Damaged Sound: Glitching and Skipping Compact Discs in the Audio of Yasunao Tone, Nicolas Collins and Oval

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ABSTRACT

From the initial release of the CD in 1982, artists have tampered with the system to test it, compose with it and sample from it. The author examines the use of the cracked and manipulated CD in the work of Yasunao Tone, Nicolas Collins and Oval in relation to their differing approaches and the role of the CD in sound expansion. Tone and Collins are interested in indeterminacy and the benevolent catastrophe in composition, while Oval's process has more in common with pop production and studio practices.

THE SOUND OF GLITCHING CDS

A common experience of any regular café-goer is hearing the sound of a skipping CD. Café music is most often intended as background space filler; the music is not there to be listened to and is most often ignored until the CD, perhaps covered in scratches and dust and played through a second-rate stereo, inevitably starts skipping. The stuttering CD in the café environment causes all to stop and take notice. The high-pitched glitch of a ticking CD "hanging" on a small section of audio causes an instant reaction. The customers look around for someone to fix the problem, forward to the next track or change the offending CD altogether so they can go back to their conversations without the noise. What could be worse than the sound of a skipping, glitching CD?

Fig. 1. Yasunao Tone, Wounded Compact Discs. Tone placed tape on the surfaces of CDs, "wounding" them before playing in a regular CD player. (Photos © Gary McCraw.)

This article examines three musicians who create works based on the damaged sound of the distressed CD player as it tries to cope with the loss of binary information. Composers/musicians Yasunao Tone and Nicolas Collins and the group Oval heard these digital sounds as ripe for exploitation towards sound expansion, chance-generated composition, indeterminate performance [1] and even pop music. The different approaches of the three are discussed: Tone and his interest in chance and indeterminacy in composition; Collins and the chattering music created from his modification of the CD player itself; and Oval and its sampling of the sound of skipping CDs for sequencing material for abstract pop music.

A key approach in music creation in the 20th century was that of sound expansion, as the historical avant-garde sought to make new and unique sounds beyond those created within the traditional framework of Western art music. A number of techniques were utilized to this end, including extended techniques, prepared instruments and the use of nontraditional sound-producing devices [2]. Part of the trajectory of sound expansion was the use of modified, cracked or broken technologies originally intended for the mediation of sound. John Cage engaged in this approach with his piece *Cartridge Music* (1960), a work that requires a turntable to be modified by removing the stylus and replacing it with objects such as pipecleaners, wires, feathers, slinkies, matches and toothpicks [3]. Subsequent to Cage's low-fi phonograph experiments, a number of Fluxus musicians also engaged in destructive sound-expansion practices, destroying a number of traditional instruments, as well as turntables and records. Of particular note was Milan Knizak. For his work *Destroyed Music* (1963–1979), Knizak cut vinyl records into sections and glued them back together to create composite discs that caused the phonograph needle to pop and bang over the joints, combining sound from disparate recordings. The tradition of sound expansion and, specifically, the direction of broken, cracked and manipulated sound equipment is the historical

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background from which the use of glitching CDs can be seen as developing.

The use of CD skipping in music has been an extremely productive approach and has itself, especially through Oval, spawned a subgenre involving what Collins calls the "benevolent catastrophe." Tone, Collins and Oval, however, have divergent approaches and interests. These interests stem from the musicians' own histories, such as Tone's involvement in the Tokyo Fluxus movement and his interests in indeterminate composition. While Collins, like Tone, is involved in avant-garde work, his history is closely tied to the experimental electronic practices of the 1960s and 1970s in the United States. Both Collins and Tone have been involved in the contemporary digital audio scene. Collins remixed a track for Microstoria's *Reprovisers* (Thrill Jockey, 1997), a side project of Oval's Markus Popp; Tone in 2002 won the Golden Nica for Digital Musics at the Prix Ars Electronica. Oval, on the other hand, developed out of an indie pop background and subsequently crossed the boundaries between art and pop. All three are involved in the use of the cracking, breaking and transforming the mediated sound of the CD system and through various manipulations engage in sound practices that cross between music, sound and noise.

Compact Disc Technology and the Glitch

> *Incorrect or missing data from a Compact Disc can result in clicks, pops, dropouts, "skipped grooves," and "stuck records."*
>
> —David Ranada, 1984 [4]

Compact disc technology was developed by the Philips and Sony Corporations and introduced in Japan and Europe in October 1982 and in the United States in March 1983 [5]. The format quickly emerged as the sound-storage and music-publishing medium of choice.

The glitches heard from a CD player—the skips and stutters—are not caused by actual skips; the CD player's laser does not actually "stick" in the way a phonograph needle becomes physically locked in a groove. Instead, the skips and stutters that we hear when playing a CD are errors being emitted from the system as audio. The ticks and pops are due to binary values being read incorrectly—if the level of the error is so great that the error-correction software driving the digital system is not able to cope, it emits false sounds. For a CD to do this it needs to have been handled very badly. Dust and small scratches, especially across the disc, do not normally affect the audio output, as errors are covered by the system's error-correction software, which corrects misreadings and information losses.

David Ranada, of *Stereo Review* magazine, from the very beginning of the medium sought ways to test the system for himself. For his first feature on CDs, Ranada worked out a way to make a CD jump and skip. The resultant review was printed in December 1982, before the commercial release of the CD player in the United States. Ranada described the error-correction system and his attempts to cause significant data loss:

> If the maximum burst-error length that can be concealed . . . has been exceeded . . . a CD player stands a good chance of either emitting very strange sounds or muting altogether. And that is just what happened in my listening tests [6].

Ranada made "a very thin wedge of laser-opaque adhesive tape and affixed it to the surface of the CD, pointing it toward the centre of the disc" [7]. As the laser moved across the tape, it went through the various types of errors described above until it "stopped and its disc drawer opened, encouraging me to remove the offending record" [8]. He compared his most extreme test to sawing out a slice of a vinyl record and trying to play it back on a turntable. In a later article Ranada noted that the wedge could be made from Scotch Magic Tape and describes in more detail how wide he made it [9]. Ranada found by poking around in the circuitry that he could read exactly how many errors were being concealed and realized that error correction was itself erratic and would often deal with large errors in different ways from playing to playing [10]. This became important for future uses of the technology, especially for those musicians who push the system in an attempt to draw out the accidental and unforeseen from the device.

CD manufacturers and developers had created a new form of technology that was said to be able to correct errors and damage done to discs. While Ranada did not see his process of manipulating CDs as anything more than what a conscientious reviewer would do to provide his readers all possible information about the medium, his testing system would be very close to the technique used by Yasunao Tone to produce his indeterminate compositions.

Yasunao Tone's Wounded CDs

Tone's work combines contemporary digital music with that of the historical avant-garde. His use of indeterminate techniques dates back to the early 1960s, when he was at the center of a decade of radical experimentation in the arts. Tone was involved in the experimental proto-Fluxus Group Ongaku and had worked in early Fluxus festivals in Europe.

In 1984, Tone came across a method that he thought could be used to cause a discrepancy in the playback of the then-very-new CD technology [11]. Tone had read that digital recording has almost no noise and produces sound very faithful to the original, but when it misreads 1 with 0, it makes very strange sounds due to the binary code becoming a totally different numerical value [12].

The passage exemplified the emphasis that was placed on the lack of noise in digital recording technology. It hinted, however, that one could make noise with the new technology by overriding the error-correction system. Tone recounts:

> I called my audiophile friend, who owned a Swiss-made CD player, and asked about it. It was a simpler method than I suspected. I bought a copy of Debussy's *Preludes* and brought it to my friend's place. By his engineer friend's suggestion, we simply made many pinholes on bits of Scotch tape and stuck it on the bottom of a CD (Fig. 1). I had many trials and errors. I was pleased [with] the result, because the CD player behaved frantically and out of control. [It] was a perfect device for performance [13].

The result changed the pitch, timbre, rhythm and speed of the piece. The CD also produced a "stuttering" that was different each time the disc was played. The stuttering CD extended the possibilities of performance in a number of ways: Tone's skips pushed the functionality of the system to the extreme, the mechanism jumping around the disc and playing random sections in a confused manner. The sounds produced by the affected discs were never quite the same. This meant that in performance, the performer could have no clear idea of what would happen, making such things as scoring very difficult. Tone commented: "Playing prepared CDs according to the score was like advancing in a maze where ambush was everywhere, and that made the performance situation all the more interesting" [14]. Tone would literally bang the player with his hand to cause it to jump from one glitch to the next—just where it would stop and on which sound it would stutter could not be known from one playing to the next. Tone has said:

> A new technology, a new medium, appears, and the artist usually enlarges the use of the technology. . . . The manufacturers always force us to use a product their way, . . . however, people occasionally find a way to deviate from the original purpose of the medium and develop a totally new field [15].

In just one year following the introduction of the CD player in the United States, the idea of a playback system featuring pure, clean audio was displaced by Tone's noisy, glitching CDs. The technique has been extremely productive for Tone, who has used it from 1985 through to the present day.

In keeping with his indeterminate approach to composition, Tone, like a number of other avant-garde composers, has had concerns about the idea of recording and releasing music. The outcomes in an indeterminate composition will be different in each performance; however, a recording remains the same on each playing. Tone's answer to this dilemma was to make a piece that could not be played live and was totally predicated on the CD release for its realization. *Musica Iconologos* (1993) is Tone's first released work, a composition of computer-generated snippets of noise. *Musica Iconologos* was created in such a way that the piece itself was not realized as music until it was mastered [16].

Musica Iconologos created a problem: while the piece existed solely in the digital recording process and could not be played live, Tone was mostly interested in live performance practice. His answer to this problem lay in his use of the "wounded" CD—he took copies of the *Musica Iconologos* CD and prepared them with invisible tape, performing the piece with CD players. The work was radically re-mixed as it stuttered, skipped and jammed throughout the performance—the piece now reflected the conditions that interested Tone in performance, those of indeterminacy and chance. Tone released a CD that stands as documentation of this practice. Entitled *Solo for Wounded CD* (1995), the release demonstrates the extreme nature of Tone's audio production [17]. The audio heard on the disc is loud, noisy and erratic as the CD skips from one computer-generated outburst to another.

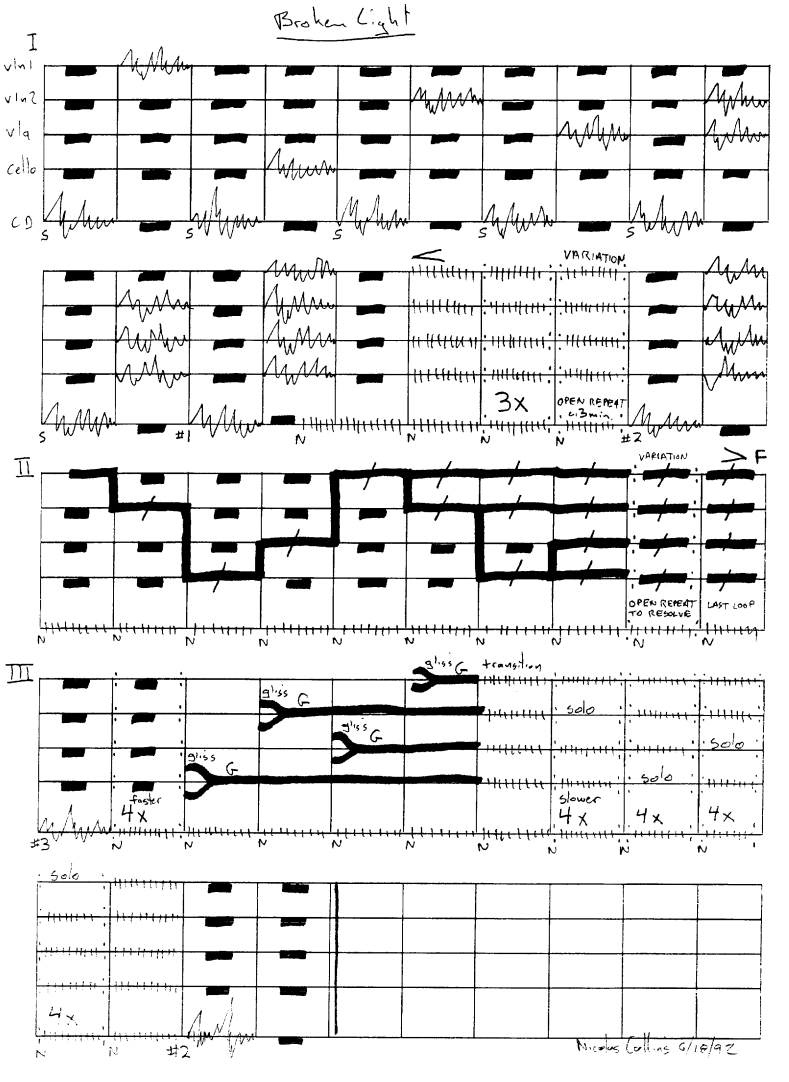
The Un-Muted CD Players of Nicolas Collins

Collins's approach to technology and his use of CD players for performance are similar to Tone's in that they share an interest in indeterminacy in performance. Collins differs in that his approach involves tampering with the CD player's internal mechanism rather than a corruption of the disc. Collins had been using circuits and modified electronic equipment for the creation of music since the 1970s [18]; his work is linked to a generation of composers, including Alvin Lucier, Gordon Mumma and David Tudor, who experimented with electronics in such a way as to shift the musical score from paper to the circuit board. In 1988 Collins opened up a CD player and fiddled around with its circuitry. In a 1995 interview Collins recalled that he "looked at the CD player as a challenge. I prefer vinyl in almost every aspect, but 5 years ago it looked as though the CD would take over. I took it upon myself to try to corrupt this 'perfect' medium" [19].

Without any real knowledge of the workings of the technology, Collins assumed correctly that the CD player's laser never left the disc's surface, reading not only audio information but "hidden" information such as error-detection and information-coverage data, as well as data defining track locations, lengths and so on. Locating the player's control chip, Collins came across a "mute" pin, which he removed, resulting in a constantly chattering playback. He states:

> With this pin removed, the CD player never shuts up, and one can hear the sound as the laser "scratches" (a magnificent, cartoonish ripping noise) or "pauses" (fast looping rhythms, possessed

Fig. 2. Nicolas Collins, excerpt of *Broken Light*, score of first composition for skipping CD and string quartet, 1991/1992. This is the first in Collins's series of pieces that employ customized consumer electronics in conjunction with traditional instruments to rework tonal material from earlier music, in this case the string music of Corelli, Locatelli and Torelli. Under the control of the performers, the CD player "scratches" across the disc, isolating and freezing short loops of recorded music. The performers' parts, both written and improvised, mesh and clash with the CD. (Commissioned by the Soldier String Quartet and premiered in May 1991 at the Musique Action Festival in Vandoeuvre-les-Nancy, France. © Nicolas Collins.)



> of a peculiar stutter and swing). Further modifications to the control system, done in collaboration with engineer Sukandar Kartadinata, opened up more extreme aberrations of digital misbehaviour [20].

Thus, with no muting, the CD player reads *all* of the disc's encoded information as audio—even the information that keeps the disc in place while in "pause" mode. Collins is interested in "sticking something into a machine and watching it come out different at the other end" [21]. He enjoys the "Skipping loop rhythms . . . because unlike on a record they are not regular, they hiccup or stutter" [22]. As with Tone's stuttering CDs, it is never certain each time just how the player will cope with errors—perhaps looping, jumping, skipping, stuttering or hanging for a moment before veering off.

Collins's interest in the sound of the modified CD player (Fig. 2) comes from his interest in hi-fi sound contrasting with the "snap crackle pop of the digital click" and the "automatic rhythmic variation of the skipping" [23]. Collins is listening for the "benevolent catastrophe," an occurrence he does not hear in contemporary digital audio. He argues:

> The analogue circuitry of older electronic music usually sounded best and did the most interesting things when it was being "misused" or was on the verge of breakdown—but computers typically go silent or drone listlessly when they get lost [24].

Oval: Double-Clicking an Entire Genre

> *The ability to create new content by sabotaging the linear playback of data has proven to be a successful interface for Popp, who has double-clicked an entire genre of electronic music using it.*
>
> —Kim Cascone (2000) [25]

Oval, consisting of Frank Metzger, Sebastian Oschatz and Markus Popp, can be seen as forbears to the popular use of cracked and broken media in the contemporary digital audio scene. The group's audio projects have sparked wide interest in the various methods by which the breakdown of digital and analog audio can be used for musical experimentation.

Oval is best known for two releases, *Systemisch* (1994) and *94diskont* (1995). For *Systemisch,* Oval focused its output on the sampled and sequenced skipping CD, the sound most of us had previously heard as distressing and annoying. The traumatic sound of the skip exposes the myth of the CD format being indestructible, with an unlimited life span. Oval aestheticized the sound, making it listenable. The group's work is very unlike the audio produced by Tone, whose wounded CDs have the ability to cause irritation, even for an audience already exposed to and versed in the uses of the stutter in sound and music. Oval's sound is more readily approachable. The pieces' stutters are caught in the looped skipping and repeating rhythm of the CD. Programmed bass plays under the mid- and high-range skips and glitches, which at times form a nearly regular clapping sound. The complexities of the sounds caught and sequenced by Oval are what make them so appealing. These sounds are full of texture, the paths of the tracks are compelling. Oval has taken the sound of CD failure and turned it into something accessible [26].

Oval is far apart from the compositions and performance of Tone and Collins. Oval is not part of the musical avant-garde but instead hails from the indie pop-and-rock movement of the late 1980s. *Systemisch* can be clearly heard as "skewed" pop, as the pieces hold onto the basic structures of pop with melodic motifs and repeated phrases formed basically into a verse-and-chorus type structure. It is perhaps because of this that Oval has become so popular to an audience intent on discovering new musical sounds and approaches while relying on something familiar.

In the late 1980s Metzger, Oschatz, Popp and several other musicians would meet regularly at Popp's house for improvised music sessions. Popp played guitar and bass, Oschatz played keyboards and percussion, and Metzger sang. Popp introduced an Atari computer and a sampler, and the jams led to the development of Oval [27].

Before the release of its first album, Oval produced three tape-only releases, one of which was entitled *Oktober* (1991). The tape includes "Neopren," which was the first track to use the "glitch" that would subsequently become their signature. This initial CD stutter effect happened by accident. Metzger had borrowed from a public library a jazz CD that was in terrible condition. The CD stuttered and "created interesting 'glitches,' mostly because it wasn't simply hanging as it would usually do, the 'stutter' was moving, so the pattern was constantly changing randomly. Later we tried to reproduce this effect" [28]. The glitch appears in the last 30 seconds of the track, forming a heavily effected sound to end the piece.

Oval sampled the sounds of the stressed CDs, recording the audio produced by the skips, and looping and dropping the pitch by 1 or 2 octaves. Soon after this Oval began preparing the CDs themselves with nonpermanent marker pens and small strips of adhesive tape. Oschatz describes this method as giving

> more continuous samples but with complex rhythms and additional clicks and glitches. The resulting loops were very exciting at the time, at the other side they were nearly impossible to improvise to. This was mostly because of the complex and full sound (because the samples were taken from fully mastered songs, which already utilised all frequencies) [29].

At that time Oval was a band experimenting with traditional pop arrangements with the addition of electronic elements, including the newfound skipping CDs. When faced with the full and rich sound made up of the glitches, Oval had a problem in that it did not seem possible to add more instrumentation. The group introduced the use of Cubase as a tool for sequencing the full-frequency CD skipping samples [30]. Oval developed the use of sampling and sequencing of glitching CDs further in Oval's third tape release and the subsequent release of *Wohnton* (1993), Oval's first full-length album. Jörg Heiser, in an early review entitled "dechingdechingdeching," points to the CD skips as a key factor in the sound of Oval [31]. He argues that Oval produces an "ensemble of noises set by a computer which is not immediately music," and observes that the CD skip still hints at the original sounds found on the CD, but with a new beauty found in the CD error. He notes that the looped and sequenced skips no longer have the "gratingness" of the original glitch and stutter, as Oval has chosen "nice passages" and layered them over each other, with the looped and repeated nature of the process creating music out of what would otherwise simply be noise. Heiser argues that the process is not intended [simply] as destructive, Oval are not destroying anything in their process: the marking pen used to cause the glitch is simply cleaned away after the results are sampled. Heiser states, "the CD's faulty noises were not discovered in order for Oval to create nice music from an unintended destruction but rather to create unintended beauty from intended destruction" [32].

In 1993 Oval created a sound installation entitled *Wohnton* (Fig. 3), which used reworkings of a number of tracks from

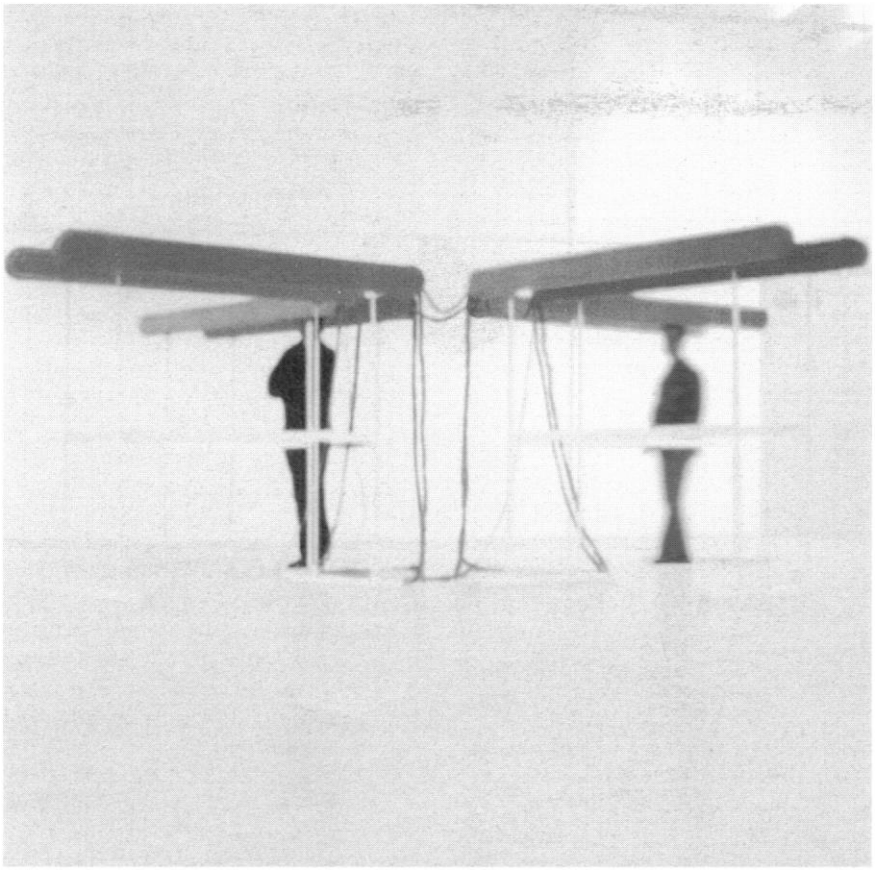


Fig. 3. Oval, *Wohnton*, sound installation, Arnhem, the Netherlands, 1993. This installation consisted of 128 miniature speakers with eight modules connected to an 8-track playback system. The audio for the work was made from extended versions of tracks from the *Wohnton* CD (1993) with the vocal tracks removed. (© Oval. Photos © Wiebke Grösch. Postprocessing by Sebastian Oschatz.)

their first album of the same name. The exhibition was first shown in November 1993 in Arnhem, the Netherlands. It consisted of 128 miniature speakers within eight modules, which in turn were connected to an 8-track playback system allowing the sounds to move around listeners as they themselves moved around the exhibition space [33]. The installation was exhibited in a number of galleries, as well as at dance parties, between 1993 and 1996 [34].

The installation was the first time that Oval produced work much longer than standard pop duration. The tracks used were extended versions, with vocals removed, of the earlier pieces "Alles in Gedanken," "Hallo Draussen," "Kardamom," and "Hallo Draussen" played backwards. These pieces were made into 15-min tracks consisting of 3- to 5-min loops. The sound installation was the first sign of where Oval was to progress, as the group shifted its focus from improvised pop to experimental art music.

Oval extended this approach on *94diskont*, for which it created the 24-min track "do while" from the earlier piece "Kardamom" (which was originally on the *Kolor* (1993) demo tape and just over 1 min long). "Do while" loops around its central themes many times over the course of the track. There is almost no change from loop to loop. It does not follow obvious song structure, nor does it have any clear moments of tension or climax. Instead it is in stasis from start to finish. There is nothing harsh in the mix, and its length suggests a type of ambient environment without peaks and troughs.

While Oval has continued as a unit with the sole membership of Markus Popp, its use of the skipping CD fades into the background as it uses and re-uses the same audio files. *Systemisch* and *94diskont* influenced the subsequent digital audio scene, spawning a myriad of digital audio artists who crack software and hardware to produce sound [35].

Tone, Collins and Oval represent three very different approaches to the use of skipping and glitching CDs in experimental sound composition and creation. It can be said that Tone is more interested in the possibilities of indeterminacy within the system than he is in the actual audio outcomes. For Tone, the CD player becomes a chaotic random sound generator working through a process centered on his wounded CDs.

Commonalities between Tone's work and the experimental sound practices utilized in such subgenres as glitch and microsound, which use glitches and cracks in digital media to produce a new aesthetic in music, are apparent. As various artists have developed these approaches, however, many of the indeterminate features of the style have been lost as sounds become sampled and sequenced, as risk and chance are lost in a perpetual loop. Tone has never stopped using indeterminate techniques, and his development of the wounded CD technique has continued to be an extremely productive approach for his compositions.

Collins's interest is similar to Tone's at the point where catastrophe meets indeterminacy. His work with manipulated CD players focuses on the generation of novel compositions and sounds within a predetermined system.

Unlike the indeterminacy and catastrophe of Tone and Collins, Oval's audio represents the planned use of recorded, sampled and sequenced glitches. The samples are used over and over in repeating and looping tracks, overlaid with other pre-recorded skipping CD sounds. There is no need to score the prepared discs, as they are never played live. This process owes much more to the pop production processes than it does to 20th-century composition.

Oval was at the beginnings of the current pop music trend of working with chance and the accident in a digital environment, pushing digital technologies to their limits and recording the outcome to be later cut and pasted into a final sequenced track. However, once the accident is tied down, the actual glitch is pushed back into the past, a distant memory. Going beyond Oval's work, a number of laptop musicians—such as Farmers Manual, Fennesz and Hecker from the Austrian label Mego—have, in addition to using sample-and-sequence techniques, taken to pushing things further, opening their applications and code to invasion from disparate data to produce unknown and unforeseen audio [36]. Tone's, Collins's and Oval's use of the relatively new CD technology has been and continues to be an important influence on producers working in the area of expanded techniques and experimental sound and music.

References and Notes

1. For a discussion of the use of the terms "chance" and "indeterminacy" in composition and perfor-

mance, see John Cage, *Silence* (Middleton, CT: Wesleyan Univ. Press, 1973) pp. 18–35.

2. Extended techniques are performance techniques that literally extend the sound of the instrument by playing it in ways not originally intended—for example, playing a violin with the wooden side of the bow or plucking it with a found object. In prepared techniques, by contrast, the instrument itself is altered. John Cage's works for prepared piano called for nuts and bolts to be placed on the strings of the instrument.

3. David Revill, *The Roaring Silence: John Cage: A Life* (New York: Arcade, 1992) p. 198.

4. David Ranada, "Understanding Compact Disc Errors," *Stereo Review* **49** (April 1984) p. 48. Ranada became *Stereo Review's* champion of the CD system, writing a number of articles on the new format.

5. For a more detailed account see Ken Pohlmann, *The Compact Disc Handbook*, 2nd Ed.(Madison, WI: A-R Editions, 1992).

6. David Ranada, "Digital Debut: First Impressions of the Compact Disc System," *Stereo Review* **48** (December 1982) p. 70. "Burst-error" is the term for an error caused by the CD's pits being covered. As many as 3,500 pits can be covered and still be corrected exactly by the system. More information on error correction and the actualities of the CD system can be found in Pohlmann [5] and in Luc Baert et al., *Digital Audio and Compact Disc Technology*, 3rd Ed. (Oxford: Focal Press, 1995).

7. See Ranada [6].

8. See Ranada [6].

9. David Ranada, "How to Buy a CD Player," *Stereo Review* **48** (July 1983) p. 59. Note there is a picture of the official test disc made by Philips next to Ranada's own creation. The Scotch Tape example is of specific interest as it is what Tone used when "wounding" his CDs.

10. Errors are handled by error-correction software and algorithms that use a system of redundant data to extrapolate from the error to try to either replace the lost data or, in severe cases, cover the error. The system sometimes handles errors differently from playing to playing due to the tiny physical size of the system's data storage and the large quantity of data lost. For more information, see [6].

11. For a history of Tone and his involvement in the avant-garde arts scene and indeterminate composition, see Caleb Stuart, "Yasunao Tone's Wounded and Skipping Compact Discs: From Improvisation and Indeterminate Composition to Glitching CDs," *Leonardo Electronic Almanac* **10**, No. 9 (2002).

12. Yasunao Tone, liner notes to *Solo for Wounded CD*, Tzadik CD 7212 (1997).

13. Yasunao Tone, from a transcript of an interview published in *Revue & Corrigée*, No. 46 (2001). Note that all quotes from this interview come from the original English transcript, which was then translated into French for publication.

14. See Tone [12].

15. Yasunao Tone, quoted from an interview with Christian Marclay, in *Music*, No. 1 (1997) p. 43.

16. Yasunao Tone, "John Cage and Record," *Intercommunication* (Japan), No. 35 (2000). Text sent by Tone to author. A newly edited version of this text appears in this issue of *Leonardo Music Journal*.

17. The title for the piece comes from a work by Fluxus artist Alison Knowles, entitled *Wounded Furniture*. The work, composed in 1965, is for "an old piece of furniture in bad shape. Destroy it further, if you like. Bandage it up with gauze and adhesive. Spray red paint on the wounded joints. Effective lighting helps. This activity may be performed with one or more performers, and simultaneously with other events." See "Events by Alison Knowles" at <http://www.nutscape.com/fluxus/homepage/aknowles.html>.

18. See Nicolas Collins, "Cargo Cult Instruments," *Contemporary Music Review* **6** (1991) pp. 73–84, for a description of early experimental musical instruments built by Collins.

19. Nicolas Collins, interview with John L. Walters, 1995. See <http://homestudio.thing.net/revue/content/collins2.htm>.

20. Nicolas Collins, "Modified CD Players" web site text (currently unavailable), December 1998.

21. Nicolas Collins, "In Conversation with Martin Conrads" <http://homestudio.thing.net/revue/content/collins.htm>.

22. See Collins [19]. Collins has used modified CD players in a number of compositions and collaborations, including: "Broken Light" on *It Was a Dark and Stormy Night*, Trace Elements CD TE-1019 CD (1992), which uses a performer-controlled skipping CD, as does "Still Lives" (for trumpet, voice and skipping CD) on *Sound without Picture*, Periplum CD P 0060 (1999). *A Host, of Golden Daffodils*, Periplum CD PL08 (1999) is made up of "improvised duos with Peter Cusack" and is "strewn with CD artifacts." Information from e-mail correspondence with Nicolas Collins, 16 November 2000.

23. Nicolas Collins, e-mail correspondence with author, 27 November 2000.

24. Nicolas Collins, "Low Brass: Trombone-Propelled Electronics," *Leonardo Music Journal* **1** (1991) p. 44.

25. Kim Cascone, "Popp Art," *Artbyte* (November/December 2000) p. 77.

26. The level of this accessibility can be seen in the fact that Oval's music has been used for commercial purposes in perfume advertising and the fashion-heavy catwalks of Tokyo.

27. Frank Metzger, e-mail interview conducted April–May 1999, interviewer unknown. See <http://meso.net/oschatz/oval/metzger.html>. In its first incarnation Oval also included Holger Lindmüller.

28. Frank Metzger, e-mail correspondence with author, 29 January 2001.

29. Sebastian Oschatz, e-mail correspondence with author, 17 January 2001.

30. Cubase is an application favored by musicians to create techno and electronic dance music. The application is used to sequence beats and sounds.

31. Jörg Heiser, "dechingdechingdeching," *Heaven Sent* (February 1994).

32. See Heiser [31].

33. See Oschatz [29].

34. Oval, *Wohnton Installation*, <http://www.meso.net/oschatz/oval/wohntoninst.html>.

35. See Cascone [25]. There are a number of issues related to the discussion that are not covered here: Popp's removal of Oschatz; Metzger's self-removal from the group; Popp's ideas about music and audio; and the development of the Ovalprocess software. These various issues were all subsequent to the first three releases and hence are beyond the scope of this paper.

36. The label Mego is at the center of this movement towards cracked applications and the use of disparate data. See <http://www.mego.at>.

Selected Discography: Yasunao Tone

Musica Iconologos, Lovely Music CD 3041 (1993).

Music of Group Ongaku, Hear CD 002 (1996).

Musica Simulacra, CD sponsored by Harvestworks Digital Arts Center (1996).

Solo for Wounded CD, Tzadik CD 7212 (1997).

Wounded Man'Yo #38-9/2001, Alku CD Hajime 39 (2002).

Yasunao Tone, Asphodel CD 2011 (2003).

Selected Discography: Nicolas Collins

It Was a Dark and Stormy Night, Trace Elements CD TE-1019 (1992).

Sound without Picture, Periplum CD P0060 (1999).

A Host, of Golden Daffodils, Periplum CD PL08 (1999).

Selected Discography: Oval

Wohnton, Ata Tak CD WR6 (1993).

Systemisch, Mille Plateaux CD MP009 (1994).

94diskont, Mille Plateaux CD MP013 (1994).

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