Noisy Autonomy: The Ethics of Audible and Silent Noise

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In this paper, I summarize the medical evidence regarding the auditory and non-auditory effects of noise and analyse the ethics of noise and personal autonomy in the social environment using a variety of case studies. Key to this discussion is the fact that, contrary to the traditional definition of noise, sound can be noise without being annoying, as the evidence shows that some sounds can harm without being perceived. Ultimately, I develop a theory of 'noisy autonomy' with which to guide us in discussing the public health ethics of noise and other sounds.

Introduction

Our house is oddly quiet now that lockdown is over and the children are back in school. This has given me some time to think about noise. By its very nature, noise is annoying; unwanted sound that disturbs and causes distress. But noise is not only annoying; it can also have serious health effects. Some noise is necessary, but much noise in modern life is unnecessary, and people who create noise risk harming the physical and mental health of others, whether or not that noise is necessary. As such, noise is clearly a bioethical issue.

Let's start with some definitions. Noise is all around us, but noise is not simply sound. Generally, noise is defined as 'unwanted' or 'undesired' sound (e.g., 'any sound that is undesired or interferes with one's hearing of something' (Merriam-Webster, 2020)), which makes the determination of whether a given sound is noise sound rather subjective as it is a matter of personal choice, to some extent. However, one cannot choose not to be annoyed by a sound, much as one would like to be able to do so; that is precisely why noise can be so annoying and why exercising one's autonomy with regard to sound can lead to conflict: one man free to shout is another's terrorist.

To the extent that it is a personal matter which sounds are wanted and unwanted, it is true that noise is subjective; indeed, some people are not really that bothered by noise. Schopenhauer judged such people rather harshly: 'Certainly there are people, nay, very many, who will smile at this, because they are not sensitive to noise; it is precisely these people, however, who are not sensitive to argument, thought, poetry or art, in short, to any kind of intellectual impression: a fact to be assigned to the coarse quality and strong texture of their brain tissues' (Schopenhauer, 1851). However, it does not follow from the fact that determining whether a sound constitutes noise is a subjective process, that the issue of noise can be reduced to sonic relativism. In fact, the opposite is true; the very fact that it is up to each of us to determine what we regard as a noise means that the ethical status of the sound and who or whatever is generating it is dependent on the listener's verdict, not the producer's. If neither the producer nor the listener regarded it as noise, there would not be an issue (at least in terms of how noise has traditionally been conceived); if both regarded it as noise, it would also presumably not be an issue as steps would be taken to reduce the noise. The ethical issues around noise arise from the fact that *someone* does not want it, while someone else does (or at least regards it as justified, even if potentially unwanted).

Noise can be annoying in two main ways: it can be annoying in its own right, and it can be annoying because it prevents or diminishes enjoyment or completion of what one was doing. It is not just that the noise is annoying; it is that it stops you enjoying what you would be doing if it were not for the noise. As such, noise is a spoiler. Roughly speaking, whether noise is ethically

doi:10.1093/phe/phab026

Advance Access publication on 29 October 2021

acceptable depends on whether it is necessary and thus justifiable, but before exploring the ethics in detail, we should attempt to quantify the potential harms arising from noise; as we shall see, even if a sound is not categorized as noise, it can cause physical harm. This raises the curious point that noise can also be noise not because its sound is unwanted but because the medical harms associated with it are not wanted. While some of the medical effects will not be encountered unless one is annoyed by the noise, others will occur regardless of whether it is regarded as noise or mere sound (this issue is explored more in the next section).

Before proceeding, it will be useful to define what I mean by 'noisy autonomy'. Noisy autonomy is best understood as our capacity for self-determination in relation to how noise (both audible and silent) affects our lives; as such it is an important component of our personal autonomy. In practical terms, it concerns both our rights in terms of making noise and our obligations in terms of considering the effects of that noise on others. The subjective nature of noise as annoyance means that there is ample room for disagreement about precisely where those rights and responsibilities lie. This balance between rights and responsibilities is further complicated by the fact that imperceptible or unperceived noise can also be harmful, and we also have both a right to know this and an obligation to take it into account; knowledge about the effects of noise on oneself and others is highly significant for noisy autonomy.

As will become clear, noisy autonomy reflects a relational understanding of autonomy (Mackenzie and Stoljar, 2000; Donchin, 2001); it concerns not only the traditional bioethical conception of respect for individual autonomy but also acknowledges that 'persons are inherently social and politically and economically situated beings, raised in social settings, who learn to develop their interests and values in conversation with other social and politically and economically situated beings' (Baylis *et al.*, 2008). Indeed, noise is the perfect instantiation of our social embeddedness, as we cannot live without making or hearing it, and noise can harm others without even being perceived. Given the (anti-)social nature of noise, considering it from the perspective of relational autonomy is more appropriate than more traditional individualistic conceptions of autonomy. (Such relational accounts of autonomy are increasingly common in bioethics (Jennings, 2016) and are particularly suited to public health ethics (Owens and Cribb, 2013).) Finally, as we shall see, noise also raises important issues regarding justice because of its differential presence in different environments.

The Harms of Noise

Noise is not only annoying; it costs lives. In Western Europe alone, the World Health Organisation estimates that noise causes the loss of 1 million healthy years of life every year (Fritschi *et al.*, 2011). Medically, the effects of noise are categorized as either auditory or non-auditory. The former category is rather narrow; auditory harms are essentially those that produce hearing loss, whether occupational or social in cause. In contrast, non-auditory harms comprise a broad category that encompasses annoyance, cognitive impairment, sleep disturbance and cardiovascular health. In this paper, I focus on non-auditory harms, but the term 'non-auditory' can be confusing because annoyance is a conscious non-auditory effect that is nonetheless directly related to what is heard, while those affected by sleep disturbance may not be aware of any ill effects, making such harm non-auditory but also non-conscious. A *Lancet* review states that:

> Annoyance is the most prevalent community response in a population exposed to environmental noise. Noise annoyance can result from noise interfering with daily activities, feelings, thoughts, sleep, or rest, and might be accompanied by negative responses, such as anger, displeasure, exhaustion, and by stress-related symptoms. In severe forms, it could be thought to affect wellbeing and health, and because of the high number of people affected, annoyance substantially contributes to the burden of disease from environmental noise. (Basner *et al.*, 2014)

Annoyance is not merely an emotional state; it also has physiological consequences: 'noise exposure increases systolic and diastolic blood pressure, changes heart rate, and causes the release of stress hormones' (Basner *et al.*, 2014). While annoyance might seem a rather obvious direct reaction to noise, medically speaking the emotional stress reaction is referred to as indirect, while physiological disruption due to noise (other than hearing loss) is referred to as a direct pathway:

> Potential mechanisms are emotional stress reactions due to perceived discomfort (indirect pathway), and non-conscious physiological stress from interactions between the central auditory system and other regions of the CNS (direct pathway). The direct pathway might be the predominant mechanism in sleeping individuals, even at low noise levels. (Basner *et al.*, 2014)

Noise also affects cognitive performance and development in children (Passchier-Vermeer and Passchier, 2000).

As mentioned in the introduction, it is important to note that noise disrupts autonomy in not one, but two ways. One not only does not want to hear the noise; one wants to carry on one's activities without them being disrupted by the noise. For many people, it is not just the noise itself that is annoying—it is the way in which noise prevents or interrupts the enjoyment of some other ongoing activity, as already mentioned. As such, noise is both intrinsically and extrinsically annoying. Furthermore, both the intrinsic and the extrinsic annoyance will increase in inverse proportion to the perceived necessity of the noise. Ultimately, 'chronic exposure can .... increase the risk of hypertension, arteriosclerosis, and ... severe events, such as myocardial infarction and stroke ... [with] higher prevalence and incidence of cardiovascular diseases and mortality in highly noise-exposed groups' (Basner *et al.*, 2014).

In addition, while noise can disturb sleep by waking people up, it can also cause disturbance without the person being aware of it: 'Human beings perceive, evaluate, and react to environmental sounds, even while asleep ... Short-term effects of noise-induced sleep disturbance include impaired mood, subjectively and objectively increased daytime sleepiness, and impaired cognitive performance' (Basner *et al.*, 2014). Thus noise can actually harm people in four distinct ways: (i) it can cause hearing loss (the auditory effect); (ii) it can cause stress and distress via annoyance; and (iii) it causes non-conscious physiological harm through (e.g.) heart damage caused both by the (conscious) stress and (iv) via direct non-conscious physiological effects on the body. Note that there can be overlap between these categories; some people may not be annoyed by a particular loud sound (and might not class it as noise in the traditional sense) but might nonetheless be physiologically harmed by it. Thus noise can be noise without being perceived at all, but also while being perceived but without being perceived as annoying. Table 1 summarizes these categories of noise and their harmful effects.

The non-conscious harms attributable to noise raise two interesting and interrelated issues regarding the definition of noise and the nature of noisy autonomy. If noise is unwanted sound, and I hear an unwelcome sound, then I can accurately and reliably label that sound as noise. Yet the scientific evidence illustrates that sound can harm even if it is not actually annoying for an individual—indeed, the medical literature refers to such sound as noise even if it is not unwanted. As such, the medical literature labels sound as noise if it causes harm, rather than simply if it causes annoyance (though this particular point does not seem to be acknowledged anywhere in the literature), changing the definition from being subjective to having some degree of objectivity. The person who has a high noise threshold might even be hearing noise at very harmful levels without being bothered or annoyed by it; such a person is thus more likely to be unaware that noise he or she is generating—whether high or relatively levels—might be annoying for others.

The idea that sound can be noise without being annoying has obvious implications for noisy autonomy. What if a person is aware of sound that does not pass her threshold of auditory disturbance, and she thus does not regard as noise, while also unaware that those sounds are harming her? According to this person, this is not noise, but according to the medical literature, it is—at least in the non-auditory sense of sound that causes harm. As such, it is simultaneously a non-annoying noise (or rather, sound, by the old definition), and a non-auditory noise—so it is noise despite not being noise in at least two senses.

Of course, if someone were to tell me about the non-auditory harms to which I am exposed, I might well regard them (the sounds, not the person) as annoying, which could in turn lower my threshold for annoyance at hearing the auditory signals associated with the non-auditory harms. Ironically, of course, learning about the potential harms could in turn increase my stress levels in two ways; by making me worry about the non-auditory

Table 1. Categories of noise and their harmful effects

Effect of noise	Nature of noise			
	Perceived as noise (annoying)	Noise (perceived yet not annoying)	Non-perceived noise	Hearing about harms of non-perceived noise
Hearing loss (auditory)	If sufficiently loud	Possible (e.g., loud music)	No	No
Stress and distress (indirect)	Yes	No	No	Yes
Physiological harm (direct)	Yes	Yes	Yes	Yes (via stress)

effects of noise and by increasing (or creating) the stress associated with the sounds in question when I experience them; before, they did not annoy me, and now they may. However, while it might increase rather than decrease harms done to me, telling me about the non-auditory effects of noise does increase my range of future options for autonomous choice by educating me about a harm that I was not aware of, even if I am not currently able to exercise my autonomy in any way that can prevent that harm from affecting me. However, I can then act in such as way as to limit my own noisemaking activity to prevent others from these newly recognized (and other) harms. Having set the scientific scene, we can now move on to a closer consideration of the ethics of noise.

The Ethics of Noise

Noise clearly causes vast amounts of harm to millions if not billions of people. Often the term 'noise pollution' is used to reflect the harm that it causes (paradoxical as any noise is by definition pollution; a more accurate term might be sonic pollution). Yet sometimes noise is necessary. Even Schopenhauer, who detested noise, acknowledged that a case can be made for justifiable noise:

> Hammering, the barking of dogs, and the screaming of children are abominable; but it is *only* the cracking of a whip that is the true murderer of thought. Its object is to destroy every favourable moment that one now and then may have for reflection. If there were no other means of urging on an animal than by making this most disgraceful of all noises, one would forgive its existence. But it is quite the contrary: this cursed cracking of whips is not only unnecessary but even useless. (Schopenhauer, 1851)

Schopenhauer might have been happier in Ancient Rome, where a law was once implemented that prohibited coppersmiths on any streets where professors lived. Fortunately, whips are only rarely heard nowadays, but we have plenty of newer alternative sources of noise, cars, planes and mobile phones among them. In this section, I consider several different sources of noise and their justifiability in order to assess their ethical status.

The start of our first lockdown was made easier by the fantastic spring weather, but it was difficult to enjoy the garden because someone always seemed to be mowing their lawn. In considering different examples of noise and their associated effects on persons' autonomy and well-being, we should of course be mindful of context. One person generating lots of noise on a silent hillside is worse than dozens driving on the motorway, partially because each person on the motorway is simply doing what everyone else is doing there, and because that is what motorways are designed for. Generally speaking, hillsides are designated as natural spaces, which imply a certain degree of peace and quiet. The context of noise also relates to how disruptive it is to activity; if I am doing the dishes or working in a noisy kitchen or even watching a loud film, someone turning on a lawnmower two gardens away will hardly register, whereas if I was having lunch in the garden enjoying birds singing, the effect would be quite different.

Another important contextual feature is the reason for making noise, and whether that reason is reasonable. Voice suggests four requirements for his 'Test of Reasonable Noise':

> The noisy practice is connected with a reasonable comprehensive doctrine.
>
> The practice is part of the history and traditions of that doctrine.
>
> The practice is essential to the activity (as judged from within the perspective of that doctrine).
>
> The reasonableness of the practitioners is evident in attempts to meet the concerns of other citizens. (Voice, 2009)

Thus, someone might have a good reason for playing music outdoors as part of a music festival, but not for listening to loud music without earphones in the quiet carriage of a train. Music festivals have a long tradition, and the noise is to some degree necessary; in contrast, listening to music on a speaker instead of earphones in a place that is meant to be quiet is unnecessary and hence unreasonable.

However, the aforementioned non-conscious nature of some harms caused by noise raises some problems for this account. Voice (2009) states that 'Obviously, no sound is noise without someone hearing it as noise' but as stated above, the evidence shows that unperceived sound can harm in a way that is unwanted, and as such constitutes noise. Thus, even if people are not woken by church bells being rung late at night, their sleep can still be disturbed, with harmful physiological effects. This also applies to people who are awake; they might not be annoyed by background noise that nonetheless has a negative effect on their well-being. Non-conscious effects could and should be factored into any test of reasonable noise, tipping the balance more towards noise being unreasonable because of probable yet generally unquantifiable health effects.

Another issue affecting Voice's test is that it is not obvious why history and tradition should be considered relevant countervailing factors to be weighed against

public health harms. The fact that a noisy activity has a long history is irrelevant if it causes harm to people's health and well-being now. Furthermore, a practice could be essential to an activity without being noisy. Any evident reasonableness on the part of the practitioners would include attempting to find non-noisy ways of achieving the goal achieved by the noisy practice. If they refuse to attempt to do so, they are not being reasonable. So if Voice's test is actually unreasonable, particularly given the medical evidence of harm from auditory, non-auditory and non-conscious noise, what should the criteria be for reasonable noise? In other words, what constraints should there be upon our noisy autonomy?

Respecting other people's noisy autonomy—which includes not only the freedom to make noise but the freedom to be free of it if one so wishes—cannot consist simply in avoiding making noise that one would find annoying. There are several reasons for this. As already mentioned, perceptions of noise are subjective, and what might not seem like noise to you might be very noisy to me. This could be because you have a high noise threshold and I have a low one. Complicating the picture further is the fact that you might have a good reason for making the noise, but I do not know what that reason is, potentially resulting in a situation where you are making sound that you do not regard as a noise, for a good reason, but to me it seems like loud noise for no good reason. We also know that noise can harm without being perceived by any involved party as noise, but that is difficult to consider in such deliberations; perhaps, we simply have an additional weak obligation to avoid making noise because of the non-auditory unperceived harms it can do to others.

Noisy autonomy can also be illuminated by considering the scale of the potential harm that can be generated very easily; indeed, it is all too easy to make noise and very difficult to avoid it. One person can engage in activity that causes noise to be heard by hundreds, or even thousands (e.g., a loud car driven at speed at night). Some people will not notice the noise at all, but could still be affected by it if it causes physiological damage. Others will notice the noise, but not mind it, even if it causing such damage, making it sound rather than noise according to the old definition. Others will be annoyed by the noise and label it as noise in the classic sense. (Of course, noise is also relevant during the current Covid-19 pandemic; some countries have banned music in pubs because the noisier the environment (BBC, 2020), the more likely it is that people will raise their voices and increase the risk and range of viral spread.)

Droning on: Two Noisy Cases

Now let us turn to some cases to consider noisy autonomy in practice. Given the importance of context to our assessment of the justifiability of noise, it is not surprising that a great deal of annoyance can result when new sources of noise are introduced into a novel context. Two similar examples are the introduction of jetskis and speedboats to a countryside loch, and the use of drones up a mountain. Loch Lomond is Scotland's largest loch by surface area and has been a haven for those seeking nature and beauty for over a hundred years. It also lies only half an hour's drive from Glasgow, and the south-west shores have been subject to a degree of commercialization. In the early 2000s, there was intense debate around the use of the loch by water-skiers, jet-skiers and motorboats. One correspondent to the *Glasgow Herald* wrote that 'The emphasis seems to have slipped towards simply banning jet skis, which, while desirable, only addresses part of the speed problems. Water skiing is just as noisy, just as damaging to the enjoyment of every other person either using the loch or its surroundings and just as dangerous to the health of both wildlife and humans ... The noise is incredible' (Morrisson, 2004). However, those who use powered transport on the loch derive great enjoyment from doing so; so could the generation of this noise be considered as reasonable?

The use of engines on the surface of a loch that is the centrepoint of a national park is perhaps the classic example of conflict between people exercising their noisy autonomy in particular ways that may be mutually incompatible. The walkers, yachters, climbers and picnickers would prefer to have peace, quiet and tranquillity; the powerboaters and jet-skiers want to do as their names suggest. Is it fair to them to ban such activity because it disturbs the majority of visitors to Loch Lomond? The nature of noise puts noisy loch users at a substantial disadvantage in terms of reasonableness. It only takes one speedboat with one person on it going up the loch at 50 miles an hour to shatter the peace and quiet for miles in each direction, violating the negative liberty of those using the loch for quieter pursuits. In terms of relational autonomy, this could also be seen as dominating 'quiet' loch users by denying them the ability to exercise their noisy autonomy; one can only exercise one's freedom in this sense if one is not dominated by others (Wenner, 2020). The disutility of even one boat being used this way in terms of the annoyance and potential stress to other loch(side) users is out of all proportion to any potential enjoyment of those on the boat. For some walkers and other people around the loch, this noise might merely be offensive; but for others, it could

actually do harm. The aforementioned point about annoyance stemming not only from the noise itself but from distress at the disruption of another activity is particularly relevant here. The medical evidence also shows that time spent in natural settings is beneficial for health and well-being. If that time is disrupted by man-made noise, not only is stress and annoyance caused because of that noise; the opportunity to exercise freedom in attaining that benefit is also compromised. Thus noise can not only spoil fun and harm health; it can also prevent health benefits being achieved. (One might term this noise's double effect; it harms health and also prevents health being improved through relaxation.) In such circumstances, the term 'offensive' is insufficient; *harm* can result both from irritation at the sound itself and from the prevention of peaceful activity in the vicinity of the loch.

Ironically, however, if there are 10 boats, the increase in disutility for 'quiet' loch users compared with one boat is so marginal that it becomes easier to make a case for power-boating as a permissible practice. The difference between (near-) silence and one boat is massive; the difference between one and 10 is almost insignificant by comparison. And of course, the competing utility of boat users is substantially increased for each extra boat on the water. Recognizing that a complete ban on vessels with engines on the loch would be disproportionate, the National Park introduced byelaws to regulate noise and other disturbance; all such vessels 'shall be fitted with a silencer expansion chamber or other contrivance suitable and sufficient to prevent the occurrence of noise amounting to a Nuisance caused by the escape of the exhaust gases from the engine' (LLTNPA, 2013). Furthermore, though the maximum speed in the centre of the loch is 90 kilometres per hour, in all areas within the designated zones on the west, south and east of the parts of the loch most frequented by walkers and other nature lovers (including swimmers) the limit is 11 kilometres per hour—i.e., much quieter. While many lovers of tranquillity would prefer an outright ban on vessels with engines, this solution seems proportionate and ensures that different groups of citizens can access the loch in a reasonable way, while respecting one another's autonomy. (While this example might not seem relevant in terms of non-conscious noise, it is entirely possible that residents living around Loch Lomond do not mind the sound of powerboats, yet are subconsciously harmed by it, or even if it annoys them while they are awake do not realize that it is disrupting their sleep and thus harming them.)

A more recent development is the introduction of drones into natural settings. On holiday recently on the Isle of Skye, my family and I climbed up to the Old Man of Storr, a famous natural pinnacle about 500 metres above sea level that sits below even bigger cliffs. At one point, I heard a loud buzzing sound and warned the kids to look out for wasps, before realizing that the sound was coming from high above our heads: it was a drone. On realizing this, the sound was instantly transformed into a noise. Note that this was not because it was hugely loud; rather, we had been enjoying the spectacular views and the peace and quiet; now, the tranquillity was disturbed by the drone and we also had to keep an eye on it to make sure it was not going to fall on us (if it had been a wasp, I would not have categorized it as noise as we could easily have moved out of range of the sound and the sting; a drone is different). Its user was not obviously in sight, although we could see several few people quite far away (as the Storr is a popular site). Had I seen the operator, I would have asked him to turn the drone off. Would that have been proportionate? The drone may have been being used to film or take photographs rather than 'just for fun', but the sound would have been audible to dozens of other people, many of whom were presumably annoyed as well. The noisy whirr of the drones' rotors entirely changed the environment of the Storr, and preventing us from exercising our autonomy as we wished to.

Again, this might be deemed offensive rather than harmful, but the drone was certainly creating noise pollution that harmed the environment and our experience of it; the operator may have been unaware of this, but that in turn suggests something of a lack of consideration, or that he was operating it from too great a distance. I return to the issue of the threshold for harmful noise in the next section.

In fact, as I found out once I was back in the office, this drone operator was not following best practice and also breaking the law as reflected in the Civil Aviation Authority's 'Drone Code' (UKCAA, 2019). The drone was directly over our heads for several minutes despite the law stating that drones should be at least 50 metres away (horizontally) from any people other than the operator. Note, however, that while these legal stipulations mean that the drone should not have been flown over our heads or up at the Storr, they do not say anything about the level of noise emitted by a drone. Had the drone kept away from us, the law would have been satisfied, but we would not have been, as we would still have heard the drone at almost the same volume. The Code stipulates that all drone operators must pass a test and register as users, but says nothing whatsoever about

noise. In contrast, a best practice guide for drone users in Scotland states the following:

> Drones are noisy bits of kit and the last thing people want when out enjoying the tranquil sounds of Scotland's nature is a drone buzzing around their heads. Have respect for other users of the countryside, don't just throw your drone up next to a group of walkers, it's disrespectful and inconsiderate. If you are desperate to catch that shot and there are people around, it is good practice to ask any other users, walkers, climbers, bikers, etc. for permission. (Houston, 2020)

(Note the assumption that the drone is being used for a specific purpose.) This respectful guidance puts the reasonableness test in the hands of those affected by the drone's noise: the choice is left to those affected by the noise. In effect, it is up to them to decide whether it is noise, and whether that noise is reasonable. However, in many parts of Scotland people could be affected by the noise of a drone without being seen by the operator, which raises issues not only around noise but also around safety; the law states that operators must always keep the drone in sight, but not that they must ensure they can see anyone who could be within 50 metres range of it—a paradox given the requirement to ensure a drone should be kept within 50 metres range. In terms of respecting others' noisy autonomy, those generating noise have a responsibility to ensure that they are at least close enough to accurately gauge the potential for causing annoyance to others.

Noisy Autonomy, Harm and Justice

The drone and loch examples both feature noise in recreational scenarios, and for a more detailed exploration of how noisy autonomy relates to harm and justice, returning to urban examples of noise will be helpful. Before proceeding, however, we should return to the issue of whether and when noise is harmful as opposed to merely offensive.

In the UK, noise is defined as anti-social if it causes 'nuisance and annoyance' (CAB, 2018). Nuisance and annoyance suggest that noise is offensive rather than harmful, but at the same time 'anti-social' suggests a certain degree of harm. Of course, anti-social noise regulations and laws normally concern disputes between neighbours, but they can also be applied more widely. (This definition of anti-social noise is interesting in light of the traditional definition of noise as *any* annoying sound. In effect, the UK definition creates a category of annoying sounds that are not annoying; noise that is not anti-social is deemed unannoying, but remains annoying sound according to the traditional definition of noise.)

The question of whether noise annoyance is offensive or actually harmful is highly context-dependent. As Passchier-Vermeer and Passchier (2000) put it: 'Noise annoyance is a feeling of resentment, displeasure, discomfort, dissatisfaction, or offense when noise interferes with someone's thoughts, feelings or actual activities. It is not yet possible to predict noise annoyance on an individual basis because of the large variety of (partly unknown) endogenous and exogenous characteristics that affect annoyance'. Further complicating these factors are three others; annoyance also relates to a given person's anxiety, any fear of the noise source, and whether the noise was perceived as avoidable. The same authors found that taking air, road and rail noise at a level of 70 decibels, around 15 per cent found the rail noise annoying, 25 per cent found the road noise annoying and over 40 per cent found the plane noise annoying (Passchier-Vermeer and Passchier, 2000). In other words, and unsurprisingly, whether a noise is annoying depends not only on the person experiencing it but also on its source. Nonetheless, if noise causes discomfort or distress, then it is probably reasonable to categorize it as harmful. In the case of the Drone, I was indeed distressed because I had sought a quiet retreat from technology, and the noise did cause discomfort; the fact that the noise was certainly avoidable also played a role. In the case of the loch, where mitigations and noise restrictions are in place, it seems more likely that noise will merely cause offence. But ultimately, in any scenario where noise causes annoyance or offence, it can cause stress, and stress can harm in a variety of ways: 'psychologic (feelings of fear, depression, sorrow), behavioral (social isolation, aggression, excessive use of alcohol, tobacco, food, drugs), and somatic (cardiovascular, gastrointestinal, respiratory illnesses)' (Passchier-Vermeer and Passchier, 2000).

There are clearly borderline cases where the margin between offence and harm is slim but as explained in the Harms of Noise section and associated table, noise can clearly harm people in four ways: it can cause hearing loss (auditory effect); it can cause stress via annoyance (see previous paragraph); and it can cause non-conscious physiological harm via conscious stress that harms the body and via direct non-conscious effects on the body.

Many people are exposed to these harms because they live close to major sources of noise such as railway lines, major roads and motorways. If they regard this noise as annoying, they risk some serious health harms, including stroke and heart attack, according to Basner *et al.* (see Introduction section). But of course, they might find this

noise annoying at first, but become used to it over time. As already explained, however, the fact that they no longer find the noise annoying does not mean that it is not harming them; as Basner *et al.* state, even noise experienced when asleep, such as loud traffic, can impair mood, increase sleepiness and reduce cognitive performance.

All of these harms are associated with noise pollution, and laws exist to regulate industrial and domestic production of noise. But in terms of noisy autonomy, if individuals are to exercise self-determination with regard to how noise affects them and others—in other words, in order to exercise relational autonomy meaningfully—it is imperative that people *know that unperceived noise can be harmful.*

Yet the nature of this harmful yet not annoying noise has another problematic feature; if we seek to maximize citizens' noisy autonomy by telling them that the noise that they now no longer regard as annoying is nonetheless harming them, we risk increasing the overall harm to which they are exposed by increasing the risk that they will worry about the noise, and also run the risk of making that noise annoying again for that very reason. Yet even without considering the importance of information for self-determination, if we regard harms such as the potentially avoidable cognitive impairment of children as important, such risks of increasing harm must be deemed reasonable and necessary. I return to this issue in the following section, but another issue that complicates this already-complex aural landscape is that even if told about these harms, some people might be unable to relocate to somewhere quieter due to economic constraints; most noise burden is borne by those who live in noisy city centres, not those in quiet leafy suburbs. In addition, lower-paid workers are more likely to have jobs that put their hearing at risk, and over 1 million people in the UK are exposed to levels of noise that put their hearing at risk at work (in addition to the increased risk of harm from other causes due to high noise levels, such as not hearing warnings) (IOSH, 2021). This phenomenon—which I term 'sonoeconomic inequality'—means in turn that the noisy autonomy of those living in noisier areas is subject to greater constraints than those living elsewhere—another challenge for health justice. The effects of noise on children living in urban areas are even more of a pressing concern for two reasons: they are a vulnerable population subject to greater protections, and some of the harms of urban noise affect children more than adults in terms of years of life with reduced quality of life (Passchier-Vermeer and Passchier, 2000).

Policy and Personal Implications of Noisy Autonomy

The drone example illustrates both how noise is often neglected by legislation on new technology, and how this fact requires the adoption of good practice by operators of that technology. In this case, the autonomy of other people is respected by reliance on reasonableness and a respectful approach being adopted by potential noise-makers. But how should regulators and society as a whole approach the challenging issue of dealing with non-conscious noise, which can harm people without them being aware of it?

Ideally, legislators would take much greater account of the harms caused by non-auditory noise. As suggested above, any discussion about the proportionality and reasonableness of noise generation should consider not only the potential for annoyance and distress but also the physiological non-auditory and non-conscious harms. For example, if science shows that drone use at night disrupts people's sleep patterns (even without them knowing it), that would be evidence in favour of a prohibition on such use—though not necessarily conclusive evidence. Similarly, it seems plausible that people's enjoyment of outdoor spaces might be at least marginally compromised by background noise that remains subconscious; I might notice a drone when someone else doesn't, but it could still be affecting them regardless.

Legislators should also take our noisy autonomy seriously. Generally, if there is a known threat to public health, the public are informed about it, and there is no obvious reason why that should not be the case here. Indeed, the very idea that noise can be harmful without being perceived is one that the public should be informed about, as it would increase their autonomy to have this information; different life choices might be made if people knew about all these additional potential harms of noise. Furthermore, if people should indeed be informed about the potential negative effects of non-conscious noise upon their health, they should probably also be told about the non-auditory effects on their cardiovascular system of getting annoyed about noise—paradoxically, even if this will increase their risk of such harm, because they will be both more likely to get annoyed by noise, and more likely to get stressed through worry about those effects. Finally, the serious health justice issues raised by noisy autonomy also warrant careful consideration by public health bodies and legislators.

Enhancing citizen's autonomy by informing them about all the potential ill effects of noise could also have the effect of reducing the amount of noise. If people are aware of and even worried about the effects of noise on health, they are likely to be more considerate in terms of generating sound—hopefully reducing the frequency (no pun intended) with which sound crosses the threshold into noise. Thus, maximizing noisy autonomy by informing everyone about the auditory, non-auditory and non-conscious effects of noise is likely to increase those effects in the short term (by making people more aware of noise and hence at least temporarily more harmed via stress response and distress), while also being likely to lessen the incidence of noise in the medium to longer term through increased noise conscientiousness. Of course, maximizing the public health benefit by reducing noise is not the only advantage; in addition, it is good to maximize people's capacity for exercising their autonomy in ways that also do not infringe the autonomy of others. In other words, by informing people about the complex nature of noisy autonomy—or at least making them aware of the potential for causing perceived and unperceived harm in this regard—they will be able both to act more autonomously and to respect others' autonomy to a greater extent. (Again, given our obligations regarding noise and the harms it can cause others, a relational rather than individualistic account of autonomy is appropriate when considering the public health ethics of noise.) One constraint on their ability to act more autonomously, of course, is the issue of sonoeconomic inequality mentioned above; some citizens are more able than others to act against or move away from noisy neighbourhoods.

Conclusion

In some apartments in Switzerland, men are forbidden to urinate while standing during the night. This might seem like a bizarre rule that infringes men's autonomy in an unacceptable way. However, this gets things precisely the wrong way around. It is not banned because of worries that they would do so in the dark and miss the bowl, but because of the potential for noise generation and sleep disturbance posed by loud peeing in the wee small hours (pun intended). Why should people bear the harm of conscious or non-conscious sleep disturbance, against their will, because a man prefers not to sit down while urinating? They should be able to exercise their autonomy in enjoying uninterrupted sleep. (Despite generally high standards of construction, walls can be thin in Switzerland.) If educating people about the harms of noise reduces the incidence of noise, it will also tend to reduce the infringement of others' autonomy through bothersome generation of unnecessary noise.

Noise is important for our autonomy, and autonomy is important for noise. We have rights and responsibilities regarding noise, and thus we must consider noise not only in terms of individual autonomy but also relational autonomy. The phenomenon of unperceived yet harmful noise further complicates the picture. I hope to have convinced the reader of three key claims. First, while we all have a certain degree of autonomy in making sound, generating noise can infringe autonomy in many ways. Second, the traditional definition is wrong: (non-conscious) noise can be noise without being noticed, or even without being heard, because people would regard it as troublesome if they knew of the harm that such sounds can do. And finally, governments and public health authorities have a duty to maximize people's autonomy by not only attempting to reduce both non-conscious and other non-auditory noise (as well as noise that could damage hearing) but also by educating them about the potential harms of noise and sounds that do not yet pass their personal noise threshold. This is the case even if, in so doing, we turn sounds that were not heard into silent yet recognized noise, and thus increase the harms that we were initially warning about. While this might seem counter-productive, doing so both maximizes our noisy autonomy and will also hopefully reduce all sorts of noisemaking in society.

Conflict of Interest

None declared.

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