Mapping the question of mapping

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Abstract. This paper proposes a method to study the question of mapping: the field between capturing what happens in an environment, the gesture, to what happens in an output medium. While motivations for creating interactive works that involve mapping are very diverse, within these works common techniques and methods are used to achieve unique artistic works. The method proposed provides a way to document these techniques and methods and place them in an aesthetic context. The aim of this method is to provide a basis for a common vocabulary among artists to talk about mapping.

Keywords. Mapping, digital musical instruments, interactive installations, interactive dance.

What is the question?

In interactive works where *gestures* in the environment affect output media, the main question the artist is dealing with is how to make a meaningful connection between the gesture and the output. These interactive works range from digital or augmented musical instruments, dance and technology performances, to interactive media installations.

The field (see figure 1) between this capturing of what happens in the environment (the gesture) to what happens with the output medium is often refered to as 'mapping'.
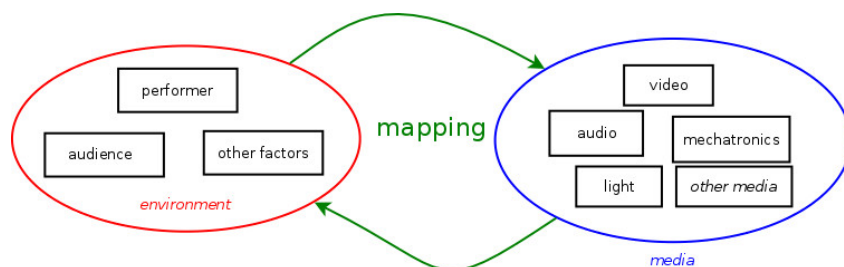

Figure 1: The question of mapping: the connection between a gesture in the environment to output media.

The term 'gesture' is used very broadly: these can be intentional gestures of a performer, but also ancillary gestures that occur, or accidental gestures. They can also be gestures of a phenomenon in the environment: the change of temperature and humidity over the course of a day.

The 'arbitrariness' of mapping is often criticized as 'anything can be mapped to anything' and therefor it is inpenetrable, but in fact this is where a significant part of the artistic expression is. To quote Michel Waisvisz, a pioneer in this field: "the algorithm for the translation of sensor data into music control data is a major artistic area; the definition of these relationships is part of the composition of a piece. Here is where one defines the expression field for the performer, which is of great influence on how the piece will be perceived" (Waisvisz, 1999)[1].

If we can distinguish styles and genres in how musical notes are placed in harmony or disharmony within musical pieces, we should also be able to distinguish styles and genres in how artists create these algorithms, these mappings. And to do so, we need to understand what is going on in these algorithms and the artistic motivations to use them.

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[1]http://crackle.org/MW's gestural round table.htm

The answer to the question is manifold and the way artists approach the question for a large part depends on their motivation for creating the artistic work, but also on the technological means that are available to the artist at the time.

The field of HCI (Human Computer Interaction) deals with how humans interact with computers, and the tools and techniques developed in that field find its application in artistic works. There are however also distinctions: the interactions artists pursue are often idiosyncratic: either based on their own artistic needs (and not those of a separate 'user'), or the subject of the artwork is the interaction itself. Thus the validation of what a 'good' interface is, may be quite different than in HCI research. In digital musical interfaces, artists look for a performative way to control their electronically produced music: they shape their performative effort that will allow them to make their music. In dance, the motivation often lies in creating different ways of experiencing (movement of) the body and space. In media art, the art might be in the interaction itself, a physical phenomenon might be the subject of the artwork, or the interaction might be used as a means to explore another topic alltogether.

The artistic motivations and the resulting works are very different from each other; yet they use similar tools to achieve their aims and within these tools, many common methods and techniques are used to process, translate and map data to the output are being used. While the technology that is involved is continuously developing, these methods and techniques might stay the same, or can be transfered to new technologies. Artists have a need for a common vocabulary to talk about these methods and techniques, so that exchange may happen between artists who use different hardware and software.

With interactive technologies becoming more ubiquitous in our surroundings (e.g. Internet of Things and wearables that use biometric technologies), along with apps that promise us insight from the data that these 'smart' systems produce, the question of mapping also gains importance on a societal level: where is the border between providing insight from data through sonification and visualisation and artistic interpretation?

Related work in the artistic field

Miranda & Wanderley (2006)'s book provides a good introduction to the topic of mapping, though mainly focuses on the first part of mapping: gestures and how to capture the gestures and get the data into computers. The question of how this data is then used within the computer to map it to sound is only discussed in broad terms: explicit mapping strategies or implicit strategies making use of neural networks or pattern recognition tools. The book cites that the discourse in the literature on explicit mapping strategies "generally considers mapping of performer actions to sound synthesis parameters as a few-to-many relationship".

The proceedings of the NIME conference[2] are a valuable resource for publications about the topic, though as it is an academic conference there is a lack of publications on artistic work done outside of the academic world. Technical novelty tends to dominate over extensive artistic performance with the instruments. In particular papers on digital musical instruments that artists have built and developed and performed over many years (say 5 or more) are lacking in the discourse here.

Kwastek (2013) presents an elaborate discussion on the aesthetics of interaction in digital art, which she places in the context of interaction as an aesthetic experience and the aesthetics of play. Other overviews of and reflections on interactive art are found in Wilson (2002) and Bianchini & Verhagen (2016). Kozel (2007) gives a great insight into phenomonological aspects of performance incorporating technology, and how (interactive) technologies can change and question the perception of the body.

While the references above provide great resources, and I am aware that I am not discussing them at length here and that these resources are not exhaustive, I find that there are still questions that need further study: (1) What is the connection between the aesthetic motivations of the artist and how this aesthetic is realised in the work? (2) How is this aesthetic implemented with the technology? (3) How do technological and aesthetic choices in this process influence each other in the artistic practice?

I believe that, by bridging the gap between the aesthetic and technological, important new insights can be gained and it would be made easier for artists entering this field, to build up on previous work (generated knowledge) from other artists.

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[2] Available via http://www.nime.org

A method for studying mapping

The methodology that I am proposing is a combination of interviews with the artists who created the instruments/works and an in-depth analysis of how the works are built.

In the interviews with the artists (and/or the engineers that are involved), I attempt to get an understanding of the artistic concepts that are behind the development of the work, how the idea evolved throughout the process of development and what choices were made along the way. I also discuss with them how the work is performed and how this relates to the artist's practice in general and how it changed their practice. In the analysis of the work I make note of what physical elements the work consists of, how these are interconnected and how they are positioned in space. How the work functions: which algorithms are used and what musical/visual/choreographical concepts is the work based upon. Which hardware and software is involved in the work, tracing how gestures are translated to output media.

I am currently applying and further developing this method both in case studies for the forthcoming book "Just a question of mapping" as well as in work sessions with artists (selected from open calls) under the title "Mapping my mapping". The outcomes of both will inform the other chapters in the book to describe these methods and techniques, both from an artistic and an technical perspective. I will work with graphic designers on creating a visual language to aid in documenting mappings.

Breaking down the process of mapping

Interactive works can often be broken down into various elements that are interconnected (see figure 2): (1) a gesture is performed in the environment, (2) which is captured by a sensor that translates the gesture into an electronic signal, (3) the signal is processed by an electronic circuit, often to digitize it, (4) after which it enters some sort of computational model that translates the data to parameters that control (5) an output medium such as sound, light, video or mechatronics. This is a simplification of the steps involved, and there may be various modifications to this general scheme. Nonetheless, breaking down the process of mapping in these steps may be a good start to understand these works.
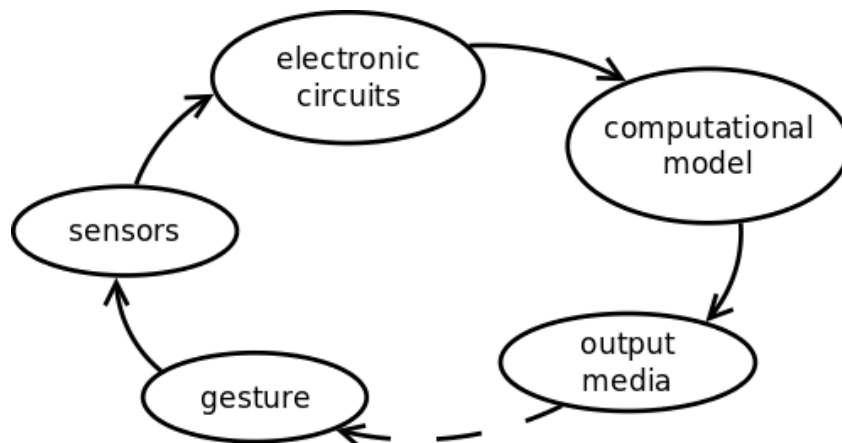

Figure 2: Steps in the mapping process.

One of the first steps in gaining an understanding of the mapping is then identifying which physical elements are involved in the work and how they are interconnected. Which sensors or control interface elements are used, how are they mounted or placed in space, which circuitry is involved, what computers are involved and what software runs on these computers, which output media are involved and how are they controlled. Then how are these elements connected: which cables run between them, what protocols are used for these connections, what kind of data flows through the elements.

After this physical exploration, the signals themselves are traced: how at each of these elements is the signal or the data translated to other ranges, gated, or compared with thresholds, combined with other data streams, feeding into computational models that generate new data, and eventually connected to one or more parameters of the output medium.

Artist's choices and motivations

The choices at any of the steps above are based on artistic, technical and practical motivations, often coming forth out of experimentation. This is not always a linear process where an artist starts with a concept and ends up with an instrument according to this concept. Ideas may be discarded along the way, if they are not interesting to play. Technical options may prompt new ideas and directions. And throughout the process an artist may go back and forth between the different steps.

Choices made along the way are often based on accessibility: in cost, availability and familiarity to the artist. Or they may be based on coincedence: two ideas that just happened to come to mind around the same time and seemed interesting to combine.

Summary of first observations

From initial literature research and processing the first interviews for my case studies and the first work session, I have made some observations, with which I want to conclude this paper.

The process of mapping is an interdisciplinary effort and requires both engineering and artistic skills. While common strategies, tools and elements are used, each work is highly individual and often changing over time. New strategies, tools and elements are continually invented, embraced and (in some cases) abandoned again. The process is situated in time and relates to the available technical means and current artistic practices: it is connected to the music and other artistic paradigms embedded in available software and hardware, and how artists adopt, change, break and transcend these paradigms.

As such it is an enactive process of codevelopment of artistic concepts and technology. The resulting work may be seen as embodiments of the artistic concepts and performative expression of the artist. Conversely, the instruments are physical objects that allow the exploration and development of these aesthetic concepts (Magnusson, 2019).

In disciplines such as music (across genres), dance, media art and interactive art similar methods and approaches are used and artists often move between these disciplines. Therefore, it is necessary to look at these practices across disciplines, while at the same time discerning the different artistic concepts of interaction and embodiment in these different discplines and how these may influence choices for particular methods and techniques.

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