

Examining the Perception of Liveness and Activity in Laptop Music: Listeners' Inference about What the Performer is Doing from the Audio Alone

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ABSTRACT

Audiences of live laptop music have been known to express dismay at the opacity of performer activity and question how “live” such performances actually are. Yet motionless laptop performers endure as a musical spectacle from clubs to concert halls, suggesting that for many this is a non-issue. Understanding these perceptions might help performers better achieve their intentions, inform interface design within the NIME field and help our understanding of what ‘liveness’ means in the context of new performance practices. To this end, a study of listeners’ perception of liveness and performer control in laptop performance was carried out, in which listeners were presented with several short audio-only excerpts of laptop performances and answered questions about their perception of the performance: what they thought was happening and its sense of liveness. The study suggests that listeners naturally associate liveness with perceived performer activity (such as improvisation and the audibility of gestures). Listeners were also shown to be able to recognise generative music processes,

Keywords

laptop performance, liveness

1. INTRODUCTION

Live laptop performance appears to be subject to an inherent philosophical anxiety, stemming from its historical status as deriving from, but being fundamentally different to, live instrumental performance: the performer commands control over a powerful, layered, mesh of sound, but as far as the observer is concerned, they might as well be checking their email. Whilst the recent proliferation of digital musical interfaces has seen a resurgence of gestural performances with digital instruments, many performers choose not to work gesturally, having carved their niche in the meta-control of machine-produced elements using standard computer interfaces: clicking buttons, entering text, dragging-and-dropping and so on. Embracing this approach, in the words of Stuart, they “sit behind their screens with little or no

perceivable movement, lost in thought as they manipulate files and patches” [14]. This is presented by some as a problem, and work within the NIME community often attempts to bring to the field a more traditional sense of performance and, specifically, tangible gesture [10,15].

Such issues are exemplified through many instances in popular music. The electronic duo Autechre are intensely active in their performances, but choose to conceal themselves in darkness; fellow electronica pioneer Aphex Twin performs DJ sets of his own music, but draws from a collection of custom unreleased tracks, sometimes hot off the press; the duo The Books play guitar and cello over backing tracks of their studio-produced work, accepting that they could not perform the intricate electronic parts of the compositions live.

Cascone [5] contextualises the perceived problems of laptop performances within the concert hall tradition, the political economy of pop and the expectation of ‘spectacle’. Sitting uncomfortably in this context, he proposes that laptop musicians need to move away from spectacle and find their own way to establish ‘aura’. It could be argued, from these and other examples, that audiences have simply adapted to the nature of liveness in electronic music. Audiences may perceive the sonic activity itself as a type of performance, to be exploited by experimental artists, as suggested by Stuart in his notion of aural performativity [14]. They may simply not conceive of energetically performing persons as part of the experience of live music, a view advocated by artists such as Francisco Lopez [11], who claims that the notion of the performing artist is a hangover from past traditions. Yet despite this, audiences appear to value the presence of the artist, ‘live’; as Prior says, “‘aura’, far from disappearing, is alive and well in attitudes to the immediacy and presence of the live performer” [13].

In our view much contemporary electronic music practice does involve a performer meaningfully controlling the music, often not in a gestural, instrumental manner, yet otherwise true to a notion of “musical performance”. The performer’s control may be of more or less interest to different members of the audience. Regardless, concerning perception of what is happening, laptop performance is not as utterly opaque as some have implied from the visual opacity of the performer’s actions. Information about performance control can also be found in the audio itself. An understanding of what performers do is growing among listeners of emerging electronic subgenres, even when performer actions are visually obscured. Performers in some genres seem to purposefully foreground this liveness in the audio itself.

We believe that instead of acknowledging these subtleties, liveness in laptop performance is too easily cast in extremes: the standard of instrumental performance versus the

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performative shortcomings of the opaque laptop. The reality requires more study, along the lines of [6]. In this paper we explore the idea that a person listening to an audio recording of a laptop performance can make statements about liveness and other qualities in the performance, and describe what they think the performer might be doing. We do not claim that listeners can necessarily infer the right answers (though they may do), but that their perceptions can be revealing, and probably ultimately influence how performers conceive of their performances. We expect that listeners frequently make informed guesses about performance activity and in doing so manage to experience laptop performance not so differently from other musical performances. The use of generative elements and increasing audience awareness of such methods further complicates considerations of liveness. While there has been much discussion of where to attribute authorship when generative elements are used, there has been little discussion of how their use impacts perceptions of liveness.

We have conducted a survey and used the responses to examine both listeners' conceptualisations of liveness and their perception of performer action, instrumentation, and generativity. We present our findings and use them to develop a more detailed understanding of liveness and the perception of performance in laptop music.

2. Concepts and Definitions

While aware of the analysis of liveness in [1,2,7,8] and others, we were interested in leaving the definition of 'liveness' relatively open within the survey. We were not only interested in how participants qualified liveness, but also in what was perceived as not-live: whether this was looping, backing tracks, generative processes, or things sounding sequenced.

Performance and performativity have varied meanings. In a common contemporary usage [3], notions of performativity can be applied to even the most everyday behaviour. From this viewpoint the artists we discuss are undoubtedly performing. Even if doing nothing or even faking, the essence of their performance lies in the fact that they stand on stage, in control, and with all eyes on them, and thus avail themselves to an analysis of performativity. In some forms of dance and street performance, after all, motionlessness is itself clearly performative. Such a perspective therefore relieves us of the problem of explaining performance in terms of physical action. By contrast, from a traditional understanding of instrumental musicianship, we can define performance as what the performer on stage is doing to control the music being heard. We can also include the notion that a computer (or other non-human entity) can be a performer too by taking part in musical decision-making, and that some of the things that contribute to the experience of a musical performance happen prior to the concert (e.g., the preparation of material or of performance conditions, as in prepared instruments).

We define generativity as any process whereby what happens next is not determined directly by the performer, but indirectly by algorithmic processes set up by the performer. This includes full compositional decision-making systems such as the improvising agents of Pachet [12], or simple uses of randomness to reconfigure melodic patterns. Whilst this definition allows for some very trivial cases, including sample-and-hold LFOs, we assert simply that 'more generative' systems would be identified with being 'more sophisticated', as perceived by listeners.

We define improvisation as any decision-making that is made during the performance rather than in advance.

While we did not offer definitions of liveness, performance or improvisation to those taking our survey, as we wanted to understand how these terms would be interpreted, we did

provide a definition of the less common term 'generativity': "computer processes such as randomness for making melody or beat patterns".

3. Study

3.1 Related Work

Others have done studies of listening and perception, but there remains an absence of empirical data on perceptions of laptop performance. Gurevich and Fyans [9] undertook a related study in which they showed subjects videos of performances using gestural 'DMIs' (Digital Musical Instruments). Taking an 'ecological' approach in which performances are seen as occurring within networks of relations, they considered the effects of new technologies on creating new musical ecologies and performance practices. They note that interacting with a digital system through moving a slider requires fundamentally different skills – often intellectual, as oppose to perceptual-motor – than interacting with a drum through striking it. However, they are interested in how skill is perceived predominantly through visual clues, and we would like to bring a similar focus to the purely aural. In addition, while their study involves electronic instruments, it does not examine the laptop itself as an instrument.

Bergsland and Tone [4] presented a vocal performance to two groups of students, one of which was blindfolded. Whilst the seeing group focused more on the performer's actions and technologies used in the performance, there were only minor differences in describing the amount of skill and control in the performance. Whilst one could conceive of the visual dimension as adding to an audience's understanding of the performance, it was also shown to be a distraction, as the audience tried to figure out what was happening, rather than listening to the music.

Against this background, there is a place for additional studies of user perceptions of live laptop music, with a focus on listening.

3.2 Aims

Through this survey, we set out to examine:

- *Conceptualisations of liveness*: what perceived aspects feature in listeners' formation of what is live, such as whether the performer is directly manipulating sound through gesture, whether the performer is highly active (regardless of how they are controlling the sound), whether the music is non-repetitive, contains preconceived elements, and inferences made from indirect factors such as genre.
- *Listeners' identification of specific performer actions and instrumentation*, including the perception of generativity and gestures such as 'moving a fader' or 'hitting a button'.

We approach this use of survey methods with an awareness of the danger of over-interpreting the results. Amongst many reasons for this two prominent points to note are: (1) our survey was directed towards respondents who would have some degree of familiarity with electronic music and contemporary electronic music culture, through the choice of mailing lists that it was promoted on. We did not go to great pains to classify respondents in this first instance. In the future results could be better distinguished based on background; (2) the survey explicitly requires participants to make guesses with no benefit of certainty. Thus all answers are inherently speculative. Some answers might not be confidently asserted, while some might be very confident assertions based on a thorough understanding of the processes, performer and tools involved.

4. Method

We gathered eight recordings of recent live laptop performances from eight different artists (five solo artists and three duos) and selected two minute excerpts from each. The performances were made in live public concerts, not for the purpose of this study. The rationale for our choice of artists was that they performed with laptops, and we were in prior contact with them and thus able to obtain information from them about what they were doing, along with the audio. Beyond this requirement, we simply set out to gather a diversity of laptop performance styles, without any preconceptions about what styles might provoke what responses. We presented these in an online survey and asked survey participants to listen to three pieces and answer a number of questions. Pieces were presented anonymously and in a random order.

Participants were recruited through an email call-out, targeted mainly at communities of electronic music practice. Participants were invited to respond to three pieces, but were able to carry on to respond to all pieces if they wished. Participants were asked an open-ended question about what they thought the performer or performers were doing to control the music, including what type of interfaces they might be using. Participants were not told anything about instrumentation or number of performers, except that the study was of live laptop music performance. They were asked to be as specific as possible, referring to specific sounds and time-stamps in the recording. They were then asked a number of Likert-scale questions relating to (i) perceived familiarity of the piece/performer, (ii) the perceived degree of improvisation, (iii) the perceived degree of liveness, (iv) the perception of mistakes, (v) how preconceived the material sounded, (vi) the perceived use of backing tracks, (vii) the perceived level of activity of the performer(s), (viii) the perceived use of generative elements, (ix) the perceived use of user interfaces besides the laptop, and (x) the level of enjoyment. Participants were also asked their age and gender, whether they made electronic music, whether they played an instrument, how often they went to performances of electronic music, and their level of knowledge of electronic music software.

A repository containing the original survey questions, descriptions of the tracks and their performers' activities, and the original (numerical only) survey results is available to accompany this paper.¹ A very brief overview of the tracks is given in Table 1, but readers should refer to the more detailed descriptions given in the online documents to get a better idea of the material. Links to the excerpts are included there.

5. Results

We had 146 responses to our survey, resulting in a response rate per excerpt of between 24 and 33 (owing to the random allocation of excerpts). The age of participants ranged from 18 to 69. The majority of respondents both created electronic music and played an instrument (74%), and went to electronic music concerts sometimes (40%) or often (38%). Although 29% described themselves as experts and only 3% described themselves as knowing nothing at all, the distribution of self-evaluation of expertise was widely spread between these two extremes (3% 'know nothing', 11% 'rough idea', 20% 'some experience', 18% 'pretty experienced', 19% 'know a lot', 29% 'expert'). Text responses indicated that a number of participants objected to the idea of having to guess something that was impossible to know, whilst others gave only statements of

preference or offhand comments. However, in general respondents made reasonable attempts to listen and make guesses about what the performers were doing. Variation in numerical results was relatively high and given the small sample sizes responses were not analysed for significance.

5.1 Liveness

We first look at perceptions of liveness, considered in terms of the text-based responses and the relevant questions (ii-vii).

ID	Description	M	G
1	Techno, Ableton, FX tweaks, fades.	Y	N
2	Avant garde, MaxMSP, sample triggering and FX tweaking.	N	N
3	Entirely live-coded Extempore, statistically generated melodies and drums.	Y	Y
4	Entirely live-coded custom rhythmic language, mostly percussive.	Y	Y
5	Live coded system, live triggered events. Meta-control and FX control.	N	P
6	Electronica, duo using Ableton, SuperCollider, and a gestural controller.	Y	N
7	Electronica, drums and simple melodies, loop-based with loop triggering and FX tweaking.	Y	P
8	Avant garde breakbeat, duo using semi-generative elements. Triggering of clips, fades, meta-control of statistical generative elements.	P	P

Table 1: Basic summary of tracks, M = metronomic, G = generative, P = partially

The responses to the question of perceived liveness themselves show a slight overall tendency towards viewing excerpts as live, with track 5, followed by 2, 6 and 8 most commonly perceived as live and track 7 in particular viewed as non-live. The perception of track 5 as live confirms a traditional instrumental sense of liveness, in which triggering via drum pads was correctly perceived and is the obvious reason for participants associating the track with liveness. Track 2 has a similar triggered feel, supporting this view. Tracks 6 and 8 do not involve drum pad triggering, and the basis for the perception of liveness here is less clear.

Tracks 2, 5 and 8 were also the most commonly regarded as improvised and track 8, although not live triggered, has a chaotic, erratic structure, which seems the most likely explanation for the perception of liveness. Interestingly, though, reports of performer activity were more ambivalent, suggesting that conceptualisations of liveness do not require intense activity.

The reporting of track 6 as live is harder to interpret, but was also weaker overall. Participants describe hearing the performer 'manually tweaking' or hearing a 'little tweaking' ('tweaking' being a recurrent term used throughout the descriptions) and that the performer 'manipulated pre-structured elements', implying that the performer used pre-composed material and the liveness consisted of small but audible adjustments to parameters within pre-determined structures.

These results show the expected association between liveness and a sense of improvisation. Tracks perceived as being live tended to be perceived as improvised but with exceptions that may be of interest. For example track 7 was deemed the least

¹ <https://www.dropbox.com/sh/x118ocivurf7r/0AZUqOqCO3>

live, followed by track 1, whereas track 1 was deemed the least improvised, followed by track 7.

Further studies might not demonstrate a strong correspondance between improvisation and liveness, as many performances are clearly live yet not improvised. For example, a track that sounds more pre-emptively structured is less likely to be perceived as improvised, but the artist may still be active in creating the structure. Alternatively, in the case of, track 1 which was viewed as neutral in terms of liveness but very un-improvised, the performer is engaged with controlling a ‘lead voice’. An improvised track, by contrast, may convey a sense of disorder and ambiguous structure, as exhibited by tracks 2, 4, 5 and 8. Despite being least live, track 7 was third in terms of

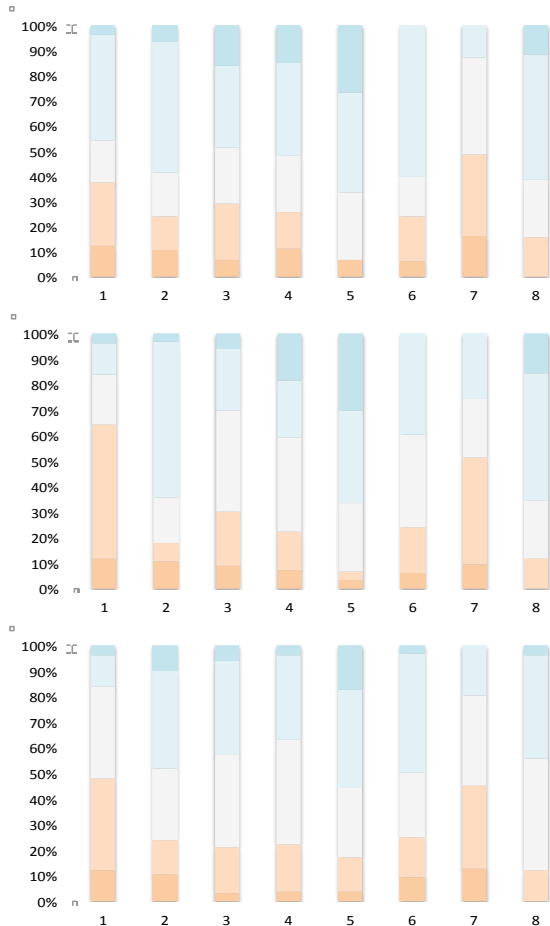


Figure 1: Perceptions of liveness (top), improvisation (middle) and activity (bottom) for each track (brighter blue = stronger agreement, brighter orange = stronger disagreement, light grey = neutral).

perception of there being a backing track. With the exception of track 7, however, which may be anomalous, we also note that participants may have been biased against declaring tracks as non-live given that the survey was described as being about ‘live’ laptop music.

Liveness and activity also appeared to be closely related for some tracks, supporting the idea that liveness is perceived as the degree of activity of the performer. Liveness and the perception of mistakes were somewhat related for some tracks. Track 5 was associated with a stronger perception of mistakes. Track 2 less so. Track 8 was perceived as being reasonably live despite not being perceived as containing mistakes. As the graphs in Figure 1 show, responses were highly varied, with most tracks receiving a full spread of opinions. We consider

some of the variation by looking at text responses and other questions for specific respondents. For the most widely spread excerpt, track 1, the respondent who viewed the track as most live showed in their text response a good awareness of what the performer was actually doing and considered the performer active. However, this respondent also viewed all of the tracks they listened to as sounding live, suggesting they simply accepted them as such. Those who rated the track as non-live viewed the music as boring and repetitive and considered the performer inactive.

Text responses gave an indication of other factors that influenced perceptions of liveness. Participants often assumed something was played live based on timing or quantization. Comments show how ‘inaccurate’ timing was seen to be played live: “There are some beats that aren’t locked/tightly quantised-

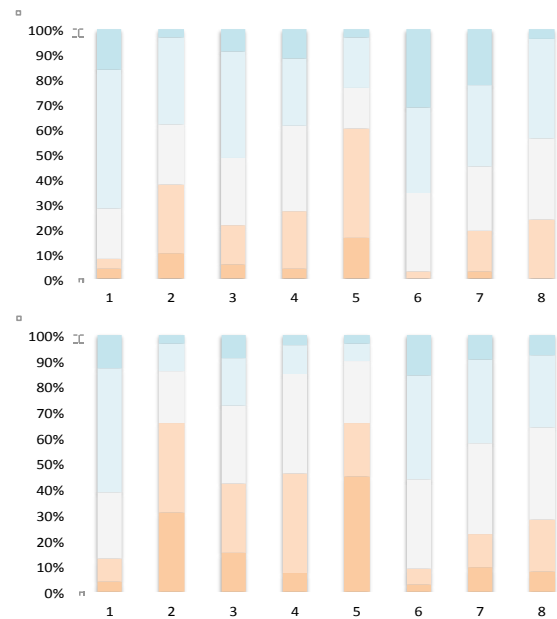


Figure 2: Perceptions of preconceivedness (top) and backing track (bottom).

this could be played live on drum triggers, or a wonky loop triggered, or again a backing track,” “The background strings seems to be played from a keyboard as they are not quantized, and they are a bit random”, “it does sound performed because of the lack of precision of the timing”. This reveals a strong association between the conceptualisation of live and the idea of human instrumental performance. Of course we are aware of the possibility that the performer might be sampling live keyboard, in which case seeing the performer play would clarify whether this was the case.

Similarly, tight timing was seen as indicative of non-liveness: “The drums are clearly quantized”, “the military bugle seem quite precisely timed so I would be impressed if they were cued in live.”

Other examples show the basis on which participants identified gestural actions: “the ‘skronky’ twisting sounds are raw enough to be created live by a person using an odd interface (knobs, sliders or Wacom-style pen”;

“the loud note repeated twice so fast suggests that this is a start point being punched in using a drum pad or similar” and even attributing a gesture to “experimental physical interface (light sensors or similar).” Tracks 2 and 5 were perceived more as being free of a backing track. These pieces were non-metronomic and involved a small number of in-unison or well-coordinated voices. Tracks 3 and 4 were also perceived as being free of backing tracks, although

less strongly. These were the two pure-live-coded performances. In the case of track 3 this is surprising because there appear to be background elements such as a beat. In the case of track 4, the instrumentation is stark so the inference is less surprising. It is possible therefore that they involved subtle coordination and synchronisation of elements enabled by the live coding. The two tracks most associated with backing tracks (1 and 6) were also the least associated with generativity. Thus a hypothesis is that regularity and repetition are more indicative of backing tracks, despite our expectation that precision and complexity might be equally associated with backing tracks. This would be interesting to examine further, for example by considering perceptions of complex studio compositions.

Tracks 1 and 6 were strongly associated with preconception, whereas tracks 2 and 5 were disassociated with it. Preconception may be negatively related to generativity but not necessarily with liveness (recall track 6 is associated with liveness and improvisation). This suggests that preconception is associated with fixed composed elements. Thus a "preconceived generative element" or a "preconceived configuration" is a weaker concept.

5.2 Generativity

Generativity was accurately identified by a number of participants. We found this to be a reasonably surprising result. Most surprising is that track 5 is associated with generativity despite also being associated with live triggering. Tracks 3, 4 and 8 were strongly associated with generative elements (correctly – i.e., in each track there is some algorithmically controlled randomisation of what is happening). Track 2 was incorrectly mildly associated with generative elements. The only track strongly disassociated with generative elements was track 1. We interpret this as meaning that continual micro-changes in drum and melodic lines that are typical of generative music are easily identified as such and distinguished from variation that derives from pre-composition. This may either be because they have a distinctive 'computer generated' quality,

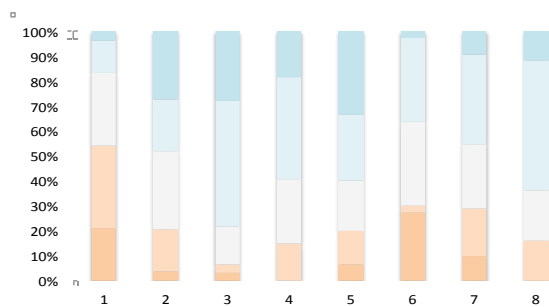


Figure 3: Perceptions of generativity.

given away by traits such as systematic loudness variation and rhythmic randomness, or because the ongoing variation is evident and clearly not human-controlled.

Some text responses confirm which elements are being perceived as generative, but do not indicate how these views of generativity are formed: “changes in music patterns are changes of algorithms,” “melody and rhythm both sound generated,” “the melody seems algorithmically generated”. Respondents also made reference to randomness as a computational process: “note in tracks are chosen randomly”; “piano in a certain range of notes randomized in notes speed and level”.

The perceived generativity in tracks 2 and 5 are harder to explain. Generative systems may be meta-controlled (e.g., a slider controlling the pitch-range of a randomly modulated melody), and thus both live-controlled and generative. This may explain the correspondence between generative elements

and liveness, or it may be that respondents consider generative elements to 'have liveness'. This distinction would make an interesting future study.

The two pure live coded tracks (3 and 4), strongly associated with generativity, were also correctly strongly identified as being laptop-only. Track 2 was strongly identified as being laptop only, possibly corresponding to written responses that the performer was clicking and dragging on a waveform or timeline to cut up an existing pattern, and also possibly to the piece's sparse instrumentation. Track 5 also has sparse instrumentation but was clearly identified as using drum pads. Some respondents suspected track 2 as using drum pads, but we believe there was less evidence of tightly timed rhythmic control, thus less evidence from drum pads.

5.3 Specific Knowledge

Some participants revealed specific knowledge of software and techniques that they thought they could identify in tracks, sometimes with strong convictions. Participants would associate certain sounds or styles with specific software, for instance, the sound of the built-in effects in Ableton Live: “Ableton Live loop slicer. I'm willing to bet a few Euros on this. The choppy sounds exactly like that” (in fact the piece in question was entirely live-coded); “mostly the piece sounds like Ableton’s inbuilt effects”. Sometimes pieces of software are associated with the sorts of musical processes they might afford, for instance, “something tells me it's a Max patch sequencing sounds in a partly predefined fashion.” These responses may reveal biases either towards software well known to the respondent, or to software that the respondent knows is commonly used (both Ableton and Max being the most common in their respective areas), and the ways in which they expect it to be used.

6. Discussion: Auslander and Liveness

Although these are only indicative results, they show a correspondence between perceptions of activity, improvisation, and liveness. A natural conclusion from these results then is that liveness is being associated first with human action (bodily liveness), with triggering being more salient than tweaking (possibly because rhythmic action is more noticeable). Liveness is then associated with other forms of control (cognitive liveness), which include anything indicating ‘live’ decision-making, the stronger manifestations of which are understood as ‘improvisation’. We could also imagine a third completely imperceptible level of ‘live’ which merely requires the artist to be present, and presenting their own creation.

Our study makes no comment on what Stuart refers to as ‘aural performativity’ [14] since we have stripped the essential contextual elements away. This remains a parallel and complementary conceptualisation of live musical experience. But we feel it affirms our belief that forms of non-gestural control can be heard as live performance, thus broadening the idea of liveness as a manifestation of performer control beyond the paradigm of instruments being manipulated by traditional physical gestures.

The results can be compared with the treatment of liveness in the writings of Auslander [1,2], who argues that there is nothing essential in the mode of presentation of musical material, or the material itself that distinguishes live from non-live. Thus film and theatrical performance do not naturally fall into categories of non-live and live respectively, but can drift across categories according to context. For example, recorded film material can be placed into a theatrical context without it creating a confusion of liveness. Auslander preferences a cultural-historical interpretation of what it means for something to be live, with liveness arising historically as a concept in response to the emergence of recorded media, and specifically

in opposition to the term mediatised. Thus Auslander's notion of liveness is coherent with the view that electronic musicians and their audiences have naturally coevolved an understanding of liveness that is relevant to their practice, regardless of the use of sampled and precomposed material in performances, the DJ being the definitive case in point. Auslander adds that "the anxiety of critics who champion live performance is understandable, given the way our cultural economy privileges the mediated and marginalizes the live." [2]

In this light, we consider the following four points developed by Auslander:

1. Liveness and mediatization derive their difference from historical factors rather than ontological conditions [2]. Live performance cannot remain "ontologically pristine" [2]. "Mediatized" means "a product of the mass media or media technology". [2].
2. "Live and mediatized performances are parallel forms" [1].
3. The live gets overwhelmed by the mediatized [1; 2].
4. Liveness exists dually in opposition to the quality of being recorded [2], yet doesn't exist before 20th century audio-visual technology, written and oral accounts are not considered as recordings [2].

From the observed perceptions of laptop performance, we believe a concurrent, more traditional sense of the terms is needed:

1. Liveness can be based on the prior perception of performer activity or decision-making.
2. Liveness and mediatization can co-occur. Live laptop music involves the performance of the mediatized. Mediatization may in fact amplify perceptions of liveness.

From this viewpoint, audiences call something 'live' when they feel aware of performer decisions, typically but not always manifest in explicit physical activity in the moment of the performance, and this is independent of the media used, whereas for Auslander 'live' comes as a historically determined duality with 'mediatized'.

But while 'live' in this usage is said to appear in 1934², seemingly a time of increasing use of media technology, its use is said to mean 'in person'. 'In person', with the meaning of 'by bodily presence' dates to the 1560s. Where 'live' is satisfied by the concept of 'bodily presence', a live performance is one in which the bodily presence of the performers can be perceived, with apparently increasing levels of presence. That bodily presence may have become more abstract and cognitive in response to the laptop mode of performance, crossing over into the technological sphere.

7. Conclusion

As we have stressed, the results are not conclusive but serve as the basis for hypotheses which also largely confirm our intuition. Whilst our study does not and cannot show that audiences can know what a laptop performer is doing, it suggests that (a) certain processes, tools and techniques of laptop performers are understood (b) different levels of liveness are apparent, from lower level event-triggering and effect-tweaking to more meta-level process control and (c) there are also competing notions of liveness (and its opposite), and various things will signify liveness to certain audiences. The results also support the idea that the identification of specific pieces of software (such as Max or Ableton) and controllers (such as the monome or MPD) reflect different 'idioms', much as one might describe the idiomatic sound of a Stratocaster or more traditional instruments.

The ideas discussed here suggest further studies, particularly more detailed interviews and observations, that would truly engage with the subtlety of notions of performance using new (and old) technology. These hypotheses should be tested against alternative explanations, such as the possible claim that our respondents are left to guess and the opacity of the audio leads to ambivalence, except in the cases where gestural performance cues give a clear reason for reporting liveness. There may be other views of liveness that are not present in the audio. If we had provided longer video footage of a DJ mixing, for example, then they may have been identified as live in a way that the current study would never have identified. These dimensions are also important to explore.

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² Etymology examined using the Online Etymology Dictionary <http://www.etymonline.com/> (accessed 5/02/2014).