

# Fictional Instruments, Real Values: Discovering Musical Backgrounds with Non-Functional Prototypes

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## ABSTRACT

The emergence of a new technology can be considered as the result of social, cultural and technical process. Instrument designs are particularly influenced by cultural and aesthetic values linked to the specific contexts and communities that produced them. In previous work, we ran a design fiction workshop in which musicians created non-functional instrument mockups. In the current paper, we report on an online survey in which music technologists were asked to speculate on the background of the musicians who designed particular instruments. Our results showed several cues for the interpretation of the artefacts' origins, including physical features, body-instrument interactions, use of language and references to established music practices and tools. Tacit musical and cultural values were also identified based on intuitive and holistic judgments. Our discussion highlights the importance of cultural awareness and context-dependent values on the design and use of interactive musical systems.

## Author Keywords

Design Fiction, Value Discovery, Music Cultures

## CCS Concepts

•Applied computing → Performing arts; •Human-centered computing → User studies; User centered design;

## 1. INTRODUCTION

Social and cultural environments influence how we interpret and shape the material world [7]. Wenger introduced the notion of *community of practice*: a group of people who share a common interest or activity and that belong to a social structure that reflects shared histories of learning [33]. Being part of a community does not simply imply the acquisition of specific skills. We also inherit “the same set of understandings, expectations, significances and meanings that are characteristic of that community” [10].

While discussing the “De-Scriptio of Technical Objects”, Akrich argues that designers “express a scenario of the device in question - a script out of which the future history of the object will develop” [1]. Akrich suggests that a large part of the work of innovators is that of *inscribing* a vision

of the world (e.g. predictions on behaviours and norms) into the future artefact.

In the context of instrument design, it is possible to argue that a luthier transfers into a music technology specific cultural values [24]. Instrument makers envision for their instruments contexts (e.g. music venues and schools), aesthetics (e.g. musical languages) and behaviours (e.g. performance techniques). Musicians can also be considered as influential vectors through which musical values are conveyed within communities. Different musical communities might then develop different values influencing the development and use of music tools [17].

In this paper we aim to gather evidence of the presence of musical values in instrument prototypes. In particular, we are interested in exploring whether observers with music technology experience can work out the background and values of an instrument designer based on photos of the instrument and descriptions of how it works.

In a previous study [22] we ran a design fiction workshop in which musicians active in different musical contexts were invited to sketch non-functional instrument mockups “as if by magic”. We then organised an online survey in which music technologists were asked to speculate on the background of the musicians who designed the particular instruments based on a few pictures and a short description. In this paper we examine how our participants discovered musical values while analysing both the fictional musical designs and the discourses related to their functioning and purposes.

After covering relevant literature on the topics of culture and values in NIME research and value sensitive design, we will introduce the online survey “From Magic Machines to Musical Instruments” and the analysis of its main outcomes. Finally, we will present our findings, discussing the implications of a value-rational approach to NIME design.

## 2. BACKGROUND

### 2.1 Culture and values in NIME research

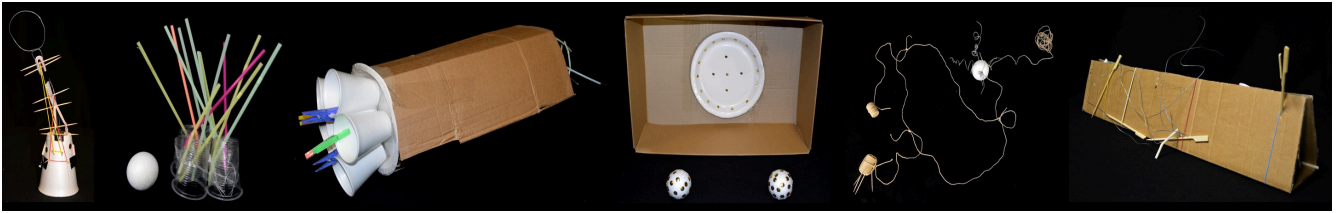
NIME is concerned with creating new instruments, principally but not exclusively using digital technology. The NIME community also embraces certain cultural and aesthetic values (although with wide variance across practitioners) whose identity is the topic of ongoing conversation [17, 6, 28]. Finally, NIME prides itself on its multidisciplinary, including its parallel roots in HCI and arts practice [27].

None of the three aforementioned statements is an inevitable consequence of any of the others. Even as specific technologies are inscribed with values from their creators [1], digital technology does not itself necessarily explain the aesthetic values of the community. The influence of HCI on NIME might appear to have an aesthetic component, as second-wave HCI theories of information flow share a language with notions of musical expression as communication [17, 16]. However, a full accounting of NIME values depends



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**Figure 1: The fictional musical artefacts used in the survey. From left to right: AntennaLele (AL), CorpoSuono (CS), Plucker (PL), NonStopSound (NS), SonicAlarm (SA) and Stochastic (ST)**

on many non-technological factors, including repertoire [16], pedagogy [26] and performer skill [15].

This paper does not intend to resolve longstanding debates about what values are (or should be) found at NIME. Rather, we examine the ways in which an individual designer might express their own values through making, and what cues an observer would then use to recognise them.

## 2.2 Value discovery in HCI

Within HCI, one of the most recognised methodologies for the translation of stakeholder views and values into technical design decisions is Value Sensitive Design (VSD) [13]. VSD can be defined as “a theoretically grounded approach to the design of technology that accounts for human values in a principled and systematic manner throughout the design process” [13, p.64].

A key feature of value sensitive design is the sourcing and identification of potential values. A working definition of *value* within VSD is: “what is important to people in their lives, with a focus on ethics and morality” [13, p.68].

Although value-driven research is often concerned with moral and social values (e.g. sustainability, democracy and inclusivity) [32], various research approached the discovery of stakeholders’ values based on more culturally-specific and user-centred processes [5]. Our work is oriented towards these kinds of mediation in order to explore patterns of experience and meaning-making [18] related to the engagement with music technology. We are therefore interested in the exploration of values as situated knowledge embedded into subjective perspectives and practices [31].

In particular, our paper focuses on the discovery of values [20]: a practice generally associated to the initial phases of values-led inquiries [19].

## 3. STUDY DESIGN AND ANALYSIS

### 3.1 Previous design fiction workshop

Design fiction has been defined as “the deliberate use of diegetic prototypes to suspend disbelief about change” [23]. The narratives that an artefact conveys are not just about the imagined device and its functionalities [3], they rather contribute to “the creation of *cultural objects*, allowing them to act as prompts for a story *we tell about ourselves*” [2].

In a previous study we ran a design fiction workshop in which musicians active in different musical contexts were invited to imagine not-yet existing musical instruments. Participants were therefore invited to build mock-up instruments that work *as if by magic*. The purpose of the workshop was to produce cultural artefacts [2, 14] through crafting activities. We were therefore interested to explore how subjective musical values and cultural mindsets would be transferred into a future technology.

We avoided tool kits, electrical components, sensors and software units. We instead privileged mundane and everyday objects (e.g. cardboard, paper plates, masking tape, twine and metal wires, straws and toothpick): by sidestep-

ping materials that could resemble existing designs and functionalities we aimed to free the participants and facilitate the emergence of subjective values and purposes.

During the workshop we collected a set of information on the musicians’ instrumental backgrounds, musical practices and aesthetic preferences. Moreover, once musicians finished building the *prototypes* we invited them to present the artefacts and explain its functionalities.

Our work draws on the work of Kristina Andersen and it can be considered a variation of the Magic Machine workshops [2, p.30]. For a detailed explanation of the As If By Magic workshop methodology and findings see [22].

### 3.2 Artefact selection

For our survey, we then selected six prototypes (Figure 1) based on both the physical properties of the objects and the musical background of their creators. The following artefacts, identified along with the background of its creator and its intended function, were included:

- **AntennaLele:** jazz - guitar (and bass) player with a strong engineering and sound and music computing background - ukulele-like instrument with a bendable neck that can be used to “*shape melodies and harmonies*”;
- **CorpoSuono:** classical - keyboard player with interests in contemporary composition and a few experiences in the use of technology for music performance (e.g. synth) - organ inspired instruments with tubes filtering the air that can produce complex timbre;
- **Plucker:** classical - guitar player with no experience in music technology and instrument design - wearable (glove like) polyphonic instrument with inside strings to be manipulated with one hand to control pitches and volumes;
- **NonStopSound:** EDM - producer and performer of alternative electro-pop music with a background in music technology and expertise in instrument design - playful instruments based on a box containing a plate and two balls, sounds are by tilting the box making the balls and plate interact with each other;
- **SonicAlarm:** electroacoustic - composer and performer interested in contemporary electronic music and improvisation with a strong engineering background, interface design skills and no instrumental background - wire-based instrument to be attached to both upper and lower limbs that produce sound via the interactions between its attachments;
- **Stochastic:** free improvisation - sax performer engaged with free improvised and experimental music with no music technology or instrument design expertise - percussive malleable instrument equipped with many different tools and materials for sound generation and exploration.

### 3.3 Survey design

We ran an online survey targeting musicians and technologists with experience in musical interface design. We recruited the participants using academic mailing lists (NIME and SMC) and social networks. We aimed to see if respondents could discover musical values through the prototypes and link them to specific aesthetics and communities.

Survey participants reviewed an image of each fictional instrument and a short description of it provided by its creator<sup>1</sup>. For each artefact, the descriptions were assembled by quoting the creator’s interview (artefact presentation) during the fictional design workshop (audio recordings manually transcribed). While selecting the quotes we aimed to compose descriptions that could briefly address the following topics: (i) prototype functioning and performative technique, (ii) envisioned musical purposes and aspirations, (iii) aesthetic and stylistic attitudes.

The survey asked the following open questions: “What kind of musical style/genre do you think the musician plays? Why do you think that?” and “What instrument(s) do you think this musician plays? Why?”. Each participant was presented with 3 of the 6 artefacts (balanced random order).

After completing the survey, participants were required to provide information on their musical and technical backgrounds. This allowed us to get an understanding of their musical activities and training, style(s) of music they are engaged with, STEM and design training and instrument design expertise.

### 3.4 Survey Analysis

The survey was open for one month and we were able to involve 22 participants: 5 female, 16 male and 1 no declared gender. The range of participants’ age is 24-62 (mean 35). Almost all the participants declared to have experience in the design of musical instruments or interfaces (19) and to use music technologies (20). Almost half of them attended the NIME conference at least once (10).

We analysed the collected data following a thematic analysis methodology based on coding [9]. We adopted a data-driven (inductive) approach: looking for patterns, similarities and correlations while analysing the data [29]. We conducted five iterations of coding. From open coding to category formation each concept earned its way into the discussion by repeatedly being present in the “row” data [8]. Based on the collected data we could also analyse in more detail respondents’ musical and technical background:

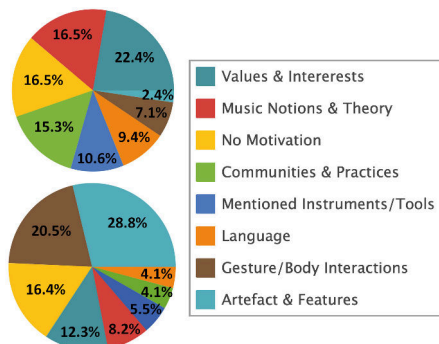


Figure 2: Code frequency for genre/style (above) and instrument (below) guesses

- **Level of musical expertise:** amateur (12), professional (8), none (2);

<sup>1</sup>Both questionnaires and results are available at <http://instrumentslab.org/data/NIME2019SurveyValues.zip>

- **Years of music practice:** between 5 and 10 (1), between 10 and 20 (11), more than 20 (8), none (2);
- **Musical training:** instrumental performance (12), computer music (including electroacoustic, sonic arts and live electronics - 3), composition (contemporary and traditional - 2), other (music production, instrument design and music theory - 3), none (2);
- **Main musical activity:** piano performance (4), guitar performance (4), instrument design (4), computer music (composition and performance - 4), brass performance (2), multi-instrument player (2), violin performance (1), composition (1);
- **Main genre:** classical (4), electroacoustic (3), EDM (3), experimental (3), jazz (2), improvisation (2), pop (1), rock (1), metal (1), folk (1), punk (1);

## 4. FINDINGS

### 4.1 Guess accuracy

Overall, our participants were rather successful in guessing the genre/style of the artefacts’ creators: 44% of answers were correct, and a further 27% partly correct. 12% of answers were incorrect, 9% made no attempt, and 7% of answers were off-topic. On the other hand, participants were less successful while imaging the instrument played by the prototypes’ authors: only 20% were correct, 21% partly correct, 40% were incorrect, 13% made no attempt, and 6% of answers were off-topic. We did not find any correlation between musical or technical background of the survey respondent and accuracy of their guesses.

Responses we label as “partially correct” present some elements associated with the designer’s background, without clearly identifying a community, genre/style or instrument that could be directly linked to the declared background of the musician that designed the fictional artefact. Responses of this sort might identify broad musical areas (e.g. tonal music), reference specific contexts (e.g. ensemble, labels and musicians) or point to some of the musical tools characteristic of specific genres/styles. Partially guessed comments also often refer to family of instrument (e.g. wind instrument) or identify an instrument/genre that has been declared as “secondary” by the creator of the artefact.

### 4.2 Motivations

Considering respondents’ answers on *why* they guessed a particular background, we identified several themes (Figure 2). Sometimes participants did not provide any motivation for their guesses; during our analysis we created a *no motivation* category. These data were obtained based on the quantification of our codes. Due to the presence of diverse themes within the same input, occasionally the same response has been coded multiple times (max input length = 109 words, average codes per input = 1.2).

**Musical values and interests** - While motivating their replies participants tended to introduce abstract concepts often related to musical values and interests. Most frequent comments of this kind include references to the ideas of *control*, *unpredictability* and *instrument agency*. **SA<sup>2</sup>:** “*Electroacoustic. The fact that the designed instrument does not allow full control would be hated by any other kind of musician*” - **ST:** “*Percussion instruments, because this chaotic logic of random sounds is closest to a percussionist set.*”

Notions such as *manipulation* and *flexibility* were often mentioned. **ST:** “*It looks like the kind object you would devour with your hands, and you are looking at your hands*”

<sup>2</sup>Abbreviations refer to artefact names; see Figure 1



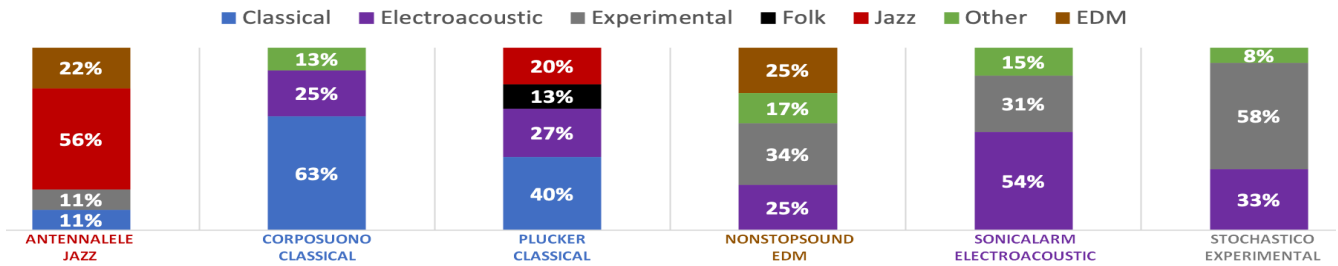


Figure 3: Percentages of the participants' genre/style guesses for each artefacts.

with satisfaction as you manipulate and you hear the results of that tactile control.” - **AL**: “Maybe improvised music. Try to merge a sax and a double bass sounds like a solo improviser who wants to expand his/her possibilities with an instrument that can be changed.”

The identification of compositional attitudes and interests towards experimentation were also common. **ST**: “This object seems like something a composer would create, not necessarily a instrumentalist/musician. The temporary feeling of it lends it self to degrade over time, providing more kinds of tones to the composer.”

**Music notions and theories** - Other recurrent themes emerged from our analysis are related to the presence of both music theory notions and spectromorphological conceptions of sound. **PL**: “The main parameters the musician seems to be interested in are pitch and volume. They mention the timbre/general sound of the instrument, but don't seem to be interested in exploring and modifying its timbre or sound texture ...” - **AL**: “I think the person is a singer because they long for melodies AND harmonies of a complex nature, and the voice on its own is very simple.” - **NS**: “it couldn't play any rhythmic style, probably only could to make effects with low attack sounds...”

**Communities and practices** - While discussing the fictional objects, participants tended to refer to musical practices typical of specific communities (e.g. orchestra). We also often found allusions to influential musicians, narratives and tools associated to particular artistic contexts. **CS**: “Classical. Conceptually, they are thinking of large ensemble performance and collective sound generation.” - **PL**: “They also seem to be interested in polyphonic music, moving several voices to make chords, I interpret that kind of like Bach chorales...” - **PL**: “Clear Hugh Davies nerd here, probably really into kid 606 and the idea of katzenclaviars but would never build an actual one” - **CS**: “The form of the object reminds me of several indigenous percussion instruments...” - **AL**: “Maybe they are a sad church musician ... It sounds as if they are yearning for the structure of “melodies” and “harmonies” (all of which traditional church music provides) but in a completely other sound world ... (rather than singing the soprano line the whole time).”

**Use of language** - The use of language found in the description of the artefacts was often interpreted as a relevant cue. For instance, this emerged in regard to the metaphors used to express musical practices and intentions. **ST**: “Definitely something abstract and modern. For instance, not a classical player ... Mainly based on comments such as ‘I usually do ... shapes of sound’ suggests they are used to thinking about novel instruments and the language is more conceptual and not precise ... (And for instance classical musicians, tend not to always be that creative.)” Alternatively, specific terms were identified as markers. Thus interpreted as powerful hookups towards specific musical community. **NS**: “Synths, and production - if you are talking ‘production’ you are talking recording and if you are choosing your sound in production, typically not live instruments

so yup, sticking with EDM.”

**Gesture and body interactions** - Participants often considered the gesture and body interactions implied in the artefacts or stated by their authors. **PL**: “Guitar: ‘the way you stroke a certain string can alter the pitch depending on how much pressure you use on it.’ A subtly of guitar playing, not a major interaction.” - **PL**: “Clarinet, but with strong background in piano. They have a sense of the importance of touch and pressure...” - **PL**: “Guitar and bass, because of the strumming and plucking gestures the instrument induces, keyboard synthesizers, because of the idea to press something to produce the sound...”

**Artefact features and mentioned tools** - Artefact features such as shape, functioning and accessories were often used to decode the prototypes, generally by comparing them with existing musical instruments and tools. **CS**: “Wind of some sort ... they are looking to mechanise wind instrument tone production.” - **ST**: “The percussive aspects of the object make me think maybe a drummer has made this. I do not think a wind or reed player (any mouth instrument) made this.” - **ST**: “Possibly a guitarist. Applying strings to a oblong body is guitar-like.”

Finally, the musical tools mentioned in the description of the instruments were often used to identify the genres and instruments associated to the background of the object's inventor. **NS**: “I think the musician likes or makes electronic music. A synth and randomness has been mentioned. Could also play some other instrument.”

The most frequent themes used to discuss genre/style were abstract values and musical notions followed by situated/embodied practices and tools. Less referenced are those themes linked to the artefacts' interactions and physical features. On the other hand, the instrument guesses were often directly motivated by the prototype's aspect, configuration and material affordances. Musical values and notions were less frequently introduced and references to practices, communities and language rarely appeared.

### 4.3 Guesses for each artefact

Figures 3 and 4 show the percentage of guesses for the targeted genre and instrument, grouped into categories of genre and instrument. Participants mainly considered the AntennaLele to be created by a jazz musician. Specific music notions (e.g. melody, harmony and chord) and values (i.e. variety and flexibility) were often associated to this genre. **AL**: “Jazz, Electronic, they want a flexible moldable instrument”. For the instrument guess, the musician has been often imagined as a double bass player due to the similarities with the artefact form.

Corposuono has been mainly interpreted as created by a classical musician. The reasons given were mostly music theory notions and practices linked to the classical culture (e.g. large ensemble and chords). Many participants suggested that the musician should be a wind instrument player due to artefact's structure and functioning. **CS**: “A wind instrument. Because of the configuration of the prototype”.

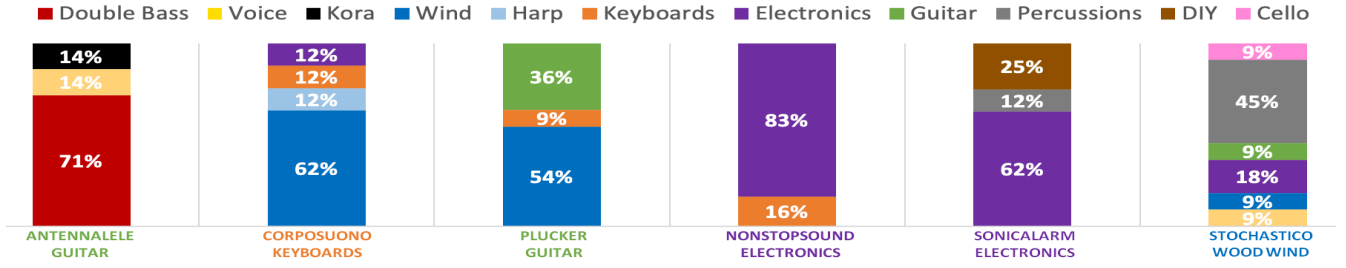


Figure 4: Percentages of the participants’ instrument guesses for each artefacts.

The Plucker was often linked to the classical genre, mainly in reference to the traditional music notions expressed by the creator while presenting the artefact (e.g. pitches and notes). **PL**: “*Classical/Jazz, because of the importance of pitch and the organ reference*”. The instruments mentioned in the prototype description (i.e. organ and french horn) were often associated to the classical domain and often participants imagined the designer to be a wind instrument player. However, various participants identified the correct instrument based on the gestures and interactions mentioned by the musician.

NonStopSound has been associated to diverse genres. Experimental and electroacoustic due to the indeterminacy linked to the sound production technique, and EDM due to the language used to describe the object. On the other hand, most participants recognised the musician instrumental background. **NS** “*Maybe modular synth or a high level dedicated audio programming environment ... The way she describes playing seems indeterminate so perhaps has not received a formal musical training*”.

Due to the originality of the artefact configuration and the discourse on instrumental agencies and chaotic behaviours, respondents associated SonicAlarm to electroacoustic and experimental genres. **SA** “*I imagine some kind of experimental/noise electronic music, because of the randomness he’s seeking. Also because it would mix music with some performance that would involve human body through walking or throwing things*”. For the same reasons the artefact has been often interpreted as invented by a performer of electronic devices (e.g. synth, laptop or DIY instruments).

Finally, Stochastic has been often related to experimental contexts (including free improvisation, contemporary and alternative genres). The motivations provided often referred to the precarious nature of the instrument and the particular language used to describe the object. **ST** “*Discussion of ‘sculpting’ sound is suggestive of electro-acoustic music styles, rather than of mainstream diatonic concerns*”. Many participants imagined the musician to be a percussionist due to the structure and functioning of the artefact.

## 5. DISCUSSION

Our findings suggest the presence of various affinities between the themes and designer backgrounds. For instance, instrumental agency, unpredictability and exploration were often considered as electronic and experimental concerns. The same applies to interests in timbre manipulation and abstract musical thinking. On the other hand, values such as control and flexibility and references to traditional music theory were often related to classical and jazz domains.

Interestingly, these tendencies seem to be mainly related to cultural and aesthetic attitudes rather than the designer’s experience with music technology. Our participants often associated the same set of musical values with designs produced by musicians with very different technological skills. For instance, artefacts such as SonicAlarm (electroacous-

tic composer with an engineering background), NonStopSound (alternative EDM producer with a background in instrument design) and Stochastic (sax player active as free improviser with no music technology expertise) were often associated to the same set of values and interests (e.g. unpredictability and timbre exploration).

However, in this paper we are not interested in proposing any explanatory model of any particular individual’s musical values or interests. We acknowledge that our sample of 22 music technologists is likely not representative of the music technology community as a whole.

One of our main points of discussion relates to the overall ability of the survey respondents to discover the multiplicity of cultural sources and musical practices in the designer’s background. One example of this sensitivity is provided by NonStopSound. By looking at the general picture, the stylistic musical influences identified across all respondents somehow summarises the profile of the artefact’s creator (i.e. active in the context of experimental electro-pop who performs using custom designed instruments and synths).

While considering the particular backgrounds of our participants and responses provided, we did not find any distinctive trend (e.g. in regard to specific musical backgrounds or technical expertise). However, by analysing the information collected, it is possible to deduce that the majority of our participants are knowledgeable or expert music technologist active in specific communities of practices for a considerable period of time (i.e. for 10 years or more).

The involvement into particular communities of practice implies “ways of learning - of both absorbing and being absorbed in - the culture of practice” [33, p.169]. Studies on human learning indicate that “people pass through several phases in the learning of skills” [12, p.167] Novices mainly act on the basis of predefined rules and best practices. Experts, drawing on intimate experience and personal perspectives, balance standard procedures with intuitive behaviours and holistic judgement [11].

We suggest that our research provides the possibility to engage with this type of knowledge: context-dependent values emerging from situated practices and communities. This is supported by various participants’ comments that we could identify. **PL** “*This person seems like a classical musician ... There is something familiar to me about how this person seems to think of the sounds ‘altering with your hands’, ‘altering the pitch depending on pressure’ ... I sense that I speak a similar language to this person, musically, and my own background is strongly classical. So I feel this is a classical family member.*” In this context, we therefore interpreted this kind of correlations as related to empathetic dynamics rather than rational/deductive processes.

Considering the genesis of new musical instruments through the perspective of *mediation* [4, 21] it is possible to argue that new design often re-mediate physical properties and cultural paradigms already associated to existing devices. Magnusson argues that “what new instruments translate from earlier technologies are not simply the simulation of

an interface, but a whole constellation of embodied contexts” [25]. Within this constellation we also include the values, imaginaries and concerns inherited from communities of practice and cultural heritage.

This paper aims to highlight that, besides technical expertise, the design of a music technology entails the materialisation of purposes, assumptions and values. These are situated factors, emerging from specific communities, contexts and cultures [30]. As stated by Akrich “technical objects have political strength” [1]. NIME research often focuses on the design and evaluation of musical instruments, sometimes with unstated cultural assumptions which may derive as much from the researchers themselves as from a target musical community. A culturally-aware approach for the design of musical interactive systems might want to clarify the influence of specific musical backgrounds and cultural environments, thus framing the context-based point of departure and identifying mindsets, attitudes and objectives according to specific set of values and interests.

## 6. ACKNOWLEDGMENTS

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