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SECOND-WAVE UBIQUITOUS MUSIC APPROACHES TO KNOWLEDGE SHARING

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Abstract: *This paper describes two ubiquitous music (ubimus) environments that foster knowledge creation and resource sharing. The proposed designs tackle knowledge production support taking into account the embedded-embodied nature of musical activity and the community-based aspects of meaningful mutual engagements. The first case deals with deployments of the jam2jam system in formal and informal educational settings, emphasizing the role of listening as a strategy for knowledge generation. The second example targets the design of a creative-action metaphor that makes use of environmental sonic cues for aesthetic decision-making – time tagging. We place the problem of knowledge sharing within the context of current theoretical approaches to creativity. The results indicate that creative musical activities may involve the usage of environmental cues and intense social interactions. These aspects need to be addressed when designing support technologies for creative action.*

Keywords: *Second-wave ubiquitous music; knowledge sharing; jam2jam; time tagging.*

Introduction

Research in the social and applied aspects of ubiquitous music (ubimus) making indicates that knowledge production and sharing may constitute key enablers for creative musical outcomes (Brown et al. 2014; Lima et al. 2012). In this paper, we discuss the concepts of shared, tacit and explicit knowledge. We describe the current approaches to musical creativity support, highlighting their limitations and potentials targeting a broad perspective on knowledge acquisition and sharing. Finally, we analyse two cases within the context of the ongoing efforts to support creative experiences by musicians and non-musicians in educational, artistic and everyday settings.

Knowledge and creative magnitudes

Since Polanyi's (1958) initial formulation of the concept of tacit knowledge, the idea that some forms of knowledge are not amenable for sharing has increasingly gained acceptance. Based on a survey of 60 papers from the area of knowledge management, Grant (2007) analyses the impact of the tacit knowledge concept and formulates a model based on Polanyi's work. Grant's (2007) model adopts Polanyi's basic precept that all knowledge includes a degree of tacitness. Hence, a continuum between tacit and explicit states provides a better representation than the either/or usage found in other proposals of knowledge management through information technology. Grant's survey indicates that the adoption of an overly simplistic view of the tacit/explicit dimension leads to significant failures in knowledge management practice, especially in information-technology projects. The proposed model features contexts which are suitable for stakeholders with a limited background experience, with little tacit knowledge; through settings where experts with shared backgrounds

and experience can make use of their tacit knowledge; includes situations in which personal knowledge that can hardly be made explicit; and contexts where it is impossible for the stakeholders to articulate their knowledge, hence the label 'ineffable'.

Rather than equating tacit to implicit knowledge, Grant suggests that implicit knowledge might be described as tacit knowledge that has the potential to be made explicit. For example, a community that shares a common view of the necessary resources to achieve a goal while avoiding making their knowledge explicit through spoken or written language. The use of explicit representations – such as verbal explanations, graphic depictions or the implementation of symbolic systems – depends on the degree of specialization of the participants. Experts within a field have a large pool of shared tacit resources. Beginners, on the other hand, demand broadly shared knowledge, such as natural language, to eventually gain access to implicit resources.

Polanyi's model of tacit knowledge can be applied beyond the context of knowledge management. While knowledge transfer is an important aspect of artistic practice, no less important is the generation of new – original and relevant – knowledge (Dewey 1934). The processes involved in the production of new knowledge, encompassing both activities and results, have been dealt with within creativity studies (Kozbelt et al. 2010). A recent categorization of general creativity magnitudes fits well within the dimensions of knowledge proposed by Grant and Polanyi. Following (Beghetto and Kaufman 2007; Kaufman and Beghetto 2009) four levels of creative magnitude have been proposed: eminent creativity (Big-c), professional creativity (pro-c), everyday creativity (little-c) and personal creativity

(mini-c) (Kozbelt et al. 2010: 23). Big-c or eminent creativity encompasses manifestations socially established as paradigmatic examples of creative results, such as published works of art and scientific theories. Eminent creativity outcomes target professional creative products that involve wide social exposure. Personal experiences leading to creative products fall within the context of everyday or little-c creativity studies (Richards et al. 1988). Mini-c creativity is characterized by internal, subjective and emotional aspects of everyday creativity. Thus, the little-c label is reserved for everyday creative phenomena that yield products. Between little-c and Big-c phenomena, Kaufman and Beghetto (2009) suggest a third type of creative behaviour: professional creativity or pro-c, encompassing creative achievements that do not attain the eminence of Big-c manifestations. Both pro-c and Big-c processes require explicit knowledge only accessible to experts. The difference between these two magnitudes can be gauged by the social impact of the creative outcome. Within the context of musical practice, Big-c products are usually surrounded by a large production of explicit knowledge in the form of written discussions, analyses and derivative works (Simonton 1990). This facilitates the access to the musical work by a broader public. Pro-c products also rely on a fair amount of extramusical knowledge, but in this case implicit knowledge involving specialized skills in listening and sound-making plays a large role. Everyday musical creative phenomena are characterized by nontechnical settings and the participation of casual stakeholders (Keller et al. 2014b; Keller and Lima 2015). Therefore, little-c music-making does not require specialized knowledge and relies on local resources and personal experience, reducing the demands of tacit knowledge to achieve creative results.

Contrastingly, the ineffable quality of tacit knowledge characterizes mini-c musical phenomena. While musical creativity has traditionally been equated to sonic outcomes, the relationship between the material resources and the cognitive processes leading to those outcomes has only recently been addressed. How to share tacit knowledge remains one of the issues to be tackled by ubiquitous music research.

Musical knowledge

Where is musical knowledge situated within the tacit/explicit dimension? The answer depends on the type of knowledge being considered. While musical systems shaped after the acoustic-instrumental paradigm – i.e., a view that reduces musical experience to symbolic or mechanic systems based on the constraints and possibilities afforded by acoustic musical instruments (cf. Bown et al. 2009; Keller et al. 2011; Keller et al. 2014 for critical reviews) – rely on explicit resources such as common-practice musical notation and digital emulations of instruments, ubiquitous musical designs have striven to attain both accessibility and sustainability through the incorporation of embedded-embodied experiences and community-shared knowledge. Even though there is nothing wrong with the reproduction of music practices that have been done for four hundred years, from a ubiquitous music perspective we believe creativity-oriented designs have to tackle the emergent music practices that target everyday venues involving the participation of non-professionals.¹ Hence, while acoustic-instrumental designs entail virtuosic performances (Wessel and Wright

¹ This need has been highlighted by the multiplication of music-making activities on networked platforms after 2020.

2002), ubimus designs embrace manifestations of everyday creativity (Keller 2020; Keller and Lima 2015; Pinheiro da Silva et al. 2013). The type of knowledge required by these two approaches to musical interaction design is very different. Acoustic-instrumental designs rely on explicit symbolic notation and/or extensive exposure to specialized instrumental practice. Ubimus designs rely on local and opportunistic usage of social and material resources.

The next two sections of this paper describe two ubiquitous music cases that involve musical and extramusical knowledge production and sharing. The first case targets educational settings and focuses on knowledge gained through social interaction. The second case summarizes results gathered in everyday settings (originally not meant for music making) and features knowledge acquisition and decision-making through the use of sonic environmental cues.

Case 1: Meaningful engagement with jam2jam

This study looks at the educational affordances of the jam2jam interactive software environment. Jam2jam is a generative music system whose parameters are managed in real time by a human performer (cf. <http://explodingart.com/jam2jam>). Jam2jam provides a virtual band of generated music in popular music styles with user control over high-level musical parameters for individual parts including timbre, density, pitch range or tempo. Depending upon the version of jam2jam in use, controllers can be on-screen icons of faders, MIDI-based slider interfaces, or touch screen interface elements sending OSC (open sound control) messages to the generative engine. Jam2jam applications can be networked together into a synchronised music system

and parameter adjustments by any performer are broadcast to all nodes so that the state of all instances of jam2jam remain the same. Designed to promote meaningful engagement with music (Brown and Dillon 2012), the jam2jam system and associated activities, relied on aural and gestural engagement with an interactive music system. By focusing on modes of engagement (Brown 2000) the system leverages music listening skills as a feedback mechanism to monitor various types (modes) of skill development.

Jam2jam performances provide a network-jamming experience which pose two particular challenges for listening acuity and thus for skill development. Firstly, ensemble members may be geographically distributed, thus the normal visual or verbal cues associated with face to face musical performance are not present. This increases reliance on other coordinating cues such as sound. Secondly, the music is algorithmically generated and the performance control over sound events is indirect therefore gestural motor memory is not a reliable judge of parameter level balance making aural feedback more critical. In addition the generative parameters can produce unexpected results, only noticeable in the audio stream, which may require immediate responses.

Network-jamming interaction via jam2jam involves recognising sources of agency which might be oneself, another ensemble member or the generative algorithm. In the case of a distributed performance this task relies quite heavily on sonic cues. There are interface movements that provide hints that something is being changed, without specifying who or what has made the change. In an analysis of jam2jam interactions Adkins et al. (2012) point to Ricoeur's 'course of recognition' as a framework for understanding participant interactions. Ricoeur

divides the course of recognition into three elements: ‘recognition as identification’ where we notice that someone or something is acting and can classify or identify the characteristics of the action, ‘recognizing oneself’ such that distinctions between our actions and those of others or of other things are made explicit, and ‘mutual recognition’ where the recognition of oneself by others leads to a sense of personal and social identity.

Ricoeur’s framework provides a useful structure for exploring the role of aural awareness in performances with ubiquitous music systems, like jam2jam. The first component ‘recognition as identification’ is evident in ways participants learn the behaviour of the system and of other participants. The musical styles in jam2jam are popular music idioms such as reggae and synth-pop and a user’s familiarity with the genre conditions their expectations. Through individual exploration of parameter adjustments users learn to identify musical changes and begin to appreciate the emergent combinatorial effects of multiple parameter adjustments. In collaborative sessions combining this knowledge with visual cues performers are able to notice interventions from other participants.

Moving to the second component ‘recognition of oneself’, users can fairly easily appreciate changes they make from those of others and from the computer-generated variations. Given that the generative algorithm’s automation is quite limited, these distinctions are clear. Nevertheless, for novice musicians the combinatorial complexity of several parameters and several parts varying simultaneously can be confusing.

Distinguishing between the actions of multiple ensemble musicians also requires attention. In some cases arbitrary areas of responsibility are

established, for example player A may manage the drum part while player B manages the harmonic material. This subdivision of labour assists in ‘knowing’ who is acting. However, in most cases any change could be made by any player in the network. So a change by itself is not sufficient for recognising who is acting.

The third framework component, ‘mutual recognition’, addresses such identification of others and their identification of your actions. Over time musicians can become familiar with the patterns of behaviour and the ‘sound’ of other musicians. In jam2jam sessions the same can occur. However the indirect nature of audio control often makes learning these behaviours challenging. In a sense the task is one of meta-listening where attention is paid to the patterns of change rather than to the qualities of those sounds being generated by the computer. Despite these difficulties, users of jam2jam are still able to recognise tendencies toward subtle or dramatic variations, passive or aggressive control behaviours, and distinctive ‘moves’ that characterize individuals, comparable to performers that have favourite ‘licks’ or ‘riffs’ and composers that have recognisable musical signatures.

Generative ubiquitous music systems, like jam2jam, are often deployed for activities with non-expert musicians. The scaffolding provided by the automated playing facilitates their participation. It may seem that the ‘recognition’ process previously described may be a barrier to engagement. However research into uses of jam2jam shows a different outcome. Various deployments of the jam2jam system have been used in formal and informal educational and community music settings. In each of them, listening is a key strategy for knowledge generation and sharing. Listening is critical because musical expression and

communication is central to the jam2jam experience. These outcomes suggest that music-making transcends other communication methods and involves a wordless knowing of others that becomes a basis for relationships and interactions within social contexts (Dillon 2011).

Case 2: Time tagging in everyday settings

While the first case focused on knowledge production and exchange within educational settings, this section deals with support for creative activities in everyday contexts. Back in 2010, Keller and collaborators proposed time tagging as a strategy to avoid the computational burden of the visually oriented approaches to audio mixing (Keller et al. 2010). This creative-action metaphor provided a fertile ground for musical experiences in everyday settings featuring the participation of non-musicians (Farias et al. 2014; Keller et al. 2013; Pinheiro da Silva et al. 2013). Experiments with casual users doing simple mixing activities on portable devices indicated that the time tagging metaphor fostered creative results (Farias et al. 2015) and efficient usage of resources (Radanovitsck et al. 2011).

Two generations of prototypes were designed and deployed (Farias et al. 2015). 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. The objective was to test whether the interaction technique would be suitable for a complete sound-mixing cycle: from the initial state — defined as a collection of unordered sound samples, to the final state — a time-based organised set of sounds. 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 (frog calls). 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 (Keller et al. 2009).

After the initial validation phase, two complementary studies were conducted. Focusing on the demands of casual participation in everyday contexts, a second study (Pinheiro da Silva et al. 2013) was carried out in public settings (at a shopping mall, at a busy street, in a quiet outdoor 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 comprising urban sounds and biophonic sources. Creativity support was evaluated by means of a creative-experience assessment protocol encompassing six factors: productivity, expressiveness, explorability, enjoyment, concentration, and collaboration (CSI-NAP v. 0.1 – Carroll et al. 2009; Keller et al. 2011b).² Outdoor sessions yielded higher scores in productivity, explorability, concentration and collaboration when compared to studio sessions.

A third study made use of recorded vocal samples created by the participants (Keller et al. 2013). To untangle the effects of the location and the type of activities, three conditions

² The CSI-NAP protocol has gone through multiple deployments and adjustments that currently reflect the need for versatility while keeping the consistency of the assessments. See Keller et al. 2014 for a theoretical discussion of requirements for creativity assessment.

were studied: place, including domestic and commercial settings; activity type, i.e. imitative mixes and original creations; and body posture, executing the mix while standing or sitting. Ten subjects took part in an experiment encompassing 40 interaction sessions using mixDroid 1G. Subjects created mixes and assessed their experiences through a modified version of the CSI protocol (Keller et al. 2011b). 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 musical 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 deployments 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.

Conclusions

We presented the application of two ubimus approaches to overcome the problem of knowledge acquisition and sharing during creative musical activities. The second example featured time tagging, a creative-action metaphor that makes use of local sound cues to scaffold decision-making. The three time-tagging studies discussed in this paper point to a growing body of evidence indicating that this creativity support metaphor may be well suited to handle knowledge sharing in ubiquitous musical activities. The first case

provided a discussion of the use of jam2jam in educational settings, a ubimus system designed both for remote and colocated synchronous musical activities. The deployments of jam2jam indicate that participants deal with knowledge acquisition and agency at three levels. The first involves 'recognition as identification' - where the participants' actions are related to the corresponding sonic outcomes. The second entails 'recognition of oneself' - involving the ability to separate one's own sonic products from other participants' sonic products. The third level encompasses a process of 'mutual recognition' - where the musical exchanges lead to a sense of shared identity.

Both studies illustrate how listening provides support for creative activities that demand knowledge acquisition and sharing. In his article "Music is a wordless knowing of others" the jam2jam project developer, and former leader of important Australian research initiatives, Steve Dillon reported that inexperienced musicians, including young children and the disabled, are able to establish meaningful musical interactions and indirectly develop musicianship skills through group-based musical activities (Dillon 2011). He suggests that this knowledge of others and of music develops naturally through sonic, visual and tactile communications indicating that in creative activities we can do more than listen for pleasure, we can be listening for knowledge.

To complement these findings, the second cycle of ubimus initiatives has highlighted the role of multisensoriality as a conduit for shared decision-making, including not only modality-specific information but also intermodal strategies such as the use of taste, smell or shapes and visual textures as resources to induce musical actions. These strategies point to the need to revisit the standard concepts

employed in music theory as a way to align the theoretical constructs with the post-2020 reality of a growing diversity of artistic practices that are not supported, and much less encouraged, by 20th-century music theory (cf. Keller and Lazzarini 2017; Keller et al. 2021).

A promising line of ubimus research targets the development, deployment and assessment of pliable design constructs, such as ‘musical stuff’ (Messina et al. 2022). Musical stuff is defined as “(1) a phenomenology of (2) pliable entities that enable (3) distributed creative activities, (4) deployable on the musical internet.” This four-component definition takes into account the distributed aspects of music-making emphasizing the role of the community-based common assets that are still accessible by means of network infrastructure (items 3 and 4). It also stresses the dual nature of ubimus stakeholders, indicating that human and material resources tend to depend on each other and consequently resist the enforcement of hierarchies (items 1 and 2).³

This proposal is, of course, one among many others. An exciting quality of recent ubimus developments is the emergence of strikingly different approaches to handle old and new problems of technological design and deployment which feature a profound respect for aesthetic diversity and a sensitivity toward the potential impact of artistic endeavors on our planet (Costalonga et al. 2021). These emerging

³ This aspect may appear to be subtle but it carries the potential to reshape the design of musical infrastructure. Rather than insisting on ‘master-slave’ models of organization, second-wave ubimus proposals tend to rely on distributed decision-making processes that reduce explicit exchanges. This tendency goes against the grain of interaction models applied in social networks, which rather than building and fostering the expansion of common assets, strongly enforce corporate ownership of resources and permanent feedback from users to ensure financial returns through individualized data tracking.

ubimus frameworks help us to keep our focus on what matters: diversity, sustainability, well-being and community-building. Without these qualities, technological developments are just empty shells.

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References

- ADKINS, B., DILLON, S., BROWN, A. R., HIRCHE, K., GIBBONS, C. The Role of Generative Arts in Supporting Cultural Participation: A conceptualisation of the jam2jam network Jamming Tool. In M. Docherty, S. Kenderdine, T. Wyeld (eds.), 13th International Conference on Virtual Systems and Multimedia (VSMM) (pp. 1–9). Brisbane: The International Society on Virtual Systems and MultiMedia, 2007. <http://australia.vsmm.org/proceedings.htm>
- BEGHETTO, R. A., KAUFMAN, J. C. Toward a broader conception of creativity: A case for “mini-c” creativity, *Psychology of Aesthetics Creativity and the Arts* 1:2, 2007, pp. 73-79.
- BOWN, O., ELDRIDGE, A., MCCORMACK, J. Understanding interaction in contemporary digital music: From instruments to behavioural objects, *Organised Sound* 14, 2009, pp. 188-196.
- BROWN, A. R., Modes of Compositional Engagement. *Mikropolyphony* 6, 2000. http://pandora.nla.gov.au/pan/10054/20021007-0000/farben.latrobe.edu.au/mikropol/volume6/brown_a/brown_a.html

- BROWN, A. R. Engaging in a sound musicianship. In G. McPherson (ed.), *The Child as Musician: A handbook of Musical Development* (pp. 208–220). New York: Oxford University Press, 2015.
- BROWN, A. R., DILLON, S. Meaningful Engagement with Music Composition. In David Collins, ed., *The Act of Musical Composition: Studies in the Creative Process* (pp. 79-110). Surrey, UK: Ashgate, 2012.
- BROWN, A. R., STEWART, D., HANSEN, A., STEWART, A. Making meaningful musical experiences accessible using the iPad, In Keller, D., Lazzarini, V., Pimenta, M. S., eds., *Ubiquitous Music*, Heidelberg Berlin: Springer International Publishing, 2014, pp. 65-8.
- CARROLL, E. A., LATULIPE, C., FUNG, R., TERRY, M. Creativity factor evaluation: Towards a standardized survey metric for creativity support, In *Proceedings of the Seventh ACM Conference on Creativity and Cognition*, Berkeley, CA: ACM, Berkeley, CA, 2009, pp. 127-136.
- COSTALONGA, L. et al. *The Ragpicking DMI Design: The case for green computer music*. 10th International Conference on Digital and Interactive Arts. 2021.
- DEWEY, J. *Art as Experience*. New York: Putmans, 1934.
- DILLON, S. C. Music is a wordless knowing of others: Resilience in virtual ensembles, In A. Brader (ed.), *Songs of Resilience* (pp. 239-254). Newcastle upon Tyne: Cambridge Scholars Publishing, 2011.
- FARIAS, F. M., KELLER, D., PINHEIRO DA SILVA, F., PIMENTA, M. S., LAZZARINI, V., LIMA, M. H., COSTALONGA, L., JOHANN, M. Everyday musical creativity support: mixDroid second generation (Suporte para a criatividade musical cotidiana: mixDroid segunda geração), In Keller, D., Lima, M. H. and Schiavoni, F., eds., *Proceedings of the V Workshop on Ubiquitous Music (V UbiMus)*. Vitória, ES: Ubiquitous Music Group, 2014.
- GRANT, K. A. Tacit knowledge revisited – We can still learn from Polanyi, *The Electronic Journal of Knowledge Management* 5(2), 2007, pp 173-180, <http://www.ejkm.com>.
- KAUFMAN, J. C., BEGHETTO, R. A. Beyond big and little: The four c model of creativity, *Review of General Psychology* 13(1), 2009, pp. 1-12.
- KELLER, D. *Everyday musical creativity*. In *Ubiquitous Music Ecologies*, London: Routledge, 2020, pp. 23-51.
- KELLER, D., ALIEL, L., FILHO, M. C. & COSTALONGA, L. Toward Ubimus Philosophical Frameworks. *Open Philosophy* 4(1), 2021, pp. 353–371.
- KELLER, D., BARREIRO, D. L., QUEIROZ, M., PIMENTA, M. S. "Anchoring in ubiquitous musical activities", In *Proceedings of the International Computer Music Conference*, Ann Arbor, MI: MPublishing, University of Michigan Library, 2010, pp. 319-326.
- KELLER, D., CAPASSO, A., TINAJERO, P., FLORES, L. V., PIMENTA, M. S. Green Canopy: On The Road [Ubiquitous Music Work] In *Proceedings of XII Brazilian Symposium on Computer Music (SBCM 2009)*, Porto Alegre, RS: SBC, 2009.
- KELLER, D., FERREIRA, E., PINHEIRO DA SILVA, F., LIMA, M. H., PIMENTA, M. S., LAZZARINI, V. *Everyday musical creativity: An exploratory study with vocal percussion (Criatividade musical cotidiana: Um estudo exploratório com sons vocais percussivos)* In *Proceedings of the National Association of Music Research and Post-Graduation Congress - ANPPOM*, Natal, RN: ANPPOM, 2013.
- KELLER, D., FLORES, L. V., PIMENTA, M. S., CAPASSO, A., TINAJERO, P. Convergent trends toward ubiquitous music, *Journal of New Music Research* 40(3), 2011, pp. 265-276.
- KELLER, D. & LAZZARINI, V. Theoretical approaches to musical creativity: The ubimus perspective. *Musica Theorica* 2(1), 2017, pp. 1-53.
- KELLER, D., LAZZARINI, V., PIMENTA, M. S. (eds.) *Ubiquitous Music*, Vol. XXVIII, Berlin and Heidelberg: Springer International Publishing, 2014a. (ISBN: 978-3-319-11152-0.)
- KELLER, D., LAZZARINI, V. & PIMENTA, M. S. Ubimus through the lens of creativity theories. In Damián Keller, Victor Lazzarini and Marcelo S. Pimenta, eds.,

Ubiquitous Music, Berlin and Heidelberg: Springer International Publishing, 2014, pp. 3-23.

KELLER, D., LIMA, M. H. Supporting everyday creativity in ubiquitous music making, In Kostagiolas, P., Martzoukou, K. and Lavranos, C., eds., Trends in Music Information Seeking, Behavior, and Retrieval for Creativity. Vancouver, BC: IGI Global Press, 2015.

KELLER, D., MILETTO, E. M., OTERO, N. Creative surrogates: Supporting decision-making in ubiquitous musical activities, In Proceedings of the 3rd International Conference on Computation, Communication, Aesthetics and X (xCoAx 2015), Glasgow, Scotland: xCoAx, 2015.

KELLER, D., PINHEIRO DA SILVA, F., GIORNI, B., PIMENTA, M. S., QUEIROZ, M. Spatial tagging: an exploratory study (Marcação espacial: estudo exploratório), In Costalonga, L., Pimenta, M. S., Queiroz, M., Manzolli, J., Gimenes, M., Keller, D., Farias, R. R., eds., Proceedings of the 13th Brazilian Symposium on Computer Music (SBCM 2011), Vitória, ES: SBC, 2011b.

KELLER, D., TIMONEY, J., COSTALONGA, L., CAPASSO, A., TINAJERO, P., LAZZARINI, V., PIMENTA, M. S., LIMA, M. H., JOHANN, M. Ecologically grounded multimodal design: The Palafito 1.0 study. In Proceedings of the International Computer Music Conference (ICMC 2014), Ann Arbor, MI: MPublishing, University of Michigan Library, 2014b.

KOZBELT, A., BEGHETTO, R. A., RUNCO, M. A. Theories of creativity, In Kaufman, J. C., Sternberg, R. J., eds., The Cambridge Handbook of Creativity. Cambridge, UK: Cambridge University Press, 2010, pp. 20-47.

LAZZARINI, V., YI, S., TIMONEY, J., KELLER, D., PIMENTA, M. S. The Mobile Csound Platform, In Proceedings of the International Computer Music Conference, ICMA, Ann Arbor, MI: MPublishing, University of Michigan Library, 2012, pp. 163-167.

LIMA, M. H., KELLER, D., PIMENTA, M. S., LAZZARINI, V., MILETTO, E. M. Creativity-centred design for ubiquitous musical activities: Two case studies,

Journal of Music, Technology and Education 5(2), 2012, pp. 195-222.

MESSINA, M., KELLER, D., ALIEL, L., GOMEZ, C., FILHO, M. C. & SIMURRA, I. The Internet of Musical Stuff (IoMuSt): ubimus perspectives on artificial scarcity, virtual communities and (de)objectification. INSAM: Journal of Contemporary Music, Art and Technology 9, 2022, pp. 26-50.

PINHEIRO DA SILVA, F., KELLER, D., FERREIRA, E., PIMENTA, M. S., LAZZARINI, V. Everyday musical creativity: Exploratory study of ubiquitous musical activities (Criatividade musical cotidiana: Estudo exploratório de atividades musicais ubíquas), Música Hodie 13, 2013, pp. 64-79.

POLANYI, M. Personal Knowledge: Towards a Post-critical Philosophy, London: Routledge, 1958.

RADANOVITSCK, E. A. A., KELLER, D., FLORES, L. V., PIMENTA, M. S., QUEIROZ, M. mixDroid: Time tagging for creative activities (mixDroid: Marcação temporal para atividades criativas), In Costalonga, L., Pimenta, M. S., Queiroz, M., Manzolli, J., Gimenes, M., Keller, D., Faria, R. R., eds., Proceedings of the XIII Brazilian Symposium on Computer Music (SBCM 2011), Vitória, ES: SBC, 2011.

RICHARDS, R., KINNEY, D., BENET, M., MERZEL, A. Assessing everyday creativity: Characteristics of the lifetime creativity scales and validation with three large samples, Journal of Personality and Social Psychology 54, 1988, pp. 476-485.

SIMONTON, D. K. History, chemistry, psychology, and genius: An intellectual autobiography of historiometry, In Runco, M. A., Albert, R. S., eds., Theories of Creativity, Newbury Park, CA: Sage, 1990, pp. 92-115.

WESSEL, D., WRIGHT, M. Problems and prospects for intimate musical control of computers, Computer Music Journal (26:3), 2002, pp. 11-22.

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