

200kΩ, we get the following:

$$R1 = \sqrt{10k \times 200k}$$

$$R1 = (\sqrt{10 \times 200})k$$

$$R1 = 44.72 \text{ k}\Omega$$

Any resistance value for R1 greater or less than this value will give you a smaller voltage swing. The further away from the optimal value, the less your voltage swing.

Also when building your voltage divider sensors using variable resistors, don't forget to factor in any known input impedance into your calculations.



ACMC05 Generate + Test	
The following items are available for sale in Brisbane at ACMC05, or can be ordered from the Publications Officer.	
ACMC05 Conference Proceedings:	
Printed (181 pages).....	\$20
CD-Rom.....	\$5
ACMA CDs:	
Machine Message.....	\$15
Assembly.....	\$15
acma2004.....	\$15

Upcoming events:
3rd Iteration Conference November 30th to December 2nd, 2005 : Melbourne, Australia. For more information about the conference and the call for works see: http://www.csse.monash.edu.au/~iterate/TI/
ICMC 2005 - Free Sound Barcelona, September 5-9, 2005 http://www.icmc2005.org

Thoughts on Volume: an Email Exchange with Robert Sazdov

Warren Burt
(WARNING: Adult Concepts)

Robert Sazdov, a composer who lived in Perth, and now lives in Sydney, wrote to me on 24 October, 2004. UoW is the University of Wollongong.

(Unedited email)

Dear Warren

I am hoping to apply for a doctoral program at UoW. [SNIP - irrelevant paragraph removed] Hope to have a chat on Friday night.

Regards Robert.

I replied to him, and, in a friendly, but intentionally provocative way, asked him about the volume levels he intended to play at. The Wellington referred to here is the 2004 Australasian Computer Music Conference which took place at Victoria University, Wellington, New Zealand at the beginning of July 2004.

(Unedited email)

Hi Robert!

[SNIP - irrelevant paragraphs removed]

Yes, let's talk on Friday night. Are you going to play as loudly as you did in Wellington? If so, I'll bring my professional earplugs. We were sitting in the first couple of rows in Wellington, and your piece felt like jack hammers on the skull, and pile drivers in the stomach. I don't think I've ever experienced the sonic equivalent of being in a domestic-violence relationship so vividly! In fact, it's been the reason I haven't talked to you much - I didn't know how to approach you, because I felt your music was so violent! (As you can tell, I have a problem with extreme volume in music - it's not just aesthetic, it's physical, personal, and political as well! :-)) But if you're friendly, I can be friendly too! All best wishes, and cheers - see you Friday night, Warren.

He replied to me, in an equally friendly and accommodating way. ACMC Perth was the 2003 Australasian Computer Music Conference, which was held at Edith Cowan University in Perth, Western Australia. Guillaume is Guillaume Potard, a research associate of the Faculty of Creative Arts at the University of Wollongong. He is in charge of research on the CHESS system, Creative Arts 16 channel experimental sound system.

(Unedited email)

Hi Warren

Thank-you so very much for the documents you forwarded! It was very informative and I have to say impressive to read through your application. I really don't know where to start in my answer regarding the piece performed in Wellington. Yes, I would have to agree it was loud and it was meant to carry a lot of high frequency energy. It was an attempt to portray the emotion of the subject matter and political stance. However, with the hall acoustics and other issues I won't bore you with, the frequency spectrum was vastly altered, further increasing those 'harsh' frequencies and projecting them in far more elevated manner. For the 2003 ACMC in Perth, which I hosted with Lindsay, I managed to secure sponsorship from KRK and set-up a 12.2 multi-channel system. With assistance from students I configured the speakers to adapt to various established multi-channel systems, tuned the systems, and ensure it 'sounded good' within the 'classical' acoustic space. The piece I performed sounded great. I guess spatialising within the set-up contributed vastly to the end result. Back to Wellington, during the sound check I tried to EQ some of the frequencies, however, it didn't translate within the space. To sum up it was a bit of a lesson on 'studio' to 'performance venue' translation. Also, Guillaume might still have the piece performed at this years Sonic Connections on the CHESS system. I am sure it won't have the same effect as the piece in Wellington and should give a better reflection of my musical personality. I assure you I am far from being a violent person! Passionate, politically minded, and opinionated, I am guilty of :) Earlier this year I interviewed legendary Japanese noise artist Merzbow for a new music show on community TV in Perth. I could hardly hear what he was saying due to his soft and inward personality. He was a complete contradiction in terms of musically output to personality. These days he dedicates his performances to his ducks and is actively involved in lobbying against KFC due to their treatment of chickens; he is also a vegan. His music was so penetrating, my ear plugs didn't help much as my ears were ringing all night/morning. For Tronicphosis I am planning on a loud, but not a harsh performance. I will be trying out some new techniques and approaches within a stereo environment and it is totally improvised - I will be selecting sound files minutes before I perform. To be on the safe side I would recommend ear plugs, particularly if the Bar has a big PA. Looking forward to your performance and hopefully a lengthy chat after!! Again, thank-you for the documents and taking the time to help out.

Regards Robert

I replied to Robert, and suggested that this correspondence could become an article of some kind, where the issue of volume in contemporary art music was discussed. Here is my reply:

(Unedited email)

Hi Robert!

Thanks for your reply. I'll look forward to talking on Friday, or at length another time, in more placid circumstances. Here's my current thoughts. You said "if the Bar has a big PA." That's the problem, isn't it? My class did their concert a couple of weekends ago. They applied for funding themselves. They wrote the music themselves. They played the pieces themselves. They did the publicity themselves. They did all the tasks, like budgeting, ushering, organizing venues themselves. Then they got "a friend" to come in, who had a sound system, and he put everything through it, and it all sounded the same, and it all sounded lousy, and at the very end, they gave control over that most trivial and inconsequential aspect of the whole thing, THE SOUND, to a guy who might as well have been a total stranger. Well intentioned he may have been, and less than 100% competent he definitely was, but giving up control over the sound like that is an absolute contradiction in what we stand for. Well, what choice do we have? might be the reply. The choice to bring our own sound system, the choice to work with a smaller sound system, the choice to perform in our own living rooms, the choice to do a hundred alternatives, rather than simply let the "sound man", who usually is a slightly deaf boy, govern what the audience actually hears. Of course, that might involve questioning the whole sociology of what we do when we do it. (I'm bringing my own computer monitors to the Unibar. I'm going to play through them. If it sounds anything like moderately adequate, I'm going to tell the sound person I'm not playing through their system. If my sound gets lost in the mix, it will just be like one of those violin lines in a Charles Ives piece which surfaces from time to time, then gets buried again in the mass. Big deal.) But there must be a way to get good sound, at reasonable volume levels, and a reasonable performance situation, without having to go the full institutional route of hiring a monster sound system in a big hall. I'm still working on this one..... By the way, I'm not totally against loud sound. Just last week, Catherine and I were at Stanwell Park station. A big freight train came roaring through - a 3 engine job. All the wheels of all the cars behind it were squealing with high frequencies that would kill a koala at 14 paces. Everyone, and I mean everyone at the station had their fingers in their ears. Man, talk about a sonic assault! Occasionally, Catherine and I would pull our fingers out of our ears for a second, maybe two. Magnificent. Amazing. Physical vibrating of the internal organs through sound. And it lasted, maximum, five minutes. And we had warning that it was going to happen (the whistle, the build up of the sound) so it was not a surprise. All in all, a great experience. Here's my dilemma.

- 1) An activity that causes people physical pain is a violent activity.
- 2) These activities are usually only done under consenting circumstances, otherwise they are considered violations. (Think of an S&M club - people go there to experience violence. But if, in the bar, someone punches someone

-
- in the face in a brawl, they're still prosecuted for assault.)
- 3) If one's sound levels shear some hair cells off the inside of someone's semicircular canals, and they lose part of their hearing, that is just as much an act of violence as if one were to punch that person. Remember, torture regimes that "leave no external marks" are just as much disapproved of as torture regimes that do.
 - 4) Is a concert a "consenting circumstance?" I think not.
 - 5) A concert is an occasion of trust. We give control over our aesthetic experience to someone else, on the grounds that we and they have created a special occasion for that to take place. Part of that special occasion is a trust that we have that violent acts will not be committed against us. (Participatory theatre where the actors would attack the audience would have the same problems.)
 - 6) So the question then is: If electronic music becomes an art form that I usually have to protect myself against (because it will physically damage me), then why should I continue to participate in it?
 - 7) If I do decide to continue to participate in it (because it's my aesthetic lifeblood), and I'm not willing to shut up, then what are the alternatives? Is debate an acceptable alternative? Is there room for debate on this issue in the electronic music community?

So that's my dilemma. It would be good to talk about this - maybe even have several people talking and record the conversation and transcribe it for publication in Chroma, or something like that.
Cheers, Warren

The concert took place, but Robert and I didn't have much of a chance to talk, of course, with all the rigmarole that doing a gig entails. A talk is in the future. But the afternoon before the gig, I decided to see how much a sound pressure meter actually cost. It turned out they were \$50 Australian. So I bought one, and brought it to the concert. The average sound level during Robert's performance, by my meter, moving it to several different points in the hall, was 90 db, with the central section hovering around 100 db and the loudest part peaking at a sustained 106 db. (C weighting, with both slow and fast transient averaging.) The loudest act of the evening I measured was Ubercube, a duet of Emily Morandini and Monica Brooks - they started out at about 95 db, but soon moved to around 105 db with sustained loud sections at around 112 db. I didn't measure the duet of Aaron Hull and Julius Ambrosine, because at that point, I'd left my meter in my bag backstage, and they were so loud I just left the hall - even my 15db attenuation earplugs weren't enough for

that. But even outside the bar, the sound was so loud it was frightening. I don't know what the volume of our trio (Gary Butler, Houston Dunleavy and myself) was, but I suspect that it wasn't that loud - I used small computer monitors - Gary used his guitar amp, and Houston played acoustic instruments through the PA - in fact, he was the only one of us who used the house PA. Both Houston and I occasionally left our seats and wandered through the audience, me playing on a battery powered mini amp, and Houston playing acoustically. Jim Denley played through the house PA - his average level was about 80 db, with occasional peaks at 90 db. During his piece, I noticed the house PA had a bad hum in it. After his piece, I measured the hum. It was 72 db, constant. That's the volume of a normal person talking constantly. During most of the performances, the sound man hired for the night would leave the desk. During Robert Sazdov's piece, he played cards with his friends. Between the pieces, he played recorded music, which averaged at 100db in volume.

When I pointed out to people that 85 db was the legal limit in industry before hearing protection was required, and that 90 db is defined as the beginning of dangerous volume by the US Dept. of Labor Noise Regulations, mostly, they acted sheepish, and tried to make throwaway comments. Or they took the comment seriously, but with that sort of conceptual shrug that says, But what can we do about it? One young man asked me if I drank, the implication being, I think, that just as drinking is a consensual activity where you know you're doing something dangerous, but you do it (hopefully) in a controlled and responsible fashion, so was going to hear loud sounds a similarly consensual but potentially dangerous activity. I was eager for him to pursue this line of argument, but when I told him I didn't drink any alcohol, he simply broke off the conversation and went to talk with another friend. So much for debate.

The following morning, even having worn earplugs throughout most of the gig, I had a tinnitus in my left ear so loud that it was louder than the external sounds coming in. This prompted me to write the following, a development of the dilemma I expressed to Robert above.

1. The ear is a part of the body.
2. The hand is a part of the body.
3. If someone offers me a handshake, and I

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- accept, I trust them not to, either accidentally or intentionally, crush my hand and break my fingers.
4. If they do violate me in this manner, and crush my hand or break my fingers, this is considered assault, and legally, I can sue them, and ethically, I believe I would be entitled to thump them. (Although with a broken hand, my ability to thump them might be severely diminished!)
 5. If someone offers me their sound to listen to, I trust them not to, either accidentally or intentionally, play at such volumes that they shear hair cells off my inner ear and contribute to my loss of hearing or painful experience.
 6. If they do violate me in this manner, I would consider this assault (though the law might not), and following the analogy above, I should feel entitled to sue them, or thump them.
 7. Or let's try a sexual analogy. If a male places their penis into another person's orifice without their consent, or any person of any gender places their fingers, or other implement, into another person's orifices without their consent, this is considered rape, and the person doing it is a sex offender, and they, if convicted, are placed on a register of sex offenders and prevented from having certain types of employment in the future.
 8. If someone places their sound into my aural orifice, at such volumes that they, without my consent, cause physical damage to me, can I consider this sonic rape, and am I entitled to prosecute, and demand that they be put on a register of sound offenders? The language may be (intentionally) inflammatory, but I believe the analogy holds. If it doesn't, I'd like to hear from someone why it does not.
 9. To reiterate a point made above – if the damage caused by loud sound is internal, and not visible, does this make it any less noxious than damage which is visible? Again, taking the example from war crimes tribunals – torture which damages internal organs, but leaves no visible marks, is still considered illegal, barbaric, and cruel.
 10. These arguments could even be extended to friendship – if someone physically violates my hand or my orifices, I would find it difficult extending the trust of friendship to them. Why is it, that if someone violates my ears, I am still expected to be friendly with them? If I can't trust them with my ears, can I trust them

with other parts of my body? Am I the only one who thinks that people should be responsible for their actions, and consistent in the application of ethical principles in their lives?

I admit that these may be extreme positions, but feel that taking them is a good way to define the terms of the debate. I would now like to send this out to people for comment, to see if they feel there is any point in debating this issue. Or, if there is not, and playing at dangerous volumes is now a fact of life in art music (computer music, electronic music, improvised music – call it what you will), and the only response is to shut up and take it, or to wear hearing protection to all gigs (a precaution which I find insulting and the necessity for it indefensible), can anyone tell me why I should not withdraw totally from that scene, and refuse to attend events given by or even interact socially with any members of that scene? I await your responses.

30 Oct 2004

Warren Burt A Post Script – the biological implications of volume.

Having bought my sound pressure meter, my wife Catherine wondered what different pressure levels felt like. Watching the meter, I talked to her, adjusting my voice so that it registered 60db, 70db, 80db, 90db, and 100db. Each time I said This is 60db or This is 70db etc. two or three times for each level. Except for 100db. That took so much effort I could only say it once. The interesting thing was, that even though I tried to say This is 100db in as friendly a manner as I could, it still came out as if I was yelling at her in anger. The necessity of putting a lot of air pressure behind my speaking (or yelling, in this case) to be able to reach 100db meant that I totally lost control of the emotional tone of my voice. This made me realize that the only non-mechanical sounds we hear that are over 100db are either warnings, expressions of extreme emotion, or natural forces beyond our control. In the case of natural forces, like a volcano or a waterfall, the continuous loudness is a warning for us not to get too close. In the case of warnings and expressions of extreme emotion (yelling in anger, a huge whoop of joy, etc.) they are all very short expressions, limited by the breath capacity of the person making them. It was only with the rise of mechanically made sound (the organ (or hydraulis), invented about the 2nd century

BC; or the railway engine, invented about the 1830s) that we began to hear humanly produced sounds which were loud, continuous, and whose duration was not limited to the breath capacity of a single person. So when we use very loud sounds, and do so in a sustained manner, we are, consciously (or unconsciously) violating what might be called the natural hearing behaviour of the human animal, that is, the pre-mechanical way hearing developed over years of evolution. This might not be a bad thing to do - mechanics (and its more recent extension, electronics) allows us to do things the body can't otherwise do. But when doing so leads to us damaging ourselves, then I think we have to ask if the reasons for violating our natural hearing behaviour are sufficient to justify the danger inherent in doing this. Also, I think we have to be aware of the emotional implications of our acts. In the 1970s, the Belgian composer and instrument inventor Godfried-Willem Raes made an instrument called Bellenorgel. It was a set of telephone bells, door bells, warning claxons, etc. They were controlled by a series of telephone relays, so that the order of the bells was always unpredictable. He found that rather than being fascinating, or beautiful, it was almost impossible to listen to the instrument. This was because all the sounds he had used were warning sounds. Each announced the intrusion of the outside into our private space. This was sometimes heard as a threat, sometimes as an annoyance. So no matter how interesting his patterns, or how beautiful the sounds were, in the end, the emotional implications of the bells won out, and hearing the machine felt like a perpetual threat, or at least, an unending state of uneasiness. In the case of extreme volume, if one is using it, one should be aware that usually the only conditions we would hear something that loud would be situations of threat or danger. If one wants an audience to experience a different emotional state than threat, danger, or being dominated through the use of volume, one might be justified in making a public statement before playing alerting the audience that extreme volume was about to occur, and that one hoped the experience would not entail hearing sounds of that volume as a threat. This might involve, again, changing the nature of the social ritual of music making, but I think it's a change well worth making. In any case, as biological beings, we are not free of our history, and if we are going to use extreme

volume, we should be aware of what our biologically inbuilt responses to high volume are.



Initial comments from Paul Doornbusch and the editor in regards to questions raised by Warren's debate:

Hearing damage is very real. Even classical and orchestral musicians suffer regularly from noise induced hearing loss. How much more are we at risk when we use amplification in the primary sound production stage.

Clubs in some US cities now must have sound level monitoring and various other public protections in place. The sound level standard is the same for Australia, 85dB average level is the limit for 8 hours of sustained exposure before hearing loss, 88dB for 4 hours, and 91dB for 2 hours.

What is ACMA's responsibility to the audience? Do we need to monitor the levels at our concerts, and reduce or limit those levels if they exceed an acceptable level? Does artistic license outweigh moral obligation?

Time to think and discuss.

Some related web links:

<http://www.nohsc.gov.au/smallbusiness/businessentrypoint/hazards/noise/default.htm>

http://www.worksafe.gov.au/index_search/default.asp?qu=noise

<http://staff.washington.edu/rneitzel/standard.s.htm>

<http://www.whs.qld.gov.au/safetylink/noise/noise04v1.pdf>

<http://www.aafp.org/afp/20000501/2749.html>

<http://www.hearnet.com/index.shtml>

http://www.hearnet.com/images_site/energizer/hip_to_hear_survival_guide.pdf

