Common Transient Sounds: The Kitchen is a Very Noisy Place

By Harry Teder

People in kitchens can seem rather cruel to individuals wearing hearing instruments. The noise of dishes and kitchen utensils generates sound peaks in the 80-105 dB range. Sounds of this intensity will drive most hearing aids into saturated maximum output (MPO). This may be the reason why those sounds are considered as proverbial hearing aid irritants.

The clatter of dishes and silverware is frequently cited in professional literature and verbal presentations as a source of annoyance for hearing instrument users. As a longtime hearing instrument wearer, I could only smile in rueful recognition when told by an audiologist friend that "many of my male clients believe that their wives torture them deliberately by needlessly banging dishes and pots in the kitchen."[1] I had often thought that my wife, otherwise the gentlest of souls, seemed to be uncharacteristically rough with her kitchen utensils. Couldn't she just handle them more carefully?

Just how loud are those irritating sounds? While information on other everyday noises has been published,[2,3] no systematic data on the "dishes, pots and pans" family of noisemakers appears to be available. Killion[4] briefly mentions that a spoon dropped on a plate produces 110-115 dB, but that is the only reference I have found.

Measuring the Noise

During the 1987 World Series in Minneapolis, CBS News used a sound level meter (SLM) in the Metrodome and measured a hometown crowd cheering the Twins at up to 120 dBA sound level. Much was made of that number as being an extremely loud sound, equivalent to a jet aircraft on takeoff power at a distance of 200 ft.

My initial venture into the kitchen with a meter produced numbers not nearly as impressive. A reading of 70-75 dBA during some vigorous operations with pots on the stove about equaled the normal sound levels in a moderately noisy restaurant.[2] I knew this should not be unduly bothersome, yet the sounds were sharp and irritating. Since the SLM is an averaging device, could it be missing the sharp peaks I was hearing?

A digital oscilloscope connected to the SLM revealed that this was indeed the case. The instantaneous peaks produced during meal preparation and dish-handling activities usually exceeded 80 dB and frequently reached 90 dB in the breakfast nook area—nine feet from the scene of the action. When the SLM was right by the kitchen sink, many peaks exceeded 100 dBA.

For most events, five samples were taken and averaged. Care was taken to assure that the measuring equipment was not overloaded at any time. Considerable variation in observed levels is evident, not surprisingly in view of the uncontrolled nature of the activities. Table 1 separates the sounds according to whether they were measured at the 9-foot distance, or at the kitchen sink location adjacent to the noise sources. As a side note, the item regarding the nailclippers is included because the author has wondered for a long time how such an insignificant activity could sound so loud. Here is the answer.

Are These Noise Levels Bothersome?

The Environmental Protection Agency labels noises (dBs) in the mid-90s as "very annoying" and states that "100 dB can be produced by shouting in the ear."[5] Mean uncomfortable level (UCL) occurs in about 100-110 db SPL or HLs from normal up to 45 dB HL.[6,7]

It appears, then, that the measured noises are likely to be annoying and uncomfortable before they ever get to a hearing aid. How long do these sounds last?

Harry Teder has enjoyed a career as a well-known engineer in the hearing industry. He recently retired from Telex after designing hearing aids for 25 years and wearing them for 29 years.

Table 1: Peak Sound Pressure Levels in Common Kitchen Noises

	Peak SPL (dB)	Range (dB)
Kitchen sink area (approx. 2 ft. distance)		
Close cupboard door	84	78-89
Set salt shaker on counter	87	84-94
Set lid on 6" pot	104	101-107
Set plate in sink	91	90-93
Put silverware in sink	87	83-93
Pots and pans to cupboard	89	88-94
Drop pot lid 3" to counter	102	100-105
Drop fork 1" to plate	104	101-107
Set soupspoon in bowl	103	98-107
Tap spoon on glass ("attention")	97	94-101
Tap spoon on cup ("attention")	104	102-105
Finger nail clipper in action	111	108-114
In breakfast nook (9 ft. distance)		
Dishes to cupboard	90	84-95
Close cupboard door	82	80-86
Set jar on counter	84	–
Drop teaspoon on tile floor	84	–
Put lid on frying pan	91	85-94

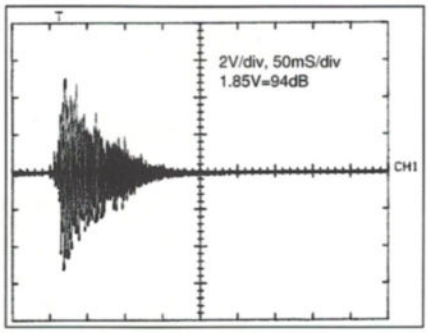

Fig. 1: *Sound of a dinner plate place on another plate.*

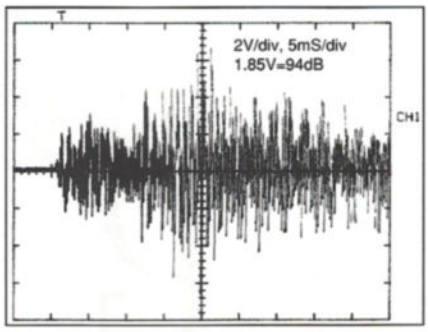

Fig. 2: *Lid placed on a 6" steel pot.*

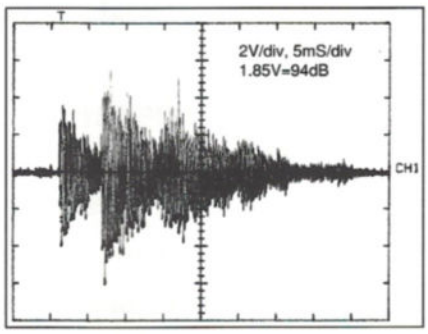

Fig. 3: *Set knife and fork on a plate.*

In Fig. 1, which illustrates the sound of a dinner plate being placed on another plate, the highest peak extends to about 103 dB, and a broader peak of 30 mS duration at 101 dB before decaying. The entire sound lasts about 130 mS.

The sound of the lid being placed on a 6" stainless steel pot (Fig. 2) peaks at 104 dB, with a ringing sound at 101 dB lasting about 25 mS. Setting knife and fork on a plate (Fig. 3) hits an instant peak of 99 dB, and the sound exceeds 87 dB for about 200 mS.

Note that it is possible that such very short noises may not seem as loud to the listener as longer signals used for identifying UCL levels. The dB levels may therefore not be directly comparable. This phenomenon, called auditory integration, is well documented for threshold levels[8]; whether it holds at UCL levels is not clear. At threshold, greater signal levels are required for the same response when the signal is made shorter than about 200 mS, with an integration slope of 8-10 dB per decade. If the same integration slope is assumed for the sounds shown, then a reduction in perceived loudness of 8 dB applies to Figs. 1 and 2.

Why Do These Sounds Bug the User?

The anecdotal evidence of annoyance caused by kitchen-related sounds seems to be firmly associated with hearing instrument use. Why is that? While I am unaware of any controlled research in this area, one can speculate on the likely culprits.

It is not known whether the "noisy dishes irritant syndrome" affects linear and compression aids equally or not. The difference may arise because the two circuit types control their maximum possible output (MPO) differently. The intensities of these sounds are high enough to momentarily drive nearly any hearing instrument to its saturated MPO. In compression aids, the momentary overshoot ("attack MPO") before the compression takes control can go much higher than the long-term MPO. While the long MPO is usually a fitter adjustment, the attack MPO is usually not, and thus may substantially exceed the UCL. In recent history, there have been compression aids on the market that had a separate peak-clipping adjustment for controlling the overshoot, but the author is not aware of any currently available at this time.

It is true that only a short portion (1-2 mS) of the ANSI attack time extends into the circuit's MPO region, but the peak of a pistol shot only lasts about 0.1 mS, and it sure is loud! In linear aids, the MPO is theoretically controlled instantaneously, with no attack time. Thus, the problem of momentary excessive loudness should not arise. To repeat, we do not know whether that is true in practice. However, there is another factor common to both types of circuits: Amplifiers distort badly during the moments they are in saturated MPO, and the distortion may be contributing to annoyance. Again, this is an area that has not been explored to any great extent. There are tantalyzing hints; there is research from the broader field of audio amplification that may or may not be applicable to hearing instruments, but not much concrete evidence.

Just one example: back in 1971, a paper from the Karolinska Institutet in Sweden[9] investigated something they called forward distortion of hearing aids. This occurred during the recovery from momentary overload and caused serious intermodulation distortion. Sounds like the very thing that happens during dish clattering! No further work appears to have been done on this.

Acknowledgements

Many thanks to my wife, Margaret, for letting me record her meal-preparation activities. It got so she was apologizing for every unusual noise! ◆

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continued on page 49

residents of the region. Hagen and his team fit 84 patients with hearing instruments that were supplied by members of the medical team and through a sizeable contribution from Unitron Industries. Additionally, the group performed hearing tests, repaired hearing instruments and made new earmolds.

Hearing care is not attainable for many in the poor region of Guaymas, where a typical behind the ear hearing instrument can cost the equivalent of one year's earnings. The problems for children with hearing deficiencies are compounded by their removal from normal education systems and placement in institutions reserved for the deaf and learning disabled. Many of the patients treated by the team were underprivileged children who now look forward to the opportunities presented by their return to mainstream society.

This was the second consecutive year that Hagen and Bye traveled to Mexico to provide free hearing care. ◆

Correction

The Nov/Dec *Hearing Review* lists the 1995 Academy of Dispensing Audiologist's (ADA) convention as taking place on October 17-22 in Myrtle Beach, **NC**. This *should* read Myrtle Beach, **SC**.

Transient Sounds

continued from page 12

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Solving Challenges

continued from page 41

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This article was submitted by Henri Garcia, vice president, Marketing, Philips Hearing Instruments, Eindhoven, The Netherlands and Wayne Staab, PhD, special consultant to Philips Hearing Instruments on Peritympanic Hearing Instruments. Inquiries can be submitted to Staab at 602-942-4939.