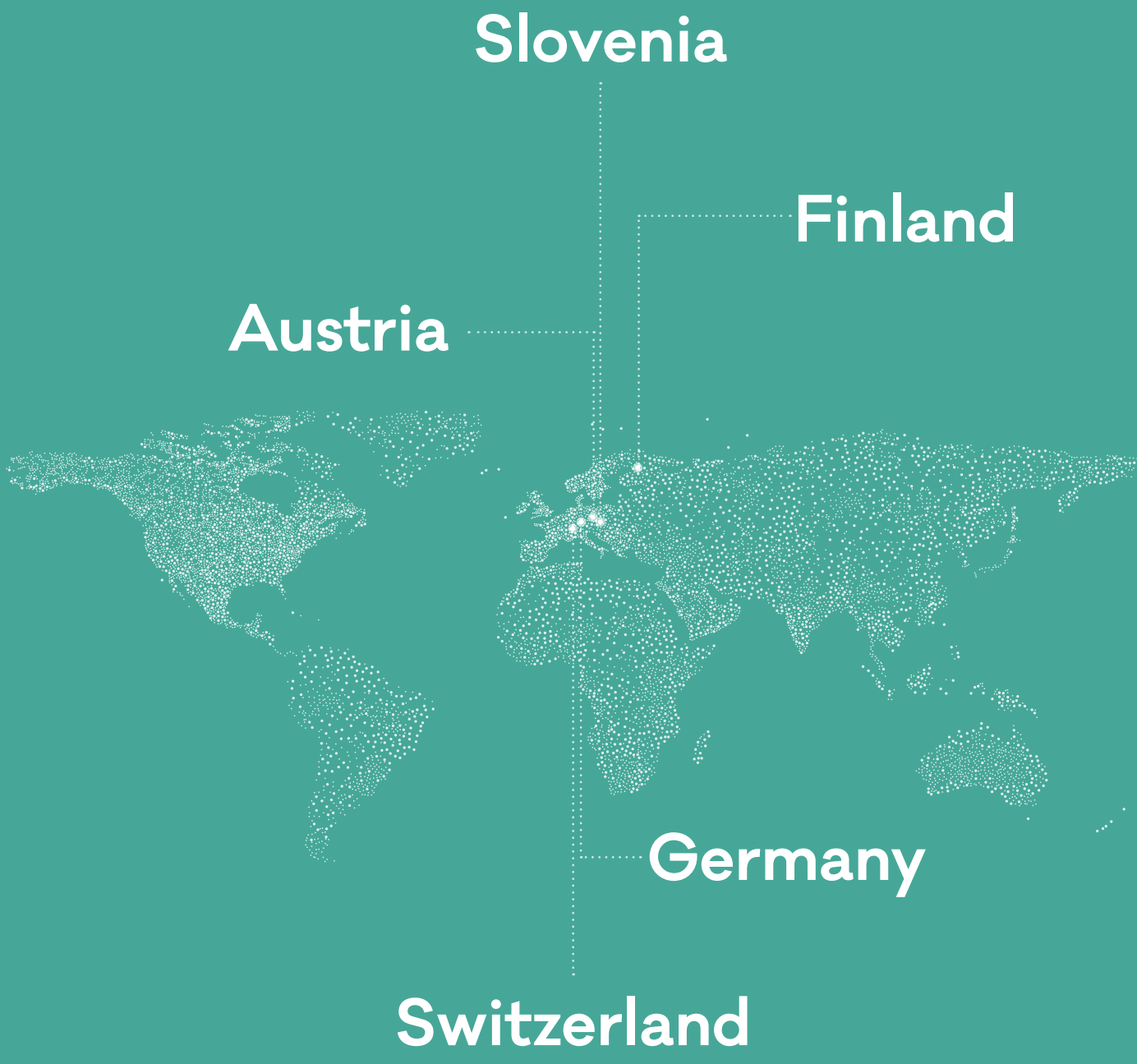
Countries with the biggest increase in Mimi users:

2020 saw Mimi used in more countries than ever before with our users increasing across the globe.



Countries with the best hearing quality:

Countries in Europe and the Schengen region rate as those with the best hearing quality among all Mimi users.



What conclusions can we draw from this? There's a variety of reasons why hearing may be better in these countries. These countries have mandatory health insurance, facilitating access to primary and specialist health care from birth. Thus, health care is more egalitarian than the countries most impacted by poor hearing. However, one of Slovenia's biggest health care challenges is long waiting times to access healthcare[35]. Therefore a digital hearing test may prove far more accessible than waiting for an in-person appointment.

Additionally, it's possible that these countries have a higher level of office-based and digital roles that can be carried out from home.

This meant longer periods with lower noise pollution as a result of the 2021 COVID-lockdowns. The whole of the EU, including Schengen countries, all have modern public transport with quieter machinery than many countries and a commitment to sustainable vehicles that are quieter than older cars. Further, there's a strong element of social control around the use of the equipment and loud machinery - Germany and Switzerland have the notion of ruhezeit[36], times when you are legally obliged to keep the noise levels down.

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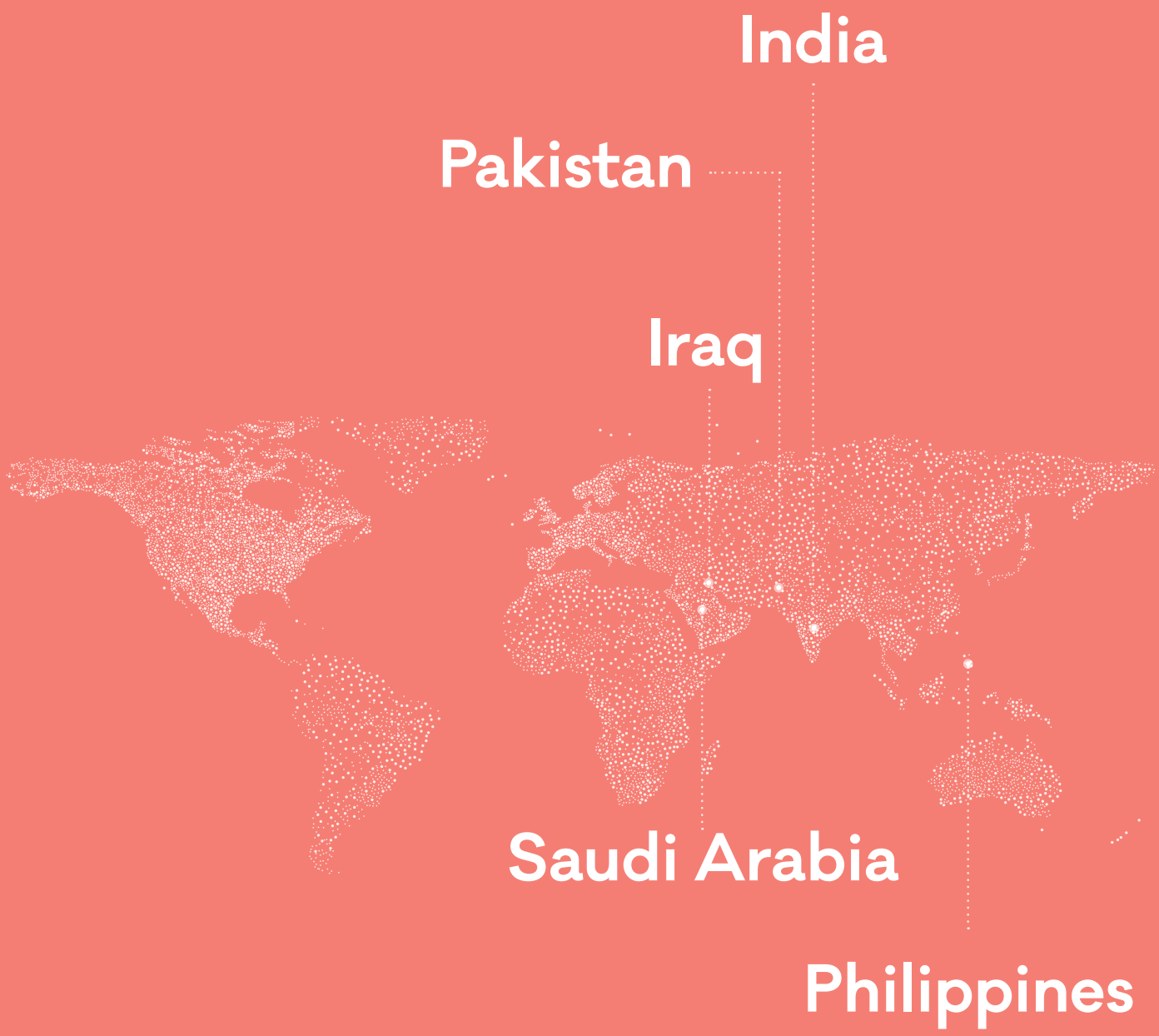
[35] https://www.euro.who.int/en/countries/slovenia/news/news/2018/5/health-for-all-in-slovenia

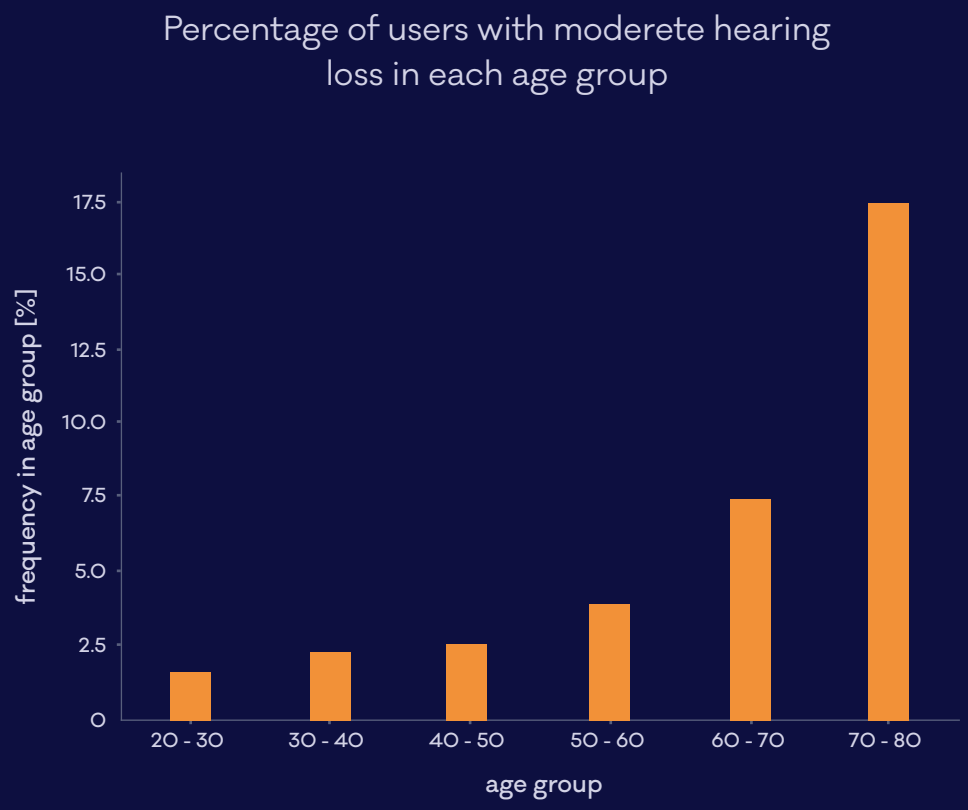
[36] https://blog.lingoda.com/en/what-is-ruhezeit-in-germany/

Countries with the most hearing difficulties:

As discussed previously in the section on noise pollution, non-Western countries featured Mimi users most impacted by hearing difficulties.



How does hearing differ among different age groups?



Regarding Mimi testing rates in 2020, of those between the 20- 30-year-old age range - 20% have slight hearing loss. This number rises to 25% in 30-40 years olds and 30% in Mimi testers in the 40-50 age category. 55% of 50-60 year olds have some degree of hearing loss, 70% of testers aged 60-70 and 85% of people aged 70-80.

The WHO stated that age-related hearing loss (ARHL) - also known as presbycusis – is expected to increase with the current demographic shifts, and that current estimates suggest that over 42% of people with any degree of hearing loss are aged above 60 years[37]. Globally, the prevalence of hearing loss (of moderate or higher grade severity) increases exponentially with age, rising from 15.4% among people aged in the 60s to 58.2% among those aged more than 90 years.

[37] https://www.who.int/publications/i/item/world-report-on-hearing

Hearing loss is no longer an older person's game

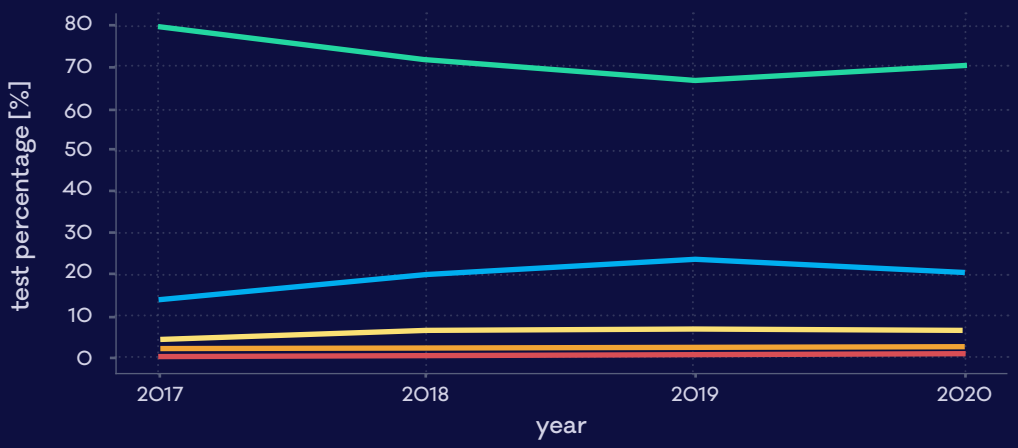


Figure: Share of test for 20-30 year-olds with different hearing loss grades:

0 - no loss
5 - slight loss
10 - mild loss
20 - moderate loss
30 - severe loss

Our data indicate that the incidence of people under 30 with no hearing loss has decreased. Among the people who undertook Mimi's hearing test in the 20-30 year age range, the number with no loss (—) has decreased by 10% over the last four years. Those with mild hearing loss (—) have increased slightly, while those with slight loss (—) represent around 20% of Mimi users.

In other words, the hearing in young people doing the Mimi Hearing Test has not improved in the last four years. It could be interesting to track changes in sound personalization among repeat users in the future as these users age.

That said, it's difficult to attribute any increase or lack of decrease of hearing loss to any standalone hearing quality factors. It's equally likely that the numbers indicate an increased interest in sound personalization - we saw a significant increase in the use of the Mimi Hearing Test to calibrate AirPods, for example. Some may be seeking enhanced audio quality for listening to music, Zoom calls, and podcasting as consumers. Others might be more conscious of their hearing health as they consume more audio on daily. What is true is that young people are increasingly moving to urban areas where noise pollution is often an intrinsic part of daily living.

The level of noise pollution is affected by commuting on public transport, traffic and construction work and loud next-door neighbours. As well as impacting the general quality of life, noise pollution can result in hearing loss, anxiety, cardiovascular disease and sleep disorders. All of this could account for an increased interest in wearable tech such as noise-cancelling headphones, increasing user access and interaction with Mimi tests.

Motivation: Why are people interested in doing a hearing test?

Mimi has the advantage of capturing a portion of the population that may not otherwise undergo a hearing test during the earlier stages of hearing loss. The vast majority of our users do not undergo a hearing test in response to a perceived or defined problem. 64.32% attribute their test to curiosity. This could be either curiosity of what difference sound personalization could make to their hearing experience or curiosity if they have less than optimal hearing - or both, it is unclear. Conversely, the test could be in response to a recent investment in high-quality earphones, headphones or other audio equipment and a desire to calibrate these for high-quality sound and enhanced audio experience. Our AirPods users were below 20% of Mimi users in Jan 2019. This increased to 45% at peaks in Dec 2020. Some of this demographic could include audiophiles, musicians, DJs, podcasters, and users of in-air wearable tech measuring health biometrics such as heart rate and sleep tracking.

But what is clear is that 25.75% of Mimi test-takers undergo a test in response to believing they have a problem. This could be in response to difficulty understanding audio in films, on zoom calls, or hearing concerns in everyday life.

A further 8.07% identify an existing hearing loss, while 1.87% note that their hearing has worsened. Thus, hearing problems are a concern for almost 40% of Mimi-test takers.

Conclusion

Few could have imagined the fundamental social and structural changes of 2020 in response to the COVID-19 pandemic. Closing schools and workplaces and drastically reducing social contact and travel not only helped reduce the spread of COVID-19 but had the secondary effect of improving air and noise pollution levels in most cities. Amongst the chaos and loss of life, while people stayed at home, wildlife roamed the streets and rivers, and birdsong became a sound of the city for the first time in a very long time.

But it's questionable how many of the benefits of the pandemic will persist in the coming years. Seeing what was possible in the short term is not always enough to maintain massive social change. While much of the workforce embraced remote-first digital work, some companies remained less enthusiastic, rescinding their commitment to a fully remote workplace.[38] Fortunately many are introducing a flexible hybrid model that focuses on the well being of employees and the company.

For many, the shift from virtual to digital was not idyllic. People with hearing problems faced the isolation of being unable to lip-read the words of those wearing masks and had to wait for captioned text during virtual events. For others, we saw sound become a constant companion to many as social activities went digital and music, podcasts and gaming became ubiquitous. But both of these scenarios created an opportunity for greater hearing awareness as people sought sound clarity, whether to understand meetings with greater clarity or to get the optimum audio experience of new earbuds.

The pandemic cemented the value of Mimi's sound personalization and the importance of the World Hearing Index to provide a global view of how the world hears. As technology increases with exponential speed, we can expect combinatorial innovation in audio hardware. AI, machine learning, and IoT create highly compelling opportunities for the ultimate digital audio experience for decades to come, in everything from autonomous vehicles to VR and future versions of the quantified self.

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[38] https://edition.cnn.com/2021/06/19/business/return-to-office-company-policies/index.html

Introducing Mimi Hearing Technologies

Founded in 2014 in Berlin, Mimi Hearing Technologies is the foremost innovator in hearing-based sound optimisation and digital hearing tests. Mimi's mission is to create a world where hearing is no longer a barrier to interact and enjoy life.

Hearing-based audio personalization

Mimi Sound Personalization is a unique processing technology that replicates the way the human ear works. It adapts the audio signal to a user's hearing ability, compensating for less than perfect hearing.

Mimi works by assessing your hearing ability and creating a customised audio preset like fitting a pair of glasses. The user's audio is then processed using this preset and personalised to their unique hearing ability. Everyone's hearing is individual and highly complex. A users hearing ID is a unique representation of their hearing ability and how it changes over time. User's can create a hearing ID and seamlessly switch between any device enabled with Mimi, personalizing audio anytime, anywhere.

Mimi is based on three patented core technologies – with over 77 patent applications – that allow Mimi's unique technology and processing algorithm to profile more than 100 parameters in order to accurately assess, customise and optimise the delivered audio to an individual's hearing ability.

The user's hearing ability is primarily assessed in two areas: the lowest intensity sound that they can detect and their ability to process 'masked' sounds, i.e. the quietest sound they can perceive in the presence of masking sounds such as noise. This enables personalized audio to account for difficulty hearing conversations clearly in the presence of background noise - in such scenarios clarity, not volume is the challenge and is typically not resolved by increasing the audio volume.

Mimi can be easily integrated into consumer electronics devices, such as headphones, smartphones, TVs, in-flight entertainment and a range of systems and platforms. In Europe, our iOS and Android hearing test apps are certified as medical devices (CE, class 1), and globally, they are the most-used mobile hearing test, with over 1.5 million downloads from 180 countries. Partners include Loewe, TPV, X by Kygo, beyerdynamic, Bragi, Compaq Television, and Qualcomm.

Award-Winning Technology

Mimi Hearing Technologies' products and integrations have won numerous prestigious international awards, including the CES Innovation Award in Las Vegas (2019 & 2018) for Sound Personalization in beyerdynamic headphones, the SATVISION Innovation Prize (2018) for sound optimisation in Loewe TVs, the Sonar+D Award for Innovation in Barcelona (2017), StartUps & Developer Award at the San Francisco Music Tech Summit (2017) and the IFA Berlin Prize for Audio Innovation (2017).

IFA prize for audio innovation Berlin 2017

Sonar+D Award for innovation 2017

CES Innovation Awards 2018

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