Understanding Networked Music Communities through a practice-lens: Virtual ‘tells’ and cultural artifacts

Demosthenes Akoumianakis  
Department of Applied Informatics & Multimedia  
Technological Education Institution of Crete  
Heraklion, Crete, Greece  
dana@epp.teicrete.gr

Chrisoula Alexandraki  
Department of Music Technology & Acoustics,  
Technological Education Institution of Crete,  
Rethymnon Branch, Crete, Greece  
chrisoulla@staff.teicrete.gr

Abstract—The paper investigates how practice-based studies can provide a lens for understanding the life of virtual communities. The domain of investigation is music interpretation lessons as conducted using the DIAMOUSES system for networked music performance. The practice-based framework proposed is built around two notions: technology inscribed structures and cultural artifacts appropriated or enacted. Qualitative analysis of interview data makes useful inroads to understanding what members are actually doing in virtual space and how their actions, reactions and social encounters are manifested or revived through the music community’s virtual ‘tells’ or remains.

Keywords-component; practice lens, networked music performance, music interpretation lesson, cultural artifact

I. INTRODUCTION

Traditionally, the relationship between music performance and computing focuses on the use of computers to preserve, reconstruct and transmit musical materials for the sake of groups sharing a common interest or enthusiasm. Very few works concentrate on the reverse relationship—how networked computers create new digital music culture? Musical culture is frequently revealed through artifacts and the knowledge they embody. It is claimed that in the digital era such artifacts may take the form of virtual remains or ‘tells’ [22] encountered in virtual music settlements [23]. In this paper, we pick up this latter thread to analyze a specific scenario (i.e., music interpretation lessons) from a practice lens [32]. In doing so, the present work will partly challenge the prevailing view for analyzing virtual communities, which is implicitly or explicitly focused on community management theories (i.e., how communities are discovered, established, sustained and maintained) while dismissing or undermining the practice they are about to serve. Our key concern is to step towards analytical perspectives for gaining insights to what constitute virtual traces, how they are revealed and what knowledge they offer regarding networked music performance communities and their culture. An important issue in this effort is to unfold the methodological challenges confronting researchers interested in understanding how new media influence (i.e., reconstruct or extend) culture and to ground this perspective on a practice lens [26].

The paper is structured as follows. The next section reviews the relationship between community and practice aiming to sketch the baseline of the present work. Then, we elaborate on the ingredients of an approach for understanding communities through their practice as revealed by their cultural artifacts and the supporting technological inscriptions. This forms the critical lens for a practice-based analysis of a case study addressing a virtual community engaging in music interpretation lessons. Analysis of the case study reveals interesting features of the respective community and leads to several remarks about practice, how it manifests and shapes culture as well as how it is framed and revealed in virtual settings. The paper is concluded with summary and recommendations for future research.

II. THEORETICAL MOTIVATION AND RELATED WORK

There are two strands of theoretical thinking that are broadly relevant to our current work. The first relates to the concept of a ‘community’ as advanced by social scientists over the years and as considered in recent social studies of technology. The second is concerned with ‘practice’ as epistemology of knowledge in action, thus an indicator of culture. Our effort in this section is to bring to the surface current thinking on a basic dilemma: ‘Is it culture as pre-existent that shapes community or is the community that emerges in practice and through such evolution it creates new culture?’ To this end, we present a non-exhaustive review of the argumentation presented in scholarly works in an effort to highlight controversies and research challenges, thus underlying the rationale of the present work.

A. Community conceptions

Since the late part of the 19th century, community as a social phenomenon has been, and continuous to be the subject of considerable debate for sociologists leading to two main traditions in theoretical thinking. The first considers community from a process-oriented perspective accounting for social solidarity, material processes of production and consumption, law making and symbolic processes of collective experience and cultural meaning.

The second tradition considers community in terms of territorial boundaries, place-based social interactions, collective value and shared symbol systems that create a normative structure typified by organic traditions, collective
rituals, fellowship and consensus building [1]. The latter perspective seems to have been more influential in designing technology for managing online communities (e.g., LambdaMOO [2], MicroMuse [3], Phish.net [4], FurryMuck and JennyMUSH [5]), to name just a few.

Despite, its popularity the ‘place’-based perspective is abandoned (or does not seem to be followed) when analyzing phenomena within these online places. Thus, concepts such as collective value and shared value systems are seldom addressed. Rather, the primary focus is on methods for analyzing processes for developing structures that resemble ‘civil society’ such as neighborhoods, public forums and marketplaces [2, 6], or a kind of anthropological study of evolving social structures within these ‘places’ [7]. A shift from the typical ‘place’-based conception of online communities towards a network type organization is evidenced by the rise of social networking applications. Unlike online ‘places’, these applications make no claim for pretending to function as ‘civil societies’; rather, they provide linking mechanisms for individuals to form networks, which can then be leveraged for social, cultural, and economic purposes. The above trends are widely acknowledged in recent scholarly works where the term ‘community’ is interpreted in the context of computer-supported social networks [8] as means to foster new virtualities such as value-creating networks [9] and distributed communities [10].

B. The practice turn

The practice turn is the term used to coin a wider movement towards an analysis of practice as epistemology useful for the study of work and the kind of practical and ‘hidden’ knowledge that supports it [11]. Although such a movement is rather polysemic and non-homogeneous – comprising insights by social scientists [12, 13, 14], organization and management scholars [15, 16, 17], it has nevertheless, accumulated a critical body of knowledge, which forms the common bond for many practice-based studies [18]. Amongst these studies, the practice lens brings to the forefront the analytic distinction between technology as artifact (i.e., a technology’s artifactual character) and technology use in practice [15].

According to the practice lens, technologies can be seen as prerequisites for particular outcomes but the existence of prerequisites does not determine the outcome. Thus, through technology used in practice, new structures may arise which were not initially foreseen during the development of the technology. Accordingly, it stands to argue that virtual communities should be conceived of and analyzed as emergent structures. Due to the digital medium, their prerequisite is ‘connectivity’ since connectivity facilitates recurrent interaction of people with whatever properties of the technology at hand. Phrased differently, virtual communities, as emergent structures, cannot be treated as embodied in technology. Instead, what is embodied in a technology is a particular set of symbols and material properties allowing for social connectivity. Then, virtual communities emerge when such social connectivity is instantiated in practice by groups of people or organizations sharing common repertoire of resources.

III. TOWARDS A FRAMEWORK FOR PRACTICE-BASED ANALYSIS OF VIRTUAL COMMUNITIES

The analysis so far suggests two separate conceptions of virtual ensembles – one emphasizing community and thereby focusing on how communities are formed, sustained and cultivated, and another one that is practice-based concentrating on what people do in virtual settings.

A. The need for a practice-oriented framework

Studies concerned merely with community management have not provided the grounds for sufficient insight on how practice is reconstructed, enriched or augmented in virtual settings. Phrased differently, scholarship on community management reveals a variety of means for building togetherness (such as friendship, communication needs, common interests, business objectives, etc), the conditions for maintaining and sustaining social ties online as well as the new challenges confronting the design of virtual settlements. Although these studies reveal critical community features, such as identity management, registration policies, user roles, access rights, information sharing mechanisms, etc., they cannot explain the new patterns observed in the way people socialize or use language online and the resulting communications acts (i.e., phrases such as ‘I googled the term XYZ’), but also the new structures that emerge as a result of the users’ recurrent engagement in virtual settings. Recently, Gherardi [11] has attempted to consolidate this research tension by prompting the question ‘… is it community that constitutes the container of knowledge … since communities pre-exist their activities or is it the activities themselves that generate a community as they form the ‘glue’ which holds together an ensemble of people, artifacts and social relations?’. The practice lens can be conceived as an effort resulting from relaxing the assumption of community as pre-existent structure and focusing on what takes place online, under different technological regimes, leading to community.

B. Constituents of a practice lens

The present work adopts this perspective and seeks to investigate how computing and new media re-shape life to the extent that novel practices and new culture are created. Our practice lens evolves around two key constituents, namely cultural artifacts and technology-inscribed structures.

1) Cultural artifacts. Cultural artifacts reveal the community’s existence, unfold the community’s purpose and practice and can be used to reconstruct the community’s remains. As in the case of archaeology where elements of a past culture are discovered through remains, virtual communities should be studied in relation to the artifacts that reveal their purpose. Archaeologists consider as cultural artifacts any kind of material remains of culture, aiming ‘not so much to reconstruct what once was, but to make sense of the past from a viewpoint of today’ [19]. Such cultural
remains are seen as bi-products of culture, but not culture itself. Analysis of artifacts in situ and in relation to the other artifacts evokes particular understandings of the culture that they exist within. In this sense the practice lens links with a type of cyber-archaeology [20, 21] in so far as it fosters commitment to discovering virtual communities through their cultural ‘tells’, as these can provide an integrative framework for community life, whether virtual or real [22, 23]. However, in virtual settings, such material remains are bits of program code and data, which can only be made sense of using dedicated software. Thus, cultural artifacts of a virtual community are inextricably linked with the software toolkits through which such artifacts are instantiated in practice.

2) Technology-inscribed structures. The second constituent of the practice lens relates to technology inscribed structures. Technological inscriptions come in the form of functional requirements as well as non-functional quality attributes embodied in a technology. Collectively, they substantiate social connectivity, which in turn, enables co-engagement of members in designated domains. To gain a better insight into the role of inscribed structures one may consider the Google search engine. Functional components of Google search include handling of directories, databases and indexes, page ranking algorithms, etc. Nevertheless, these functional aspects alone do not convey Google engine’s material capacity unless conceived in the context of non-functional qualities such as connectivity to make use of multiple servers and architectural abstraction, which in turn reflect choices made about its design, construction, and operation. It stands to argue therefore, that although functionality embodied in technological artifacts is clearly important, it is not likely to be the critical technological inscription facilitating what Orlikowski coins as ‘variety of technologies-in-practice’ when referring to emergent social practices of a technology. Instead, it is the non-functional attributes such as abstraction, interoperability, information and social connectivity that enable or constrain these emergent social practices. The challenge is that they are hard to inspect, assess and fulfill. A useful construct to understand non-functional quality attributes in virtual settings is the notion of affordances. Gibson [24] developed the idea of affordances to explain how people and other animals orient to the objects in their world in terms of the possibilities the objects afford for action. An affordance perspective recognizes how the materiality of an object favors, shapes, or invites, and at the same time constrains, a set of specific uses [25]. In this view, possibilities of action are not given, but depend on the intent of the actors enacting them. Consequently affordances enable or constrain material actions and thus emergent social practices. Another contribution of the affordance perspective is that it can be used to relate what happens online with the resultant offline behavior. In this account, affordances offer a frame for understanding virtual endeavours through their online and offline constituents. Specifically, they designate desirable qualities (i.e., abstraction, plasticity, social transluence) to be inscribed in technology so as to transcent the boundary between online and offline praxis. In other words, through suitable affordances (of objects) it is possible to translate an online setting in the local language of participants, as well as to allow ‘sensing’ intents of local actions and feed them through to the virtual space.

C. Implications

The practice lens, as outlined above, translates to a rather distinct line of argumentation. Specifically, virtual communities should be considered as phenomena emerging in cyberspace through recurrent enactment of structures inscribed in technology. In this account, they are not solely a new communications strategy, but rather a complex of cultural practices that occupy multiple locations, both virtual and physical. Practice is conceived of as activities on objects whose affordances (i.e., inscribed non-functional qualities) designate their use. Then, understanding virtual communities through their practice requires a commitment to analyzing traces and remains of online and offline praxis.

IV. CASE STUDY

In our recent work, we have attempted to explore the link between virtual community and the practices in which members become engaged [26]. Our current effort seeks to bring the required insights by attempting to understand one concept through the other. On the one hand, we aim to understand how practice shapes virtual communities, thus what are the technology constituting structures that enable communities to be established in virtual settings. On the other hand, we are equally keen to understand how practice becomes implicated in socio-technical community contexts, thereby becoming expanded and enriched. These objectives have been approached by qualitative analysis of networked music performance sessions - specifically the conduct of music interpretation lessons. This forms one of the networked music performance scenarios investigated in the context of the DIAMOUS project (http://www.teicrete.gr/diamouses/stage/screenshots/index.html, see also acknowledgement) [27, 28].

A. Overview of the research setting

The case study focuses on music interpretation exercises carried out by a virtual learning ensemble. It was designed to focus explicitly on the online reconstruction of widely accepted practices based on conventional music notation embodied in a dedicated practice toolkit for collaborative co-engagement [27, 28]. Our experimental scenario involves a multi-site engagement in a music interpretation lesson with one moderator and several participants. To conduct a music interpretation lesson, moderators (conductors or music tutors) prepare shared music materials (i.e., music scores, recordings, videos), schedule and organize the music lesson and invite participants. Participants, on the other hand,
access shared contents in their own pace, and during the lesson, they negotiate the act of interpreting the shared resources in accordance with their personal virtuosity. This is manifested as collaborative music performance of a designated music score. Synchronization and latency issues are technical challenges in their own right, which have been explored elsewhere [28, 29].

There are two prerequisites for taking part in music interpretation lessons. The first is the users’ acceptance of the moderator’s invitation, which is followed up by registration to a ‘room’ containing the shared material of the lesson. Such ‘rooms’ are implemented as dedicated portlets using the Liferay content management system, which serves as the community support medium. Registration is a two-stage process. Firstly, participants become members of the community by building their music profile. Then they register to ‘rooms’.

The second prerequisite entails downloading a dedicated practice-specific toolkit, which allows members to engage synchronously in the micro-negotiations of a specific music lesson. For each Liferay ‘room’, the toolkit instantiates a corresponding ‘practice room’ for each registered participant. Practice rooms host the shared online materials of a lesson. During the lesson participants can manipulate the replicated representation of a music score, control the collaboration floor, communicate (synchronously) with peers and initiate transmission and reception of audio signals. Additional facilities such as the use of a web camera and a chat facility allow users to maintain visual contact with remote sites as well as to exchange informal messages. Micro-negotiations between participants take two primary forms (a) social interactions using microphones and the chat facility, and (b) graphical tasks on the shared and replicated music score – as this artifact offers a special type of language for music, its interactive version was designed so as to provide functionalities for editing, annotating, highlighting, and in cases of improvised music genres, modifying parts of the music score. All these actions are granted to one user at a time, i.e. to the holder of the floor.

B. Data collection methods

Data were collected through technical evaluations scheduled and performed over a period of three months. During these evaluations we employed virtual ethnographic techniques to collect data and analyze actual music interpretation lessons. A virtual ethnography was organized as a moderated synchronous collaboration session involving the researchers in the role of moderator and up to four participants. Following an ethnographic session, participants were interviewed and took part in a workshop. Data were collected from three sources:

(a) the practice toolkit which records request-response acts, synchronous and asynchronous tasks (i.e., counts on active rooms, live discussions, threads, postings, replies to invitations) as well as a broad range of manipulations of the shared artifacts during a lesson (i.e., the music score, the metronome, signal controls);
(b) participant interviews;
(c) the comments and issues raised during the workshop.

Our analysis as presented below draws upon a total of three virtual ethnographies, while the interviewing strategy followed is summarized in Table 1. The same semi-structured interview was used in all cases.

<table>
<thead>
<tr>
<th>Table 1: Interviewing strategy for data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant affiliations</td>
</tr>
<tr>
<td>Number of interviews</td>
</tr>
<tr>
<td>Type of interview</td>
</tr>
<tr>
<td>Duration of interview</td>
</tr>
<tr>
<td>Interviewing period</td>
</tr>
</tbody>
</table>

The interview was organized around the two prominent constituents of the practice lens, namely cultural artifacts and technology-inscribed structures. Our working assumption is that cultural artifacts can reveal what is actually done during a music interpretation session, while technology inscribed structures may unfold the type and properties of the communities formed. In order to devise appropriate interview questions and discern the role of cultural artifacts, we studied earlier works on network music performance and reviewed a variety of computer-mediated music materials, sonic objects and virtual musical instruments, collective composition systems, real time collaboration and jamming. This led to the identification of several possible artifacts such as the conventional music score, alternative graphic notation constructs and visualizations [34, 35], as well as a broad range of tools for exchanging digital musical materials [36, 37, 38]. All of them offered useful insights on different elements of an emerging culture on networked music performance. To illustrate the point, we can briefly comment on conventional music scores. Indeed, scores do not only offer insights regarding the creator of a musical piece. They also act as a linguistic domain through which the world of music is made sense. In other words, a music score provides a language for communication and expression [30] since it encapsulates melody, harmony, their relationships as well as further structural characteristics of the musical piece [31]. Furthermore, a music score may be used to reconstruct music across time, thus making it persistent and widely available. It is worth pointing out that our review of related works did not concentrate only on candidate cultural artifacts but also on the respective practices being facilitated. An example is electroacoustic music composition, which nowadays is mainly a virtual practice instituted by digital manipulation, reuse and sharing of recorded or synthesized audio signals. By inspecting software aimed at electroacoustic composition as well as the outcome of such computer-assisted work (e.g. audio synthesis patches and algorithms), it was possible to discern the collaborative features of this practice and some prominent limitations. For instance, it is quite common that when distributing works, artists will include descriptions of the processes used to create work and even share the code. However, such descriptions serve as qualifications of a performer’s own account of shared resources and do not reflect collaborative engagement of a virtual ensemble (i.e., why certain materials were chosen, what problems were
encountered and how they were resolved). Another shortcoming of currently available systems is that cultural artifacts of music seldom reveal the history of collective engagement (i.e., remarks, opinions, skills or actions of individuals as they co-engage in practice). Phrased differently, the design of these artifacts lacks affordances to capture details of their appropriation in community settings. Based on these experiences and the features implemented into the DIAMOUSES toolkit, we devised a small set of interview questions aiming to assess the role of cultural artifacts as they are being used by collaborators during live music interpretation lessons. These questions are listed in the right-hand column of Table 2.

### Table 2: Interview topics

<table>
<thead>
<tr>
<th>Inscribed structures</th>
<th>Cultural artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community formation mechanisms</td>
<td>Means for understanding the shared practice</td>
</tr>
<tr>
<td>Prior knowledge of participants involved</td>
<td>Making sense of what is expected</td>
</tr>
<tr>
<td>Appropriated versus enacted structures &amp; implications</td>
<td>Social awareness of what peers are doing</td>
</tr>
<tr>
<td>Motive for recurrent participation (in other communities)</td>
<td>Online practice reification and materiality</td>
</tr>
<tr>
<td>Community (online) practice vs. members’ offline activities</td>
<td>Alignment between online and offline practice</td>
</tr>
</tbody>
</table>

Turning to the second constituent of the practice lens, namely technology inscribed structures, our concern was to assess two primary issues. The first relates to material properties of network music performance communities and how they are enabled through the appropriation of the inscriptions in the technology at hand. Thus, our concern was to decode how these communities are formed, whether membership is sufficient to facilitate engagement in practice, the extent to which communities, once formed to address a specific practice agenda (i.e., music interpretation lesson), sustain their momentum and persist across different practice agendas and what technology-embodied structures facilitate them. The second issue of concern was to assess what emerges out of the collaborators’ appropriation of inscribed structures. In other words, we sought to investigate the extent to which co-engagement leads to new structures (i.e., cliques, sub-communities) emerging in practice and not being foreseen or designed for. If such emergent structures were revealed, this would provide sufficient evidence and justification of the distinction between for appropriation and enactment, which is central to the practice lens. In light of the above argumentation, the interview was supplemented with a few more questions on technology-inscriptions as shown in Table 2.

V. ANALYSIS AND DISCUSSION

In this section we summarize key findings from our ethnographic studies and the follow-up interviews. Our intention is not to present details of technical evaluations as these have been discussed elsewhere [28]. Instead, our aim is to test the sufficiency of the practice lens in revealing traces of community life by analyzing cultural artifacts of practice and the technology inscribed structures.

A. Cultural artifacts of practice

All participants confirmed that virtual music communities emerges and sustains its function through the members’ recurrent interactions with cultural artifacts. By analyzing responses to the questions ‘Means for understanding the shared practice’ and ‘Making sense of what is expected’ in Table 2, it was revealed that two cultural artifacts dominate synchronous collaborative music interpretation lessons, namely the music score and the recorded outcome of the distributed performance.

1) The music score: The score, as means for representing music, qualifies as cultural artifact for several reasons. Participants offered varied justifications. In order of preference, they are summarized as follows:

- ‘[the score] … is a human-made object, which gives information about the culture of its creator’
- ‘[the score]… forms a type of language for music, allowing not only description, but also re-interpretation of a musical piece’
- ‘meaning resides within the score and takes the form of melody, harmony, the interrelationship of melody and harmony and the overall form or structure of the piece’

Further insights to the role of the score during a music interpretation lesson were revealed by the responses to the question on ‘Social awareness of what peers are doing’ (see Table 2). Participants noticed the affordances designed into the shared music score and how these affordances foster and facilitate shared meaning and collective sense of the common information space. Participants indicated that

- ‘I could immediately deduce what I was expected to do and at the same time, I could obtain and maintain the impression that I was not alone’.

Interestingly, it was also noted that:

- ‘such meaning does not result from the communication facilities available, but it resides solely with the score’.

Another related finding was provided by less experienced participants:

- ‘every time I lost my track, I referred to the score to regain focus’

The above leads to the conclusion that the score, in addition to being learning material, it also serves as a boundary object intertwining between the online and the offline setting, this serving the purpose of structuring (and re-structuring) unknown contexts and/or actions and assigning them with meaning.

2) The recorded performance: By analyzing responses to the question ‘How online practice is reified and obtains material properties’, respondents identified the
collective outcome of the group’s distributed music performance i.e., the recorded audio signal, as yet another cultural artifact socially constructed by the virtual ensemble. Specifically, all participants agreed that:

- ‘[… the recorded performance] is what remains as trace of the music interpretation lesson’

However, it was also strongly argued that the recorded audio signal represents only a part of the community’s practice. Another important part relates to the history of co-engagement leading to the recorded outcome. This was revealed by statements such as:

- […] the recorded performance] does not sufficiently highlight the collaboration, the mistakes made, the justifications given, the virtuosity of individual performers, the stress unfolded during the lesson, the effectiveness of the moderator, the contents of the online chat

It can therefore be concluded that the remains of a virtual ensemble engaged in music interpretation lessons comprise on the one hand the dynamics of collaboration during the lesson and on the other hand, the ‘packaged’ outcome codified in popular audio formats (e.g. wav or mp3). Notably, the latter type of virtual ‘tells’ in the language of Jones and Rafaeli [23] can be easily reconstructed using tools of the current technological paradigm (i.e., music players and browsers), while the former type remains bytes of code until such time that it is reconstructed using only the practice toolkit through which it was initially constructed.

B. Technology inscribed structures and their role

We now turn to the second issue of interest to the present work, namely inscriptions in technology. Our interest is to assess the respondents’ perceptions of what is inscribed in technology and the means (i.e., appropriation or enactment of technology inscribed structures) through which such inscriptions foster sense of community. As this was anticipated to be a more difficult and challenging topic, the questions were framed around the notion of community (see first column in Table 2) hiding technical ‘jargon’ such as quality attributes and how they are associated with technological artifacts.

1) Community types: Responding to the question on ‘Community formation mechanism’ participants distinguished between mechanisms for building and maintaining electronic neighborhoods (i.e., community through neighboring) and mechanisms for practice-oriented co-engagement (i.e., community through practicing). Participants also noticed that each type of community is fostered through different technological artifacts. Communities through neighboring are facilitated by the portal where participants designate their choice of musical instrument (e.g., piano, saxophone, guitar, etc) as well as music genre (i.e. classical, jazz, pop and funk) as a means to participate in one or more Liferay rooms. The inscription associated with this type of community was the dedicated electronic registration system. By enacting this system participants observed that:

- ‘users declare what they can do and and register their interest in a lesson, … thus becoming neighbours’
- ‘as neighborhoods, we enjoy a variety of common services such as asynchronous communication services (SMS, GroupSMS and threaded discussions) and information sharing’

The second type of community amounts to neighbors engaging in the shared practice of music interpretation lesson through practice toolkits. This type of community of practice is formed subject to different conditions. For music interpretation lessons the condition is an invitation by the moderator. Engagement in practice entails asynchronous interactions between the members as well as synchronous collaboration using the downloadable practice toolkit. The toolkit forms the only means through which a music interpretation lesson is conducted. In terms of implementation, this toolkit makes use of an augmented open source third party library, namely JMusic, to facilitate interactive exploration of the shared music score and a custom API to allow interoperability between the graphical user interface and the C++ libraries of the audio transmission modules. The synchronous collaboration-oriented structures (i.e., session management, object replication and synchronization) inscribed to facilitate social connectivity and awareness were built using an abstraction mechanism designed for this purpose. Collectively, these structures provided the means for building interactive embodiments of the linguistic domains of music lessons.

2) Appropriation versus enactment of structures: Orlikowski’s work [32] identifies appropriation and enactment as two mechanisms distinct but integral to the practice lens. She draws the distinction by recalling that ‘… existing structurational models of technology examine what people do with technologies in use, positing such use as an appropriation of the ‘structures’ inscribed in the technologies’ p.407. Enactment is then introduced to emphasize a focus on emergent rather than embodied structures. Our content-based analysis of the respondents’ remarks on questions such as ‘Appropriated versus enacted structures and implications’ and ‘Motive for recurrent participation (in other communities)’ provides evidence to support a slightly different interpretation of enactment. Specifically, we observed that all community supporting functions embodied in the Liferay portal through design, were conceived by users as appropriating structures inscribed in technology to serve solely ‘community through neighboring’ practices such as formation, information sharing and communicating. Respectively, the electronic registration system, the custom information / content templates and the dedicated communication portlets were understood as components enabling these practices. Although the choice of embodied structures being appropriated at times may differ across users (i.e., for communication some preferred email, others SMS and only moderators employed GroupSMS) there was consensus both on the scope of these structures and the exact steps for using them. Moreover, there was no confusion on members,
Enactment was largely conceived as a mechanism associated with the practice toolkit. Specifically, two types of enactment were noted. The first relates to becoming co-partners in the designated practice of music interpretation lessons. The second is a form of enactment grounded on what emerges as a result of the members’ co-engagement in practice. The former, namely enactment as co-engagement, was revealed by the fact that the practice toolkit is the only means enabling emergent structures of the type ‘communities through practicing’. The latter, namely enactment as collective praxis, is revealed by the ‘packaged’ outcome of cultivated virtual communities of practice. The emergent property of enactment is evident in the cultural artifacts produced by the respective communities and which cannot be foreseen in advance. For instance, the interpretation of a music score and its codification as an audio file is emergent rather than pre-determined outcome of the micro-negotiations of the virtual team.

Our case study was also informative of some peripheral implications of enacting designated inscriptions in technology. For instance, in one ethnography the group reported sharing of their rehearsed work through a different social networking medium and using this medium to establish and sustain (another) virtual community with third parties (not taking part in the music interpretation lesson). Notably, it was also reported that this had a positive implication, in the form of high interest expressed on the DIAMOUSES technology and tools.

3) **Online an offline praxis:** A final useful insight relates to how (i.e., through which artifacts) online practice is implicated in offline activities and vice versa. The findings re-established the critical role of cultural artifacts as boundary objects and confirmed that offline practice is strongly intertwined but not fully determined by what happens online. This conclusion shares common ground with recent works by organization and management scientists [33]. In our case, online practice and offline (local) performance are intertwined through the shared music score and computer-mediated social interaction such as verbal queues expressed either orally or textually (i.e., go back and forth, focus on specific phrases etc). Nevertheless, the current version of the shared music score is not sensible to contextual information characterizing offline performance at remote sites (i.e., score following is not supported). Consequently, enactment of designated actions locally may lead to variable performance and this variation may be important. For instance, we observed that correct musical performance is still possible using suboptimal local (material) practices (i.e., wrong notes or erroneous rhythmic patterns). One possible improvement is to augment the affordances of the score so as to support score to audio alignment as a means for making sense of local practices.

VI. **CONCLUSIONS & FUTURE WORK**

This paper set out to provide insights to networked music communities through an analysis of virtual ‘tells’ revealed by cultural artifacts of practice and inscriptions in technology. This is quite distinct in orientation as most studies concentrate on community management theory to understand virtual communities, thus ignoring the practice these communities become engaged. Our analysis leads to the conclusion that virtual community is constituted by structures inscribed in technology, while the community’s existence is manifested through cultural artifacts which reveal both community traces and elements of the practice in which members become engaged. Moreover, understanding what is inscribed in technology is best facilitated by analyzing quality attributes which make explicit the artifacts of evolution and emergence (i.e., the properties which are not explicitly designed into the technology). Our analysis is also supporting the conclusion that in virtual settings practice is revealed through two ‘faces’ or constituents, namely practice unfolded through social interaction and practice encapsulated in processes, tools and artifacts of the practice toolkit. Most of the recent studies on virtual communities do not recognize this duality that characterizes practice, as they concentrate on the face of practice as revealed through social interaction and analysis of content transcripts. Framing practice in processes, tools and artifacts offers valuable insight to the collaboration that takes place online and the means enabling this collaboration. Our case study reveals that such collaboration creates cultural glues and shared context, which is important for virtual groups. Additionally, it unfolds recurrent praxis, which to a large extent is what sustains community and facilitates its evolution.

Another contribution of the case study is in pointing out desirable features, which however, could not be revealed with the current generation of tools. It turns out that an important issue relates to capturing the history of the group’s collaborative performance. This can be attained by augmenting the affordances of the corresponding cultural artifacts. Specifically, the music score can be augmented to allow capturing of the succession of score manipulations (i.e., inclusion of expressive marks, note or rest insertions/deletions, annotations etc). This will track how the designated practice evolves. Furthermore, score following is important to enhance sensitivity of the online space to local (offline) conditions and praxis. As for the audio recording, history is essentially manifested through the temporal evolution of the recorded audio signals. However, for this information to be further usable in manifesting practice and how it evolves, one needs to analyze the audio signal in higher-level semantic descriptors. Such descriptors may for example be the variations in tempo and rhythm, the deviations of the played notes from the notes depicted on the score, the introduction of expressive marks indicating dynamics and ornamentation, as well as other music qualities that will manifest not only the way each musician responds to score directives but also how performers and moderator affect one another. Audio description formats such as SDIF or MPEG-7 may be used for this purpose as they enable richer community traces. To this end, audio descriptors may concern both static information (such as the piece of music performed, the names of the music performers, the participating musical instruments, the date when the lesson...
took place etc.), as well as dynamically evolving information which can be temporally aligned with the audio signal (e.g. note pitches, tempo variations, dynamics, etc.). Such descriptors will allow for tracing the evolution of the lesson, both in terms of the practices projected as score manipulations as well as their influence on the act of musical interpretation.

ACKNOWLEDGMENT

DIAMOUSES (2006 – 2008) was funded in the context of the Regional Operational Programme of Crete and coordinated by the General Secretariat for Research and Technology, of the Ministry of Development of Greece.

REFERENCES


[34] M. Kuuskankare, M. Laursen, Strategies and methods for creating symbolic electroacoustic scores in ENP. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 5493 LNCS, 2009, pp. 262-271


