Challenges for a Second Decade of Ubimus Research: Metaphors for Creative Action (part 1)

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Abstract

This is the first part of a discussion on the challenges of a second decade of ubimus research. I lay out and exemplify the concept of metaphor for creative action. I summarize the results of three studies employing the time tagging metaphor, configuring an effective strategy for supporting everyday musical creativity. Then I report results of a study employing the stripe metaphor – an extension of time tagging devised for usage of a large number of resources. Twelve subjects, encompassing musicians and casual participants, realized improvisatory sessions in a non-standard setting – an audio and musical equipment store. The results indicated a promising new avenue of research targeting lay-musician interaction.

1. Introduction

In 2009, after two years of intense exchange – led by two Brazilian research groups, NAP (UFAC/IFAC) and LCM (UFRGS) – the initial proposal on ubiquitous music research (ubimus) was laid out in a series of papers and artworks presented at the Congress of the ANPPOM [1] and at the Brazilian Symposium on Computer Music [2, 3]. Subsequently, case studies and artistic products were presented as invited exhibits, talks and panels at the Biennial of Latin American Art in Denver, Colorado (2013), ANPPOM (2014), SIMA (2015) and SEMPEM (2016). An upcoming issue of Per Musi features a section dedicated to ubimus and special volumes were published by Sonic Ideas (2013), Cadernos de Informática (2014) and Scientia Tech (2015). Aside from the multiple chapters and papers that have appeared in specialized publications over the last few years – such as the Journal of New Music Research, Organised Sound, and the Journal of Music Technology and Education – a reference volume was released by Springer Press in 2014. Hence, I believe we can say that ubiquitous music constitutes a consolidated research field.

One of the objectives of ubimus endeavors is to provide access to creative music making for a wide range of participants. Supporting good-quality musical products without creating unnecessary barriers to novice participation is particularly tricky. Hence, ubimus research has yielded alternative approaches, including the development of creativity support metaphors. These metaphors can be used to guide the implementation of technological infrastructure. Whether the metaphors are effective means of support for creative activities demands experimentation and data collection in real settings. Thus, ubimus studies deal with the assessment of creative products and processes while subjects carry out musical activities in everyday contexts.

In this paper, I summarize and discuss the results of field studies employing time tagging [4] and report results of a study employing the stripe metaphor [5]. Firstly, I lay out the concept of metaphor for creative action. This is intrinsically linked to ubimus research, and to the best of my knowledge, it has not been articulated in related fields – including computer music, creativity studies or human-computer interaction. The second section of the paper provides a short description of the time tagging metaphor and summarizes the experimental findings of three ubimus studies, highlighting the limitations of the initial implementations. Part of these limitations are

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addressed by the second generation of mixDroid prototypes, embodying the stripe metaphor. Access to massive resources is one of the factors considered in this new set of support tools. I report a study involving both musically trained and lay subjects in everyday settings. Lay-musician interaction emerges as one of the key findings of the experiment. Whether the phenomenon of increased engagement is linked to the participation of both musicians and naive subjects is an experimental question that demands further study. In the last section of the paper, I place these issues within the larger context of future research endeavors in ubimus.

2. Metaphors for creative action

Creativity support metaphors furnish a contact point between musical interaction metaphors [6] and the approaches to creativity laid out in interaction aesthetics [7]. Metaphors for creative action differ from domain-specific musical interaction metaphors (see the proceedings of the NIME conferences for multiple examples of the latter). While musical interaction metaphors strive to provide support for musicians within the context of executive activities, metaphors for creative action strive to increase the participants' creative potentials. Hence, they are applicable to a variety of design activities, including planning and exploration. Creative potentials can impact the intended and the unintended by-products of the activity. So they not only target explicit cognitive processes. Metaphors for creative action may find application when the activity demands usage of tacit knowledge.

The creativity support metaphors described in the following sections – time tagging and the stripe metaphor – employ designs based on ecologically grounded strategies [4]. Time tagging uses sonic cues as proxies for the temporal distribution of sonic events. The next section provides multiple examples of experiments that employ time tagging and the stripe metaphor for mixing sonic resources.

3. Time tagging experiments

Two generations of prototypes were designed and deployed [5, 8]. As an initial validation process, Keller et al. (2009) used an emulation of a first-generation mixDroid prototype (mixDroid 1G) for the creation of a complete musical work [1]. The procedure encompassed several mixing sessions. The mixDroid 1G prototype was used in the emulation mode on a laptop computer and was activated through pointing and clicking with an optical mouse. Several dozens of sound samples were used, with durations ranging from less than a second to approximately two minutes. The temporal structure of the mix was based on the temporal characteristics of the sonic materials (biophonic sounds). The result was a seven-minute stereo sound work – *Green Canopy On The Road* – the first documented ubiquitous music work, premiered at the twelfth Brazilian Symposium on Computer Music, held in Recife, PE [1].

Focusing on the demands of naive participants in everyday contexts, a second study [9] comprised creative activities in public settings – at a shopping mall, at a busy street and in a quiet area featuring biophonic sounds – and in private settings – at the home of each participant and at a studio facility. Six subjects participated in 47 mixing sessions using samples collected at two outdoors sites comprising urban sounds and biophonic sources. Creativity support was evaluated by means of a creative-experience protocol encompassing six factors: productivity, expressiveness, explorability, enjoyment, concentration, and collaboration (CSI-NAP v. 0.1 – [10]. Outdoor sessions yielded higher scores in productivity, explorability, concentration and collaboration when compared to studio sessions. Compound effects of sound sample type and activity location were observed in the explorability factor when biophonic sound samples were used. Similar effects were detected on explorability, productivity and concentration in the conditions employing urban sounds.

A third study [11] made use of recorded vocal samples created by the participants. In order to untangle the effects of place and activity type, three conditions were studied: place, including

domestic and commercial settings; activity type, i.e. imitative mixes and original creations; and body posture, realizing the mix while standing or sitting. Ten subjects took part in an experiment encompassing 40 interaction sessions using mixDroid. Subjects created mixes and assessed their experiences through a modified version of the CSI protocol applied in the previous studies [10]. Explorability and collaboration factors yielded superior scores when the activities were carried out in domestic settings.

The results highlighted the impact of the venue on the support of everyday creative experiences. The outdoor spaces were preferred by the participants of the second study and domestic settings got slightly higher ratings in the third study. While the profile of the subjects impacted the outcome of the third study, this trend was not confirmed by the second study's results. Hence, the main conclusion to be drawn from these studies points to the impact of the venue on the subjects' evaluation of the creative experience. Both their ability to explore the potential of the support metaphor and their ability to collaborate were boosted by domestic settings and by outdoor settings.

4. Fostering professional creativity in everyday settings, the stripe

Despite the positive outcomes of the experiments involving time tagging support for novices, no attempt was made to address the needs of professional participants. Given the different requirements of musicians and non-musicians [12], it would not be surprising to find that effective support for novices does not meet the expectations of professional usage. In this section, I describe a new metaphor based on time tagging and a methodological strategy that incorporates an ecology of devices to support creative activities by both musicians and laypeople in everyday settings.

The second generation of mixDroid prototypes features a new interaction mechanism: the stripe (figure 1). The stripe acts as a functional unit that features both interaction support and audio manipulation. This metaphor ties to the sonic sample the functionality previously linked to the audio channel in analogue systems. The objective is to allow for synchronous interaction with a large number of elements to overcome the screen-size limitations of small devices. Stripes enable mixing using both hands. The amount of active stripes depends on the device's computing power and on the participant's cognitive abilities. Thus, similarly to previous time-tagging implementations [8], devices with low computational resources can be used for complex creative activities in everyday contexts.

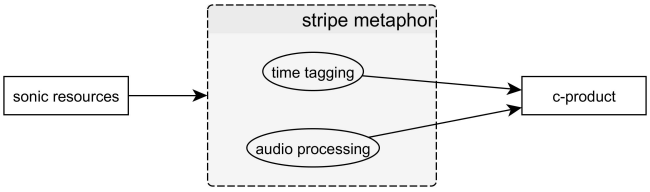

Figure 1: The stripe metaphor: bringing together audio processing and creative decision making on a single functional unit.

The *stripe* acts as an entry point to the sound data. Each stripe displays basic information on the sample being handled, including the file name, the total running time, the current time and the execution state [5] (see figure 5). Each sound file linked to a stripe is processed independently. By linking the interaction mechanism with the sound sample, the stripe releases the user from the requirement of dealing with multiple samples as a block (as it is the case in the mixing-console metaphor that has the audio channel as its basic functional unit). Synchronous mixing of multiple sound sources is supported without compromising the parametric independence of each source. From the perspective of the user, sounds that demand fast interaction can be placed on stripes that are close to each other. This flexibility, combined with the ability to select stripes though scrolling, should grant quick access to a large number sonic items.

5. *Provocative Synthesis II:* a stripe metaphor study

The study *Provocative Synthesis II* addressed the impact of the stripe metaphor in musical activities involving both musicians and novices.

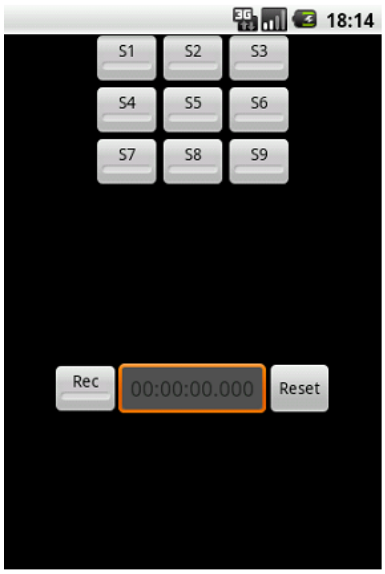

Figure 2: mixDroid 1G, on emulator.

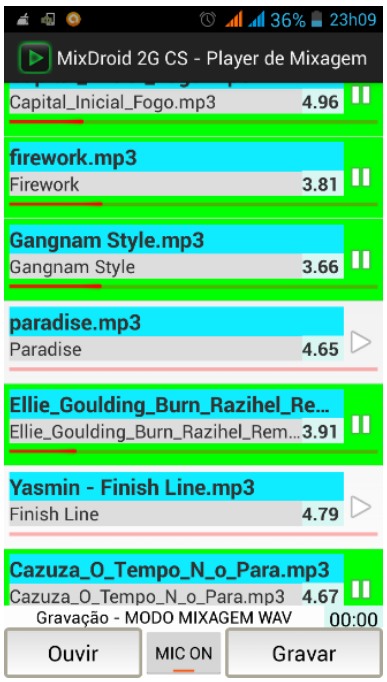

Figure 3: mixDroid 2G, the stripe metaphor.

The study encompassed musicians performing amplified electric instruments and casual users triggering audio sequences on mixDroid 2G CS. This proposal forms part of a series of ubimus experiments devised by the musician Edemilson Ferreira [11, 13].

Settings and equipment. The study was carried out at an audio and musical equipment store located in downtown Rio Branco, AC, Brazil. The hardware included a portable computer, a six-channel JamHub mixer, and stereo headphones for each of the participants. The JamHub system [14] features independent returns through headphones for each user. The output from the mixer was routed to the computer and sound levels were monitored by the researcher (Figure 4). The prototype mixDroid 2G CS was used on an Iconia One Acer tablet, running the Android 4.1 operating system. The musicians played electric guitar and electric bass.

Subjects profile. Twelve subjects participated in the sessions, including 6 musicians and 6 laypeople (table 1). Their average age was 28.5 years with a standard deviation of 6.76 years. Three of the six self-described musicians had no formal study but reported ten or more years of proficiency playing either electric bass or electric guitar.

N	age	men	women	musicians	non-musicians	formal study
12	28.5 ± 6.76	7	5	6	6	3 years

Procedures. The eleven improvisational sessions had an average of 4 participants per session. Each activity lasted approximately two minutes. Lay participants sat on benches, while the musicians preferred to play standing. Musicians were free to improvise within the bounds of the rhythmic reference laid out by the soundtrack and by the verbal instructions. Throughout the sessions, the mixDroid player was responsible to start the sonic exchanges. All sonic results were recorded as PCM uncompressed audio files.

As in previous creativity assessment experiments [5, 12, 9], we employed the CSI-NAP to collect data on the creative activity and the creative products. Two factors assess the creative products (relevance and originality). The other four factors target the experience involving the settings, the tools and the participants' experience (easiness of use – the inverse of cognitive effort; focus on activity; fun or enjoyment during the activity; productivity – whether the activity and the result were considered productive; and collaboration – involving the support for social interaction among the participants). The 5-point Likert scale adopted varies from 'I strongly disagree' (-2) to 'I strongly agree' (+2). Zero stands for no preference or no answer. All the participants filled the forms immediately after each session.

Figure 4: Subjects participating in *Provocative Synthesis II* at an audio and music equipment store.

Results. The overall results indicate a positive assessment of the experience (Figure 6). Strikingly, both musicians and non-musicians gave the highest rating to collaboration support (2.00 $\pm$ 0.00). Enjoyment was also highly rated with little variation among sessions (1.91 $\pm$ 0.30). Easiness of use got high ratings by all subjects except one (1.73 $\pm$ 0.90). The other two descriptors of the experience got positive ratings but higher standard deviations: focus (1.64 $\pm$ 0.50) and productivity (1.55 $\pm$ 0.69). Finally, the musical product was described as being creative, but this result was not uniform across subjects: relevance (1.55 $\pm$ 0.52) and originality (1.64 $\pm$ 0.50).

A description of the observations done throughout the sessions may help to give context to the results. The choice of the experimental settings somehow facilitated the initial contact with the subjects. In contrast with previous experiments in everyday musical creativity[11, 15, 16, 9], *Provocative Synthesis II* involved interactions among professional musicians and laypeople. Previous experiments focusing on creative activities outside of musical venues involved difficulties in drafting participants for the tasks.

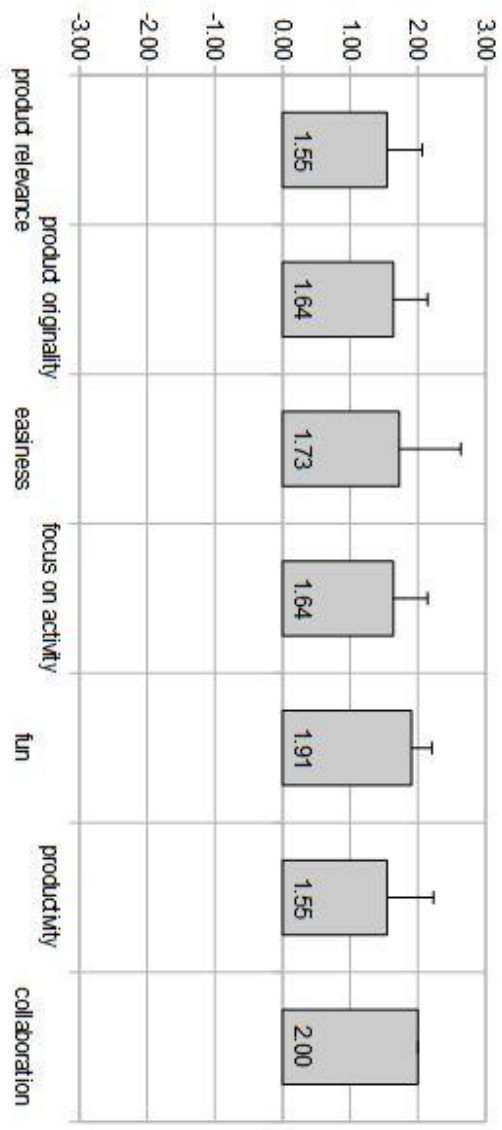

Figure 5: Results of the *Provocative Synthesis II* experiment for 11 iterations by 4 subjects per session. Data collected through the CSI-NAP.

This was not the case in this experiment. During the activities, we observed that a majority of store visitors were curious and interested in participating in the experience. While novices are generally reluctant to get involved in activities with non-musicians, in this case the possibility of participating in a creative activity with experienced musicians may have sparked their interest.

Limitations. Despite the promising avenue opened by the initial results, several difficulties still need to be addressed. Given the amount of equipment involved, technical preparations become tricky. The multi-user mixer is an effec-

tive bridge to integrate instrumental sources with ubiquitous music tools, such as mixDroid. But the dependence on wires and plugs compromises the portability of the system. A combination of wireless connectivity and software-based multi-user mixing might help to increase the mobility of the setup. Another limitation of the study is the small number of sonic resources used by the casual participants. This variable may be related to the profile of the user or to the time available for exploration. In this case, the objective was to assess the ability of the participants to create collaborative sonic products without extended preparation. Hence, it is not possible to determine whether the subjects needed more time or a different kind of support.

Contributions. The high ratings given to the collaboration factor indicate that both the musicians and the untrained subjects felt they were contributing effectively to the musical result. Neither the characteristics of the settings nor the creative products conform to the expected patterns of a professional musical experience. Consequently, these results cannot be classified as a professional-creativity musical outcome (cf. [17] for a theoretical discussion of this issue). Furthermore, the high level of collaboration reported here was not observed in other everyday creative activities [11, 9]. The results may be interpreted as an indication that the musical experiences at the fringe of professional and everyday creativity open opportunities for effective contributions both from musicians and novices.

6. Challenges for future ubimus endeavors

A recent review of musical creative practices [18] mentions four trends that demand stronger theoretical and methodological frameworks: (1) change of focus from creative products to processes [19]; (2) increased reliance on information technology support [20]; (3) increased importance of local resources in creative activities [21]; (4) a shift from prescriptive models to descriptive and predictive models [22, 23, 18]. The design strategies discussed in this paper provide examples of creative decision making grounded on local material resources. The two support metaphors proposed in this paper enhance the available set of techniques to handle these resources.

A good example of the importance of creative processes is provided by the lay-musician interaction phenomenon observed in the stripe metaphor study. Despite the increased levels of engagement by naive participants, it is not clear how to address the demands of professional stakeholders to achieve creative outcomes. The strategy employed in this study involved restrictions on the type of musical material – through verbal instructions provided at the outset – and freedom of action for casual participants. Effective support may involve a combination of fixed resources and open procedures. How much flexibility and what level of guidance are necessary are questions to be answered through multiple iterations of designs and experiments.

The emergence of everyday musical creativity as a social phenomenon worth of study provides grounding for Truax's assertion that current musical practices have raised the demands for technological support. Little-c music can hardly be conceptualized without the existence of mobile and ubiquitous technology. Wireless networks, portable devices and embedded technologies constitute the venues that foster creative music making almost anywhere [24]. The time tagging studies reviewed in this paper indicate the need of a broader understanding of the support requirements for everyday creativity. A variety of environmental impacts on the creative activities were consistently documented, as enablers for creative action and as negative influences on the participants performance. While outdoor spaces got positive evaluations when compared to studio settings and domestic spaces were chosen over commercial spaces, the assessments were not uniform across all factors.

An important flag raised by the *Provocative Synthesis II* study is the potential exploration of an inclusive form of social engagement involving both proficient partners and casual participants in ubiquitous musical activities. Acoustic musical instruments demand long periods of training to achieve minimally rewarding musical results. This practice is aligned with the needs of pro-

fessional creative results. The concept of everyday musical creativity that emerges from recent ubimus studies widens the geographical availability of spaces for music making by including creative phenomena which are not linked to artistic venues and enhances the access by stakeholders that have been traditionally excluded from creative practice. The results of the study point to good levels of engagement when both musicians and casual participants are involved. But support for lay-musician interaction may imply tailoring for specific needs.

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