

‘Blending Dimensions’ when Composing for DMI and Symphonic Orchestra

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ABSTRACT

With a new digital music instrument (DMI), the interface itself, the sound generation, the composition, and the performance are often closely related and even intrinsically linked with each other. Similarly, the instrument designer, composer, and performer are often the same person. The *Academic Festival Overture* is a new piece of music for the DMI *Trombosonic* and symphonic orchestra written by a composer who had no prior experience with the instrument. The piece underwent the phases of a composition competition, rehearsals, a music video production, and a public live performance. This whole process was evaluated reflecting on the experience of three involved key stakeholder: the composer, the conductor, and the instrument designer as performer. ‘Blending dimensions’ of these stakeholder and decoupling the composition from the instrument designer inspired the newly involved composer to completely rethink the DMI’s interaction and sound concept. Thus, to deliberately avoid an early collaboration between a DMI designer and a composer bears the potential for new *inspiration* and at the same time the *challenge* to seek such a collaboration in the need of clarifying possible misunderstandings and improvement.

Author Keywords

DMI, composition, musical mapping strategies, symphonic orchestra, music production process

CCS Concepts

•Applied computing → Sound and music computing; Performing arts;

1. INTRODUCTION

With new digital music instruments (DMI), their design often overlaps with composition and performance [10]. In many cases designer, composer, and performer are united in one person [17, 1, 12]. In some other cases, DMI designers give their instruments to composers to study unconsidered issues [11]. Open questions include whether the DMI or an artistic concept comes first [12] or if even a growing repertoire can drive creativity [5].

This article contributes to the ongoing debate around the designer-composer-performer tension. The case study,

which is presented, decouples a DMI from its designer and the composition for *blending dimensions*. This intention was embedded in a process covering the composition, a recording and music video production, and a public live performance. The DMI *Trombosonic* used for this study already featured in a series of performances and evaluations [7]. The designer of the *Trombosonic* initiated this project together with a symphonic orchestra, the *TU Orchester*.¹

The whole music production process was evaluated by reflecting on the experience of three key stakeholder perspectives: the composer, the performer, and the conductor. This reflection concerns unplanned and unforeseeable changes throughout the production process, their causes, and how they were handled. Furthermore, we report on the mutual impact concerning the DMI and artistic considerations behind the composition and the performance. Finally, we discuss our findings against the backdrop of the state of the art in the designer-composer-performer relationship.

2. LITERATURE REVIEW

When working with new DMIs, activities such as designing, composing and performing are often unified in one person [17, 1, 12]. According to a survey from 2018, 78% of the sample population designed the DMI that they play and 97% of the surveyed performer have been involved in the instrument design [12].

To compose or perform is different as with well-known and established instruments such as a piano, for instance. If you write a piece for piano as a composer you most likely know exactly how a piano works, sounds, and can be played. Many composers did so throughout hundreds of years. With new DMIs, however, their complexity can be overwhelming compared to established instruments [13]. On the contrary, simplicity in DMI design can reduce or avoid this complexity and at the same time encourage creativity [18]. New DMIs have also been given to composers other than the designers on purpose to offer the instrument to a wider community and get feedback to refine the instrument’s design [11].

Nevertheless, musical pieces are often linked to the DMI and a specific concept or a specific mapping, which is often considered essential for the instrument [8]. Also the composer often “doubles as the performer-engineer” [1] (p.101). Only some cases, such as the *Reactable* [9], show that DMIs can become popular, be sustainable, and are used by other composers and performers than their inventors.

The sustainability of a DMI and the reproduction of a musical piece is being discussed along with matters of design and evaluation. Ferguson and Wanderley [4] propose the “ability to reproduce a performance of a particular piece” (p.32) as one effective measure to evaluate DMIs. Simi-

¹The official orchestra of the Vienna University of Technology, <https://www.tuorchester.at> (last access 09.04.2019)



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larly, Butler [2] strengthens the need for pedagogical etudes to learn performance techniques as evaluation for DMIs. O'Modhrain [14] presents a framework for the evaluation of DMIs. Besides the designer, composer, and performer, he also considers the audience and the manufacturer and their viewpoint on DMIs. A different approach is presented by Snyder [16]. He did not actually evaluate his new DMI but rather continuously developed it and reports on design problems, creative inspirations, and unplanned discoveries.

3. RESEARCH APPROACH

Methodologically, this work relies on two sorts of qualitative data and its reflection. Firstly, data collection happened from the initial idea and start of the project until the final production and live performances. Everything was documented accompanying each step for more than a year in a protocolar way. The summary of these continuously extended reports is presented in chapter 5.

Secondly, we draw on the experience of three key stakeholder within this project as summarized in chapter 6. Two of them, the composer and the conductor, were interviewed after the whole production ended. They were asked questions about their experience with the whole process, the composition, and the DMI Trombosonic.

The performer of the Trombosonic as the third key stakeholder had a special role. He, as the designer of the DMI, accompanied the project scientifically from the beginning and authored this publication. His experience is taken into account as well as it is an integral element representing both, studying and doing the performance [15]. The performer recorded his experience as diary notes throughout the project and analysed it in an auto-ethnographic manner [3].

4. THE DMI AND THE COMPOSITION

The DMI *Trombosonic* and the musical result, the *Academic Festival Overture*, as both described next, are not part of the actual data body and focus of this research. But they both form the framework for this study.

4.1 The Trombosonic

This digital music instrument is inspired by the slide trombone. It is played by using arms, fingers, and mouth in various embodied ways due to its compact, wireless, and sensor-based design. The main control interfaces are an ultrasonic sensor as imaginary trombone slide, a thermal resistor as mouth piece, and a gyroscope to use the instrument's movement for sound modulation. See Figure 1 to get an impression of the instrument. A full description concerning the conceptual, technical, and musical background is available in [6].

The Trombosonic featured in around a dozen public performances. All performances were played by the designer, mostly solo, and all musical pieces for the DMI were composed by himself for the instrument so far. These pieces include electro-acoustic compositions as well as popular music. Furthermore, the Trombosonic was evaluated for uses beyond its primary purpose as musical instrument. This evaluation focused on children and adults of different ages without prior knowledge about the DMI and their experience when using the instrument as well as the opinion of an audience at a live performance [7].

4.2 The Academic Festival Overture

This musical piece, the *Academic Festival Overture*², is a composition for classical symphony orchestra and the DMI

²The original German title is "Akademische Festouvertüre"

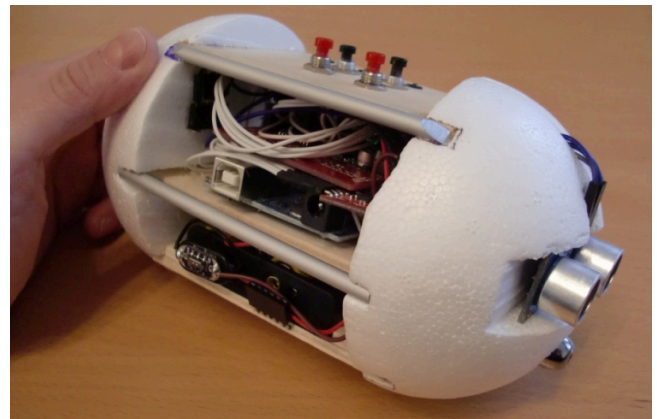


Figure 1: The Trombosonic

Trombosonic. The whole music piece is based on Johannes Brahms's Symphony No. 1 in C minor, Op. 68, and in particular the first nine measures or approximately 30 seconds. A music video of the full piece is available online.³

The orchestra uses normal scores and plays variations of these first eight measures of the original scores of Brahms. (see Figure 2, left) The orchestra instrumentation is written for 2 flutes, 2 oboes, 2 clarinets, 2 bassoons, 2 contrabassoons, 2 horns on C, 2 horns on Eb, 2 trumpets, 3 timpani in B C Db, 8 first violins, 8 second violins, 6 violas, 4 cellos and 4 basses.

The solo part, played by the Trombosonic, is more complex and is notated in two ways: musical scores (see Figure 2, right) and a textual explanation for the concept. The Trombosonic uses a 30 second playback of Brahms's Symphony No. 1 manually controlled by a start and stop button on the instrument. For sound generation, the Trombosonic uses an externally amplified Max/MSP-based synthesizer.

During the first half of the piece, see letter A in Figure 2 (right), the Trombosonic loops just the first eight note of the playback which creates a staccato-like sound. At letter B, the Trombosonic uses the playback as it is, but starts and stops it according to the scores.

The volume control of the playback works with the figurative trombone-slide or in fact the ultrasonic sensor on the front side. The left hand is used to increase and decrease the volume according to the respective musical symbols in the scores. The upper mordent ornaments in the scores indicate an amplitude modulation for the original recording given as formula in the textual explanation. This amplitude modulation is applied dynamically with the mouth piece, a thermal resistor. Turning the instrument clockwise or counter-clockwise transposes the playback up or down by a half tone.

5. THE PRODUCTION PROCESS

The following chapter describes the process from the composition competition with the Academic Festival Overture as winning piece, through rehearsals, to the music video production and live performances.

5.1 Composition competition

The competition was announced by the *TU Orchester* as composition for classical symphony orchestra and the digital music instrument Trombosonic. The given criteria for the piece were approximately five minutes duration submitted as scores plus a music demo. For the orchestra a classical

³<https://youtu.be/BIUWFD0HJeq> (last access 09.04.2019)

Akademische Festouvertüre

Un poco sostenuto

Akademische Festouvertüre

Un poco sostenuto

Figure 2: Scores of the *Academic Festival Overture*: First page of the orchestra score, all instruments (left), full score for the Trombosonic (right)

score notation was required with minimum and maximum shorthand for the instrumentation. The scores for the solo part were allowed to be graphical as well. The winner of this competition was awarded 2.000 Euro and at least two public performances of the piece within the year after the competition.

Composers were not required to have any prior experience with the Trombosonic or DMIs in general. To support composers regarding the Trombosonic, a website was provided with a written description of its functionality including pictures [6], two videos of the instrument (a demo⁴ and a performance⁵), and the offer to contact the designer by e-mail for questions. Furthermore, a public workshop at the *University of Music and Performing Arts Vienna* was held for all interested composers to demonstrate the Trombosonic to them, show its possibilities, and answer their questions regarding the instrument. A second optional workshop was announced as well, but no composer demanded it.

Finally, three complete submissions were registered and handed over anonymised to a jury to select the winning piece. The five jury members were the conductor, the performer, a representative of the orchestra, and two professors for composition. The evaluation criteria for the jury were the novelty of the overall concept, the playability for orchestra and Trombosonic, and the aesthetic quality.

5.2 Rehearsals and production

Two full rehearsals of the orchestra and the Trombosonic were scheduled apart from individual rehearsals of orchestra sections and the Trombosonic soloist. The first full rehearsal was intended to get an impression of the piece played live

⁴<https://youtu.be/WRVvB2uwf6Q> (last access 09.04.2019)

⁵<https://youtu.be/wm48g4xL8QQ> (last access 09.04.2019)



Figure 3: The recording setting in the *Kuppelsaal*

by orchestra and Trombosonic together. The second full rehearsal happened the day before the audio recording and music video production. The second full rehearsal and the production took place in the *Kuppelsaal* of the *Vienna University of Technology*. See Figure 3 for an impression of the production setting. The white table in the front hosts the laptop with the Trombosonic Max/MSP synthesizer, the DI boxes for recording, and a headphone amplifier for the conductor and the soloist.

The audio recording of the five minute piece was split in three steps throughout a whole day. First, the orchestra recorded 30 seconds of the original beginning of Brahms's Symphony No. 1 to be later used as playback for the Trombosonic's sampler. This was a normal recording situation for the orchestra and the conductor without the DMI at all. Right after the playback was recorded, the audio engineers

mixed and mastered the orchestra recording as it was used immediately in step two as playback for the Trombosonic.

In the second step, the orchestra and the Trombosonic recorded the piece together. For this step, the orchestra was recorded acoustically with microphones as usual in such a setting. The Trombosonic's synthesizer, however, was plugged in directly without using a speaker to not interfere with the natural orchestra sound. Only the soloist and the conductor could hear the Trombosonic using headphones.

The third step was the video recording. Again, the audio engineers quickly cut and mixed the music recording of the whole piece to use it as playback for the video production. During several takes with static and mobile cameras the orchestra played live in parallel to the mixed recording while the DMI played playback only during the video recording. The whole music and video recording took around 10 hours without post production, which happened afterwards in an external studio.

5.3 Release and live concerts

The public release of the Academic Festival Overture production was at the official ceremony of the 250 years anniversary of the Vienna University of Technology. The first live performance of the piece happened two months later when it was played as part of the regular concert series of the orchestra. The concert took place in the same hall as the recording. But instead of the white table with the recording equipment (see Figure 3) two special full frequency range speakers were used. They were located near the soloist with the Trombosonic for an optimal sound experience within the orchestra setting.

6. STAKEHOLDER EXPERIENCES

Three key stakeholder of the production around the Academic Festival Overture were the composer, the orchestra's conductor, and the designer and soloist of the Trombosonic. They are all experts within their professional domain concerning composing, conducting or working and performing with DMIs.

None of these stakeholders participated in such a project setting before and all found themselves in a new situation. For the composer this was not explicitly intended as it could have been someone else winning the competition. But the composer never wrote for a new DMI before apart from using software for his electro-acoustic compositions. The conductor was experienced with contemporary music but had no prior experience with DMIs or electronic instruments within an orchestra so far. The designer of the Trombosonic was the only composer for it so far.

6.1 Composer's perspective

The composer had no particular idea for a composition after reading the call for the competition and the description of the Trombosonic. He just thought a precise control of the instrument's sound could be limited or problematic from what he saw in the provided videos. From a conceptual point of view, he found that it will be important for the audience to understand how the Trombosonic works and how its gestural way of playing can be compared to traditional and familiar instruments. His conclusion was, that he needs an idea that is "easily to realise" with the DMI, but of course "musically meaningful," and at the same time understandable for the audience.

The actual idea for the piece came right after the workshop with the demo of the Trombosonic. The composer said, on his way home in the tramway, he suddenly had a clear idea for the concept and the music. He decided to use pre-recorded samples for sound generation as source for his

own piece and in particular Johannes Brahms' Symphony No. 1, op. 6. His reason for this decision was that, from a pragmatic point of view, there was simply not enough time to learn about the full capabilities of the Trombosonic or to work closely together with its designer. From a musical point of view, by using a sample he could avoid any potential harmonic problems caused by a DMI he is little familiar with. Brahms's Symphony No. 1 worked well for this purpose because it stays on one tone and harmony for the whole intro. Finally, the composer thought that with samples and sound modulation he could create a musical demo for the contest that sounds more realistic and pleasing compared to a demo song produced with a music notation software.

Concerning the Trombosonic as a new DMI he liked the way how it shows explicitly its sound control possibilities and the "Star Trek look," as he called it. He disliked that some sensors were too unprecise. Especially during the first rehearsal with the orchestra he was afraid that everything works as intended.

6.2 Conductor's perspective

The conductor had no prior experience with digital music instruments apart from keyboards and a performance he conducted once with an amplified celesta. The whole technical principle of gestural and sensor-based music control was new to him. The first time he saw the Trombosonic was in a video provided with the competition announcement. Although a DMI and this technical approach to music was completely new to him, he was excited and motivated from the beginning and curious how the submitting composers would make use of the Trombosonic's capabilities. Overall, he liked the idea that the orchestra will not only play new music, but a piece that needs a whole concept for a new music instrument and orchestral music.

Musically, he found the piece a good idea concerning the concept and its clever arrangement. It was technically not too demanding for the orchestra which allowed them to play it well within the capabilities of a non-professional orchestra. The "musical mixture with Brahms" was a good choice as well in this regard as it is a "symphonic reference for many which helped the player and listener to understand the piece," as he said.

The only real difficulty for him was the timing with the Trombosonic and to synchronise with the playback triggered by the DMI. That was completely new to him during the first rehearsal. Especially the timpani, which had an important part in the piece, were hard to play accurately in time with the DMI and he as a conductor had not much control of this. He could do nothing about the sampling speed of the Trombosonic but adapt to it which is unusual for a conductor.

At the same time, he liked the fact that the sample loops are triggered manually and are under full control of the performer. As it is with any other instrument, the manual gestures of the Trombosonic are essential. When the performer turns the Trombosonic slightly in a different angle, it sounds different and you actually hear this expression in realtime and live. Concerning the recording session, the conductor reported that it was new to him to use headphones and to concentrate on the click track.

Overall, for the conductor considered the Trombosonic a versatile instrument with a lot of capabilities thinking of the mouthpiece or the gestural control which could be used quite differently. He saw the role of the orchestra in the case of the Academic Festival Overture as one part of three. There was the recording which was used for sampling, then there was the performer with the Trombosonic, and finally the orchestra completed this sound symbiosis which

was something special for everybody involved.

6.3 Performer's perspective

The most interesting part for the performer in his double role as the instrument designer was during the competition and to see how someone else composes for the Trombosonic. As the designer of the Trombosonic he knows quite well what is possible or what can be possible with the instrument and what is more or less impossible.

One submitted but not selected piece, for instance, would not have been working as it used harmonics in a ways which would have been impossible to control. The result of the winning piece, however, was a complete new concept the composer created for the Trombosonic the designer himself never thought of. It was fascinating to see how the DMI inspired the composer to reuse a classical masterpiece in a modern sound approach to create contemporary music.

The scores of the winning piece were the only problem the soloist encountered during the selection process of the competition. Some notations within the scores were hard to understand or interpret without the composer's further explanation (see Figure 2). Some marks were deviating from standard score notation. Furthermore, due the new concept of using samples, it was necessary to revise and extend the capabilities of the Trombosonic's software synthesizer.

The rehearsals were the most important and demanding part for the performer as he finally transitioned from the designer to become the actual soloist. Before doing any rehearsing with the orchestra it took a couple of weeks for the soloist and phone calls with the composer to understand the score, to interpret the composer's musical intentions, and to rehearse continuously with the music demo of the orchestral part the composer provided. Nevertheless, the first rehearsal with the orchestra did not go well. The orchestra and the performer experienced a complete new situation performing together. Most of all the composer was not satisfied with the timing and accuracy of the performer concerning the interplay with the orchestra.

Soon after the first rehearsal with the orchestra, two extra rehearsals between the performer and the composer followed. Reasons for these extra rehearsals were misinterpretations on the performer's side of how to play the solo part and the need to discuss the whole piece in detail. Furthermore, it was necessary to tweak the sound generation in the synthesizer together with the composer (i.e. sample playback duration and amplitude modulation) and finally rehearse the piece under his guidance. For the performer, the two rehearsals with the composer and additional single rehearsals with the music demo over the course of weeks took around 20 hours.

After these intermediate rehearsals the second rehearsal with the orchestra worked well without any problems and only small adjustments regarding the amplitude modulation of the synthesizer. The recording went smoothly as well from the performer's perspective.

7. DISCUSSION

For discussion we reflect on the whole process and the stakeholder experiences. The most notable and at the same time rather unusual deliberate choice in the production process, was the composition competition. Right at the beginning it had an immediate implication for the composer and the composition as the composer and the designer could not collaborate directly.

The composer had no particular idea for the composition when reading the description of the Trombosonic. He rather assumed certain technical limitations and the reliability (i.e. sensor accuracy) he would have to consider

for the composition, exactly according to O'Modhrain [14]. Furthermore, he claimed the use of the DMI to be understandable by the audience. At this point, the composer acted rather *analytical* than having an actual creative idea. This changed immediately after the workshop when he first saw the Trombosonic in real. This had an *inspirational* impact and the DMI itself inspired the composer. Moreover, the competition process and not letting the designer and the composer collaborate for the composition, led to a new mapping concept for the Trombosonic. This new concept for the Trombosonic was *not* considered by the designer so far and emerged more or less accidentally due to the circumstances of the competition process. Here we can see parallels to both, McPherson and Kim [11] and Snyder [16]. As with Murray-Browne [13], the instrument became part of the composition and directly inspired the composer. But in the case of the Academic Festival Overture the "lack of transparency" (p.56) affected the composer at an early stage instead of the audience during a performance.

Preventing the designer and the composer to collaborate, had another implication apart from a new concept for the Trombosonic. When the musical piece was written - and in our case submitted and selected during the competition - the composer's work was actually done and the scores handed over for rehearsing. Only the first full rehearsal revealed deficiencies between the original intentions of the composer and the actual realisation by the DMI designer as performer. The need for collaboration between the composer and the designer became apparent and concerned technical improvement as well as performing issues.

The need for technical improvement can be seen as late consequence of the missing collaboration during the composition process. Such improvements after initial performances (or rehearsals) are not surprising with DMIs and sometimes even wanted by such collaborations [11, 16]. In our case, however, the implications were additional individual rehearsals between the composer and the performer as well as very late adaptations of the synthesizer during recording.

Regarding the performing issues, in principle, the performer was able to reproduce a performance (or rather produce it in our case) based on the provided score. This ability to reproduce indicates the quality of the DMI [4] and in turn also the quality of the piece to be performed with the DMI. The need for further, unplanned rehearsing even demonstrates that the Academic Festival Overture may serve as a piece to learn (new) performance techniques [2], especially for the Trombosonic. The piece might even be inspirational itself to inspire new DMIs [5]. The sampling technique used for the Academic Festival Overture could eventually be adopted for a different new or existing DMI.

The conductor did not feel much affected or challenged throughout this project although he saw himself in a new situation. Most interesting in this regard is, that he considered the orchestra as one part of three beside the sample of the orchestra and the DMI that plays the sample. The only challenge he mentioned was during the first full rehearsal with the DMI when he faced a complete new situation with the fixed timing of the sample the DMI used.

8. CONCLUSION

We changed the situation and viewpoints of three key stakeholder in a contemporary music production with a DMI and symphonic orchestra: the composer of a new music piece, the conductor of the orchestra, and the performer as soloist with a DMI. *Blending dimensions* within this context resulted in a new interaction and sound concept for the in-

volved DMI *Trombosonic* and the new music piece *Academic Festival Overture*.

We contribute to the ongoing discussion of the designer-composer-performer tension in the context of new DMIs. Our case study confirms the potential of inspiration and finding new concepts for DMIs when letting a composer write a piece for a DMI he did not know before. Reducing or even avoiding the collaboration between the designer and the composer to a minimum during the composition process might be fruitful for *inspiration* to find novel ideas for a DMI such as a new mapping concept.

At the same time there is a need for collaboration between the composer and the performer at certain points when it comes to a misunderstanding of score notation, performance aspects, or sound attributes. This suggests the *challenge* not to completely avoid collaboration between designer and composer for the sake of novelty, but to establish and foster this collaboration specifically at some points during rehearsing.

As a next step, a different performer than the instrument designer could be included in such a setting to gain further insights in the designer-composer-performer relationship.

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