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Article

Composing the instrument: Revisiting the concept of the instrument's score

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Abstract

This article revisits the concept of the *instrument's inherent score*, exploring how musical instruments can embody a form of notation that both shapes and inspires performance. Building on earlier research (Tomás 2016; Tomás and Kaltenbrunner 2014), the study examines the historical and theoretical foundations of this idea, tracing its roots to experimental music practices of the 1960s and 1970s, particularly within the *Sonic Arts Union* collective. Composers such as Alvin Lucier, Gordon Mumma and Nicolas Collins have described how electronic instruments embody compositional elements, effectively functioning as scores. The paper argues that the instrument's score emerges from the material and symbolic affordances of the instrument, mediating the performer's engagement with its sonic and physical properties. This concept has influenced contemporary digital instrument design, where the boundary between composition and instrument becomes blurred. The study also engages with theoretical frameworks from Vilém Flusser and Friedrich Kittler, situating the instrument's score within broader discourses on technology and embodiment. Finally, the paper explores the challenges of notating such scores, drawing parallels with choreographic practices, and concludes by emphasising the body's central role in interpreting and enacting these inscriptions during performance.

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1. Introduction

When a performer approaches a musical instrument, several affordances, limitations or constraints are revealed. These characteristics of the instrument can be considered a *score* in virtue of its property of shaping or inspiring the musical work.

In 2016, I presented the paper *Musical Instruments as Scores: A Hybrid Approach* (Tomás 2016) to the TENOR community, examining the conditions under which musical instruments can also be perceived as scores. The publication reintroduced and refined the concept of the *instrument's score*, a term commonly used by composers in the 1970s. In that study, we explored how, for many performers, the instrument becomes the score of what they are playing (Mooney 2012). The paper builds on an earlier publication called *Tangible Scores: Shaping the Instrument Inherent Score* (Tomás and Kaltenbrunner 2014), where I emphasised the same idea of inscribing my own physical and tactile scores on the surface of the instrument.

Over the past decade, I have observed how the reintroduction of the concept of the instrument's score has been well received by researchers from the TENOR and NIME communities, who have referenced these two previous papers[1]. The notion of the instrument's score has provided a framework for exploring digital instrument design (Privato 2023, Masu et al. 2020, etc.) and analysing experimental approaches in contemporary composition (Maestri and Antoniadis 2017). In this extended article, I aim to further develop these initial concepts, integrating insights from my ongoing reflections and the artistic practices of other practitioners.

2. The instrument's score hypothesis

The instrument's inherent score notion, or simply the instrument's score, does not emerge from academic or theoretical speculation. Prominent figures in the experimental music scene since the 1960s – such as Alvin Lucier, Gordon Mumma and Nicolas Collins – have used this term to describe their instrumental practices within electronics. This suggests that the notion of the instrument's score was, to some extent, a shared understanding among performers and composers of that era. In a personal conversation[2] in 2016, Nicolas Collins further emphasised the historical continuity of this perception, stating:

> 'It was very common in the 1970s (when I was a student) to spout the circuit as score mantra, but it was only recently that I asked myself, well, if its a true score then there should be a way to analyze it as such, rather than simply use it as a recipe to build an instrument'.

Collins' argument aligns with the practices of the late 1960s, particularly within the musicians' group *Sonic Arts Union*. Alvin Lucier (1998) described how many of the collective's works lacked traditional scores, stating that '*the scores were inherent in the circuitry*'. Similarly, composer and performer Gordon Mumma emphasised the compositional nature of instrument design, asserting, '*I consider that my designing and building of circuits is really composing*' (Mumma in Nyman 1999, chapter 5). Further

[1]For a complete and updated list of references, see https://scholar.google.at/citations?user=60KC5zQAAAAJ (accessed on 27-2-2025).

[2]Email communication with Nicolas Collins, May 2016.

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supporting this perspective, James Mooney, in a lecture at Oxford University (Mooney 2012), referenced an interview with the English experimental music group *Gentle Fire*. In the interview, band member Richard Bernas described playing a custom sensor-based electronic instrument called the *qHong*, stating that '*the instrument is the score of what we are playing*'. As Paul DeMarinis reflects on his work *Pygmy Gamelan*[3] (1973), he notes (1975, p. 47):

> 'Due to the evanescent nature of the signal present at the random inputs, the melodic patterns generated by the Pygmy Gamelan are perpetually changing but bound to the metric and modal constraints designed into each unit. In this sense, the electronic circuit itself functions as the score, as well as the instrument and the performer'.

Finally, Scot Gresham-Lancaster (1998) contextualises his compositional practice for *The Hub* using the following arguments:

> 'Independent circuits developed by individual artists represented a further development in this genre. [. . .] The unique aspect of this type of work lay in the circuit's de facto equivalence to a score'.

All these examples illustrate that a relevant group of composers and performers perceived the same phenomenon when exploring the sonic and physical affordances of the instrument. That is the hypothesis of the instrument's score.

Up to this point, I have highlighted a number of historical examples and statements that suggest an implicit understanding of the instrument as a score. However, my intention is not to simply reconstruct this shared intuition from the 1960s and 70s but to critically reframe and expand it from my perspective as an artist working with digital and physical instrument design. Through years of engaging with instrument creation – not only conceptually but through tactile, sonic and performative exploration – I have observed that the instrument often shapes the musical output in ways that are structurally equivalent to a score. This perspective arises not from theoretical abstraction alone, but from our embodied experience of performance and design, where the boundaries between composition, instrument and performer continually blur. It is from this critical and experiential position that I now propose the concept of the instrument's score as a hypothesis to be examined and developed further. In the following section, I will present examples that illustrate how the instrument's score emerges, particularly through the lens of experimental electronic practices where composition and instrument design become inseparable.

3. Recomposing instrumentality: Illustrative cases of the instrument as score

The musical practice of 'composing inside electronics' emerged in the late 1960s, under the influence of available electronic technologies and the evolving attitudes of postmodernism. Rather than representing a mere extension of existing compositional approaches, this shift was primarily driven by a redefinition of instrumentality. The incorporation of electronic components into composition fundamentally altered the concept of *playing* as it had been previously understood. Many electronic circuits were capable of synthesising or modifying sound without requiring direct physical manipulation. John Fulleman, a frequent collaborator of John Cage, described David Tudor's approach as the '*ability to assert just enough control over the equipment to get through a concert*' (Kuivila 2001).

This agency given to electronic circuits fostered new creative relationships, with performers often engaging with them *as they come*. In some cases, these instruments can function independently, without the need for a performer. They may evolve or generate music by sensing environmental conditions, embodying a new kind of electronic performative agency. This is evident in several of Tudor's works, such as *Pepscillator* (1970) and *Untitled* (1972), as well as Nicolas Collins's *Pea Soup* (1974) and *A Clearing of Deadness at One Hoarse Pool* (1982), where electronic processors are arranged in a feedback circuit to create autonomous electronic systems with *no input*. As both Tudor and Collins have noted on multiple occasions, these instruments require only an initial excitation. In this context, we could affirm that the instruments effectively *perform themselves*.

Interestingly, Tudor describes another group of electronic music builders, more closely aligned with Lucier, who follow an opposing aesthetic principle. Rather than presenting circuits or software *as they come,* they seek out interesting phenomena within these systems and isolate them, filtering out any unrelated characteristics. In a 1989 interview, Tudor explained (Austin 1989):

> 'My experience with Alvin (Lucier) is that he approaches things more like a romantic, so that he's an appreciator of these phenomena, and he appreciates their specific beauty. Then, when he goes to compose the work, he wants to display those characteristics, which seem beautiful to him. Whereas, in my case, I want to show it as something in nature. You know, I don't want to display it, I want it to display itself'.

This approach is evident in works such as Lucier's *Music on a Long Thin Wire* (1977) and in *Music for Pure Waves, Bass Drums, and Acoustic Pendulums* (1980) to illustrate it with two examples.

While works like those of Lucier and Tudor compellingly illustrate how compositional structures can be embedded within autonomous electronic systems, they could shift the focus away from the embodied relationship between performer and instrument. The instrument's score becomes most evident in situations where the performer actively engages with a technological system whose material and logical design shape and inspire the performance. Here, the instrument's score is not only present in the circuitry or interface but is revealed through the performer's continuous negotiation with its affordances and constraints. An example of the performative dimension of the instrument's score is Gordon Mumma's *Hornpipe* (1967). In this work, Mumma modifies a French horn by embedding custom-built circuitry directly into the instrument, enabling it to process and transform the sound in real time based on the performer's gestures. At the core of the system are four microphones placed inside acoustic pipe resonators, each tuned to a distinct frequency. The acoustic feedback loop – formed between the French horn, the resonant pipes and a loudspeaker – is integrated into an electronic feedback system that employs amplitude-gated frequency translation. The performer is not simply playing an instrument with effects but rather engaging with a hybrid system whose material and logical design defines a sonic structure. At the start, the system is balanced, producing sound only when the loop becomes unbalanced. The French Hornist's sounds disrupt the balance, triggering a chain reaction of rebalancing and unbalancing. The performer's role is to control this process, balancing and unbalancing elements in the correct sequence. *Hornpipe* is designed to display constraints and possibilities that guide the performance, merging composition,

[3]*Pygmy Gamelan* consists of four small synthesisers that generate continuous five-note melodic patterns. While the pitch material and underlying pulse remain fixed, the sequence of the notes is subject to continual reordering, interspersed with irregular silences. DeMarinis notes that these variations are influenced by ambient radio signals and electromagnetic waves, introducing environmental indeterminacy into the system.

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instrument design and embodied interaction into a single integrated system. Mumma (1967, edited 2015, p.43) notes that:

> 'My electronic music equipment is designed to be part of my process of composing music. I am like any composer who builds his own instruments, though most of my instruments are inseparable from the compositions themselves'.

These experimental practices since the late 1960s show us how much the compositional act begins by designing and configuring the technological and material system. The instrument's design, affordances or embedded structures act as compositional frameworks. These hybrid instruments inherently encode compositional or performative information through their design or behaviour. During the concert, performers have the perception of playing a specific form. The instrument's score would be those material and symbolic elements of the instrument, mostly defined by the circuitry in these cases, shaping and inspiring a player's performance.

As explained in the previous section, reintroducing the concept of instrument scores has provided language to researchers in digital instrument design to describe how instruments mediate embodiment during performance. Electronic instruments are traditionally described as open-ended systems (Tanaka 2011) because the boundary between instrument and composition is difficult to define. In order to characterise an instrument, it is necessary to implement specific input-to-output mapping strategies. However, these strategies are typically shaped by the characteristics of the composition for which an instrument is designed. In our case, in the absence of a written score, performers explore the physical and sonic affordances of the instrument, thereby perceiving the exploration of some form of precomposed structure.

Building on this idea, Schnell and Battier (2002) introduced the term *composed instruments* to describe digital instruments that '*carry the notion of an instrument as that of a score'* meaning they inherently are embodied with various aspects of a musical work. This aligns with the fact that, during the technical implementation of an instrument – whether in hardware or software – compositional ideas are often embedded into the programmed system. When circuits are configured in a particular way for artistic purposes, the composer occupies an intermediary role between designer, composer and performer. In this context, composition begins with the design and configuration of the technical system underlying the instrument.

In recent years, several researchers have employed the concept in the context of composition and instrument design. For instance, Maestri and Antoniadis (2017) utilised the instrument's score concept to explain the relationship between composition, instruments and performers, as well as to analyse works by Helmut Lachenmann and Aaron Cassidy. In the case of Lachenmann, his compositional motto is well known: '*Komponieren heißt, ein Instrument bauen – composing means building an instrument – '*. In his work *Pression* (1969) for solo cello, affirm Maestri and Antoniadis, Lachenmann instructs the cellist to employ unconventional playing techniques, providing precise notation for both the required gestures and the specific contact points on the instrument. The authors explain that through this approach, the composer investigates the instrument's sonic possibilities in a manner analogous to how a performer navigates an instrument's inherent score. Additionally, Maestri and Antoniadis describe Aaron Cassidy's *Second String Quartet's* written score as an interface for the instrumental and physical enactment of the musical whole, encompassing both the performer and the instrument. In this context, the notated score serves as a state space of gestural affordances. The relationship with sound always remains open, highlighting a fundamental connection with the instrument's inherent score: the written notation suggests specific gestures on the familiar medium of the string quartet, but performers have to engage with these gestures to produce sounds which are not explicitly predetermined in the score. Performers necessarily are invited to explore the instrument's inherent score generating a range of possible sonic outcomes.

The instrument's score concept has also been recently approached to explore instrument design practices. For instance, Nicola Privato (2023) contextualises his *Magnetic Scores* as somatosensory inscriptions in the instrument, emphasising the instrument's score as a departure point. These magnetic scores (Figure 1), according to Privato, allow for the creation of haptic scores within the device's own operational design, representing a particular example of inherent scores. As the musician moves across the surface with the control mechanisms, the magnetic elements pull and push against each other, thereby shaping the performance gestures. Another significant and recent example of designing an instrument score is Giacomo Lepri's *Chowndolo*[4], a pendulum controller whose motion is dynamically influenced by an array of permanent magnets positioned at its base (Figure 2). The magnets beneath the pendulum can be rearranged to form new shapes, with each configuration altering the pendulum's oscillations and the resulting sonorities. This leads to unstable oscillation patterns, which are converted into synthesis parameters and sound. Simon Alexander-Adams and Michael Gurevich (2015) used the instrument's score to introduce their *tangible graphic score*. The system is conceived as a touch surface facilitating modular textured plates, coupled with corresponding visual feedback. Another example is the project *VR Open Scores* (Masu et al. 2020) for the exploration of '*affordances of the VR instrument with a notation that is inherent to the system-itself*'.

As an instrument designer, I decided to use the concept of instrument scores as a design paradigm since 2013 when I proposed the first *Tangible Scores* (Tomás and Kaltenbrunner 2014). These are tactile interfaces for musical expression that incorporate a score in their physical shape, surface structure or spatial configuration[5] (Figure 3). Using sound as a continuous input signal, both synthesis and control are available simultaneously through direct manipulation of the engraved patterns on the physical score. Each interface is conceived from a different graphical score that not only represents a musical idea but has also been specially designed to provide a diverse palette of acoustic signals when touched. These tangible scores define and suggest specific gestural behaviours through the different affordances and constraints of the object. Sound is generated through polyphonic concatenative synthesis driven by real-time analysis and classification of input signal spectra. Each score is loaded with a specific sound corpus that defines its sonic identity. Thus, the *tangible score* provides implicit visual and haptic feedback in addition to its core sonic functionality, making it both intuitive and learnable as well as suitable for musical improvisation and sonic exploration.

These examples demonstrate the renewed scholarly attention to the instrument's score concept. With a focus on practice-based

[4]See www.giacomolepri.com/chowndolo (accessed on 28-2-2025).

[5]Videos and more information about the different projects produced with Tangible Scores can be found here: https://tamlab.kunstuni-linz.at/projects/tangible-scores/ (accessed on 27-2-2025).

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Figure 1. Nicola Privato: Magnetic Scores with Thales Controllers (2023) Photo: Nicola Privato. Used with permission.



Figure 2. Giacomo Lepri: *Chowndolo. Photo: Giacomo Lepri. Used with permission*.

approaches and embodied cognition, the instrument's score term has given us language to describe how to design the instrument and how the instrument mediates embodiment during performance. In analysing these projects, the definition of the instrument's score has been consolidated as the physical and symbolic elements of the instrument that shape and inspire a player's performance.

Instrument scores can be created through a range of methods that embed compositional structure directly into the material, spatial or behavioural properties of an instrument. To illustrate these design strategies, I will present a selection of examples from different artists. These examples are not intended to serve as an exhaustive or historical survey of all practitioners who have engaged in the composition of instruments. Rather, they are curated to demonstrate the diverse approaches through which instruments and scores can be co-composed. One approach for creating instrument scores is to design circuitry and feedback

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Figure 3. Enrique Tomás' *Tangible Scores* (2014). Photo: Enrique Tomás.

systems that carry compositional logic within their configuration. In such systems, musical form emerges from the internal behaviour of the instrument itself, often requiring only minimal input from the performer. This method is exemplified by works like *Bye Bye Butterfly*[6] *(1965) by Pauline Oliveros* and *Pea Soup*[7] (1974) by Nicolas Collins, where signal routing and feedback networks serve as self-generating scores. The second method involves using the spatial arrangement of resonant or controlling objects to define gestural possibilities, where the layout of the instrument suggests specific modes of interaction. Annea Lockwood's *Glass Concerts* (1968) employed an array of glass objects – sheets, rods, bottles and large panes – whose spatial arrangement and material properties invited exploratory gestures, with each object's inherent resonance shaping the performance. Hugh Davies's *Shozyg I*[8] (1968) is another key example, in which the configuration of metal objects within a resonating box invites exploratory touch and manipulation. An alternative tactile strategy employs haptic feedback and magnetic resistance to shape gesture and movement, as seen previously in Nicola Privato's *Magnetic Scores (2023)*, where embedded magnets push and pull against the performer's actions, forming a score that is physically felt. Similarly, instruments may incorporate rotating forms or moving parts to encode temporal and gestural structures; Matt Steinke's *Forms Modulator*[9] (2021) uses sculptural clay shapes on a spinning disc, which act as 3D notations scanned and interpreted by the system. A further method focuses on material-based, somatic design, in which fabric, texture and softness guide embodied interaction. Kristina Andersen's textile instruments and wearable controllers exemplify how tactility can function as notation, creating a score that is sensed through contact and motion. Engraving or imprinting visual patterns directly into the surface of the instrument constitutes another approach; my *Tangible Scores* (2014) are based on this principle, embedding graphical and tactile inscriptions that suggest gestural trajectories. These visual patterns can be carefully crafted and mapped to establish a direct correlation with sonic patterns, as exemplified by Filipino artist Datu Arellano's *Tahigami Touch Controllers*[10], where the physical arrangement of touch-sensitive pads simultaneously encodes pitch relationships. Lastly, systems that are environmentally or performatively responsive – such as

[6]From Pauline Oliveros's interview by Steve Silverstein for TapeOp, issue 41, May 2004, see https://tapeop.com/interviews/41/pauline-oliveros (accessed on 22-9-2025): *'I made my own way of making electronic music in the late-'50s, early-'60s, using test equipment – oscillators and patchbays and tape recorders. While everybody else was cutting and splicing materials, I was finding a way to improvise with the electronics. That improvisation system was using difference tones between oscillators. Setting oscillators above the range of hearing and using the difference tones between the oscillators in a tape delay system caused a lot of beat frequencies with the bias of the tape recorder. That's how I made my early electronic music, like I of IV, Bye Bye Butterfly. I used large tape recorders with big reels. I'd take the supply reel and run it through the deck and over to another machine, several feet away. Sometimes I think I even ran it through three machines. They would all record, and feed the resulting sound back to the first machine, and the second machine'.*

[7]Full description of the instrument is hosted at Nicolas Collins' website: www.nicolascollins.com/aboutpeasoup.htm (accessed on 22-9-2025).

[8]More information about the instrument can be obtained through the website of the exhibition *sho-zyg* organised by Goldsmiths University London: www.sho-zyg.com/shozyg.html (accessed on 22-9-2025).

[9]A video of Matthew Steinke's Form Modulator can be watched at the URL: www.youtube.com/watch?v=3VbnttCSXzE (accessed on 22-9-2025).

[10]A video of these instruments can be watched at the following link: www.youtube.com/watch?v=7mX1DT07Fq8 (accessed on 22-9-2025).

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David Behrman's *Runthrough*[11] (1967) – rely on feedback-sensitive behaviour where gesture, proximity and environmental conditions shape sonic results in real time. Maryanne Amacher's series *Music for Sound-Joined Rooms*[12] (1980–1995) embodies a similar compositional intention, using idiosyncratic loudspeaker placements to route sound through the architectural site itself so that the building's structure becomes the generative and structural compositional medium of the created work. Across these approaches, the common principle is that the instrument is no longer neutral or passive: its very design becomes a score inscribed in matter, prescribing interaction, shaping gesture and embedding compositional potential within the instrument's form.

4. The instrument's apparatus

The concept of the instrument's inherent score has thus far been contextualised exclusively within the framework of musical practices. While it provides a language for examining phenomena within musical domains – due to its connections with music, composition and instrumentation – it remains challenging to establish meaningful connections with broader concepts in the philosophy of technology or scholarly contributions from theorists in media art and technoculture. It is therefore essential to situate this concept within a more comprehensive discourse concerning human embodiment with technology. To this end, I propose engaging with the theoretical frameworks of Vilém Flusser and Friedrich Kittler regarding the *apparatus* of cultural objects.

The landscape of technological artefacts has evolved over centuries. What was known as a basic tool now could have become a sophisticated device or machine. Based on their function, it could be argued that electronic and digital instruments are direct descendants of their acoustic counterparts. One might suggest that they function similarly to acoustic instruments but are constructed using software and circuitry. However, the fundamental nature of electronic and digital instruments differs significantly from that of acoustic instruments. In electronic and digital instruments, gestural control and sound synthesis are entirely decoupled. A performer's physical interaction with an interface does not necessarily produce sound – for example, turning a knob on a Moog synthesiser or using a computer vision analysis to perform music. Instead, performance with these instruments involves capturing corporeal articulation in real time through sensor technologies, converting it into electrical or digitally encoded data and subsequently mapping it to sound via hardware or software. This decoupling between physical gesture and produced sound has profoundly reshaped long-established practices of musical composition and performance.

For Vilém Flusser (1984), modern cultural objects (e.g., cameras and electronic musical instruments) specialise in transforming the meaning of the world. These objects incorporate symbolic intentions which, according to Flusser, are assumed by *apparatuses*. While in the past the symbolic task of meaning-making was exclusively performed by humans, contemporary apparatuses now function autonomously with greater efficiency and scope. For instance, photographic apparatuses render scenes more efficiently than manual representation, effectively *liberating* humans from painterly reproduction. Similarly, electronic and digital instruments achieve efficiency through their capacity to embody the sonorities of unlimited instrumental types within a single object, unrestricted by real-world acoustic and physical parameters. Flusser's discourse can be comprehensively understood in light of recent developments in generative artificial intelligence.

For the philosopher Friedrich Kittler '*human being essence escapes into apparatuses, with this differentiation – and not with steam engines and railroads – a clear division occurs between matter and information, the real and the symbolic*' (Gane 2005). Kittler's post-structural thesis could be summarised with the statement 'media determine our situation'. Our knowledge and what we believe to be true are critically dependent on the cultural techniques that we use. For many people, a great deal of contemporary life is mediated by interfaces, including laptops, smartphones and television screens. Epistemologically, what we think we know about electronic instrument design is mediated by the technologies of design we count.

Within this theoretical framework, electronic and digital musical instruments may be conceptualised as tools with an *apparatus* – embodied in programming or circuitry – that delineates the specific range of possible outcomes (and only those outcomes). Performers engage with these electronic and digital instruments by exhaustively exploring the apparatus in pursuit of novel musical realisations. Our attention shifts to the engagement with the apparatus itself, emphasising its playful dimension. For instance, when Gordon Mumma *composes* circuits for instruments, he engages with both material and logical aspects of circuitry but primarily participates in the compositional act of defining an apparatus that generates sonic results aligned with his musical intentions. Exhaustively testing the limits of this apparatus – identifying boundaries and confronting the challenges of extending the apparatus to extreme or technically paradoxical ranges – constitutes a central component of both the performative and compositional practice.

This conceptualisation of musical instruments as modern cultural objects incorporating an apparatus enables us to establish connections with the instrument's score notion. The instrument's apparatus is defined as a system that integrates technological, acoustic and performative elements, shaping the instrument score's structure and function. Specifically, the apparatus translates abstract concepts into concrete parameters within the score, such as notational systems, performer instructions or interactive constraints. For example, in Mumma's *Hornpipe*, the apparatus determines the dynamic relationship between the performer and the instrument by encoding specific actions or responses into the instrument's inherent score, which are contingent on the apparatus's configuration. This translation creates a feedback loop where the instrument's score reflects the apparatus's influence while also guiding the performer's engagement with it.

To further illustrate this argument, a few examples merit consideration. Programme notes for *Bandoneon!* state that '*Bandoneon! uses no compositional means, since it composes itself out of its own composite instrumental nature*'. Notably, Tudor deliberately employs the term *composite* rather than *composed*, emphasising that the instrument's character emerges from the dynamic interplay of numerous technical elements – circuitry, synthesisers, physical interfaces, human input and programming anomalies – producing unpredictable behaviours. This methodological approach is similarly evident in *Rainforest (1968)*, where Tudor's score manifests as a technical schematic merely defining the configurations between the system's various components, inputs and outputs. Significantly, these schematics do not prescribe

[11]A recent revival of the original work with modern electronics – prepared by David Behrman – can be watched through the website of the ISUE Project Room website: https://issueprojectroom.org/video/david-behrman-runthrough (accessed on 22-9-2025).

[12]More information about this work can be found from the texts written by Maryanne Amacher for the description of the work 'The Levi Montalcini Variations', awarded at the Ars Electronica Festival 1997. https://archive.aec.at/prix/144086/ (accessed on 22-9-2025).

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how the system should be musically explored nor specify the sonic materials to be reproduced. Rather than dictating particular sounds, trajectories or compositional intentions, they delineate a realm of possibilities: the apparatus.

Ultimately, Tudor, Mumma and Lucier could have formalised traditional compositions through conventional notation, specifying sounds, movements and temporal trajectories for these apparatuses. However, their creative exploration of the apparatus disrupts the conventional relationship between composer, instrument, performer and composition. In their methodological approach, the composer embeds musical concepts directly into the instrument's apparatus. The agency to suggest and shape performance becomes distributed between the composed system itself – which is continuously shaped by environmental interactions – and the performer, who navigates and directs the apparatus towards specific sonic possibilities.

This shift from the material to the symbolic is typical of post-industrial societies. Nowadays, since the apparatuses of digital objects have conquered a significant part of our material world, a certain resistance against them has emerged. Recent philosophical trends (i.e., neo-materialism, post-digital sensibilities) propose alternative models where, without forsaking digital technologies, we are aimed at combining – if not merging – the symbolic and the material parts of our world, especially in a more sustainable way.

5. Instrument's score as notation for the body

The final phase in my study revisiting the instrument's score concept must inevitably address notation. Ultimately, we are conveying the existence of a score. The critical issue for me is not to characterise the instrument's score as a particular type of score – an approach I explored in my paper from 2016 (Tomás 2016). Instead, I find it now valuable to examine why we perceive inscriptions and scores in objects and how we might leverage this cognitive phenomenon to generate new inherent scores. To develop this idea, I will draw upon dance, an artistic discipline that has developed and transmitted choreographies across millennia without requiring written notation.

Whereas choreography has been defined as 'the art of making dances' (Humphrey 1959), composition in Western traditions is generally conceived not simply as 'the making of music' but as its inscription as well, underscoring a fundamental difference between the two practices. How might concepts from choreography help us better understand the embodiment of notation in electronic music?

Alva Noë, a philosopher of mind, defines notation as a tool for thinking thoughts (Noë 2016). As any tool, explains Noë, notation has significance only in the context of its embedding. Remove it from the context and it becomes nothing more than a thing. This is very interesting, because notating, or writing, does not represent language from outside. 'Writing' is invented by speakers to represent language to themselves.

Speech – and music – do not need writing to exist. Derrida would say that writing is a technological development (1998). Writing '*is all that gives rise to an inscription, everything that is alien to the order of the voice: cinematography, choreography, pictorial, musical, sculptural writing*'. These are all inscriptions allowing us to think on something with detail. 'Writing' even affords thinking disconnected from the necessity of using speech, like in the case of mathematical notation which is clearly not phonological.

Throughout history, composers have devised novel notation systems to formalise into writing the musical practices they were already developing. What options are available for electronic and digital musicians to notate their work? Since the relationship between physical gesture and resulting sound is rarely fixed in these contexts, composers would typically need to document bodily actions rather than sonic outcomes in most instances.

Nicola Privato's gestural instrument *Magnetic Scores* (Figure 1) can be taken into consideration. When composing for this instrument, we must first identify which gestures will be incorporated into the composition and which will be excluded. It is indeed possible to filter and constrain the gestural and sonic possibilities of any digital instrument. Once we have limited its instrumental language, we can potentially develop vocabularies of gestures and sonic mappings. However, the challenge lies in creating a notational system for the instrument, as our notation must represent physical movements. We must explain that specific symbols correspond to particular movements. This is an arduous task that must be repeated for each new instrument and often for each new composition.

Interestingly, the struggles of composers with electronic and digital instruments are comparable to those of choreographers. Dance shares the same problem in regard to notation. Although there have been efficient notational systems for representing dance (e.g., Labanotation, Benesh notation), choreographers do not use them generally to communicate the movements. Fortunately, dance has found ways to intellectually develop itself without the need of writing.

One of the most interesting precedents of post-structuralism was coined over the course of the 1890s by Stéphane Mallarmé who dreamed of '*dance as a poem unburdened of scribal accesories*' (Louppe 1994). A type of *counter-writing* in which dance would liberate the poem from signs. Around these years, Loie Fuller (Figure 4) would have revealed contemporary dance's representational realm to Mallarmé. According to Louppe, Fuller revealed dance as a poetic state enclosing bodies into a concept. For this reason, Mallarmé unfolds contemporary dance as an art without a scribe. But more importantly, Fuller shows us that contemporary dance can evolve along any trajectory, not only the physical. Can those trajectories be notated? How can one inscribe Fuller's masses of colour in her *Serpentine* choreography (1891)? For Louppe (1994):

> 'Dance is not the formulation of another language. It is a transformation of representation itself. It is a trajectory between the real and the sign. This trajectory is perturbed by the presence of a living body, intervening as such. Representation supposes the absence of the object, the absence of being. Here life inhabits what will never be its icon or its index. Dance de-represents; it courses thought through zones of perception where meaning can only be invented amidst the debris of signification . . . '

It is often said that choreographers have fixed or written a choreography, when often not a single symbol has been drawn or written on paper. Choreography for Louppe is above all '*a matter of an interior score, moving and intimate. This score is within all of us; it is the ensemble of breathings, pulsations, emotive discharges or mass displacements which are focused on our bodies*'.

In my assessment, Louppe's ideas strongly resonate with the experiences of electronic and digital performers during live performance. There exists a movement vocabulary that must be sequenced for performing. We develop an intimate bodily

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Figure 4. Portrait of Loie Fuller performing Serpentine (1902). Open Wikimedia Commons.

connection with our instruments as we practise and internalise the trajectories and weights of our gestures. However, unlike dance, our primary objective is not to create a choreography of movements but rather a choreography of sound that is the result of our movements. These movements are sometimes invisible to the audience, occasionally broad and expressive, but frequently of mental origin, with only some producing observable physical action. This resulting sequence of movements – exploring the instrument, its apparatus, and its sonic and physical affordances – constitutes our representational realm. During performance, our bodies are also enclosed in a sonic world of sound textures, timbres, trajectories, noises and silences – elements that, like all sounds, elude the possibility of being fully captured in written form. Recognising the limitations of notating sound in electroacoustic music is crucial. In the context of composition for electronic and digital instruments, one approach is to focus on the instrument itself. This means embedding musical intentions within the very objects we define as musical instruments, effectively composing the instrument's inherent score.

How does this process of inscription onto physical objects manifest? For the choreographer William Forsythe (Manning 2009), '*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*'. And '*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's approach recognises the body, rather than solely the mind, as the primary agent in exploring the environment, discovering its scores and interpreting them. The body serves as the central element in making sense of a score. From this perspective, any object or apparatus that prompts an action can be considered choreographic, a score.

Forsythe considers physical objects of various kinds to be choreographic when they elicit specific behaviours and movements from the dancers. These objects embody a choreography inherent to their material properties and to humans' capacity to perceive and interpret these affordances. For Forsythe, every object serves as a potential catalyst for movement. An example of this approach is *Nowhere and Everywhere at the Same Time, No. 2* (Figure 5), in which Forsythe defines the space by filling it with closely spaced pendulums suspended from the ceiling. In this work, the danceable space and possible movements are determined by the pendulums' inertial properties. Here, the choreographic score emerges from the performative affordances of numerous pendulums structuring the surrounding space. Other examples of choreographic objects include *The White Bouncy Castle* (1997) and *The Fact of Matter (2009)*.

I interpret Forsythe's insights as unfolding a choreographic intention embodied in the object itself. In this context, the score moves beyond its role as symbolic information and instead functions as a trigger for enacting and shaping movement. It can be argued that choreographic objects also embody an inherent score.

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Figure 5. William Forsythe's 'Nowhere and Everywhere' at the Same Time No.3. Photo by Dominik Mentzos. Used with permission.

6. Conclusion

This article has re-explored the artistic reasons and the instrumental effects of understanding musical instruments as artefacts embodying a score. In other words, to what extent musical instruments can be perceived as musical scores has been discussed. A decade after the first publications introducing the term, the historical and artistic reasons behind it have been further expanded and discussed.

The notion of the instrument's inherent score has been reintroduced and discussed. We have established a definition based not only on my insights but also on the projects that have adopted this concept. The instrument's score refers to the material and symbolic aspects of the instrument that shape and inspire a player's performance. Although this notion is context-dependent and subjective, I have demonstrated how many musicians have described it, stating that the instrument is the score of what they play. The inherent score also contributes to a performative-oriented approach to interface design. Designers can highlight elements of the instrument's score to suggest specific embodiments through the artefact.

I have observed how members of the research community have embraced the notion of the instrument's score to describe their work. This concept has provided us with a language to explain how the instrument mediates embodiment and musical development at the precise moment of performance. It applies not only to electronic and digital instruments but also to contemporary practices with acoustic instruments.

In my view, the future development of the instrument's score concept relies on the creation of methods to embody musical intentions in objects, making use of our innate ability to perceive and interpret physical and virtual inscriptions. Moreover, we could argue that humans are also specialists in inscribing representations everywhere. This dual nature of perceiving and producing inscriptions is poetically articulated by Sally Jane Norman in *Object of Notation* (2016)[13]:

'*Unfolding from within and around these beings we call our selves, we learn to read the substance of the world: to make markings stand as notation, we discern and give symbolic structure to the strands and knots of tangled temporalities that shape materials, including those that are evidence of our own corporeal existence [. . .]*'.

It appears that both inscribing and interpreting objects as inscriptions are integral to our process of learning. For this reason, many instruments designed within the paradigm of the inherent score tend to be intuitive to play. Typically, understanding how they function does not require consulting a manual. The instrument's score inherently suggests patterns of action and perception, which, similar to any other musical instrument, guide our learning process.

In contemporary performative arts, scores – as well as various forms of representations and inscriptions – can manifest in diverse materials and formats, including graphic, action-based, computational and sculptural scores. We have seen how these objects are recognised as scores due to their capacity to evoke or instigate artistic actions. The instrument's score, however, has a weakness. It can only be explored at the moment of performance; it is perceived through the performer's engagement with a given materiality – whether physical, virtual or hybrid – as a performative element.

[13]The performative presentation can be watched here: www.youtube.com/watch?v=mj6z094rj-Y (accessed on 27-2-2025).

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They emerge from embodied cognition, enacted through the direct interaction between performer and instrument.

Finally, at the core of defining, analysing and applying the concept of the instrument's score is the recognition of the body's central role in shaping discourse. This is what Kittler and others refer to as *corporeality*. For Kittler (Gane 2005), the body serves as the locus upon which the technologies of every culture connect and inscribe themselves. Technologies not only leave inscriptions but also imprint their traces upon our bodies. For this reason, Thomas and Geerke (1990) describe culture as '*the regimen that bodies pass through; the reduction of randomness, impulse, forgetfulness; the domestication of an animal, as Nietzsche claimed, to the point where it can make, and hold to, a promise*'. While we design, configure and perceive the instrument's scores and its technological apparatuses, our bodies – intrinsically complex and noisy – mediate these interactions as much as technology itself. For these reasons, the instrument's score often tends to be unstable, indeterministic and probabilistic. Fortunately, these features are no longer an impediment to recognising those structures as scores.

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