

Research Status Report #7

Well, this spring break I spent most of my time working on the 8th floor of the Education building installing new equipment and troubleshooting signal flow in a couple of the studios. I did, however, manage to squeeze in some research towards my final project. I finally got the time to record some musical examples onto digital audio tape and make a few copies, investigating the degradation involved with repeated playing and transfer of digital tape. I chose fifteen seconds of a rock selection, the opening to Sonic Youth's "Chapel Hill" on their album Dirty, and fifteen seconds of a classical selection, the opening to Chopin's Prelude Opus 28 No. 28 in F-sharp minor performed by Irina Zaritzkaya on the Naxos label. I also included ten seconds of pink noise and ten seconds of a 1 kHz tone so that I could do more accurate analyses of the finished transfers than purely subjective listening tests.

My original goal was just to see if the quality of sounds stored on digital tape could be easily lowered through multiple generations. To achieve maximum degradation, I devised a system that would employ both loss through tape fallouts and loss through transfer error. The basic copying protocol used two DATs. First, I copied the master recording onto a blank section of the second tape. I then played this copy once to endeavor to induce some tape fallout. Then, I copied this second generation onto a blank area of the first DAT. Again, I would play the third generation once through to induce tape loss. Next, I copied this third generation back over the second generation on the second DAT. Similarly, the fifth generation would be recorded over the third. I repeated this process until the fortieth generation. Also, I saved every fifth generation, not recording over that section of tape, just to preserve the progression of sonic fidelity loss. I used this system twice, once with an AES/EBU transfer and once with a S/PDIF transfer. All in all, each fortieth generation copy would have been played eighty times. As a note, these tests were conducted on a Panasonic SV-3800 DAT machine.

After conducting these tests, I compared the fortieth generation copies to the original DAT master copies. Comparing the copies to the original recordings would be a moot point, I thought, because the recordings went through A/D conversion which was not a step in which I was interested. Mainly, I wanted to examine how long sound, once captured satisfactorily on DAT, would stand up to multiple tape and generational loss. Upon talking to Tom Beyer about the experiment, it was pointed out that the design of my tests did not differentiate between tape loss and generational loss. Since the tests used both methods in an effort to induce degradation, any noticeable end quality loss could not be pin-pointed. While I understand this fine point that was brought up, it was mainly the purpose of this experiment to see whether or not DAT could be easily degraded. To accomplish this task, I therefore used as many normal and possible methods that one would encounter in the life of a DAT to see whether noticeable sound quality loss would be apparent. My main point with this paragraph is that the fortieth generation copies did not seem different at all than the original copies. Perhaps if I had used a spectrum analyzer on the pink noise, I would have noticed some slight sonic differences, but the musical examples held up rather well under the conditions.

Due to the basic failure to create a noticeable sound quality loss, I had to reinvent my project. Because of the wide variety of recordings I used, my total program to copy was around a minute and a half (including five second breaks between each piece). This length precluded me from making a large number of copies due to time constraints. With my next project, I plan to just use ten seconds of the pink noise, a two second pause, and

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then fifteen seconds of Arthur Rubinstein playing the piano. The brevity of this program will thus allow many more generations. Also, I believe that the difference between S/PDIF and AES/EBU digital transfers is, at this point, tangential to the project and doubles the amount of time involved. I will therefore only use one digital transfer protocol. According to Stephen St. Croix, repeating fifteen times a tape played ten times and then copied should induce a very noticeable loss. I am not sure whether these copies should be done over previously existing versions or virgin tape, but to err on the side of success, I shall dub the copies over the older generations. This process of 150 generations should hopefully garner the degradation in which I am interested. If not, then I would have to say that DAT machines are safer than the general audiophile public gives them credit.