Co-Creation: Early Steps and Future Prospects

George Lewis

Co-Creation: Early Steps and Future Prospects

George Lewis
New York, March 2020

In *Bernard Lubat, Gérard Assayag, Marc Chemillier. Artisticiel / Cyber-Improvisations. Phonofaune, 2021, Dialogiques d'Uzeste.*

I've been making interactive computer music and installations since around 1979, focusing on the development of programs that analyze aspects of their environment (in most cases, the improvisations of other human performers) in real time. The programs use that analysis to guide their generation of complex responses to what they find. The programs also establish their own independent generative and analytic behavior; they do not need real-time human input to generate music.

My work on the *Voyager* "interactive virtual improvisor" and "virtual orchestra" systems, which began in 1987, has been taken by many as emblematic of early work in this area; indeed, in his 2016 doctoral thesis on human-computer music improvisation, Jérôme Nika, who received his doctorate in computer science under the guidance of Gérard Assayag and Marc Chemillier at IRCAM and the Université Pierre et Marie Curie, graciously called *Voyager* a "pioneer system" (Nika 2016). Even so, my work at IRCAM from 1982-84, which preceded the advent of *Voyager* (Beurot 1982, Davaud 1984, Lewis 1984), could be regarded as an early adoption of Assayag and Chemillier's notion of co-creation.

Like a number of other composer-technologists, I have drawn upon AI and practices of free improvisation in creating a kind of music making that includes machine subjectivities as central actors. These "creative machines" (Lewis 2007) have been designed to stake out musical territory, assess and respond to conditions, and assert identities and positions—all aspects of improvisative interaction, both within and beyond the domain of music. In an article from 2000 on *Voyager*, I wrote that this kind of musical work "deals with the nature of music and, in particular, the processes by which improvising musicians produce it. These questions can encompass not only technological or music-theoretical interests but philosophical, political, cultural and social concerns as well" (Lewis 2000, 33). In fact, I can say that much of my work in critical improvisation studies (Lewis and Piekut 2016) emerges from my practices with interactive computing. However, I do depart somewhat from Assayag and Chemillier's model of co-creation, and in this brief essay, I'd like to review an alternative model that has guided my work in this area from 1979 to the present day.

Rainbow Family (1984), commissioned by IRCAM and created during my three years of residence in Paris, was the first of my interactive virtual orchestra works (Lewis 1984a). Along with the later *Voyager* project, *Rainbow Family* drew upon early 1980s AI, 1950s cybernetics, and sociomusical networks of free improvisation in creating a social aesthetic that includes creative machines as central actors. These networks of improvisative practice included important influences I drew from the cohort of French musicians with whom I frequently performed while working on the IRCAM project—among them, Michel Portal, Jean-François Jenny-Clark, Claude Barthélémy, Daniel Humair, Joëlle Léandre, Daunik Lazro, Raymond Boni, the Workshop de Lyon, and of course, Bernard Lubat.

The 1984 IRCAM *Rainbow* performances featured up to four human improvisors (contrabassist Joëlle Léandre, saxophonist Steve Lacy, bass clarinetist Douglas Ewart, and guitarist Derek Bailey) performing with three networked Apple II computers, which performed on three Yamaha DX-7 synthesizers. Audio input from the instrumentalists went to pitch following hardware, which generated voltage values that were converted to digital form.

The input information was collected by one machine and distributed over a MIDI-like network to the others; each machine analyzed the data locally.

The work was originally conceived not as a network of computers, but as three separate computer improvisors, each running a copy of the *Rainbow Family* software and making its own performance decisions. The differences in decision-making would be interpreted as a form of sonic individuation—perhaps along lines suggested by Gilbert Simondon, but also based on the terminology developed by African American improvisors, particularly in jazz, in which players strive to develop their own unique "sound" (Lewis 1996). Developing one's own sound amounted to a process of sonic subjectivation.

This was the theory. However, in rehearsals the musicians began referring not to computer A, B, or C, but to "the machine." I tried strategies of spatialization to enhance the impression of individuation, by having separate speakers for each machine's output, as well as limiting the set of sounds each machine had available for output, to further enhance difference. Neither of these strategies could shake the impression of a unitary "machine" subject. I eventually realized that what I had *not* done was to create three separate programs, each with its own behavior. Three improvisors, even performing on the same instrument, would be heard as three individuals, because the behavior of the individual performers would be different. In the case of *Rainbow Family*, the three machines were clones that pursued the same kinds of behavior over time, even if individual decisions taken at certain times differed.

My interactive systems were not originally conceived as necessitating direct, real-time co-creation between computers and people. Rather, that aspect of the performance project depended crucially on the computer program's ability to pursue and express its own sound in the way that the human musicians were already doing. Thus, much of the time spent in developing the *Rainbow* and *Voyager* programs was taken up by monitoring and shaping their performance as soloists. Once their ability as soloists was judged effective (by me), I then moved to connect their soloistic behavior to harmonize behaviorally with what they were receiving from the outside world, with the goal of allowing the humans to hear/feel that they could communicate effectively with the computers.

This way of conceiving human-nonhuman sonic relations is congruent with my description of *Voyager* from 2000 as involving "parallel streams of music generation, emanating from both the computers and the humans—a nonhierarchical, improvisational, subject-subject model of discourse" (Lewis 2000, 34). By 2007, anthropologist of technology Lucy Suchman was arguing similarly that in

> the constitution of the human/machine interface […] subject/subject intra-actions involve forms of mutual intelligibility intimately connected with, but also importantly different from, the intelligibilities involved in relations of subject and objects […] a particular form of collaborative world-making characteristic of those beings whom we identify as sentient organisms (Suchman 2007, 135).

This is one reason why my programs are not designed to rely on real-time human input to generate music; I felt that the computers needed to bring something of their own to the exchange, furthering the process of subjectivation.

Rainbow Family and *Voyager* were also influenced by the late-1970s networked computer improvisations of the League of Automatic Music Composers, particularly the League practice of "letting the network play," simply sitting back and listening as the computers created the music (Brown 2005, Lewis 2017). This is why the programs have no human operators. They are designed to operate themselves, and one development principle has been

that any conceivable behavior choices should be designed into the system as part of its base of competencies. Otherwise I am not learning much about how and why these communicative strategies work among human improvisors.

Working on improvisation with machines over the last forty years has taught me a great deal about how I and others improvise musically, although there is still much to be learned. In fact, this quest for knowledge of the improvising self is one of the major impetus behind work in this area, and one of the most successful human-computer interactions in music has been the OMax project and its siblings (ImproteK, SoMax, Djazz, etc.) conceived by Marc Chemillier and Gérard Assayag in collaboration with researchers Shlomo Dubnov, Georges Bloch, Benjamin Lévy, Jérôme Nika, Laurent Bonnasse-Gahot, in constant musical interaction with great improvisors such as Bernard Lubat, Sylvain Luc, Jacques DiDonato, Médéric Collignon, François Corneloup, Mike Garson, Steve Lehman, Mari Kimura, Cécile Daroux (†), Fabrizio Cassol, Benoît Delbecq, and many others.

In OMax, an improvisation-oriented musician-machine interaction system learns in real time from human performers, generating an improvisation from the learned model. As an important 2006 article by the team describes their understanding of the process of human improvisation, an improvising performer is informed continually by several sources—her partners, herself, and the instantaneous judgement that can alter plans on-the-fly to open up new directions in the music. Sound images of her present performance and of other performers are memorized, thus drifting back from present to the past. Figures from long term memory also act as sources of material that can eventually be recombined to form new improvised patterns (Assayag et al. 2006).

Of course, as I wrote in 2000, “As notions about the nature and function of music become embedded into the structure of software-based musical systems and compositions, interactions with these systems tend to reveal characteristics of the community of thought and culture that produced them” (Lewis 2000, 33). On this level, both machine learning systems such as OMax and non-machine learning algorithmic improvisation systems such as *Voyager* represent procedural and aesthetic models, however contrasting, of how meaning is created in improvisation.

Another commonality comes from the fact that both *Voyager* and OMax perform differently with and adapt to the styles of different improvisors. With OMax, difference emerges in the transformation of the performer's music through “stylistic reinjection,” the process of “reinjecting musical figures from the past, providing an always similar but always innovative reconstruction of the past...This is one of the major issues behind the balance of recurrence and innovation that makes an interesting improvisation” (Assayag et al. 2006). While *Rainbow* and *Voyager* had an independent manner of performance and listening that was the product not of past performances, but of its embedded set of rules and tendencies, its real-time listening process provides parameters that the systems could adopt in the production of their own music.

Assayag has suggested that in *Voyager*, the focus is on the generative autonomy of the software, whereas in OMax and its descendants, the focus is on the machine learning, either offline or in real time, during the concert (*personal email by Gérard Assayag, 22 March 2020*). I would extend this remark to portray *Voyager*’s listening process as a form of interpretive autonomy, since the system decides for itself about how to relate what it “hears” to what it plays. This process recognizes that listening is as much a part of musical co-creation as performing—or rather, listening becomes an improvisative act, a pedagogical relation in which you learn from the other through hearing what the other has to play.

In that light, I find myself wondering if a hybrid OMax/*Voyager* model could be created. Perhaps a well-tuned integration of machine learning and its models and corpuses with algorithmic music generation might enable a productive investigation of a particular kind of co-creation that is considered routine among improvisors, but which current musical computer programs cannot accomplish—the quotidian magic by which improvisors bring their ensemble pieces to agreed-upon conclusions. The ability to create ensemble endings from the open space can be (and usually is) sonically rather than visually negotiated, and the moment at which the ending suddenly appears as an option becomes a space where struggle becomes audible to both players and listeners. Such an investigation would need to include a strong ethnographic component, as Assayag, Chemillier, and Lubat have amply demonstrated.

Once I do learn more about how improvisors (including myself) create endings, I could perhaps move beyond the customary practice of ending *Voyager* performances by simply turning the machine off and having the humans create the endings, toward a more participatory instantiation of human-machine sociality. Indeed, working on improvisation and machine creativity has shown us the way to the democratization of creativity—a fundamental property that is neither limited to artmaking nor the exclusive property of designated superpeople, but has everything to do with how we all get along in the world. Here, I am reminded of Pierre Hadot's remark about the project of philosophy, one that I take as an aspiration for my work: "We are not dealing with the mere creation of a work of art: the goal is rather to transform ourselves" (Hadot 1995, 268).

Works Cited

Assayag, Gérard, Georges Bloch, Marc Chemillier, Arshia Cont and Shlomo Dubnov. 2006. "OMax Brothers: A Dynamic Topology of Agents for Improvisation Learning". *Proc. ACM Multimedia Workshop on Audio and Music Computing for Multimedia*, Santa Barbara, United States. https://hal.inria.fr/hal-00839075

Beurot, Eric. 1983. *Écoutez votre siècle 5: Musique et électronique*. Documentary telefilm, https://medias.ircam.fr/xd2cc9d.

Brown, Chris and John Bischoff. 2005. "Computer Network Music Bands: A History of The League of Automatic Music Composers and The Hub." In *At a Distance: Precursors to Art and Activism on the Internet*, edited by Annmarie Chandler and Norie Neumark, 372-90. Cambridge, MA: MIT Press.

Davaud, Michel. 1984. *Écoutez votre siècle 8: Rainbow Family.* Documentary telefilm, https://medias.ircam.fr/x55b193

Hadot, Pierre. 1995. "Philosophy as a Way of Life." In *Philosophy as a Way of Life: Spiritual Exercises from Socrates to Foucault*, edited by Arnold I. Davidson, translated by Michael Chase, 264-276. Malden: Wiley-Blackwell.

Lewis, George E. 1996. "Improvised Music After 1950: Afrological and Eurological Perspectives." *Black Music Research Journal* 16, vol. 1 (Spring 1996): 91-122.

Lewis, George E. 1984. *Rainbow Family*. Live performances, IRCAM, 23-25 May 1984 https://medias.ircam.fr/xce0825_rainbow-family-george-lewis

Lewis, George E. 1984a. *Rainbow Family*. http://brahms.ircam.fr/works/work/10042/

Lewis, George E. 2000. “Too Many Notes: Computers, complexity and culture in Voyager.” *Leonardo Music Journal* 10: 33-39.

Lewis, George E. 2007. “Living with Creative Machines: An Improvisor Reflects.” In *AfroGEEKS: Beyond the Digital Divide*, edited by Anna Everett and Amber J. Wallace 83-99. Santa Barbara: Center for Black Studies Research.

Lewis, George E., and Benjamin Piekut. 2016. *The Oxford Handbook of Critical Improvisation Studies*, Vols. 1&2. New York: Oxford University Press.

Lewis, George E. 2017. “From Network Bands to Ubiquitous Computing: Rich Gold and the Social Aesthetics of Interactivity.” In *Improvisation and Social Aesthetics*, edited by Georgina Born, Eric Lewis, and Will Straw, 91-109. Durham and London: Duke University Press.

Nika, Jérôme. 2016. “Guiding human-computer music improvisation: introducing authoring and control with temporal scenarios.” PhD diss., Université Pierre et Marie Curie and Institut de Recherche et Coordination Acoustique/Musique. https://hal.archives-ouvertes.fr/tel-01398364

Suchman, Lucy. 2011. “Subject Objects.” *Feminist Theory* 12 (2): 119-145.