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Following The Instruments, Designers, And Users: The Case Of The Fairlight CMI

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Introduction

The aim of this article is to develop a conceptual framework for understanding the historical and contemporary uses of digital sampling instruments in a variety of cultural and social contexts: in recording studios, on concert stages and other sites of musical production and performance. One of the problems for the researcher trying to do so is that the field of organology and the academic study of musical instruments appear to stop as the era of electricity begins. Visit the Musical Instruments Museum at the University of Edinburgh and you will find keyboard instruments such as harpsichords and organs but only a few items that can be plugged in: a Hohner electric piano (circa 1980) and one or two electric guitars; you won't find any analogue synthesizers, drum machines, or digital samplers – no Minimoogs, no Roland TR-808s, and no E-Mu Emulators. The study of western art music and the instruments of the past have dominated the field and Eliot Bates suggests that 'Instrument museums are mausoleums, places for the display of the musically dead, with organologists acting as morticians, preparing dead instrument bodies for preservation and display' (Bates: 2012, p. 365). This idea of the museum as a mausoleum can be traced to the work of Adorno and other modernists who viewed museums as slow and sluggish (Prior 2011) but it would be difficult to apply these descriptions to contemporary institutions like the Museum of Modern Art (MoMA) in New York

or the Science Museum in London, where an EMS VCS3, Roland TB-303, and Fairlight CMI have been on display[i]. Instruments in the collection at Edinburgh are available for use by researchers and performers and, as the fields of organology and museology continue to change, those studying music technologies and the instruments of contemporary music making – acoustic, electric, analogue, digital – can try to work in an interdisciplinary way across a number of academic fields and attempt to shift the institutional boundaries that separate them.

After organology, the next place we might go is the field of ethnomusicology where there is a long tradition of studying instruments and instrument making as part of non-Western cultural practices rather than as static objects. Kevin Dawe writes that ‘the boundaries [original emphasis] that have traditionally separated or demarcated musical instruments from other objects and technologies, as well as academic disciplines, must surely be questioned’ (Dawe: 2012, p. 197). Within the widening field of Popular Music Studies (PMS) we can turn to Steve Waksman’s (1999) cultural history of the electric guitar and Paul Theberge’s (1997) study of digital instruments in the 1980s and 90s with its focus on the musician as a consumer of technologies. The final thing we might do to understand the relationship between inventors and music makers is enter the field of Science and Technology Studies (STS). Here, we are free to borrow from a rich mix of useful concepts and engage with the work of scholars such as Wiebe E. Bijker and Trevor Pinch who are identified with the social construction of technology (SCOT) approach to understanding the design and use of technologies: from bicycles to Bakelite (Bijker, Hughes, & Pinch: 1987) and cars to contraceptives (Oudshoorn & Pinch: 2003). The social study of technology challenged technological determinism and the emphasis on inventors as heroic geniuses and moved towards a ‘focus on what social groups and actor networks actually say and do with technology’ (Bijker & Pinch: 2012, p. xxi). The text that connected SCOT research to the study of music technologies was Trevor Pinch and Frank Trocco’s (2002) book on the history of the Moog synthesizer, which presents a chronological narrative for the general reader before smuggling in

concepts from anthropology in its conclusion to explain the instrument's move from the laboratories of scientists to the studios of progressive rock musicians. My aim here is to apply the SCOT approach to the study of one of the first digital sampling instruments – the Fairlight CMI – by focusing on its designers and users. In the collection of essays, *How Users Matter*, the contributors focus on what editors Nelly Oudshoorn and Trevor Pinch call 'the user-technology nexus' (p. 2), which continued the shift in the writing of histories of technologies from a focus on the designers of technologies towards the contexts of use and 'the co-construction' or 'mutual shaping' of technologies and their users. To understand music technologies and avoid deterministic arguments about how technologies shape music and the lives of musicians, we have to follow both the designers and the users of music technologies.

The technology that is the focus of this paper is the Fairlight Computer Musical Instrument (CMI), which is generally regarded as the first commercially available digital sampler. However, its designers at Fairlight Instruments, Peter Vogel and Kim Ryrie, were primarily interested in the use of digital synthesis to replicate the sounds of acoustic instruments and their interest in the uses of digital sampling was the result of experimentation and failure. Users of the Fairlight CMI such as Richard Burgess, Kate Bush, and Peter Gabriel used it to digitally sample the sounds of everyday life and incorporate these sounds into recordings; composers such as Peter Howell and other members of the BBC Radiophonic Workshop combined the sounds of acoustic instruments with random noises to create new instruments and libraries of sound effects. Musicians use instruments in ways unforeseen by their designers and fail to follow what Madeleine Akrich refers to as the 'script' inscribed in the technical object. She writes: 'we have to go back and forth continually between the designer and the user, between the designer's projected user and the real user' (Akrich: 1992, pp. 208-9). There are examples of the instrument being used as a digital synthesizer but this is where the designer (Vogel) was also its user. Users such as Burgess quickly realised that rather than trying to replicate the sounds of acoustic instruments, the digital

sampling technology that was of secondary concern to its designers could be used as a new form of *musique concrete*. Drawing upon archival research and interviews with the designers and users of the Fairlight CMI, I take on board Pinch and Bijsterveld's advice to 'follow the instruments' (2004; 2012) as well as the human actors (or actants) and so start this story with the musical instrument.

The Instrument: The Fairlight CMI

As a Computer Musical Instrument (CMI), the Fairlight consisted of a large Central Processing Unit (CPU) with two microprocessors and two 8" floppy disk drives, a QWERTY keyboard with a monitor, and two six-octave keyboards. In an article in the August 1983 issue of *New Scientist* magazine, demonstrating there was interest in the Fairlight CMI and other new digital synthesizers from the scientific world as well as the fields inhabited by music technologists, Giles Dawson wrote: 'insert a systems disc in the left-hand drive, a library disc in the right, and you can explore a world of sound limited only by your imagination' (Dawson: 1983, p. 333). Music could also be made by using a laser pen on the monitor screen to draw waveforms that would create sounds. This appears to have been successful with audiences at the Audio Engineering Society (AES) conventions where the Fairlight was demonstrated to potential customers but irked rival companies who rejected it as a gimmick. Cameron Jones of New England Digital (NED) who had launched the first digital synthesizer, The Synclavier, in 1975 dismissed it by saying that 'using a light pen to draw a visual representation of a sound wave is kind of like using a pencil to draw a high-resolution JPEG image' (quoted in Milner: 2009, p. 317). Roger Linn was more blunt:

It was completely useless, a stupid idea, because you're only going to get very odd and bad harmonics, which was emphasized by the fact that Fairlight's sampling rate and bit width was so low. It was a feature they kept talking about, like you could 'make any sound,' but imagine making any sound by drawing a waveform. It's just impossible' (pp. 317-318).

While technologists were quick to criticise a non user-friendly interface, musicians like Peter Gabriel were interested in the opportunity to make music with these new tools. As well as the use of a light pen to draw waveforms, the other ways in which sounds could be generated by the Fairlight included using additive synthesis or by the sampling of external sounds using a microphone or line input. However, with a sample rate of only 24 kHz the objective of recording and imitating the sounds of acoustic instruments with a level of fidelity to satisfy audio data consultants was difficult. A report on the Fairlight CMI delivered to the 1980 International Computer Music Conference concluded:

Steinway needn't worry about competition from this instrument. In general, the Fairlight offers an enormous palette of sounds to the musician, but it can't do everything. Like a camera, the CMI becomes transparent to the viewer, with no characteristic sound of its own' (Levine & Mauchly: 1980, p. 366).

The Fairlight CMI is not the *only* technology that forms part of the early history of digital sampling instruments. It was one of many technological devices being designed and manufactured in the late 1970s and early 1980s using digital synthesis and/or digital sampling. As the designers of the Fairlight were developing their device in Australia, Roger Linn was working in Los Angeles on the Linn LM-1 Drum Computer that would use pre-recorded digital samples to replicate the sounds of an acoustic drum kit and in 1980 New England Digital released the Synclavier II, which offered users a 16 track digital memory recorder. Fairlight Instruments had an advantage: it made its instrument available in 1979 with Robert Fink calling it:

the first commercially available electronic musical instrument that, in addition to generating musical sounds through analogue/digital synthesis, gave its owner the ability to sample pre-existing sounds into digital memory, process them, and play them back through a keyboard (Fink: 2005, p. 341).

While Fairlight Instruments won the entrepreneurial race to design, manufacture, and market the first device to enable the recording and playback of sounds using digital sampling, the CMI was sold primarily as a digital synthesizer: sampling was a secondary concern to its designers.

The Designers: Peter Vogel And Kim Ryrie

Fairlight Instruments was started by Kim Ryrie and Peter Vogel in 1975 and named after a hydrofoil that passed a suburb of Sydney called Rushcutter's Bay, where they had set up a technology laboratory in the basement of Ryrie's grandmother's house. Ryrie and Vogel were working with an engineer and expert on microprocessor technology called Tony Furse on what would turn out to be a prototype of the Fairlight CMI called the Fairlight QASAR M8, which was released in 1976. They saw the electronic emulation of acoustic instruments using digital synthesis as 'the holy grail' (Vogel: 2011). However, the difficulties in doing so led them to digitally record or sample the sound of a piano and use a form of Fourier waveform analysis to try and understand and replicate its complexity. Vogel explained what happened next:

On a whim I decided to see what would happen if I changed the software to allow the sampled sound to be replayed at a pitch determined by the keyboard. The sampling time was less than a second and the first source connected to the ADC [analogue to digital converter] was a radio I had going with some music playing. I captured a fragment of a piano note and when I played it back on the keyboard I was surprised how good it sounded, especially polyphonically (quoted in Street: 2000).

Despite this breakthrough in the attempt to use digital technology to imitate acoustic instruments, Ryrie was unhappy at not being able to do so using synthesis because of an assumption that sampling offered less control over the sounds that were recorded:

We wanted to digitally create sounds that were very similar to acoustic musical instruments, and that had the same amount of control as a player of an acoustic instrument has over his or her instrument. Sampling gave us the complexity of sound that we had failed to create digitally, but not the control we were looking for. We could only control things like the attack, sustain, vibrato, and decay of a sample, and this was a very, very severe limitation of the original goal that we had set ourselves. We regarded using recorded real-life sounds as a compromise – as cheating – and we didn't feel particularly proud of it (quoted in Tingen: 1996, pp. 48-49).

If we go on to look at the way in which the Fairlight CMI was marketed by its designers at Fairlight Instruments and its distributors like Syco Systems in the UK, it is possible to identify a tension between the original goal of using digital technology to imitate acoustic instruments and the presentation of a revolutionary musical instrument that enabled its users to produce sounds that had not yet been imagined.

An advertisement in the magazine *Sound International* in September 1980 describes the Fairlight CMI as 'an entirely new concept in electronic musical instruments' (Fairlight: 1980) with the ability to 'sample "natural" sounds from, say, a microphone, which can then be played on the keyboard and manipulated in various ways' (*ibid.*). When New England Digital launched the Synclavier II in the same year, it claimed superiority in the imitation of acoustic or 'real' instruments:

Synclavier II is a revolutionary advancement in synthesizer technology. Its patented digital method transcends "realism". Many of its sounds are real [original emphasis], virtually undetectable from real instruments. The violins and cellos are so true, you can hear the rosin on their bowstrings' (Synclavier: 1980).

Jonathan Sterne writes how the idea that a reproduced sound can be faithful to an original sound has existed since the early days of sound reproduction. Advertisements that accompanied sound recording technologies such as the Victor record player in 1908

referred to the inability of listeners to tell the difference between the voices of opera singers and the mechanically reproduced voices of opera singers. The use of technologies to reproduce sound as a 'vanishing mediator' (2003, p. 283) is as relevant to the marketing of the Fairlight CMI over seventy years later; the same discourse of transparency and realism used to sell gramophones was part of the marketing of computer musical instruments and digital recording technologies designed to imitate 'real sounds' in unmediated ways. A Fairlight advertisement in Keyboard magazine in February 1982 asked the question 'Orchestra for sale?' as if the fidelity of the sounds that could be sampled was making orchestral musicians redundant. By 1983, Fairlight had launched the CMI Series IIx and were promoting how it could overcome the limitations of the imagination to produce sounds that had not yet been conceived rather than the authenticity of sounds that could be sampled:

This is the story about a new concept in music production. It goes well beyond the ideas of musical instruments as we know them. It is a concept inspired by the wish to create literally ANY type of music, no matter how complex or difficult to express. To incorporate literally ANY type of sound – not only classical and modern instruments but sounds of the world (Fairlight: 1983).

The removal of claims about the realism of sounds may have been a result of the technology being used by actual users in ways that did not correlate with the projected uses imagined by the designers. Some users of the Fairlight CMI felt that the ability to sample the sounds of acoustic instruments was exaggerated and instead began to use the instrument to sample the sounds of everyday life. On the concept of sound fidelity that developed at the start of the twentieth century, Sterne writes: 'sounds could neither hold faith nor be faithful – that task was left to listeners and performers' (p. 282). With the digital reproduction of sounds by computer instruments like the Fairlight at the end of the twentieth century, the test of fidelity was left to the users.

The Users

One of the earliest advertising slogans that accompanied the Fairlight CMI in the 1980s was 'Tomorrow's Music Today' but the opportunity to imagine what the future might sound like if programmed and played on a Fairlight CMI would be restricted by its expense. Figures ranging from £12,000 to £27,500 for the Series I can be found in online music magazines and audio industry websites and these have become part of the mythology of the machine – the more accurate figure is £13,000 (Crombie: 1979). The serious point is that it was affordable mainly to a small number of wealthy individuals like Stevie Wonder, Herbie Hancock, and Peter Gabriel, as well as university departments, professional recording studios, and institutions like the British Broadcasting Corporation (BBC), where it was used in its Radiophonic Workshop. Early adopters of the Fairlight CMI such as electronic music composer Eberhard Schoener, who was described by a journalist as the first musician in Europe to own a Fairlight, were evangelical about its ability to imitate orchestral sounds:

The Fairlight is incredible...you can make a sound which is just like (snaps fingers) which you can program and make a whole symphony from it. You keep a library of sounds on floppy disc. So with a Fairlight you can have a Steinway piano sound or whatever you want. You can blend and shape sounds however you wish (Denyer: 1980, p. 16).

Music technology journalists writing short histories of the Fairlight CMI have been more sceptical about whether the designers of the instrument succeeded in their search for fidelity and this highlights how judgements relating to sound quality shift with the development of new digital sampling instruments and other technologies of sound reproduction. Few would now claim that the Victor record player provided a high quality listening experience or that the Fairlight was able to sample and 'faithfully' reproduce the sounds of acoustic instruments. Paul Tingen writes 'The sound quality of the Fairlight's samples was extremely crude, but the Fairlight was nevertheless initially hailed for its capacity to emulate real instruments 'perfectly', the 'orchestra-in-a-box' syndrome'

(Tingen: 1996, p. 49). Despite this praise and the fears of organisations in the UK like the Musicians' Union, its technological limitations were the result of the high price of microprocessors at this time and the availability of RAM memory. The ability to tell the difference between the 'synthetic' sounds of the Fairlight and the 'real' sounds of acoustic instruments may have become more difficult when the CMI Series II was launched in 1982 at a cost of £27,000 (Leete 1999) or £30,000 (Tingen 1996) as it contained a higher sampling rate of 32khz. However, the use of the Fairlight CMI to reproduce the sounds of acoustic instruments was difficult because of its technical constraints or, to use James J. Gibson's term, the 'affordances' of the technology. Ian Hutchby writes that 'the affordances of an artefact are not things which impose themselves upon humans' actions with, around, or via that artefact. But they do set limits on what it is possible [original emphasis] to do with, around, or via the artefact' (Hutchby: 2001, p. 453). The available sample time on the Fairlight CMI Series I was one second and the length of sounds that could be digitally recorded and reproduced was limited. The possibility of using the Fairlight to replicate the sounds of an orchestra may have been overstated by its designers and would be ignored by users in the following cases who mixed the sounds of acoustic instruments with other noises to create surreal sound effects (BBC Radiophonic Workshop) and musicians who used it to sample the sounds of 'everyday life' such as broken glass and guns (Burgess, Bush, Gabriel).

(i) BBC Radiophonic Workshop

From 1958 to 1998, the BBC Radiophonic Workshop operated as an electronic music studio to provide sound effects and soundtracks for television and radio programmes produced by the British Broadcasting Corporation (BBC)[iii]. A Fairlight CMI was purchased in 1981 and praised two years later in a book that gives an interesting insight into the musical practices of the composers in the Workshop:

Behind many of the doors, late in the evening, the sounds still continue. Some of them being made, perhaps, on a machine called the Fairlight Computer Musical Instrument, one of the

Workshop's most powerful allies to date. Long past are the 'Glowpot Days' of do-it-yourself equipment. Synthesisers are standard aids and have done away with much of the drudgery of realisation. The Fairlight offers an almost alchemical combination of concrete music and electronic music (Briscoe & Curtis-Bramwell: 1983, p. 56)

The Fairlight CMI enabled its users to be less reliant on the mixing desk referred to as the 'Glowpot Desk' and avoided the practical difficulties of cutting and splicing tape to create sound effects. These included strange sounds of everyday life that are difficult to imagine – 'ANY type of sound' – such as germs eating plaque on teeth. One of the Workshop's composers Roger Limb explained how it was constructed:

I scrunched an apple and put it on tape, then fed it into the Fairlight and started playing it on the keyboard. It worked very well as an effect. There was a sound there that could be arranged in a musical fashion – which brings up the great big important question to which all of us reply 'Goodness knows!' The question: 'When is a sound a sound, and music music?' In other words, where is the borderline between sound and music? (p. 59).

As well as being employed to assist with the imagination and realisation of unusual sounds, the Fairlight CMI would be used in the BBC Radiophonic Workshop to create new textures by mixing the sounds of acoustic instruments with other noises. Composer Peter Howell is described as having built 'a battery of composite sounds, and named them according to their components. Clarjang is made from a clarinet sound combined with a metallic jangle. Pluckvox combines the plucking of a mandolin note with the second half, his own voice' (pp. 98-99). Howell praises the Fairlight CMI as another step in the onward march and advance of technological progress; in a statement that might have been lifted from the manufacturer's literature, he describes its creative possibilities as endless: 'With just the Fairlight there are apparently no limits. The road goes on for ever [*sic*]' (p. 99). However, the introduction of the Fairlight CMI was not the next stage of a linear path. The new

digital sampling technologies and the use of ‘real sounds’ was welcomed for providing a solution to problems that had been experienced through the introduction of an earlier music technology: synthesized sounds. Desmond Briscoe stated:

In the past, electronic sound has tended to be dehumanized, and boring, because it was created from very basic waveforms. Natural sounds have much more information in them. They are warmer and more interesting than synthesized sounds; using the Fairlight’s ability to provide the composer with a means of playing real sounds is a return to the early days without all the disadvantages of tape manipulation (p. 57).

Rather than a revolutionary instrument that could create the sounds of the future, the Fairlight CMI was being used by the BBC Radiophonic Workshop to recover the texture of sounds that had been lost as a result of technological changes in the past.

(ii) Richard Burgess, Kate Bush, Peter Gabriel

One of the first commercially available recordings to feature the sampled sounds of the Fairlight CMI was Peter Gabriel’s *Melt* album, released in May 1980 with Peter Vogel credited on the sleeve notes with duties relating to Computer Musical Instrument. When asked about his role on the album, Vogel told me ‘I was staying with Peter Gabriel while he was recording *Melt* and gave him some tuition on use of the CMI (which he had bought). We recorded some tracks that ended up on that album’ (Vogel: 2011). Gabriel began to use it by experimenting with the sounds of smashing milk bottles and bricks banging together and his biographer Spencer Bright suggests that these sampled sounds can be heard as the track ‘I Don’t Remember’ fades out. Franco Fabbri speculates that the Fairlight may have been used for string sounds on ‘Start’ or the bagpipes in ‘Biko’ but concludes: ‘all of these (except perhaps for the bagpipes) could also be generated at that time by analogue polyphonic synths’ (Fabbri: 2010, p. 179). According to the sleeve notes, the bagpipes are synthesized and the results of Gabriel’s experiments in *musique concrete* with a Fairlight CMI are not audible. In this case, the Fairlight CMI was used as a digital

synthesizer for the purpose of imitating instruments in line with the original design objectives of Ryrie and Vogel.

The results of using the Fairlight CMI to sample the sounds of everyday life are more obvious on Kate Bush's album, *Never for Ever*. Also released in 1980 and assisted by Richard Burgess who had spent time learning to programme the device, the sound of breaking glass that Gabriel had been playing with punctuates its first song, 'Babooshka'. Burgess explains the process of recording and playing back the sounds:

We took glasses I guess from the kitchen. I don't know where they came from but we had, I seem to remember, a concrete block or something in the studio and we just threw them down on the concrete block and recorded it and then I stacked up the glass. We had several samples and we stacked them up and then just found a combination of keys that made the best sound. The pitch changing is all from the keyboard on the Fairlight and mostly they were clusters, semi-tone clusters on the keyboard (Burgess: 2011).

One of the differences between the use of *musique concrete* by pop and rock groups of the 1960s and 1970s and the digital sampling of the sounds of everyday life on the Fairlight CMI in the 1980s was that users were able to organise these sounds melodically or rhythmically using its six-octave keyboards. The song 'Army Dreamers' incorporates the sounds of cocking rifles to emphasise the anti-military theme of wasted lives and lost opportunities and Burgess was able to use the Fairlight CMI to organise and perform these sounds using a keyboard device in ways that were not possible using the older technologies of magnetic tape, sellotape, and scissors. It would also be used to sample acoustic instruments such as the penny whistle but Bush did not want the sampling instrument to replace the role of the performer:

I don't feel that I want to create the world's greatest cellist on the Fairlight. I'd rather get a really good cello player in and record him with a good engineer and then use the Fairlight to do something that complemented that. The most exciting thing for me is the combination of real and natural sounds

and extremely electronic synthesized ones' (quoted in Diliberto: 1985, p. 72).

Burgess and Bush used the Fairlight CMI to incorporate found sounds into these recordings because, to her, they sounded like 'real sounds' and 'natural sounds'. The composers of the BBC Radiophonic Workshop used the Fairlight CMI to create new sounds from unusual juxtapositions and appreciated a return to 'real sounds' after the experience of using analogue synthesizers. Peter Gabriel experimented with sampling the sounds of smashing bottles but continued using the device much like a digital synthesizer. Along with Eberhard Schoener's re-creation of a Steinway piano, it is an example of the Fairlight CMI being used in accordance with the original design objectives of Fairlight Instruments. However, Peter Vogel of Fairlight was the one programming the CMI: the user of the musical instrument was also its designer.

Conclusion: Interpretative Flexibility, The Missing Masses

The designers of the Fairlight CMI wanted to use digital synthesis to replicate the sounds of acoustic instruments. Digital sampling was their solution to this problem. My argument is that many actual users were less interested in using the technology to imitate the sounds of acoustic instruments and began creating libraries of sounds they had recorded. For some, this was for reasons relating to sound fidelity. JJ Jeczalik of Art of Noise embraced the low fidelity sounds of the Fairlight as a creative tool and described to me how the fears about redundant orchestras encouraged by Fairlight's advertising campaign had the effect of increasing his own employment opportunities:

There was a lot of press at the time, which did me no harm in terms of getting work. People who were going: "it's the end of the orchestra. This is going to take over everything. Musicians are going to be redundant" and all this sort of stuff. And a lot of people wanted to see what all the fuss was about. So I was going on sessions with this kit, sampling things and

explaining that actually it had a very short sample time and to loop it you had to have all the tuning aspects and everything going for you otherwise it sounded pretty bad to be honest (Jeczalik: 2011).

According to Jeczalik, George Martin was one recording industry veteran unimpressed by the results of new digital sampling instruments like the Fairlight:

One of the sessions I was working on was Paul McCartney and he'd had a trombonist in and this was with George Martin as well and he said let's put the note in from the trombone and then we can have a horn section so sure enough I put it in, tried to loop it. It was really difficult to loop it to get any sustain and he pressed the call and he turned to me and he said "that doesn't sound much like a horn section does it?" and I went "No. Well, it's not. That's not what it is. It's a sample of trombone played with 4 notes". And it became very apparent at that moment that it was pointless sampling other instruments (*ibid.*).

Users clearly differed in their views about whether the Fairlight was able to replicate the sound of acoustic instruments like a trombone or a piano in a way that was faithful. Was Eberhard Schoener able to sample a Steinway in ways that audio data consultants could not or was he just willing to accept lower levels of sound fidelity? We enter the philosophical debate about realism and the reproducibility of sound stimulated by Edison's tone tests, referred to by Memorex in the 1970s, and revived in the 1980s adverts of Fairlight and other designers of digital synthesizer and sampling instruments. Rather than focusing on questions of faithfulness and authenticity, which as Sterne suggests can only be answered by listeners, performers, users and their experiences of music technologies, I want to end with a few thoughts about how these short case studies have been informed by theories and concepts from Science and Technology Studies and how the SCOT approach might continue to be applied to the design and use of music technologies like digital sampling instruments.

One of the key concepts from SCOT that is useful in understanding the ways in which music technologies such as the Fairlight CMI were used in a variety of different contexts and in ways unforeseen by their designers is that of *interpretative flexibility* (Pinch & Bijker: 1987), the idea that new technologies are designed and developed, undergo changes as a result of feedback from users before arriving at a period of stability and closure where a dominant use of the technology emerges. For example, the Moog synthesizer moved away from its original conception as a studio instrument to becoming a live performance instrument with the development of the more portable Minimoog in the 1970s. One problem with this concept, though, is that the use of music technologies and instruments might not end with a form of closure. For example, the design of digital sampling instruments began with the goal of replicating acoustic instruments before shifting towards uses like the creation of new sounds and the sampling of the sounds of everyday life. It is unlikely the designers of the Fairlight or the Synclavier could have predicted that the digital sampling technologies they introduced would become associated with the quotation of pre-existing sound recordings in genres like hip-hop in the mid-to-late 1980s. The appropriation of sound recordings, however, is only one way that digital sampling instruments are being used in the twenty first century. There is no closure; there is still interpretative flexibility.

In telling the story of the Fairlight CMI and the early days of digital sampling instruments, I have left out important players, actors, and companies. When Bruno Latour asked where are the missing masses in our studies of societies and their technologies he was referring to non-human actors: ‘the missing masses of our society are to be found among the nonhuman mechanisms’ (Latour: 1992, p. 248) and these might include the technologies of music making such as synthesizers and samplers. In his study of the Minimoog and its adoption as an instrument in rock, Trevor Pinch writes that ‘it is sellers who tie the world of use to the world of design and manufacture. Sellers are “boundary shifters”. They are the true “missing masses” of technology studies’ (Pinch: 2003, p. 270). He was referring to David Van Koevering, one of the individuals

responsible for developing a market for the Minimoog and, similarly, there are individuals such as Bruce Jackson who was responsible for distributing and marketing the Fairlight CMI in the USA. That though is another story for another day. By starting with and following the instruments, designers, and users of these technologies, I have tried to make a contribution to the field of organology and the study of musical instruments by sketching out the beginnings of a conceptual framework to make sense of socio-technical processes including the design and use of digital sampling instruments. By following the instruments, designers, sellers and users of music technologies like digital samplers and synthesizers, we can begin to understand the entangled relationship between human beings and non-human technologies and make sense of the socio-technological processes of making music.

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Notes

[i] These were part of an exhibition called Oramics to Electronica, which ran from 29 July 2011 to 13 July 2015. See <http://www.sciencemuseum.org.uk/oramics> for more information.

[ii] It is worth pointing out that Akrich, along with Bruno Latour, is more closely associated with Actor Network Theory (ANT) than the SCOT approach to studying technologies. ANT ascribes agency to both humans and nonhumans, a flat ontology rejected by social constructivists like Bijker and Pinch who write: ‘the typical ANT step of making no ontological distinction between human and nonhuman actants is not made in SCOT’ (Bijker & Pinch: 2012, p. xxii).

[iii] For a history of the BBC Radiophonic Workshop, see Niebur: 2010. It was re-established as The New Radiophonic Workshop (NRW) in May 2012 by the BBC in partnership with The Arts Council of England.

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