How to Talk of Music Technology: An Interview Analysis Study of Live Interfaces for Music Performance among Expert Women

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Abstract. With the aim of making women's work in music technology more visible, the organization Women Nordic Music Technology (WoNoMute) has originated conversations with expert women in the form of seminar talks and interviews that are archived digitally. This paper analyses the first seven interviews and seminar talks with women from this online archive using thematic analysis. We explore whether and how their gender determines the shape of their tools focusing on *live interfaces*. From our findings, we propose to investigate alternative usage of the technical term 'music technology' to accommodate more diversity and fluidity into the field. This can inform the revision of the language used in education and human-computer interaction in order to be more inclusive but also to become more conscious about the creation of professional and academic environments that involve music technology.

Keywords: Human-Computer Interaction, live interfaces, physical virtual communication, interviews, digital archive, performance, women in music technology, gender

Introduction

As studied in previous research, women are underrepresented in the field of music technology (Gadir, 2017; Xambó, 2018), which aligns with the broader issue of the underrepresentation of women in science, technology, engineering and math (STEM) fields (Nimmesgern, 2016; Sax, 2012). It has been highlighted the importance of creating all-female communities of learning, mentoring, and the promotion of women role models in music technology related fields as strategies to raise awareness and broaden participation (Armitage, 2018; Dobson, 2018; Xambó, 2018). Beyond that, it is important to investigate and discuss the mechanisms and reasons behind the absence of women in these fields.

With the aim of making women's work in music technology more visible, the organization WoNoMute has originated a series of seminar talks and interviews with expert women in the form of live events and a digital archive (http://wonomute.no). The events are organised around the cross-campus master program Music, Communication and Technology (MCT), a co-joint master between the Norwegian University of Science and Technology (NTNU) and University of Oslo (UiO). The master's activities are located in an audiovisual networked space, the Portal, which connects the two universities and has streaming facilities to also communicate with online viewers. WoNoMute is reimagining the *cyberspace*—a term that refers to interconnected digital and physical spaces that promote other ways of participation and communal life (Schwartz, 1999)—by creating a forum where women in music technology are visible and discuss about their work and experiences with technology.

This article addresses the following research question: *How can interview analysis with women who work with live interfaces in music inform about whether and how their gender determines the shape of their tools?*

We analysed the first seven interviews published in this online archive using thematic analysis. One of the themes identified is the use of the term 'music technology' in their work, and how gender shapes their tools, particularly live interfaces. Thus, the research question includes gender as a key factor. However, it is noteworthy that we adopt a stance as descriptive and ethnographic as possible in regards of how we approach the term of 'music technology'. The term is defined by the interviewees' voices and then linked to

the literature, which we found especially connected to the notion of musical interface as a gendered metaphor (Essl, 2003). From this perspective, this research contributes to rethink the term of 'music technology', which can inform future steps in education and human-computer interaction. Although music technology received such a prominent place in the discussion through the thematic analysis, it is out of the scope of this research to provide a more profound historical overview on the terminology.

Interface as a Gendered Metaphor

> *"Knowing how interface structures our relation to knowledge and behaviour is essential... today we perceive our environment through interfaces."*
> Monteiro (2017, p.7)

In order to stress live interfaces as possibly gendered artefacts, we highlight the communicative aspects of interfaces in general. Monteiro (2017) is describing interfaces as a cultural moment in which a specific relationship between human user and technological artifact is being established. Accordingly, its connotations of advanced technology and contemporary forms would suggest both immediacy and engagement. Further on, interfaces would represent and convey ideological meanings, therefore capable to produce false consciousness. Monteiro expresses the notion of interface as a series of actions between human and machine in time and space: *"embed choices, conduct, languages, and ultimately values, worldviews and aesthetics into technical infrastructures."* (Monteiro, 2017, p.8)

Georg Essl (2003) regarded new music interface technology as concerned with using technology for musical performance and highlighted how women authored gender as an issue in their performances. Essl describes *new music interface design* as an academic field involving electrical components for musical performance, and *music technology* as any mechanical device that generates musical sound. Georg Essl's definition of new musical interface technology involves usually electrical components and sensors, a workable definition in this paper because it echoes with our findings.

Along other practises, often summarised as 'music technology', the design of live interfaces has multi-disciplinary dimensions. Historically it has been a little diverse subject, especially women were rarely involved in interactive audio design with traditional engineering tools such as microprocessors (Stewart et al., 2018). However, there is enough evidence that indicates strongly that gender imbalance exists in creating interfaces for music and performance. This can be traced to external factors in the practise environment rather than in the technological subject itself, which has been addressed and showcased by several authors and practitioners with different methodologies (Cheryan et al., 2009; Stewart et al., 2018; Sørensen, 1992). The analysis of the interviews presented in this paper is done from the perspective of using the term 'music technology' as an interface that can communicate gender issues.

The Interview Process

In this section, we present the context of this research in terms of the MCT master and Portal, the organization Women Nordic Music Technology (WoNoMute) and the interview analysis process.

The MCT Master and Portal

The NTNU-funded project Student Active Learning in a Two Campuses Organization (SALTO) aims to promote cross-campus teaching and learning as an open laboratory (Støckert et al., 2017). A new international master has been launched within this educational scheme: Music, Communication, and Technology (MCT), which is a master's program in collaboration between the NTNU in Trondheim, Norway, and UiO in Oslo, Norway. The master's program centres around the field of music technology from a research perspective in a cross-campus setting. The students have interdisciplinary backgrounds and work in teams. The master has a dedicated physical space in both sites, the Portal, with a real-time low-latency audiovisual network and audiovisual technologies.

Women Nordic Music Technology (WoNoMute)

The organization Women Nordic Music Technology (WoNoMute) has been founded by the second author in August 2018 at NTNU, in partnership with UiO, and in alignment with the NTNU Department of Music's and Faculty of Humanities's will to improve the underrepresentation of women in techno-scientific fields. WoNoMute

is an horizontal network that promotes the work of those identifying as women in the interdisciplinary field of music technology. The organization aims to promote and connect the work of women in music technology at local, national and international levels. During the first year of the organization, a small group has constituted the core WoNoMute team, with the help of a number of contributors and advisors, in particular with invaluable contributions from the MCT students and teachers.[1]

WoNoMute is an open space defined and discussed by its members and produces content that is publicly available. During the first year, the organization has coordinated seminar series,[2] which is a monthly series of lectures by women who work around music technology and who present their work in the MCT portal, connecting the two campuses of NTNU in Trondheim and UiO in Oslo and streaming to the world. The seminar series have been curated by the second author in conversation with the organization's advisors. In connection with the seminar series, WoNoMute has also conducted interviews,[3] mostly led by the first author. The interviews have been conducted typically in the form of both a short biosketch interview video and a written interview, which are published on the organization's website.

Interview Analysis

Over the period of 8 months, WoNoMute invited 7 women figures active in music technology related fields, to give a lecture in the Portal, in chronological order: Miranda Moen, Alexandra Murray-Leslie, Tone Åse, Tami Gadir, Angela Brennecke, Pamela Z and Sofia Dahl. The live streams of the presentations and interviews are stored in the online archive. The interviews are semi-structured and have been conducted by the first author (except for the interview with Pamela Z where Tone Åse was also an interviewer). The interviews had questions related to the interviewees' background, mentors and role models, their work, and advice to women interested in pursuing their careers in music technology. The questions were inspired by the previous experience of the second author while conducting and supervising similar interviews when she was at the organization Women in Music Tech at Georgia Tech.[4]

Both seminars and interviews were generally programmed in the Portal. While the seminars were open to public and accessed from two cities and online viewers, the interviews were captured in a more intimate ambience. Driven by the interview questions, we applied thematic analysis (Braun and Clarke, 2006) to identify emerging patterns on the WoNoMute's published online material i.e. the short biosketch interview videos, the written transcribed interviews and the video recordings of the presentations. We used the software NVivo (Bazeley and Jackson, 2013) to unfold themes from this material, annotating the text snippets from each interviewee. For the written interviews, the nomenclature used includes the name of the interviewee and the reference number (e.g., *"Miranda Moen, Reference 1"*), and for the videos we give the timecode and distinguish between the presentations (e.g., *"Miranda Moen, Presentation Video, 01:12"*) and the biosketch videos (e.g., *"Miranda Moen, Video Interview, 01:12"*). In the next section, we discuss in detail the main findings from this interview analysis process, focusing on how the term 'music technology' is used.

Live Interfaces, Sonic Arts, Circuit Bending... Is Everything 'Music Technology'?

In this section, the musical interface is being inspected, based on the statements of four of our seven interviewees, when discussing about their backgrounds and experiences. In particular, we explore how the term 'music technology' is used when talking about instruments and applications. We sketch a casual frame in order to understand in what way the term is genderised according to Essl's (2003) definition. We seek for reasons and come up with interpretations, which indicate that there does not seem to be a universal statement.

According to Tami Gadir's presentation "The Music Technological Body", every form of musical expression, including all forms of bodily, classical and computer engineered instruments, are declared as 'music technology':

> *"Music is always technological. And music is always affected by gender. Or sometimes it helps to use negative formulations, we can say that there is no music that is non-technological and no music that is unaffected by gender."* (Tami Gadir, Presentation Video, 04:42)

[1] http://wonomute.no/committee
[2] http://wonomute.no/seminars
[3] http://wonomute.no/interviews
[4] http://womeninmusictech.gatech.edu

Asking what kind of images would rise when thinking about the "music technological body", Tami Gadir presented different photos and video excerpts with content that is distantly or closely related to the term. In her interview, she would affirm this position, based on her own practice:

> *"The piano was my first music technology. [. . .] I tried to teach myself that people have different skills with various types of technologies."* (Tami Gadir, References 1, 2)

Independent from that, another interviewee stated in her interview that everything is 'music technology' as well:

> *"Because it is all technology. Even somebody who just plays a concert grand piano, that is probably one of the most technologically sophisticated instruments that you can imagine. It is all about the well balanced and designed mechanical thing."* (Pamela Z, Reference 1)

In Tami Gadir's presentation, she also states that technology would not be an item that exists apart from music in a pure, pre-technological form (Tami Gadir, Presentation Video, 17:46). A number of the answers to the question "What brought you to the field of music technology?" are able to reveal preconceptions that come along with the term 'music technology' and show that the intended detachment notion between music and technology is quite strong. The term evoked partly discontinuous reactions when two of the interviewees expressed their disconnection with 'music technology' when referring to their own work, even though their musical practice included several technical layers and items. An indication for this can be inspected in the following vignettes:

> *"I don't like to describe what I do as music technology, for me, that's more the system behind the instruments."* (Alexandra Murray-Leslie, Reference 1)

To the same question, Pamela Z answered:

> *"There is an introduction of technology into the arsenal of tools that I'm using but I don't think of it as the technology part being the prominent thing. The aesthetic and the adventurousness of the work is more important to me than whether or not there is technology involved."* (Pamela Z, Reference 1)

Although Pamela Z stated earlier that the exposure to technology provoked a change in her artistic voice, when we asked her "What advice would you give to women interested in pursuing a career in music technology?", the term music technology seems to become a detached and irrelevant artefact:

> *"Again, to me 'career in music technology' sounds a little bit like you're talking about circuit benders or that they are writing and designing software. I see myself as an artist and so I can only speak from that, what my advice is about trying to be an artist. Then it doesn't matter rather you are using technology, and what kind of technology you're using."* (Pamela Z, Reference 2)

There seems to be an echo between these statements and the approaches to music technology regarding the nature of the technological or engineering part in music. Sofia Dahl, who holds an engineering degree, distances herself from the role of the engineer even though she applies engineering methods in her research:

> *"Now I can say I am an engineer, but I am not a typical engineer. I wouldn't feel comfortable working as an engineer in a company."* (Sofia Dahl, Reference 1)

Alexandra Murray-Leslie mentions international conferences on music technologies such as the New Interfaces for Musical Expression (NIME),[5] which namely fuse music and technological practice. Although her music instrument *Computer Enhanced Footwear* is mentioned in relation to it, 'music technology' is not present in the language:

> *"[T]o 3d print the prototype instruments, creating a live costuming on stage that could be actuated through gesture led my group [. . .] to new interfaces for musical expression. When I started my PhD I suddenly realised this whole incredible world of people working with their digital DMI [digital musical interface/instrument] controller or connecting virtual with classical instruments."* (Alexandra Murray-Leslie, Reference 2)

[5] https://www.nime.org

Discussion

Here, we analyse how the term 'music technology' should be reimagined to include the missing plurality and fluidity revealed by our interviewees, which is beyond the acknowledged interdisciplinarity of the field.

According to the above conversations, the interviewees with the strongest artistic practice see their work not necessarily regarded as part of music technology. The attributed expressions like "circuit bending" and "designing software" (Pamela Z, Reference 2), and "the system behind the instruments" (Alexandra Murray-Leslie, Reference 1) suggest that the *ambient belonging* (Cheryan et al., 2009) that accompanies the term 'music technology' rather associates with stereotypical environments and characteristics of engineered products.

The scholars that we discuss next propose ideas that are part of our agenda on how to reveal the stereotypical biases of technology in the academic field of music technology. For example, Sørensen introduces in "Towards a Feminised Technology?" (1992) the notion of *translation problems* from values to technology, for example values such as usefulness and efficiency. Human practice would be difficult to relate with these concepts. Similarly, Sørensen explains how humans and their activities would be gradually removed from the vocabulary in technological texts. Accordingly, Sørensen wonders whether there is the possibility that the aforementioned values could be seen as a translation into physical characteristics of an artefact (Sørensen, 1992, p.13). This could explain why many of the interviewees, even those with engineering background, do not seem to see themselves aligned with 'music technology' or engineering.

Cheryan et al. (2009) examined how material objects in environments can communicate characteristics of the inhabitant group. Environments could therefore act like gatekeepers by preventing people who do not feel they fit into those environments, from joining them. The goal of their paper was *"to demonstrate that stereotypes of a domain should be taken into account when attempting to diversify that domain"* (Cheryan et al., 2009, p.2). In Stewart et al. (2018), the researchers demonstrated that women and girls want to learn how to work with electronics and code to build audio interfaces of their own design (Stewart et al., 2018). However, they are underrepresented within established audio and music technology communities and academia (Stewart et al., 2018, p.8). Accordingly, by introducing e-textiles to audio technology women would persistently outnumber men in the gender representation.

Even though the design of interfaces in all its artistic and sonic nuances might be seen as inherent to the academic field of music technology, 'audio and music technology' terminology still resonates with STEM disciplines, as we learned from interviewing diverse practitioners, in a way that cannot resemble those practices. By designing their artistic items and technically tailoring them to their own needs, the idea of the implicated attributes that come along with the imagery of engineering and programming is transformed and often reversed. Consequently, music technological practices can be 're-written' and, in doing so, can alter our perception of technology itself. This has the potential for a 'female narrative' (Armitage, 2018) in engineering or what Sørensen calls 'feminised technology' (Sørensen, 1992).

All the above examples show that the context in which STEM methods are applied is crucial for the presence or absence of women. In the moment a gendered tool can act excluding, termed as *ambient belonging* in Cheryan et al. (2009), a gendered tool can become inclusive as well, as seen with the e-textiles. And this is also reflected in the statements of the expert women in our interviews, who do not like to describe what they do as 'music technology'.

Implications and Future Work

This article sought to answer the research question *How can interview analysis with women who work with live interfaces in music inform about whether and how their gender determines the shape of their tools?*

From our analysis we observed that the established terminology in the academic environment of music technology fails to address the diversity of practices, especially with gendered tools that can act as gatekeepers for women. We thus propose to investigate alternative terminology that is suitable to accommodate a diversity of uses and practices. This is an important finding that was possible through the analysis of the publicly available material from the WoNoMute online digital archive. In turn, it has been crucial the creation of both a public and a private cyberspace for forum debate and dissemination of a variety of women's work in music technology in a connected and modular venue, the Portal, in order to promote these initial conversations. When attempting to diversify the music technology domain in academia, education and industry, it should be taken into account that not only language but the design of the environment are relevant factors to be considered (Cheryan et al., 2009).

We acknowledge that this research is limited to a specific group of practitioners, academics and professionals who identify as women, and that more research needs to be done in order to provide a more generalisable representation. For example, it is an open question whether similar reflections could be found among practitioners, academics and professionals who identify as men or non-binary. Here we focused instead on an in-depth qualitative analysis of a small but diverse group in terms of backgrounds and experiences to initiate this debate. As future work, we foresee the need of establishing working groups, where multiple stakeholders take part into discussions with the aim at revising the terminology in order to be more inclusive and move the field forward.

Conclusion

In this article, we noticed that interfaces for music performance are not only artefacts, but ideas. The term 'music technology' alone is not capable to encompass the existing diversity of practices as it carries ideas of activities related to the term that are stereotypically gendered. The discussion showed, with a number of examples from women who work with topics related to music technology, that the context in which STEM methods are applied is crucial for the presence or absence of women. Finally, we discussed the implications and future work of this research, namely rethinking the terminology in academia, education and industry, related to the term 'music technology', so that it becomes more inclusive and environment-aware. We acknowledge that gender is one of the dimensions in diversity, and we hope that this research can encourage to reflect new perspectives on the techno-scientific terminology.

Additional Information

The following list includes the links to the written interviews, biosketch video interviews and presentation videos discussed in this paper, which are part of the WoNoMute online digital archive:

Miranda Moen
– **Written interview**: http://wonomute.no/interviews/miranda-moen
– **Biosketch interview video**: https://youtu.be/xdMMQiUG7mU
– **Presentation video**: https://youtu.be/QJBmbiEb8dc

Alexandra Murray-Leslie
– **Written interview**: http://wonomute.no/interviews/alexandra-murray-leslie
– **Biosketch interview video**: https://youtu.be/VPpy01W0fAw

Tone Åse
– **Written interview**: http://wonomute.no/interviews/tone-aase
– **Biosketch interview video**: https://youtu.be/SRX81BHTWbc
– **Presentation video**: https://youtu.be/y8PI-E0o6Wc

Tami Gadir
– **Written interview**: http://wonomute.no/interviews/tami-gadir
– **Biosketch interview video**: https://youtu.be/DoO9mq3khGQ
– **Presentation video**: https://youtu.be/okEgjIjpJkY

Angela Brennecke
– **Written interview**: http://wonomute.no/interviews/angela-brennecke
– **Biosketch interview video**: https://youtu.be/OV8A98-HRIk
– **Presentation video**: https://youtu.be/mpFSF2PHcFo

Pamela Z
– **Written interview**: http://wonomute.no/interviews/pamela-z
– **Biosketch interview video**: https://youtu.be/DQMF2ABrJvs
– **Presentation video**: https://youtu.be/v3ql6QMNi4U

Sofia Dahl
– **Written interview**: http://wonomute.no/interviews/sofia-dahl
– **Biosketch interview video**: https://youtu.be/SV42EZF3Gx0

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