
Tangible Scores

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Abstract

In this paper the art installation "Tangible Scores" is presented, laying emphasis on its design decisions, features and constraints. In order to explain the important relationship between physicality and artistic expression, the concept of "performative materiality" is contextualized within the framework of tangible musical interfaces. Then, a hybrid vision of performative interfaces is introduced. Under this hypothesis, and through the creative exploration of their physical affordances and constraints, tangible musical instruments may be interpreted as scores too.

Author Keywords

Tangible Interfaces, Interfaces for Musical Expression, Notation, Scores, Performative Materiality

ACM Classification Keywords

H.5.m. [Information Interfaces and Presentation, HCI, TUI]

Introduction: Performing with Tangible Interfaces

From classic ethnographic studies we know how the act of "performing" is central to human understanding [1] and post-modernism have drawn attention to the way performances seek to reinforce and communicate our identities in society [2]. Recent research on socio-situated interface design [3] is coherent with the idea of socio-oriented performing frames: an interface can be only fully analyzed and

evaluated within its social context. These theories suggest that when using an interface, cognitive scaffolds can only exist in the context of a social setting. Certainly, the capability of performing carries a substantial context and the sociological ecology of acting in front of "others". In our field, relevant studies [4] have shown how TUIs have improved performativity because manipulation of tangible objects is more legible for observers than GUI interaction. These facts have brought performative interfaces to the attention of our research community as one of the most promising directions [4].

Performative Materiality and Scores

Jacucci and Wagner [5] have explained why the materiality of our tangible interfaces is performative too: *material artefacts have a history, emerge as part of specific events in time and become part of performative action*. Physical materiality has always a performative potential. The theory and application of *performative materiality* within HCI has been extensively studied by Johanna Drucker [6]. Drucker suggests that the materiality of a system only occurs when we action it, and only and at that moment we perceive and discover it, always distinct in each instance. For Drucker, *material conditions provide a inscriptional base, a score, a point of departure, a provocation, from which a work is produced as an event*. Certainly, material features, in their peripheral, evocative, and referential function, provide border resources for interaction. But can these features be considered as scores?

In contemporary performative arts, scores can take diverse forms and materials: graphic scores, action scores, computational, sculptural, etc. We can only assert that a score represents the potential of perceptual phenomena to instigate action, the result of which can be perceived by a sense of a different order. If we talk about traditional music, a

score would be the instigator for a transition from the visual to the aural via our body. In this direction, the choreographer William Forsythe [7] explains that a score *is by nature open to a full palette of phenomenological instigations because it acknowledges the body as wholly designed to persistently read every signal from its environment*. Forsythe lays more importance on the embodied relation with the performer: scores appear in the moment when a performer finds a performative potential within an object or a concept. Thus, each object would be an embodied device open to the phenomenological interpretation, a potential available to its conversion into a performative event.

This generalized definition of scores suggests a hybridization and we could then interpret our tangible interfaces as scores. Under this hypothesis, the affordances of our interfaces take the important role of defining the way an interface is played through different constraints, but more important, they would suggest *what is played* too.

Due to the novelty of many of our musical interfaces there is no possibility of using a standard notation. Therefore, performing music with digital interfaces often happens without scores: compositions are created in real time by performers. Then, performing often means exploring the morphophoric elements of the interfaces used, reading the "inherent score" that they contain [8]. Alvin Lucier [9] coined this term for explaining how within many of the works produced by the Sonic Arts Union *there were no scores to follow; the scores were inherent in the circuitry*. This inherent score can afford interesting performative enactments when an interface contains enough structural elements of performative potential. Under this hypothesis, performing with an interface would be the creation of relations and meaningful structures between the inherent score and its enacted audiovisual interpretations via our embodiment.

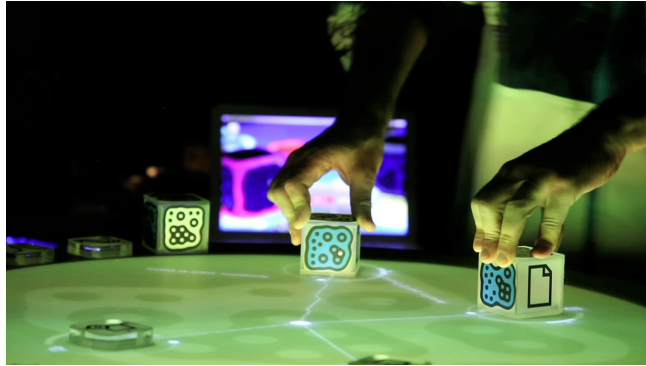


Figure 1: A Reactable

For the analysis of this hypothesis of hybridization, we propose the definition of two types of inherent scores: purely extrinsic (representational) or intrinsic (inherent to the affordances of the interface). For example, the visual composition of tokens on a table-top interface like a Reactable (Figure 1) is an extrinsic score: it represents the computational status of the system. In this case, the inherent score cannot be found in the affordances (expressed through form, color, material, texture, etc) of the tokens or in the reference frame. For example, again in a Reactable, we could replace the original acrylic of its tokens with wooden pieces: that would not affect the sound mapping at all. Additionally, the way we touch those tokens will not modify the sonic output. Therefore, this instrument does not incorporate a tactile intrinsic score.

Opposite, we talk about intrinsic inherent scores when a physical affordance determines features of what is digitally enacted, playing a computational role too. An example of this intrinsic score would be "*Dirty Tangible Interfaces (DIRTI)*" [10] (Figure 2). It consists of a material placed in



Figure 2: Dirty Tangible Interface - DIRTI

a glass dish that is analyzed by video tracking for its 3D relief. This relief, and the dynamic changes applied to it by the user, are interpreted as activation profiles of a granular audio synthesis. The grayscale camera image is the source for detecting various parameters like densities, colors and shapes. In this case, our gestures on the instrument are mostly conducted by the properties of the material of interaction. The sonic mapping depends intimately on the material too. As we are explaining in the following section, the incorporation of intrinsic scores into an interface suggest the use of sensors for analyzing the dynamic properties of its structural objects. Composing the score would mean composing the materiality, where materials should be "*designed to compute*" [11].

Finally, it is possible to create or find combinations of intrinsic and extrinsic scores within an interface. For example, a table-top interface incorporating representational tokens

on a modified reference frame that would reinforce specific physical aspects of the tokens. In this case the extrinsic composition of tokens can be affected by the properties of the material supporting it. In the following section of this paper we will describe and analyze a case of study designed by one of the authors of this paper: the tangible scores.

Tangible Scores

In 2014, the author together with Martin Kaltenbrunner introduced a new musical interface paradigm called *Tangible Score* [8]. Like a hybrid between digital instrument and score, in this interface a graphical score has been physically incorporated in the form of the instrument (Figure 3). This physical layer can be explored with tactile gestures like tapping and scratching. We describe "Tangible Scores" as both instruments and scores.

Tangible Scores current implementation is a digital music instrument for gestural improvisation. It consists of laser-engraved wooden surfaces representing both a graphic and a tactile score. These engraved patterns have been designed to create a big variety of timbres when touched. The sound produced at the interaction moment is registered by embedded contact microphones. Thus, Tangible Scores are acoustic interfaces inspiring different tactile gestualities through the composition of its materiality. The aural mapping is based on a multichannel live concatenative synthesis on a selectable corpus of preanalyzed sounds. Using this synthesis, the instrument is able to generate envelopes of sounds following very closely the expressive character of every gesture, e.g. its acceleration, length or attack.

Tangible Scores show us literally the "*inherent score*" that every tangible interface incorporates in its configuration, not only as a representational score but as a point of departure for all kinds phenomenological interpretations.

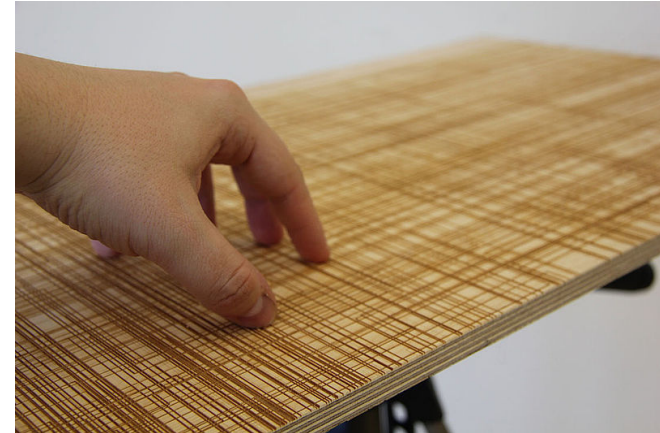


Figure 3: A Tangible Score engraved on a wooden panel

Tangible Scores can be considered a constraint. The engraved patterns conduct the tangible intentions of users. From a compositional perspective, a Tangible Score is not only a representation of a score but a playable score embodying gestural enactments. Their performative affordances, intrinsic to their interface, are readable and accessible through tactile exploration. For Maestri [12] a "Tangible Score" designer would be a *programmer of affordances, reinforcing and expanding the originals of the object used*. Finally, designers have left open the way the score must be played. The invitation to play using our fingers is clear, but the experimentation with other parts of the body or the use of diverse materials and extensions remains open e.g. mallets.

Finally, "Tangible Scores" provides a implicit visual and haptic feedback in addition to its sonic core functionality, making it intuitive and learnable but as well suitable as an in-



Figure 4: A Tangible Score in an installation version

terface for musical improvisation and sonic exploration on concert situations or as an art installation (Figure 4).

Conclusions

We have contextualized the notion of performative materiality to explain how interfaces function in relation to its physical context, mediated by the notion of affordance. A hybrid model of interfaces as scores has been presented, laying emphasis on the creative possibilities of shaping the physical materiality of the instrument as a process not only of design but of musical composition. Through the analysis of Tangible Scores we have shown the possibilities of enacting this theory on the artistic world. We hope to have provided new perspectives for designing novel interfaces.

Videos

All Tangible Scores videos can be found here:

<http://interface.ufg.ac.at/tmg/projects/tangible-scores/>

The installation format, as it will be exhibited in TEI 2016 , can be found here: <http://vimeo.com/93246088>

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