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This week I began to consider that the topic of 24-bit audio was a large and expansive one, too large and expansive, in fact, for a final report. I decided therefore to focus my area of research on a particular application of this 24-bit technology. As a natural outgrowth of my look at Tascam's 24-bit DAT recorder was an investigation as to how this high resolution audio could be appreciated by the public with the standard 16-bit compact disc system. Last week I focused on one method of transferring high resolution audio to CDs with the UV22 process. This week, therefore, I would like to look at two other popular methods by which increased musical information can be encoded in a limited 16-bit medium. These processes are Pacific Microsonic's High Definition Compatible Digital (HDCD) and Sony's Super Bit Mapping (SBM). While former Music Technology student Jason Levitt has already done research into this area, the topic has really come alive again with more recent articles considering the increase in availability of high resolution recording, mixing, and mastering tools.

Probably the more common of the two systems is Sony's Super Bit Mapping. At the recording studio in which I work (Greene Street Recording), both control rooms are equipped with Sony SBM DAT recorders. These high resolution transfer processes, as you may have guessed, are useful not only in capturing the increased fidelity of 20- or 24-bit recording onto the 16-bit format, but also for preserving as much of the sonic information from a high quality 2" master tape. One of the main attractions of SBM to engineers is that the process is compatible with every CD player or DAT machine. No special decoder is required to unravel the high resolution audio. The method by which Sony preserves this high resolution information in only 16-bits is through two common digital audio processes: noise shaping and psychoacoustic principles. By observing the Fletcher-Munson equal loudness contours, one can see that the ear is more sensitive to frequencies in the 500-5,000 Hz range (roughly the range of the human voice). According to Sony, "if the resolution of this 'highly audible at low volumes' zone is improved, the perceived fidelity will greatly increase." Super Bit Mapping therefore shifts quantization noise out of the 3-5 kHz range and redistributes it above the 15 kHz range. This noise redistribution keeps the total noise in the system the same, but reshapes the noise pattern. The underlining of the word "perceived" was added by me because the use of this word brings up a very important point. The true measurable fidelity of a 16-bit SBM source is no better than a standard 16-bit recording. However, the listener perceives the SBM source to be higher fidelity. It is this perception which is the result of psychoacoustic principles. Super Bit Mapping, in fact, does not even accurately follow the hallowed Fletcher-Munson curves because those tests were conducted with sine waves, not music. Sony has apparently done its own testing to determine how listeners perceive increased sonic resolution.

The HDCD system uses a very different approach than SBM. Invented by Keith Johnson and Michael Plaumer in Berkeley, CA, High Definition Compatible Digital necessitates the use of an HDCD decoder on the listener's end to appreciate the enhanced audio fidelity. Basically, high resolution audio which undergoes HDCD processing is first sampled at an extremely high rate (along the lines of at least 200 kHz). A standard 16-bit CD signal is then output from the HDCD processer. Another band of PCM data, however, is also output and recorded as a side band along the standard 16-bit information. When playing an HDCD disc in a regular CD player, only the regular

16-bit PCM code is read while the side band of HDCD encoding is ignored. The true power of an HDCD disc, though, is realized when it is played back on an HDCD compatible compact disc player. The extra side band of digital information is used to faithfully reproduce the original high resolution source. The main disadvantage of HDCD, as compared to Super Bit Mapping or the UV22 process, is that this special decoding system is needed to truly appreciate the benefits of the high resolution audio. Even though HDCD recordings are compatible with standard CD players, large companies are currently not interested in using the system since it requires a increase in manufacturing cost while only catering to the minutely small percentage of the population who currently own HDCD decoding systems. HDCD is therefore caught in a sort of catch-22 situation: Manufacturers will not produce HDCD discs because not enough people own decoders, while people will not bother buying decoders since not enough HDCD discs are being manufactured. It is a shame that HDCD is currently caught in this loop because the sonic fidelity that the process affords the listener is apparently better than both SBM or UV22. HDCD "returns warmth, character, ambiance, and depth to music," which was previously unavailable through a digital medium. (Levitt)

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