



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Digital Creativity Journal Special Issue = Ubimus contributions to digital creative practices (Editorial)

Brooks, Anthony L; Keller, Damián ; Lazzarini, Victor ; Turchet, Luca

Published in:
Digital Creativity

Publication date:
2024

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Brooks, A. L., Keller, D., Lazzarini, V., & Turchet, L. (2024). Digital Creativity Journal Special Issue = Ubimus contributions to digital creative practices (Editorial). *Digital Creativity*, 35(1).
<https://www.tandfonline.com/toc/ndcr20/current>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Ubimus contributions to digital creative practices (Editorial)

Damián Keller¹ Victor Lazzarini² Luca Turchet³ Anthony L. Brooks⁴

¹ NAP, Federal University of Acre, Federal University of Paraíba, Brazil

² Maynooth University, Ireland

³ University of Trento, Italy

⁴ Aalborg University, Denmark

Ubiquitous Music Group

December 2023

Recent advances in ubiquitous music (ubimus) research unveil the emergence of polarities that may foster ways of supporting diversified musical practices. These trends were already present in the transition from first-wave to second-wave ubimus initiatives and have been identified as “poles of attraction” (Keller and Barreiro 2018). Currently, these intersections may have incorporated enough know-how to stand as emerging frameworks. This editorial attempts to identify emerging threads that connect the contents of this special volume to the ongoing initiatives of the ubimus community.

A persistent discussion among ubimus practitioners involves the difficulties to define a field that does not rely on a fixed set of resources and it is not constrained by established musical idioms or styles. In fact, a key characteristic of recent second-wave ubimus trends is aesthetic pliability, encompassing frameworks based on computational and ecological thinking (Keller and Lazzarini 2017; Otero et al. 2020) and highlighting artistic endeavors grounded in communities of practice (Lima et al. 2017). As attested by the frictions among approaches that attempt to tackle multifarious musical knowledge, ubimus diversity of means and ends defies adopting a standard definition. Consequently, ubimus is better understood as a creativity-led research practice or as a movement rather than as a bounded set of formalized techniques (Keller, Messina, Bridges and Yaseen 2023).

When attempting to engage with higher-level descriptions of ubimus practice, second-wave ubimus initiatives may be grouped around three targets: ways of thinking, ways of designing and ways of deploying, as components of creativity-oriented research. Defying classifications aligned to musical genres while simultaneously providing support for extant artistic categories, ubimus infrastructures for artistic deployments feature a push-and-pull dynamic caused by the requirements of both legacy practices – such as networked music performance (Mills 2019) and acoustic-instrumental formats – and distributed creativity and interaction.

Ways of thinking and designing

Musicians have criticized the acoustic-instrumental perspective for many years, pointing to the distributed nature of musical creative processes (Keller 2000), to the increased disengagement from hierarchical musical thinking in improvisatory contexts (Lewis 2000) and to the heterogeneous nature of musical time management when music-making is freed from a fixed score (Bhagwati 2013). All these aspects are incompatible with musical interaction understood exclusively as “instrument playing”.¹ Distributed interaction is a fairly recent concept in computer science (Bardram 2012; Buxton 2013) prompted by the current lack of a fixed relationship of “one stakeholder, one activity, one device” that characterizes device-centric thinking. In line with distributed-interaction demands, recent

¹ Multiple examples of interaction design built within the constraints of acoustic-instrumental thinking can be found in events such as New Instruments for Musical Expression (later modified to “interfaces”).

proposals in technological design are starting to emphasize the dynamic relational properties of resources and stakeholders in an effort to develop approaches that remain resilient despite the fast rate of replacement of devices and the heterogeneous characteristics of post-2020 computational resources (Lazzarini et al. 2020).

Thus, and as exemplified in the discussions proposed by first-wave ubimus research (Keller et al. 2014), musical infrastructure and practice are not always aligned and are not driven by a uniform agenda. For this reason, and contrasting with the easy-going “negotiations” proposed in the context of ubiquitous computing (Dourish and Bell 2011), some ubimus researchers envision infrastructure as territorial conflict (Messina et al. 2022). These socially motivated design metaphors may unfold in layers, sometimes prompting adaptations from the stakeholders to explore the creative potential of fresh resources – a case in point are the musical activities linked to social-media platforms (Radovanović 2022). Other times, exploratory music-making pushes for changes in the design strategies, as illustrated in the recent development of distributed-interaction techniques which address a decade-long lag between the spearheading applications of distributed creativity in music and a later push for deployments of support infrastructure based on ecosystems (Lazzarini et al. 2020).

To summarize, ways of thinking and designing for ubimus practice are shaped by intrinsic factors – opportunities for action and limitations determined by the extant material, cognitive and social resources – and are also influenced by extrinsic factors – motivations, goals and deterrents that are often foreign to the musical realm. Unveiling these factors yields a more focused picture of the specific contributions of ubimus research to current creative digital practices, helping to question the myth of “creativity driven by technology”² and also providing critical tools to weigh the evidence gathered when assessing community-oriented artistic proposals.

Ways of deploying: Expanded temporalities and semantics-based strategies

A challenging aspect of creative music-making is how to plan and evaluate the emerging ways of deploying musical experiences. As early as April 2020, ubimus researchers were asking: “How can ubimus research contribute to the renewed musical needs of a society in partial confinement?” According to Keller, Costalonga and Messina’s (2020) editorial, enhanced support for social interaction is among the pressing needs of a post-2020 world.³ They emphasize that restrictions on social interaction, especially when considering children, may have long-lasting effects. This assertion has

² An interesting outlook on digitally oriented creative performance is proposed by Webb and Layton (2023: 16): “1. ‘Try again. Fail again. Fail better’ (Samuel Beckett). Ignore instruction manuals and how-to guides. Learning through playing, experimenting, and failing is far more productive and rewarding. 2. Embrace the glitches and ghosts in the machine. Like ‘real’ performance, digital liveness is full of potential mistakes and mishaps. 3. Collaborate with others. Working digitally means you can connect with anyone, any-where (sic) and for free. 4. Do not wait! Work with what you have. Construct your own studio. Make your own green screen. Experiment with positioning desk lamps, webcams, and smartphones to create new effects. Creativity is more important than the ‘best’ technology. 5. Take your time - create slowly with reflection. Making digitally does not have to mean creating quickly. Take hold of technology and use it at your own pace; do not let technology take hold of you.”

³ Coincidentally with the current situation (November-December 2023), the authors state that “The Syrian and Venezuelan migrant crises – both induced by an ongoing campaign to conquer oil reserves – have placed millions of people in a highly vulnerable and potentially catastrophic situation. The consequences of the lack of shelter and food cannot be overstated.” The same observations apply to the 2.3 million people under attack in Gaza, in this case the target is the gas reserve located in the Gaza maritime platform. The drive for energy resources has expanded the range and consequences of international conflicts.

been confirmed by various studies recently carried out in different geographical and cultural contexts by the OECD and other international agencies.⁴

The authors also point out that collaborative music making by means of ubimus ecosystems tends to encourage meaningful aspects of engagement, while avoiding some of the negative byproducts of online social exchanges. Despite this positive outlook, more work is needed on this front. For instance, there may be some limitations when deploying ubimus technology in spaces that were previously considered out of bounds for public interactions, such as transitional settings. How to deal with boundaries in privacy and intimacy as opposed to public exposure is one of the challenges faced by the emerging initiatives in domestic ubimus (Keller et al. 2022b).

Another promising thread in post-2020 creative practice points to issues arising from the non-verbal exchanges enabled through synchronous and asynchronous resource sharing, when synchronous face-to-face interaction is not an option. A question posed by the UbiMus 2020 editorial is whether facial expressions are necessary for musical knowledge sharing.⁵ Acoustic-instrumental practices built around fixed scores, centralized decision making and linear organization of time reinforce this preconception. But the authors suggest two aspects of ubimus research that may foster alternative techniques for knowledge sharing, involving the usage of expanded temporalities or semantics-based strategies.

Ubimus ecosystems let the stakeholders deal with their sonic resources through the organization of temporalities rather than through the imposition of meter. There are various examples in the ubimus literature. Time tagging is a creative-action metaphor that uses local acoustic cues to enable decision-making (Radanovitsck et al. 2011). Graphic-procedural tagging employs selected visual features of found imagetic resources as visual triggers for musical actions (Keller et al. 2015). The tool Playsound.Space renders sonograms to complement the support of semantics-based selection processes (Stolfi, Milo and Barthet 2019). The creative-action metaphor Sound Sphere provides a combination of color-coding, tones of gray and airport-style abbreviations of semantic cues to furnish parametric handles for mixing activities on its virtual sphere (Bessa et al. 2020; Simurra et al. 2023).

Given the panoply of methods available for developers deploying ubimus systems, synchronous face-to-face interactions do not seem to be a requirement for musically effective usage of computational support. Consequently, genre-specific variables such as latency and jitter tend to lose relevance when considered in the context of ubimus expanded temporalities. A flexible approach to sonic organization may help in tackling issues that gain salience during times of scarcity. Reduced physical mobility, lack of face-to-face physical interaction and avoidance of crowds are all detrimental factors for the acoustic-instrumental ways of music-making. As an alternative to the legacy approaches to musical interaction, ubimus frameworks enhance the designers' ability to deal with time-based information without linking the resources to pre-established genre features.

The four strategies just discussed are compatible with various domain-specific creative resources while remaining open to varied musical materials for their deployment. For instance, Stolfi et al. (2019) support the usage of any sound class available on the audio repository Freesound. Both time tagging

⁴A study by the Organization for Economic Cooperation and Development points to a drastic drop in children's academic performance across a large sample of countries.

⁵ A subtle change in emphasis from *knowledge transfer* to *knowledge sharing* is an ongoing experimental question of recent ubimus projects. This change is prompted by a wider adoption of dialogically oriented practices (Lima et al. 2012) in ubimus design. Some musical genres, such as networked music performance, are well served by centralized decision making. This is not the case in practices such as ubimus improvisation (Aliel et al. 2021).

and Sound Sphere let the participants use their own sonic materials. And graphic-procedural tagging relies on the extraction of visual features from found images to cue performance-oriented actions.

It may be argued that an aesthetically pliable perspective on musical interaction does not necessarily foster refined developments in creative music-making. We tend to agree that the European 19th-century ideals of individualistic self-expression, instrumental virtuosity, and the notion of art-making as an activity tailored exclusively for an elite of geniuses are not priorities of ubimus endeavors. These notions are perfectly compatible with designs based on digital musical instruments, networked music performance or chamber-music formats. Hence, these legacy practices are well served and will continue to inform the commercial music industry. The research emphasis on aesthetic pliability envisages supporting design initiatives that explore emergent forms of social interaction which lie beyond the standard division of labor between composers, performers and audience, still enforced by the acoustic-instrumental legacy.⁶

Ubimus approaches to information sharing

Despite an increased flexibility to tackle musical time, some ubimus projects require the usage of domain-specific information. For instance, scoring is an instrumentally oriented strategy that has been expanded to deal with various forms of representation, recently also embracing dynamic relational properties among resources. Scores can be rendered on-the-fly and do not need to be restricted to standard common-practice notation. As exemplified in graphic-procedural tagging, some scores may repurpose found images (Keller et al. 2015). This usage points to the potential integration of any material resource as a target for scoring, including food (Rosales 2022).⁷ Crossmodal ubimus approaches to scoring underline the artificiality of media boundaries, indicating a potential continuum between material and digital assets that may scaffold future pliable ubimus designs. Hence, there is no reason to avoid scoring unless it is adopted as a clutch for instrumental thinking.

A caveat of score-based strategies for collective decision-making is the requirement of domain-specific knowledge from untrained participants. Subtle musical information, e.g. parametric timbral characteristics, may be delivered by means of semantics-based strategies such as ASC (creative semantic anchoring – Simurra et al. 2023). Another strategy often adopted by ubimus practitioners involves the visual rendering of sonic information, as exemplified in Playsound.Space.

Given a persistent tendency to employ scoring as a musical information-sharing mechanism, the applicability of visual scores may show restrictions across two dimensions: openness and scalability. Several ubimus projects have addressed aspects of openness by supporting various types of materials (all the examples discussed above give liberty to the stakeholders regarding the amount, size and type of sonic resources), expanding the available strategies for collective decision-making. Nevertheless, as the number of items gets larger and the locations become scattered the metaphors for interaction start to show limitations.

Functional fixedness – or the tendency to repeat choices or procedures during a creative activity – has been observed when casual participants are faced with the task of choosing among a large collection of

⁶ Emerging ubimus frameworks carry various political implications regarding the adopted principles on sharing, agency and the flow of know-how. This discussion falls outside of the scope of the key topics of this volume. See (Keller et al. 2023) for an overview.

⁷ *Taste this score* (Rosales 2022) employs a video score that features visual textures of food, proposing the use of textures that capture the micro-qualities of each dish as material to be mapped onto musical parameters to enrich the eating experience.

items. A similar problem, compounded by the difficulty of predicting sonic outcomes, is often triggered by systems that offer flexible parametric layouts. A standard approach to handle this issue is the adoption of presets, or prepackaged choices of configurations. Presets are useful shortcuts that may furnish ready-made solutions to untrained participants, providing fast access to choices well-suited for stringent casual-interaction contexts. Though, blackbox solutions are hardly effective when the aim is to share know-how. More research is needed to address these caveats.

Given the variety of factors affecting the processes of decision-making, such as the changes in local environmental conditions (Aliel et al. 2018; Koszolkó 2022; Roddy 2023; Thomasi 2023), or the introduction of uncertainty through computational means (Aliel et al. 2018; Thomasi 2023), or the shared assignment of agency among human and non-human stakeholders (Barros et al. 2023; Roddy 2023), the visual weight of scoring practices may force the exclusion of ways of deploying that are gaining importance in second-wave ubimus artistic endeavors. Consequently, in parallel with the expanded notions of temporality we may be heading toward more relaxed strategies of information sharing that target other layers of meaning beyond just mapping musical activities through visual representations. These strategies also need to tackle contingencies caused by changes in local conditions. For instance, the assumption that all stakeholders participating in a distributed musical experience have to be necessarily “on the same page” may be too strong. How to assess the impact of multiple contingencies and how to establish a common ground for minimally aligned decision-making are challenges that have not been fully addressed by score-oriented approaches.

Summing up, ubimus frameworks support two key enablers for musical information sharing and production: expanded temporalities and semantics-oriented interaction. The use of flexible temporalities releases the stakeholders from the grip of metric-based systems, reducing the design’s reliance on common-practice notation and encouraging the exploration of both digitally generated and tangible resources for collective creative activities. Complementarily, semantics-oriented strategies incorporate both sonic and contextual information as tokens that can be readily shared among stakeholders bypassing domain-specific codification.

Despite its potential to facilitate group musical endeavors, semantics-based interaction also presents some caveats. The participants need to speak the same language. This requirement is not limited to semantics-based frameworks, it also applies to all creative-coding languages that demand knowledge of English (cf. Messina et al. 2021 for a critical perspective on this issue). Taking into account that native English is less common than Mandarin, Spanish, Hindi or Arabic, it is difficult to argue for its adoption as a metalanguage for music making across all cultures. Choosing spoken languages as conduits for collective aesthetic decision-making may enable alignments on broad aspects of design. But this strategy may fall short when trying to address culturally specific traits. This is an intriguing area of investigation that will certainly be expanded by the expected contributions from Asian and African ubimus practitioners.

Ubimus and the Internet of Musical Things

A recent development in ubimus research is the emergence of the Internet of Musical Things (Turchet et al. 2018; Turchet et al. 2020). This area of investigation overlaps with other work in the Internet of Things (Borgia, 2014), networked music environments (Rottondi et al. 2016), and human-computer interaction (Rowland et al. 2015), to cite but a few.

Turchet and co-authors (2018) define the IoMusT as the set of protocols, networks, ecosystems, and musical things supporting the production of services, content, and activities of musical nature within

physical and digital environments (or a combination of these). Central to this is the concept of the musical thing, a device capable of acquiring, receiving, and processing data to serve a musical purpose. Examples of these are smart instruments, mobile devices, and wearables. In the context of IoMusT, musical things are significant in that they enable ubiquitous music activities.

An important line of research in ubiquitous music has to do with communication technologies. Various techniques furnish support for networked resources (Pimenta et al. 2014), which may take place between different human actors, in combination with intelligent or partially autonomous systems. While basic IoMusT technology can be considered to be already in place, for example, by means of wireless sensor networks (WSNs) (Dargie and Poellabauer 2010) and associated IoT technologies (Borgia, 2014), the synchronous dimension of musical activities still poses a challenge to networked interactions. The challenge involves the provision of ultra-low latency and a high level of reliability in the communication channels, which is still missing in commonly available IoT wireless communication protocols. The ideas developed under the so-called tactile internet (Aijaz et al., 2017; Maier et al. 2016) offer a possible way forward, but these still need substantial breakthroughs to satisfy the realtime and high audio-quality requirements of IoMusT usage.

Further developments, as actively discussed in the context of the Ubiquitous Music Symposia,⁸ also need to take into account the mounting social pressures for more resilient, secure, sustainable and pliable infrastructure. IoT resources are increasingly incorporated in activities and settings that are potentially disruptive. Consider, for instance, domestic ubimus (Keller et al. 2022b). Home is among the ideal scenarios for deploying IoMusT-based tools. But should researchers encourage these deployments without extensive studies on their impact on the privacy and well-being of the stakeholders? Should the expansion of computational means take precedence over concerns on health, communality and the preservation of local cultural values? The next section provides a glimpse of emerging aspects of home-oriented ubimus practice that could eventually be enhanced or discouraged depending on the preliminary evaluations of the support infrastructure.

Gastrosonics

Mesz et al. provide a short overview of gastrosonics, pointing to various ubimus projects that have explored the creative possibilities of handling music and food through technological means. The authors underline the differences between gastrosonics and sonic seasoning, stating that “the latter refers specifically to perceptual [and] cognitive aspects of eating or drinking in the presence of sound”. One thread of this emerging field is closely related to the area of human-food interaction. Human-food interaction focuses on the techniques developed to support gastronomic activities through computational means. Aligned with second-wave approaches to human-computer interaction, the emphasis of this area has been utilitarian. But given the diverse and widespread cultural traditions of food handling as an artistic practice, a natural development could involve a fusion between creative music-making and creative food preparation and consumption. This is what ubimus authors envision as gastrosonic research, pointing to the unexplored combinations of various modalities of gastronomic and musical experiences and to undocumented aspects of cultural heritage tied to the mutual influences of activities involving food and sound.

The special section of the Vortex Journal, *Ubimus, Gastrosonics and Well-Being* (Keller et al. 2022a) features contrasting approaches to the handling of musical materials within gastrosonics. Mesz et al. describe a preliminary crossmodal study using drinks prepared at home as triggers for sonic choices (cf.

⁸ <https://www.ulster.ac.uk/conference/ubimus>.

Keller et al. 2022b). The sonic materials include events previously classified either as a specific taste or as neutral choices regarding flavor. Groups of participants were asked to create a sonic mix employing samples congruent with each drink. Due to the pandemic context, all interactions were done remotely. To enable telematic exchanges, the researchers implemented and deployed a modified prototype of the Sound Sphere ecology of tools (Bessa et al. 2020). The tool's functionality was augmented by incorporating gastroicons depicting the drinks consumed by the participant during the elaboration of the mix. It turned out that all participants were able to complete the collaborative tasks. The analysis of the outcomes unveiled a tendency to match the intended "taste" of the sonic results with the flavor of the chosen beverage.

In Quorum Sensing, Mesz et al. (2022) report a gastrosonic commensality experience for three guests, inspired in a nonhuman aspect of gastronomy: bacteria detect the presence of other microorganisms. The installation explores this dimension of information exchange among participants. Soup was served using glass tableware designed to establish crossmodal associations among shapes, materials and the musical outcomes. Movements of the spoon produce vibrations delivered to the body of the other participants, varying in intensity depending on the displacements of the utensils. Hence, the proposal focuses on outcomes of patterns of group actions, rather than on individual intentional activity. This approach is well aligned with the notions of distributed creativity explored in other ubimus artistic projects.

The gastrosonic experiences documented in the present volume involve the exploration of a combination of extended reality with material resources. Participants were invited to eat cheese and to drink wine while interacting with a realistic virtual-reality display (condition 1), or they were given warm jalapeño cheese or cold menthol-chocolate samples (condition 2). Cheese consumption was matched to sounds that tried to elicit pleasantness, creaminess and softness, through sonic parameters corresponding to consonant, soft and legato characteristics. The chocolate tasting was synchronized to breaking ice and crunchy-textured sounds. The visual display featured imaginary landscapes.

Mesz et al. apply a procedure of evaluation of aesthetic effect by assigning semantic labels to emotions. Most of the evaluations yielded positive outcomes, ranging from delight or interest to intellectual stimulation. Contrastingly, negative emotions were almost absent. The results of the first condition (realistic display) and of the second condition (imaginary landscapes) were very similar. The only aesthetic dimension that yielded a significant difference was surprise. This contrast was expected by the authors given the unfamiliar characteristics of the imaginary landscapes. Given these initial positive results, more work is needed to untangle the aspects related to crossmodality. In particular, the lack of negative emotional outcomes places a question mark on the method. If the data obtained tends to be only positive, it may be the case that other semantic dimensions are needed to assess the complete range of multimodal aesthetic experiences.

Designing ubimus frameworks for post-2020 digital creative practice

As discussed in the first section of this editorial, ubimus research involves at least three areas of interest, encompassing ways of thinking, designing and deploying creative resources. These three targets are not necessarily aligned and may demand specific frameworks to address on the one hand the material requirements of multimodal musical experiences and on the other hand the cognitive and social factors that shape our understanding of music-making.

Regarding the strategies for deployment, we have dealt with the emergence of gastrosonics, a ubimus approach to handle food and music within the context of both material and synthetic environments. The

deployment of these proposals may be grounded on material assets to induce crossmodal congruency, or it may involve the exploration of unfamiliar territories through the implementation and usage of simulated worlds. This continuum is comparable to the well-trodden strategies employed in sound synthesis and processing, involving generative techniques and recycled recorded materials, currently supported by streamlined script-based creative strategies (Kramman 2020; Kramann 2023) and by light-weight general-purpose signal processing techniques (Lazzarini and Walsh 2023). A pending limitation of gastrosonics may be related to the synthesis and sharing of healthy food. As a frontier of food-technology design, gastrosonics may yield new opportunities for the exploration of sonic-based components.

Another area investigated in this volume is the convergence of score-based distributed music-making with the extant ubimus approaches to flexible musical time-management. A potential dialogue between these two threads is boosted by scoring techniques that relax the restrictions inherited from common-practice music notation (Bhagwati 2013). Decentralized scores open the door for ubimus applications of distributed interaction. As crystallized in the notion of temporalities, ubimus designs may incorporate scoring by deploying musical information through pliable material resources (as exemplified in the usage of e-textiles). Textiles, printed artifacts, recycled images, or solid and liquid food may potentially be converted into creative surrogates for multimodal information sharing (Keller et al. 2015). These resources require strategies tailored to establish consistent systems of reference across modalities. This area will demand field studies to understand how organized sonic information is impacted when the stakeholders' access to shared information is compromised by deficiencies in infrastructure, by lack of shared cultural backgrounds or by misalignments in social expectations regarding the settings and resources. These issues become particularly salient when the targeted communities are located in peripheral territories and when the settings include private locations (cf. discussion on domestic ubimus).

As stated in the section dedicated to design, the Internet of Musical Things provides a viable platform to incorporate IoT resources in ubimus activities. A complementary concept to the musical thing was introduced by Fraietta, Bown and Ferguson (2020), i.e. *media multiplicities*. The authors describe their strategy as “data points and variable parameters [that] can be strategically mapped or bound using aliases, data types and scoping as an alternative to flat address-structured mapping.” They argue that the ability to send and access complex data types as complete entities rather than as lists of parameters promotes data abstraction and encapsulation. Furthermore, data structures can change during the life cycle of a computer-based musical activity. Hence, a goal of the media-multiplicities construct is to allow for greater flexibility through the adoption of modular architectures.

An example of the deployment of this entity is the multimodal installation documented by Mikolajczyk, Ferguson, Candy, Pereira Dos Santos and Bown in this volume. The complex requirements of a full-blown artistic project are explicit in their description of the methods. An interesting feature of their design process is the need to adjust the artistic decisions to the material constraints encountered during the construction and deployment of the installation's technological components. This is exemplified by the need to change the shape of the planned sculpture from a sphere to a cylinder. In this case, the motivations were practical: providing access to the sculptural elements to enable both their construction and technical adjustments. Also, emerging artistic demands may trigger structural changes, impacting both the material and the digital components of the projected design.

Working units, such as media multiplicities, that furnish support for abstraction and encapsulation make sense for ubimus goals. The ability to adjust the properties of the digital resources to the evolving

artistic demands of a creative project seems to be a basic requirement of ubimus support infrastructure. Interestingly, when situated in the context of the history of digital music making, this idea stands out as unintuitive or exotic. As musicians, we have become used to handling fixed entities such as instruments, orchestras, notes or scales that eventually deliver yet more fixed objects, i.e. musical artworks.⁹ These fixed entities were later formalized through hierarchical ontologies, such as those constructed around sound objects (Kane 2007). Hence, proposing a working unit that changes properties depending on its history of interactions with the creative stakeholders is, to put it mildly, weird.

Oddly enough, this is exactly the line of reasoning followed by Messina et al. in their contribution to the ways of conceiving ubiquitous music. Their goal, shared by other ubimus endeavors, is to avoid excluding any genre or any potentially useful resource. Electronic music practices provide several examples of strategies that were not adopted in central countries but that remain important as unique design contributions.¹⁰ There are also examples of strategies that despite their widespread adoption have yielded consistently trite results (autotuning and looping are two techniques that immediately come to mind). Thus, a proposal such as media multiplicities is aligned with the type of entities envisioned by Messina and coauthors, with properties that are flexible and untokenizable, hence resilient to be turned into commercial objects. They call these entities *musical stuff*.

Creative digital activities of the post-2020 era present increasing challenges to the extant research frameworks. Thinking, designing and deploying resources for music-making demand the incorporation of multiple approaches and an intense dialogue across disciplinary boundaries. The four proposals showcased in this volume unveil a complex profile of concerns that come into play when we consider second-wave ubimus tendencies. These tendencies indicate on the one hand the reliance on established musical genres – such as networked music performance – and legacy practices – such as scoring and the application of IoMusT resources within instrumental genres. On the other hand, they also point to boundary-breaking developments involving the incorporation of everyday settings and everyday activities in creative music-making, as exemplified in the domestic-ubimus initiatives involving gastrosonics. The artistic output documented in these projects defies the established ways of musical thinking, unveiling fluid, dynamic and culturally situated concepts that suggest the emergence of cracks in our understanding of post-2020 creativity.

References

Aijaz, A., Dohler, M., Aghvami, A., Friderikos, V., and Frodigh, M. (2017). Realizing the tactile internet: Haptic communications over next generation 5g cellular networks. *IEEE Wireless Communications* 24(2).

Aliel, L., Keller, D. and Ferraz, S. (2018). Ensaio sobre a peça Markarian 335: Conceitos em atividades criativas ecologicamente fundamentadas a partir da perspectiva Gelassenheit. In *Proceedings of the Ubiquitous Music Workshop (UbiMus 2018)*. São João del Rei, MG: Ubiquitous Music Group.

Aliel, L., Keller, D., Kavakama, O., Mochetti, R. (2021). OUIJA Project: Agency and spatial-temporal relationships in ecomprovisation (Projeto OUIJA: Agenciamento e Relações Espaço-Temporais na

⁹ A point to be stressed that falls beyond the scope of this editorial is the emergence of creative practices within ubimus that do not rely on the artwork as a required musical byproduct. One example is everyday musical creativity (Keller 2020).

¹⁰ Take, for instance, Fernando Von Reichenbach's Catalina, a graphics-based analogue synthesis controller developed in 1966. <https://proyectoidis.org/fernando-von-reichenbach/>

- Ecomprovisação). In *Proceedings of the 11th Workshop on Ubiquitous Music (UbiMus 2021)* (pp.131-143). Matosinhos, Portugal: Ubiquitous Music Group.
- Bardram, J. E. (2012). Distributed Interaction. In *Proceedings of the 4th ACM SIGCHI Symposium on Engineering Interactive Computing Systems* (pp. 3-4). New York, NY: Association for Computing Machinery.
- Barros, F., Freire, S. and Costalonga, L. (2023). Non-human companionship: Practicing free improvisation through interaction with machines. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (pp. 74-85). Derry, Northern Ireland: Ubiquitous Music Group.
- Bessa, W. R. B., Keller, D., Freitas, B. and Costa, D. F. (2020). A metáfora da esfera sonora desde a perspectiva WYDIWYHE (The Sound Sphere Metaphor from a WYDIWYHE Perspective). *Journal of Digital Media & Interaction* **3**(5), 60-88.
- Bhagwati, S. (2013). Towards interactive onscreen notations for improvisation in large ensembles. In *Sound & Score: Essays on Sound, Score and Notation* (pp. 143-177). Brussels: Leuven University Press.
- Borgia, E. (2014). The Internet of Things vision: Key features, applications and open issues. *Computer Communications* **54**, 1–31.
- Buxton, W. (2013). Designing for ubiquitous computing. *Keynote TechFest*. Redmond, Washington: Microsoft.
- Dargie, W. and Poellabauer, C. (2010). *Fundamentals of Wireless Sensor Networks: Theory and Practice*. New Jersey, NJ: John Wiley.
- Dourish, P. and Bell, G. (2011). *Divining a Digital Future: Mess and Mythology in Ubiquitous Computing*. Cambridge, MA: MIT Press.
- Fraietta, A., Bown, O. and Ferguson, S. (2020). Transparent Communication within Multiplicities. *Conference of Open Innovations Association 2020* (pp. 61–72). Piscataway: IEEE.
- Kane, B. (2007). L'objet sonore maintenant: Pierre Schaeffer, sound objects and the phenomenological reduction. *Organised Sound* **12**(1), 15–24.
- Keller, D. (2000). Compositional processes from an ecological perspective. *Leonardo Music Journal* **10**, 55-60.
- Keller, D., Alcântara-Silva, T. R. and Mesz, B. A. (2022a). Editorial: Ubimus, gastrosonics and well-being (Editorial: caminhos investigativos da música ubíqua, gastrossônica e bem-estar). *Revista Vórtex* **11**(1), 1-33.
- Keller, D. and Barreiro, D. L. (2018). Editorial – Ubiquitous Music Section: Forces of attraction and challenges in ubimus research (Editorial – Seção Temática Música Ubíqua: Forças de atração e desafios na pesquisa ubimus. *Revista Vórtex* **6**(2), 1-14.
- Keller, D. and Lazzarini, V. (2017). Theoretical approaches to musical creativity: The ubimus perspective. *Musica Theorica* **2**(1), 1-53.

- Keller, D., Miletto, E. M. and Otero, N. (2015). 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.
- Keller, D., Costalonga, L. and Messina, M. (2020). Editorial: Ubiquitous Music Making in COVID-19 Times. In *Proceedings of the Workshop on Ubiquitous Music (UbiMus 2020)* (pp. 3-16). Porto Seguro, BA: Ubiquitous Music Group.
- Keller, D., Aliel, L., Filho, M. C. and Costalonga, L. (2021). Toward Ubimus Philosophical Frameworks. *Open Philosophy* **4**(1), 353-371.
- Keller, D., Simurra, I., Messina, M., Neiva, T. M., Tedesco, S. and Mesz, B. (2022b). Domestic ubimus. *EAI Endorsed Transactions on Creative Technologies* **9**(30), 173493.
- Keller, D., Messina, M., Bridges, B. and Yaseen, A. (2023). Ubiquitous Music as a Movement? (UbiMus 2023 Editorial). In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (pp. v-x). Derry, Northern Ireland: Ubiquitous Music Group.
- Koszolko, M. K. (2022). Performative Storytelling: Setting-Based Mobile Music Creation in Action. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2022)* (pp. 29-31). Curitiba, PR: Ubiquitous Music Group.
- Kramann, G. (2020). Composing by laypeople: A broader perspective provided by arithmetic operation grammar. *Computer Music Journal* **44**(1), 17-34.
- Kramann, G. (2023). AOGscript – Design of a Stand-Alone Scripting Language for the Generation of Music. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (pp. 95-109). Derry, Northern Ireland: Ubiquitous Music Group.
- Lazzarini, V., Keller, D., Otero, N. and Turchet, L, eds. (2020). *Ubiquitous Music Ecologies*, London: Taylor & Francis (Routledge).
- Lazzarini, V. and Walsh, R. (2023). Aurora-Lattice: Rapid Prototyping and Development of Music Processing Applications. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (pp. 3-13). Derry, Northern Ireland: Ubiquitous Music Group.
- Lewis, G. E. (2000). Too many notes: computers, complexity and culture in Voyager. *Leonardo Music Journal* **10**, 33-39.
- Lima, M. H., Keller, D., Flores, L. V. and Ferreira, E. (2017). Ubiquitous music research: Everyday musical phenomena and their multidisciplinary implications for creativity and education. *Journal of Music, Technology and Education* **10**(1), 73-92.
- Lima, M. H., Keller, D., Pimenta, M. S., Lazzarini, V. and Miletto, E. M. (2012). Creativity-centred design for ubiquitous musical activities: Two case studies. *Journal of Music, Technology and Education* **5**(2), 195-222.
- Maier, M., Chowdhury, M., Rimal, B. and Van, D. (2016). The tactile internet: Vision, recent progress, and open challenges. *IEEE Communications Magazine* **54**(5), 138–14.

- Messina, M., Aliel, L., Mejía, C. M. G., Filho, M. C. and Melo, M. T. S. (2021). Live coding on Orca, the geopolitics of the English language and the limits of creative semantic anchoring: A preliminary hypothesis. In *Proceedings of the Workshop on Ubiquitous Music (UbiMus 2021)* (pp. 57-61). Matosinhos, Portugal: Ubiquitous Music Group.
- Mesz, B., Tedesco, S. and Potenza, L. (2022). Quorum Sensing. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2022)* (pp. 77-84). Curitiba, PR: Ubiquitous Music Group.
- Miletto, E. M., Pimenta, M. S., Bouchet, F., Sansonnet, J.-P. and Keller, D. (2011). Principles for music creation by novices in networked music environments. *Journal of New Music Research* **40**(3), 205-216.
- Mills, R. (2019), *Tele-Improvisation: Intercultural Interaction in the Online Global Music Jam Session*, Berlin and Heidelberg: Springer.
- Otero, N., Jansen, M., Lazzarini, V. and Keller, D. (2020). Computational thinking in ubiquitous music ecologies. In Victor Lazzarini and Damián Keller and Nuno Otero and Luca Turchet, eds., *Ubiquitous Music Ecologies* (pp. 146-170). London: Routledge.
- Radanovitsck, E. A. A., Keller, D., Flores, L. V., Pimenta, M. S. and Queiroz, M. (2011). mixDroid: Time tagging for creative activities (mixDroid: Marcação temporal para atividades criativas). In *Proceedings of the XIII Brazilian Symposium on Computer Music (SBCM 2011)*. Vitória, ES: SBC.
- Radovanović, B. (2022). TikTok and sound: Changing the ways of creating, promoting, distributing and listening to music. *INSAM* **8**, 51–73. (DOI: 10.51191/issn.2637-1898.2022.5.9.51)
- Rottondi, C., Chafe, C., Allocchio, C. and A. Sarti (2016). An overview on networked music performance technologies. *IEEE Access* **4**, 8823–8843.
- Rowland, C., E. Goodman, M. Charlier, A. Light, and A. Lui (2015). *Designing Connected Products: UX for the Consumer Internet of Things*. Sebastopol, CA: O'Reilly Media.
- Stolfi, A. S., Milo, A. and Barthet, M. (2019). Playsound.space: Improvising in the browser with semantic sound objects. *Journal of New Music Research* **48**(4), 366-384.
- Rosales, E. (2022), Taste This Score. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2022)* (pp. 73-76). Curitiba, PR: Ubiquitous Music Group.
- Roddy, S. (2023). Signal to Noise Loops v5: Breathing Space – Reflections on Covid-19. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (p. 141). Derry, Northern Ireland: Ubiquitous Music Group.
- Simurra, I., Messina, M., Aliel, L. and Keller, D. (2023). Radical Creative Semantic Anchoring: Creative-action metaphors and timbral interaction. *Organised Sound* **28**(1), 64-77.
- Thomasi, R. (2023). From Audible to Visible Ecosystems: Emergence by Modeling and the Metastable Equilibrium Problem. In *Proceedings of the Ubiquitous Music Symposium (UbiMus 2023)* (pp. 61-73). Derry, Northern Ireland: Ubiquitous Music Group.
- Turchet, L., Fischione, C., Essl, G., Keller, D., & Barthet, M. (2018). Internet of musical things: Vision and challenges. *IEEE Access*, **6**, 61994-62017.

Turchet, L, Essl, G. and Fisichione, C. (2020). Ubiquitous music and the internet of musical things. In Lazzarini, V, Keller, D., Otero, N. and Turchet, L., eds., *Ubiquitous Music Ecologies*. London: Routledge.

Webb, A. and Layton, J. (2023). 'It's not just about technology!': Creativity as a driving force for nurturing the development of skills for digital performance. *International Journal of Performance Arts and Digital Media* **0**(0), 1-19.