Investigating Social Creativity and Concept Invention in Collaborative Musical Situations

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***Abstract*—The paper outlines theoretical and methodological developments in the study of social creativity and collaboration, drawing on recent research in improvised music and collaborative mathematics. Creativity and invention are contextualized as social, distributed processes, epitomized in the field of collective musical improvisation. A set of investigative questions and methodologies under development are then outlined, drawing on work-in-progress examples from mathematics and music. Particular reference is made to FolioHarmonies, a short qualitative study documenting collaborative, open-ended problem-solving processes in the creation of original musical pieces.**

***Index Terms*—Collaboration, Invention, Conceptual Blending, Improvisation, Social Creativity, Graphic Notation, Harmonic Spaces.**

I. Background: Identifying Social Creativity in Music

Stories of blending & invention

In the mid- to late 1930s, John Cage, famously described by Arnold Schoenberg as "not a composer, but an ingenuous inventor" (Kostelanetz 2003) was credited with the invention of two new musical instruments, known as the water gong and prepared piano. These were two novel ways of playing conventional instruments, but have since become widely used in contemporary composition as instruments in their own right. Cage's "inventions" did not come up in an attempt to create new sounds or innovative music, nor did they emerge in the composer's writing room. The first came to being when Cage was invited to musically accompany a synchronized swimming ballet at UCLA with a percussion composition. The ballet was simply not going to work; the swimmers were unable to keep time, complaining that they could not hear the percussion while underwater. In an angry fit, Cage dipped the gong into the pool suggesting that even if he put the percussion *in* the water, the swimmers still wouldn't be able to follow the rhythm (Revill 1992, 55 and Nicholls 2002b). In doing so, he realized that the pitch properties of the gong were altered as it was being submerged, thus creating a powerful glissando effect.

A few years later, when the composer was due to accompany a new dance piece with a specially-commissioned gamelan-style percussion composition, an ill-informed room booking meant that it was practically impossible to fit the entire percussion battery in the room; the only instrument available was an immovable piano. Cage decided a last-minute change of instrumentation for the entire piece, installing a number of metal and rubber objects on the inside of the piano and attaching them between the strings (Pritchett 2007); he was thus able to bring the piano sound closer to the envisaged gamelan sonorities, and at the same time he inaugurated an entirely new spectrum of possibilities for timbral composition.

For Nicholls (2002a), Cage could well fit the profile of what Gardner (1993) calls an "Exemplary Creator", not because of the impact of his isolated innovations on musical composition, but due to his ability to create flexible, adaptive music that depended primarily on the context of its performance, taking serendipity on board at every step.

Another important tool for contextualizing this kind of creative activity, is the theory of Conceptual Blending (Fauconnier & Turner 2001), whereby concepts from disparate but structurally compatible spaces blend to give rise to a new, integrated whole. For example, the resonant and high-attack qualities of percussion blended with the silent, low-definition environment of underwater dance, to yield the water gong, a low-definition, resonant rhythmic instrument. Conceptual blending has been discussed quite extensively in music, particularly in relation to cross-domain integration between music, text and image (see e.g. Zbikowski 2002 & 2003, Cook 2001 and Moore 2012). The relationship between social aspects of creativity and the emergence of new, blended concepts, however, remains largely unaddressed.

Social creativity as a distributed activity

Schutz (1951) described music as a "meaningful context which is not bound to a conceptual scheme" (p. 76), and which can be communicated through a complex set of social interactions, including those between composers, performers and listeners, as well as among performers in an ensemble. Self-evident as this may seem, Schutz's view was historically quite radical, in that it was one of the first approaches to clearly prioritize social context over symbolic content (i.e. Schutz proposed an analytical understanding of music whereby people relations were deemed equally, if not more important, than note relations). In doing so, it opened the way for several decades' work of socio-centric approaches to the investigation of musical creativity.

Several musical genres and practices across different cultures and eras depend on real-time as well as asynchronous processes for their realization. They thus enable the distribution and negotiation of roles between agents, and the formation of flexible decision-making patterns and self-evaluation criteria. In recent years, the creative aspects of musical performance in a social setting have become the subject of extensive research, primarily through "real-world" studies. A case in point is the Creative Practice in Contemporary Concert Music project by Clarke *et al.* (2011-2014, see

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http://www.cmpcp.ac.uk/cpiccm_outputs.html). The research builds on the concept of "distributed creativity" (originally appearing in Born 2005, 34), to better understand and define the ways in which musical performance can be creative. However, as Clarke (2012, 2013) notes, the answer is very much dependent on cultural values which posit music as an autonomous art object, versus more functionalist views of music as a process attached to specific everyday activities.

In the majority of Western Art Music contexts, performance itself is of secondary importance in comparison to the musical work that it serves to communicate; by extension, the social distribution of creativity is seen as little more than an extraneous variable or, at best, an inevitable side-effect of the musical process. By contrast, in situations where music is understood as a more flexible, context-sensitive continuum of actions, the unique creative content of every performance can be examined according to more case-specific rules.

Collaborative Improvisation, Metaphor and Social Ontology

Such observations are at the heart of a set of crucial distinctions, involving what Hall (1992) labeled as "low context" (LC) musical situations, versus "high context" (HC) ones. In the former, the focus is on communicating a pre-inscribed message as clearly as possible, through precisely defined codes and idioms that prevent the content from being altered, distorted and therefore miscommunicated in the process. In the latter, the message itself is considered to be in-the-making, and its content is formed as the situation unfolds, according to more complex contextual and subjective parameters (e.g. the nature of the performance space, the instruments used, the time of day, particular performers' moods etc.)

Perhaps the most evident example of a high-context situation can be found in freely and collaboratively improvised music. This could include a situation where groups of players from varied educational, social and musical backgrounds, gather to improvise together. Sometimes performers in these settings have no formal musical education, or they may choose to play on a musical instrument they have never played before. Players often collaborate without the aid of a given score or instruction sheet, and with little or no co-ordination from external agents such as conductors. However, as Charles Mingus once exclaimed, "you can't improvise on nothing, man. You gotta improvise on something!" (cited in Kernfeld 1995, 119 and Santoro 2000, 271). What is this "something" and how is it defined?

In Collaborative Improvisation (CI), fundamental concepts, including music, noise and silence, are not stable across players and or given in advance. By contrast, they are invented, negotiated and revised on a case-by-case basis. Multiple agents are engaged in a real-time interplay of subjective answers to the very question of "what this is" (Is it good/right? Is it bad/wrong? Is it even music?). As a result, the very question of ontology for every improvised soundwork is both formative and dependent on the process of performance (Peters 2009, Goehr in Lewis & Piekut, forthcoming). Russell (2009) acknowledges an inherently social character of improvised soundwork ontology, and attempts a Marxist reading, suggesting that "this approach is not ontology understood as the deduction of reality from logical categories: it is the deduction of those categories from reality." (Russell 2009, 78).

As a practice, CI presents some distinct advantages and challenges for analysis and modeling, as it involves flexible musical concepts, which are formed, tested, validated, negotiated and re-adjusted in real time. A further distinct characteristic of the practice is its noted reliance on metaphor. While this feature poses a known challenge to systematic musicological research, interdisciplinary research on metaphor and conceptualization suggests it is one of the most reliable and telling tools about how we apprehend and conceptualize our social reality (Lakoff & Johnson 1980, Cumming 2000, Zbikowski 2002 & 2008), Johnson 2003, Adlington 2003, Stefanou 2004, Schroeder 2013). In CI, predominant conceptual metaphors (particularly spatial / visual / narrative / kinetic) serve as key subjective referents in an otherwise non-referential system, while "objective" musical referents (e.g. harmonic relations) are no longer treated as such, but relativized, and re-appropriated.

On the whole, collaborative improvisation thematises key aspects of social interaction, by emphasising process, unpredictability and Gestalt (Csikzentmihalyi & Rich 1987, Sawyer 2003). While earlier accounts, largely drawing on jazz improvisation, relied more on dialogical analyses and linear phenomenological accounts (e.g. Monson 1996, Benson 2003), more recent ones highlight the potential of CI in harnessing more complex interaction patterns perhaps best understood through decentralized behavioural models, such as Swarm Intelligence or SI (Borgo 2005).

Recent years have also witnessed a developing research trend concerned with (a) the types of cognition that can be associated with CI (e.g. Borgo 2005 & 2006; Goldman 2012) and (b) the ad-hoc and/or post-hoc conceptualisation of emergent real-time structures and/or decision-making patterns (e.g. Healy et al 2005, Canonne & Garnier 2012). Qualitative research methods, ethnography and practice-based research understandably play a large part in the exploration and documentation of the above processes, often resulting in case-specific or hybrid methodologies. These range from self-reflexive autoethnographic accounts (e.g. Ng 2011) to participatory studies of large-scale group music-making (e.g. Stefanou 2011).

II. Concept Invention in Collaborative Contexts: A Preliminary Case Study Evaluation

Perspectives from mathematics and FolioHarmonies

In 2009, the mathematician Tim Gowers posted a problem on his blog, and asked for readers to contribute their own partial solutions or steps towards a solution in the comments section. This was the onset of the PolyMath project (Gowers 2009a & 2009b), where participants regularly share approaches and problem-solving strategies in response to a series of mathematical questions. Subsequent research by Pease and Martin (2012) provided a qualitative analysis of the conversation data from two specially designed mini-PolyMath sessions, highlighting strong links between social creativity and concept invention in mathematics. Following a comparable, albeit more theoretical perspective on collaboration, Aaron McLeran (2009) considered jazz as a potential metaphor for social computing, to ask: "Are there social computing 'bands'? Can a social computing 'band' improve the quality of the collective output? What would be

the metaphorical equivalent in social computing for the jazz soloist?"

What if we were to attempt a transposition of such questions to collaborative improvisation, where the role of the soloist is not pre-defined, a band is not a hierarchically structured entity, and even the criteria for qualitatively assessing the collective output are formed collaboratively and *ad hoc*? The idea of setting up and studying collaborative music-making experiments, along the lines investigated in the area of collaborative mathematics by Gowers (2009a & 2009b) and Pease & Martin (2012) might add significantly to the current research gap.

Building on this idea, a one-month case study on social creativity & cross-domain musical blends was set up and carried out at Aristotle University of Thessaloniki during May-June 2014, in the context of the EU – FP7 project COINVENT (http://www.coinvent-project.eu). The COINVENT graphic score / harmonic paradigms case study (from here on FolioHarmonies) was designed and conducted by the author with initial input from Costas Tsougras (A.U.TH.) and the voluntary participation of 11 undergraduate students, from mid-May to mid-June 2014.

'Process over product' approach to methodology & objectives

FolioHarmonies was a private blog where participants were invited to contribute as Authors. Their task was to deal with two given sources, uploaded on two separate blog pages: (A) an example of a post-1945 graphic score (*Folio: December 1952* by Earle Brown, which bears no verbal instructions and uses abstract visual symbols instead of conventional musical notation (B) a set of harmonic space paradigms, drawn from examples used in the COINVENT harmonisation trials. These included sample chord progressions and harmonic reductions of composition segments by five prominent early 20th-century composers, and suggestions for extending the harmonic framework beyond these paradigms (e.g. free harmony).

Participants were presented with an open problem-solving task: to combine these two sources into a new, original and collaboratively created piece. The "how" part of this task was going to be explored through conversation and playing. It was also up to players to decide whether to collaborate in larger or smaller groups of their choice.

The chief objective of the study was to set up and document a process; consideration of the exact nature of the end product was a secondary concern. This was also in line with the subject and learning objectives of "Experimental Music", the undergraduate class that participants were drawn from. Historically, experimental music is defined as a primarily process-driven activity. It is predominantly concerned with opening spaces for actions, the outcome of which is neither foreseen nor predetermined (Cage 1961, Nyman 1974/1999).

Participants were encouraged to document their interactions as closely as possible, communicating with each other both remotely (in writing) and in person (face-to-face), but keeping face-to-face interactions to a maximum of 4 hours per group in total during the one-month study, including rehearsal and playing time. Documentation of face-to-face interactions was effected through sound and video recordings where possible, and/or through brief write-ups.

A secondary strand of the study was concerned with end products, i.e. with creating original pieces through a collaborative processing of the given material. The focus, however, was not so much on generating products that could be objectively evaluated on the basis of pre-determined parameters (and this is perhaps a significant point of divergence from relevant studies in mathematics). Rather, the idea of end products was introduced so as to encourage participants to develop their own personal and group approaches to particular end-product ontologies, which could then be tracked back to a step-by-step decision-making process. In other words, the formation of questions such as "what are we making?", "what context are we making it for?", "why are we making it like this?" and "how do we assess it?" was at the core of the study's objectives, and thus a key consideration built into its design.

Outcomes and preliminary evaluation

Four new pieces of music were generated during the study, and given their first public airing in an event organized by the participating students. Three out of four groups (Groups 1, 2 and 4) also uploaded their own original takes on the Brown graphic score. Although in some cases these new "visual scores" were not used for the final performance purposes, they are still available on the public version of the blog, along with a first report on the study results (see http://folioharmonies.wordpress.com/report).

The data yielded from the study includes over 130 pages of in-person conversation transcripts and blog posts, and over 10 hours of recordings from playing sessions and performances. Consequently, and given the openness of the study's scope, data analysis is still very much in progress on several planes, a rough outline of which is provided below.

A first-level analysis of participants' communication strategies highlights shared problem-solving patterns that emerged across all four groups, albeit not always in linear order:

1. Narrowing the problem space (e.g. from an open "what if..." or a more case-specific "what to do with these two sources" to a directional "how can we use source 1 [the harmonic spaces] to interpret source 2 [the graphic score]" and "how do we make this work?")

2. Assigning functions and/or meaning to the set material (e.g. using particular elements in the graphic score as durational markers, or assigning narrative significance to particular harmonies)

3. Mapping sonic elements onto visual ones, and vice versa (e.g. creating subscores and testing them via different realisations)

4. Defining end-product ontologies (agreeing on what the resultant piece should be described as, and what its constituent elements are).

Table 1 summarizes these end-product ontologies as described and explained by the participants themselves, in relation to their use of the given materials.

TABLE I: END PRODUCTS IN FOLIOHARMONIES

Piece	Ontology description (by participants)	Content description (by participants)	Study materials used
1	Original composition, resulting from	A combination of "noise" and harmonic spaces	Graphic score as structural device & free selection of

	a reworking of the Earle Brown graphic score		harmonic paradigms (diatonic / chromatic / clusters)
2	Original «sonic narrative»	A non-verbal narrative around the idea of people forming groups and/or struggling on their own. Each person's distinct «colour» depicted through three distinct harmonic spaces, running concurrently and occasionally blending.	Graphic score as structural device & literal individual quoting of particular harmonic successions by each player
3	Collage or controlled improvisation in two sections	2 pieces in 1, starting with a realization of the graphic score and culminating in a controlled improvisation, with set harmonic material structured around elements of the graphic score	Graphic score as structural and semantic device (on one section) & personal selection of particular harmonic paradigms for each player (drawn from Satie, Messiaen, Bartok)
4	Controlled improvisation (inspired by the Earle Brown graphic score).	A 2-dimensional space being permeated by 3-dimensional volumes, depicted musically as vocal and piano pitches and «noises» against an atonal ostinato background	Graphic score only as a starting reference. Harmonic spaces explored at random and in real time by each player.

Notably, the majority of the participants had never dealt with either graphic scores or harmonic improvisation in the past. Several students involved in the study admitted to never having engaged with any kind of compositional or improvisational practice before this point. Some observed that they might never have done this, were it not for the premise of working in a group and assuming collective responsibility for decisions. In fact, decisions reached verbally were often reconfigured and in some cases entirely reversed based on playing and listening sessions between discussions. Further analysis of the transcripts is currently in progress, with the aim of summarizing and representing these negotiations in the form of condensed narratives and/or flowcharts.

A second level of investigation, due to begin in Spring 2015, concerns the qualitative analysis of conversation patterns that emerged in the dialogues between groups. Applying and extending recent work by Pease et al. (2014) and Corneli (2014), the aim is to identify & classify specific elements of dialogue on the basis of their role & function in the conversation. A short dialogue sample from the two guitar players in Group 1, for instance, could be unpacked as a sequence of instructive, validating and clarifying questions and answers tackling several levels of the emergent musical piece, from pitch to end-product structure. A preliminary attempt at notating the variety of cross-level elements at play could go as follows:

P1: - So you take the C [<instruction> @pitch @agency]
P2: - OK, and anyway, we won't play it as it is [<validation>, <decision> @ontology]
P1: - In this order you mean? [<Q?clarification> @structure]
P2: - I mean… what do you mean I take the C? [<Q?clarification> @pitch @agency]
P1: - On an open string [<clarification> @playing technique]
P2: - Oh right. I won't tune the C. Because it sounds nice as it is, with these chords there. [<validation>, <decision>, <judgment> @pitch @harmony]

Pease & Corneli are currently developing a more systematic classification of dialogue elements in collaborative mathematics, combining diverse frameworks including Lakatos' (1976) Proofs and Refutations, Polya's (1945/2014) stages of problem-solving and Bydzynska and Reed's (2011) Inference Anchoring Theory of speech acts. This classification is being extended on the basis of examples from FolioHarmonies, with a view to creating a rich set of tags, which may subsequently be automated.

A third strand of analysis alongside conversation patterns and speech acts is the socially situated examination of metaphor and the emergence of cross-domain blends. It is possible, in due course, to effect a more detailed investigation of the harmonic and cross-domain blends achieved in the study, and a critical examination of the types of ontologies and descriptions associated with particular blends. Already at this stage there are several interesting observations to be made, particularly regarding the mapping of sonic and visual elements. Although both types of source material (graphic and harmonic) were provided in visual form, a notable feature of conversation in all four groups was a consistent reference to reading, vision and text (e.g. "let's see this" or "what does it say?") specifically when dealing with the harmonic material. By contrast, hearing, playing and sound (e.g. "when you hear me playing this" or "it sounds") are evoked almost exclusively with reference to the graphic score elements (e.g. "let's play the rectangles"). This begs a number of higher-level observations on the transference of information across domains, and the associations fostered between them. Graphic notation, despite being a predominantly visual medium, appears to be associated with a material, hands-on, sound-oriented approach, while conventional stave notation is bound with the act of reading and interpreting text, quite independently of being able to translate its features to sound.

Several other planes of investigation could be explored on the basis of FolioHarmonies or similar studies. The aim of this paper has been merely to point at the richness of data and variety of analytical approaches that may be harnessed and developed by pursuing a relatively new line of inquiry. In that sense, FolioHarmonies was primarily a scoping exercise. Given more time and subjects, follow-up studies could be designed to engage a more varied subject group, and systematically explore particular parameters in more depth.

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