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Navigating a Two-dimensional Field / *across the plane*

Jakob Bragg

Composing for the piano is beset by constant compromise. As a composer whose musical language is exemplified by glissandi, microtones, timbral transformation, and states of destabilisation and distortion, the piano—at least as traditionally focused upon the keyboard—invokes feelings of frustration and constriction. With the instrument's design predicated by performance upon the keyboard, twelve-tone equal temperament, a clarity of pitch and timbre (even at extreme dynamics),[1] and a uniform timbral profile, I find myself restricted to a narrow band of exploratory possibilities. This is amplified by my classical training as a pianist in which my fingers default to learnt gestures, familiar pitch structures, typical voicings, and are always drawn to the keyboard as a primary location of activity.[2]

In an attempt to divorce these learnt behaviours, open up a more exploratory compositional space, and re-work the many existing notational models that still focus upon the five-line stave, this article outlines my development of a new notational model that serves as both a scoring tool and, most crucially, a lens in which to approach and compose for the piano. The aims for this notational model include the following:

- decentralising the keyboard as only a subcomponent of the entire instrument
- capturing the entire body of the piano and invite exploration

[1] This clarity of pitch and timbre across extreme dynamics is one of many features of the modern piano, designed to minimise inharmonicity and maximise reliability. See Richard Dain, 'The Engineering of the Concert Grand Piano,' *Ingenia*, 12 (2002), www.ingenia.org.uk/ingenia/issue-12/the-engineering-of-the-concert-grand-piano.

[2] Western Classical training as a pianist is focused upon contrapuntal, harmonic, and melody-and-accompaniment keyboard work, as well as fingering and hand techniques that develop muscle memory and work towards virtuosity.

- allowing for manipulations to the strings, preparations, object-oriented composition,[3] and exploration of glissandi, distortion, and timbral transformation
- appearing ultimately coherent and intuitive to read.

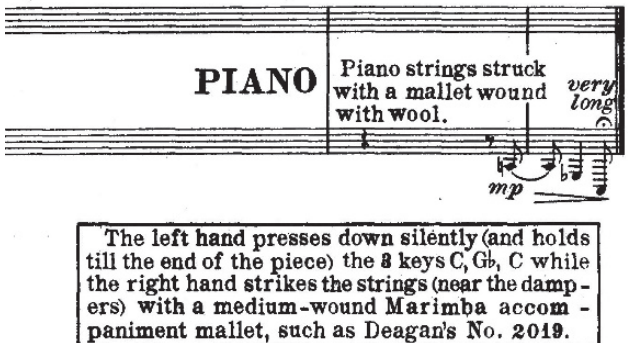
These aims will be further illustrated through my recent work, *Fourteen piano transcriptions from across the plane [plain]* (2023), composed specifically to explore the possibilities and limits of this notation.

A Brief Look at Existing Models

The search to extend the sonic possibilities of the piano, divorced from the keyboard, or at the very least, significantly expanding upon traditional keyboard playing, is a long history that predates my own exploration by well over a century. Early examples include Percy Grainger's use of mallets on strings,[4] Henry Cowell's 'string piano' technique,[5] various exponents of prepared piano including Erik Satie, Heitor Villa-Lobos, John Cage, and Sofia Gubaidulina's use of muting the strings.[6] Arguably the most radical of these early extended practices is Annea Lockwood's *Piano Transplants* (1968–82), which includes the text-based score *Piano Burning* (1968), whereupon an upright piano is burnt, completely transforming the instrument into an artefact of sound as the timber contorts, strings break, metal warps, and eventually the instrument collapses.[7]

In many of these scores, text is used to describe an activity taking place beyond the keyboard. In Grainger's *In a Nutshell* (1916), a written instruction is placed above the five-line stave with further directions indicated below (see boxed text in Fig. 1). Similarly, Gubaidulina's Piano Sonata (1965) uses the instruction 'con sord.' above the stave to instruct the performer to mute

Figure 1. Grainger, *In a Nutshell* (New York: G. Schirmer, 1916), p. 83, illustrating the use of mallets upon the piano strings



[3] The piano as a both physical object and as a cultural and historic object is discussed in Samuel Wilson, 'Orientations and the Piano Object,' in *New Music and the Crises of Materiality: Sounding Bodies and Objects in Late Modernity* (Milton: Taylor & Francis, 2021), 49–73.

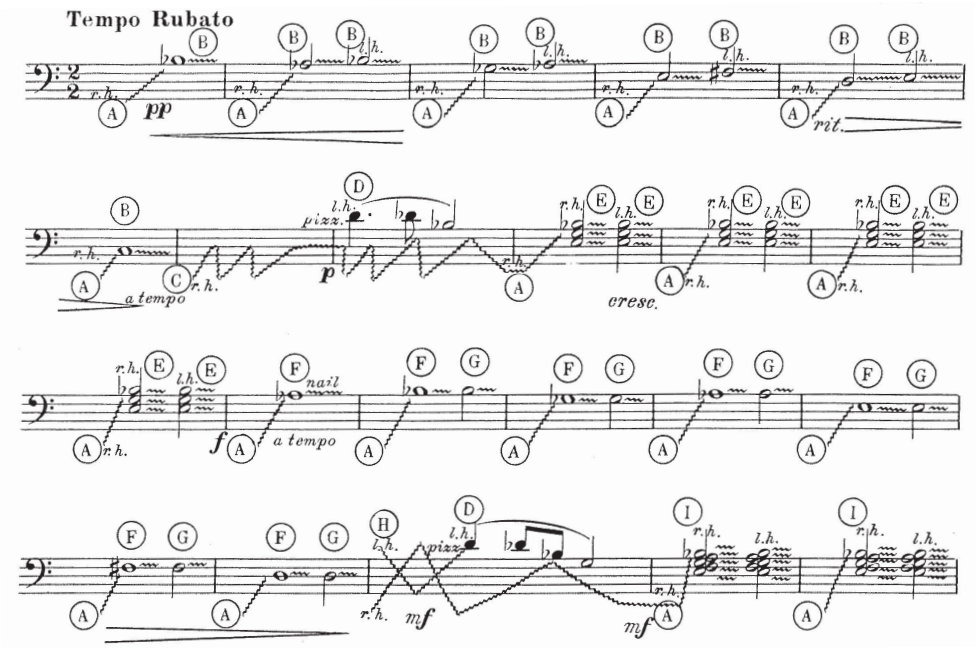
[4] Michael Hicks, *Henry Cowell, Bohemian* (Urbana: University of Illinois Press, 2002), 151–52.

[5] H. Wiley Hitchcock, 'Henry Cowell's "Ostinato Pianissimo,"' *Musical Quarterly*, 70.1 (1984): 23–44.

[6] Liang Deng, 'On the Debate over Whether "Prepared Piano" was the Creation of John Cage,' *College Music Symposium*, 55 (2015): www.jstor.org/stable/26574415; Heitor Villa-Lobos, *Chôros No. 8* (Paris: Éditions Max Eschig, 1928); John Cage, *Bacchanale* (New York: Henmar Press, 1960); Sofia Gubaidulina, Sonata for Piano (New York: Schirmer Russian Music, 1965).

[7] See Annea Lockwood, 'Piano Transplants,' Annea Lockwood, www.anneallockwood.com/compositions/piano-transplants.

Figure 2. Cowell, *The Banshee* (New York: Associated Music Publishers, 1959), bb. 1–22



the performed strings with their left finger. Cowell's *The Banshee* (1925) uses a novel notation that includes horizontal, vertical, and diagonal wavy lines to indicate hand movement along the length of the strings with encircled letters specifying the type of action made (see Fig. 2). These instructions, provided in the performance note, include direction of movement, the number of strings engaged, which body part to use, and specifics of technique.[8] More recently, Rebecca Saunders uses custom noteheads, graphics, text, and occasional auxiliary staves to communicate a language that explores performer physicality and navigation across the body of the piano.[9]

In each of these early examples, despite a significant expansion upon piano performance technique, the notation remains oriented towards the keyboard and its chromatic pitches—this trend is seen through the retention of the five-line stave upon which the majority of musical activity either occurs or is communicated. In seeking a new notational model, merely adding text to a stave is not significant enough to shift the lens in which one views and composes for the piano. Cowell's use of vertical, horizontal, and diagonal lines to communicate movement across the strings in *The Banshee* is a step towards refocusing performance parameters upon the piano. However, with these directions embedded within the five-line stave there is limited scope for detail or engagement across multiple parameters.[10] In seeking a new notational model, the keyboard must be diminished as one of many parameters of the piano, with activity beyond the keyboard not merely relegated to a footnote or an auxiliary notational feature.

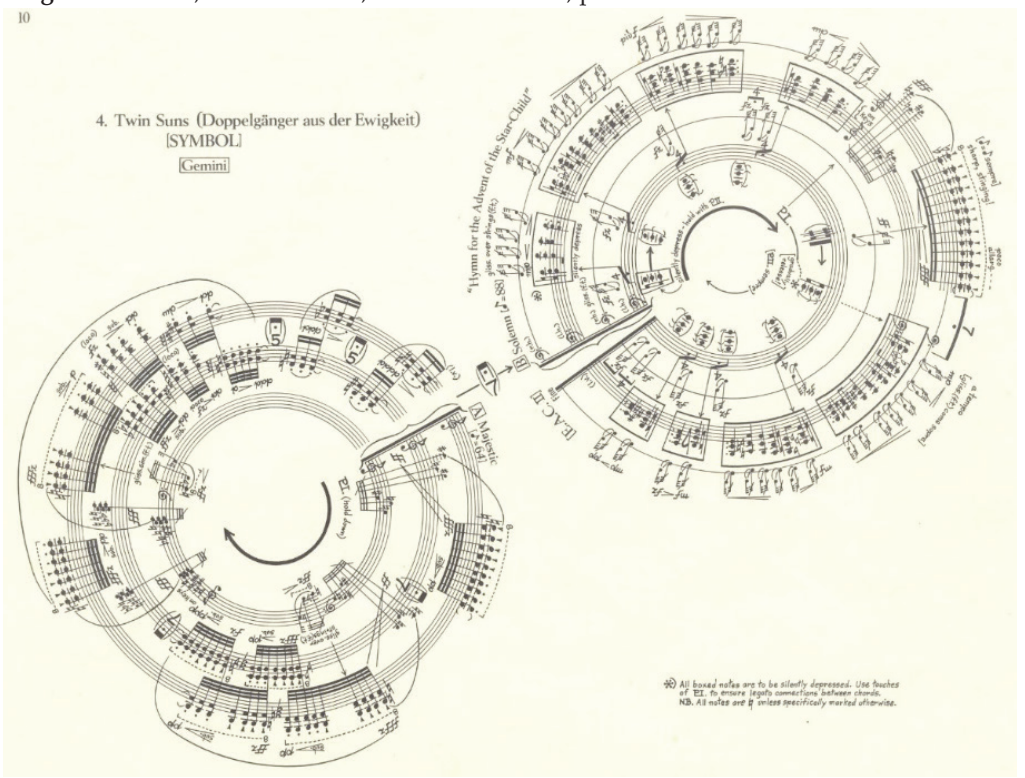
[8] For example, Letter A indicates a sweep across the strings from the lowest to the indicated pitch, whereas Letter D directs the performer to pluck the given string with their finger.

[9] See Rebecca Saunders, Crimson for Solo Piano (2004–05), viewable online at www.youtube.com/watch?v=lut4xvztISk.

[10] Details such as fluctuations in speed and the use of erratic or non-uniform motions are near impossible to notate upon this model.

Some early examples that begin to significantly shift the existing notational model include Earle Brown's *Folio and 4 Systems* (1952–54), György Ligeti's *Volumina* (1962), Helmut Lachenmann's *Guero* (1969, rev. 1988), and George Crumb's *Makrokosmos* (1972–79).[11] In Crumb's *Makrokosmos* series, piano preparations, use of harmonics, glissandi over the strings, and use of objects upon the strings are communicated through a radical notation (see Fig. 3) that includes staves that twist, loop, and retrograde upon themselves, as well as auxiliary staves that indicate vertical movement upon the strings.[12] It is the more extensive use of auxiliary staves—for actions such as tapping the surface of the piano, vertical and circular strumming of the strings, and the use of objects upon the strings that distort performed keyboard notes[13]—which provides the notational model that I will eventually build upon. In both the pieces by Brown and Ligeti mentioned above, lines and shapes of varying thickness, lengths, and verticality, abstract the pitch parameter into a system based upon visual interpretation. In Lachenmann's *Guero*, a large open stave is used to map the entire length of the keyboard with lines (amongst other score elements)

Figure 3. Crumb, *Makrokosmos* II, No. 4: 'Twin Suns', p. 10



[11] Earle Brown, *Folio and 4 Systems* (New York: AMP/G. Schirmer, 1954); György Ligeti, *Volumina* (Leipzig: Edition Peters, 1966); Helmut Lachenmann, *Guero* (Wiesbaden: Breitkopf, 1980); George Crumb, *Makrokosmos* (vols I & II) (New York: Peters, 1973).

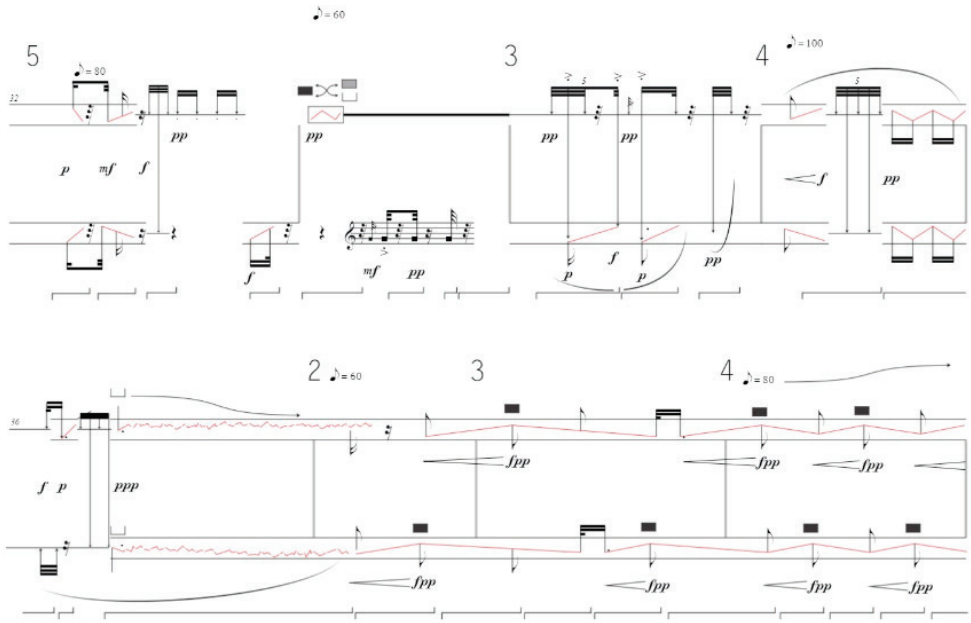
[12] The use of a similar notational complexity begins in the fourteenth century with the Ars subtilior style. See Anne Stone, 'Ars Subtilior,' in *Cambridge History of Medieval Music*, ed. Mark Everist and Thomas Forrest Kelly (Cambridge: CUP, 2018), 1125–46.

[13] See *Makrokosmos* I, 6. 'Night-spell I,' where a three-line stave is used to indicate the use of the left and right hand on the metal crossbeam and the soundboard; Makrokosmos I, 7, 'Music of shadows' and Makrokosmos II. 4, 'Twin suns' (shown in Fig. 3); Makrokosmos II, 5, 'Ghost-Nocturne: For the Druids of Stonehenge.'

indicating lateral motion and speed across the geography of the keyboard. For my own notation, the adoption of lines, graphics, and removal of the five-line stave assists in diminishing the topography of the keyboard as a stronghold for pitch-centred ideas.

More recently, Michelle Agnes Magalhaes' *Snow Soul* (2022) uses two grand staves, one for the piano keys and the other for the strings.[14] This notation visually conveys an equal distribution between both keyboard and the strings, allowing for greater scope for exploration inside the piano and the opportunity for simultaneous activity across both parameters. The aligning of a notation that reflects the geography of the piano, here the keyboard and strings, is a central aim of my notational model. Finally, two examples that focus almost entirely upon objects within the body of the piano are Santiago Díez-Fischer's *one poetic switch* (2014) and Elena Rykova's *101% mind uploading* (2015).[15] Díez-Fischer maps three objects placed inside the piano that are then rubbed, struck, bowed, and distorted by performed keyboard notes, whereas Rykova creates a quasi-operating theatre upon the piano, using mallets, ebows, wires, guitar slides, vibrating objects, and extensive preparations.[16] Where Rykova completely abandons traditional staves, opting for a notation that is visually rich with illustrations, graphic elements, and textured lines, Díez-Fischer uses a notation that is closer to my own, using independent staves to indicate the location of objects upon the strings, their movement (indicated by lines), the amount of pressure used (indicated by shaded boxes), and performed notes that are then distorted (indicated by square-noteheads). An example of Díez-Fischer's notation can be seen in Figure 4.

Figure 4. Díez-Fischer's *one poetic switch* (self-published, 2014), 5. Reproduced with permission.



[14] Michelle Agnes, Snow Soul (Babelscores [online], 2022), www.babelscores.com/catalogs/instrumental/7536-snow-soul7536.

[15] Díez-Fischer, *one poetic switch*, YouTube, https://youtu.be/0vOU6jBY-Ss; Rykova, *101% mind uploading*, YouTube, https://youtu.be/YaIfjoKnU6Q. Both videos have the score overlaid.

[16] Although appearing as a live dissection of the piano, Rykova describes the work as exploration of intention, interaction, and focused listening in an attempt to get the piano to respond. See Elena Rykova '101% mind uploading (2015)' [programme note], www.elenarykova.rocks/101-mind-uploading.

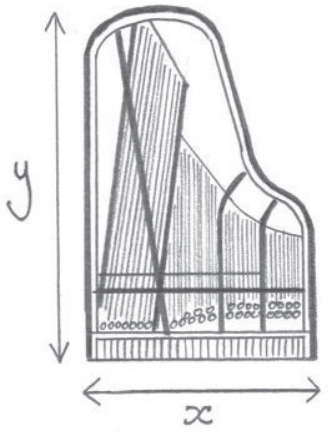
Towards a Model

What might a notation that captures the entirety of the piano look like? It would need to capture the materials of the instrument's body, the entire length of the strings, the mechanism of the keys, the hammers, the dampers, and include allowances for preparations. It would need to decentralise the keyboard without completely abandoning it as a parameter: a notation and lens that, at least for my own needs, allows for the possibility to destabilise and distort pitch, timbral transformation, manipulations of the strings, and invites new ways for thinking about piano technique. This has been the subject of exploration, firstly in 2020 with *Nest of gravel* for piano and percussion, and more recently in 2023 with my set of miniatures *Fourteen piano transcriptions from across the plane [plain]* (hereafter *across the plane*). Both works were developed with pianist Alex Raineri, whose close collaborative relationship, patience, and experimentation must be acknowledged and thanked.

The x-y axis

Encapsulating both a compositional lens (and, by extension, an improvisational and performance lens) as well as a notational model that coherently enables an array of different actions upon the entire body of the piano, a Cartesian coordinate system is mapped upon the piano using an x and y axis (hereafter referred to as an x-y axis).[17] As illustrated in Figure 5, the x-axis maps the horizontal movement from where the pianist is traditionally seated, whereas the y-axis maps the vertical movement from front to back of the instrument.

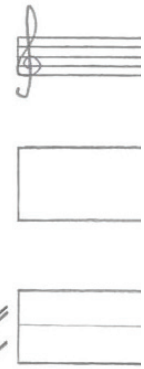
Figure 5. An x-y axis mapped across the body of the piano. Illustration: J. Bragg.



The x-axis incorporates the entire width of the piano. Depending on the corresponding y-axis, this could map the keyboard from low to high notes, map horizontal movement inside the piano moving from low to high strings, or between the regions demarked by the beams. Alternatively, one could map the entire instrument and include movement from rim to soundboard, strings and beams, and back to rim. The x-axis can be notated via three primary methods; these are illustrated in Figure 6.

[17] Developed by René Descartes in the seventeenth century, the Cartesian coordinate system is used to map objects uniquely in multidimensional space alongside the realisation of mathematical problems in areas such as geometry, algebra, and calculus. See 'Cartesian coordinates,' *Oxford Reference*, www.oxfordreference.com/view/10.1093/oi/authority.20110803095552345.

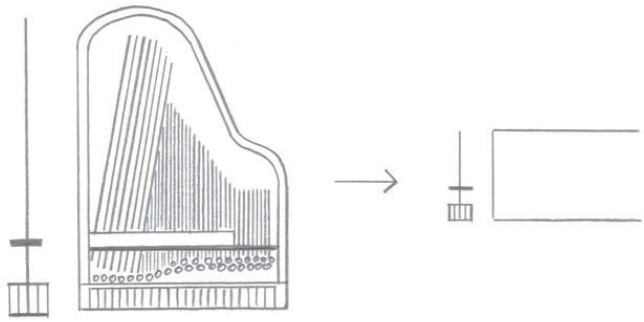
Figure 6. Methods of notating the x-axis



1. The traditional five-line stave. This remains one of the most effective ways to indicate specific pitches when moving across the keyboard or strings.
2. A wide two-line stave with the upper line indicating the highest extreme (pitch or region) and the lower line indicating the lowest extreme (pitch or region) upon the x-axis.[18]
3. A wide, multi-line stave with each space indicating a different region inside the piano, for example, the lower space indicating the monochord strings and the upper space the bichord strings.[19] This method appears in Figure 6, further illustrated via the single and double dashed lines.

The y-axis maps the entire length of the piano. Depending on the corresponding x-axis, the y-axis could include the length of the strings from dampers to the bridge, or even the entire length of the piano, comprising the keyboard, lid, tuning pins, strings in front of the hammers, beam, dampers, the full length of the strings behind the dampers, bridge, hitch pin, and finally the frame. The y-axis can be notated via a wide two-line stave with the extremes dependant on the desired y-axis parameters. For my purposes, I utilise a wide two-line stave with a graphic that illustrates the desired components of this axis. The top line indicates the furthest point the performer can reach along the string, a lower horizontal line indicating the hammers, a small space below indicating the small region of strings between the beam and pins, and below this the keyboard (see Fig. 7).

Figure 7. A custom graphic is used to map the y-axis upon an open stave. Illustration: J. Bragg.



With both axes, a two-dimensional space can be explored across the piano. The notation maps physical movement, a quasi-tablature across the body of the instrument, rather than conveying the resultant sound. This approach, with a focus upon physical action, the geography of the instrument, and reduction of multi-dimensional movements upon a two-dimensional notational image, is not unlike the multi-parametric notation discussed in *Constraint Schemata, Multi-axis Movement Modeling, and Unified, Multi-parametric Notation for Strings and Voices* by

[18] This is similar to Browne's *Folio and 4 Systems*.

[19] Similar models exist in which the inside of the piano is divided into zones. See Maja Bosnić's recent work *A/C Modulations* (2018), https://youtu.be/xbR3gUHpnAg.

Aaron Cassidy.[20] Cassidy maps vertical, horizontal, and lateral movements of both fingers and bow across the entire body of a stringed instrument, unified onto a multi-coloured, multi-staved score.[21] Despite this notation being developed for strings, it became a vital reference in the development of the notational model discussed here.

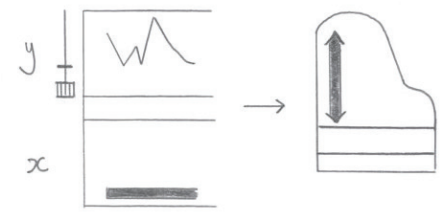
In exploring musical material across a two-dimensional space, both the x-axis and y-axis must always be present. Any vertical movement up and down the piano requires an x-axis indication to illustrate where this must occur, for example, upon the higher strings. Likewise, any horizontal movement requires a y-axis indication to illustrate where this must occur, for example, upon the keyboard, hammers, or strings.

With this method, it becomes apparent that there are broadly three different relationships that will occur across the x-y axis (these are also illustrated in Fig. 8):

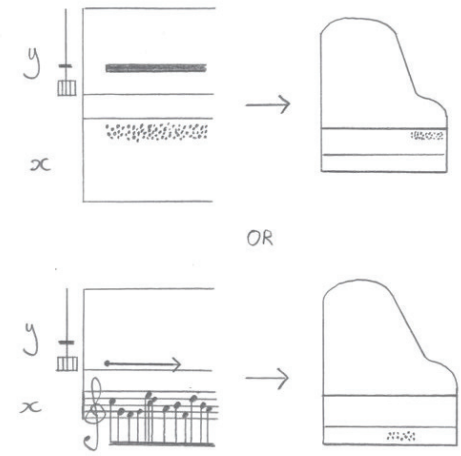
1. primary activity is indicated upon the y-axis with the horizontal position of this activity indicated via the x-axis.
2. primary activity is indicated upon the x-axis with the vertical position of this activity indicated via the y-axis.
3. both x- and y-axis contain activity with the performer navigating across a changing two-dimensional space. This compositional space is arguably the most interesting, as both axes contribute to an ever-changing material space.

Figure 8. Examples illustrating the three different relationships that can occur across the x-y axis. Illustrations: J. Bragg.

1.



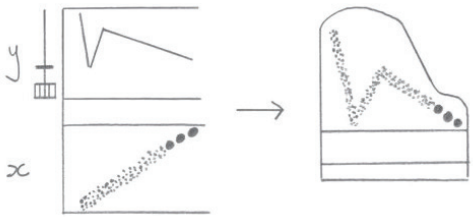
2.



[20] Aaron Cassidy, 'Constraint Schemata, Multi-axis Movement Modeling, and Unified, Multi-parametric Notation for Strings and Voices,' *Journal for New Music and Culture*, 10 (2013): 1–24.

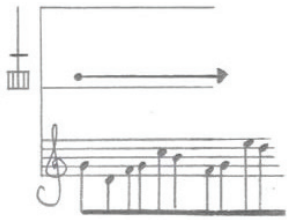
[21] See Aaron Cassidy, Second String Quartet (2010), aaroncassidy.com/product/second-string-quartet.

3.



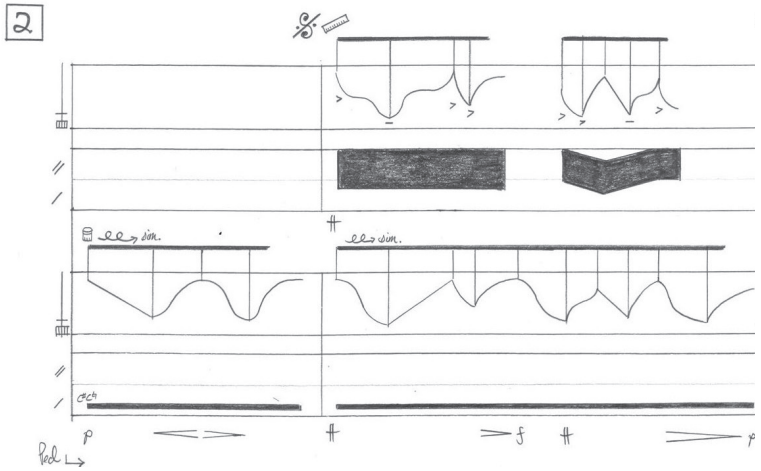
For regions of activity that remain the same for any significant length of time, an arrow can be used with the stave being cut away to reduce needless notational information. This is illustrated in Figure 9. Additionally, for ease of reading, the y-axis is always located above, and the x-axis located below.[22]

Figure 9. The region of the keyboard is indicated upon y-axis with an arrow indicating that this continues as the stave is cut away. Illustration: J. Bragg.



The use of the x-y axis can be performed by one hand or both. For many types of activity, one hand is sufficient, leaving the other hand to have its own independent x-y axis. This way, an x-y axis for each hand can be used much like the traditional grand stave, where the treble and bass broadly align with each hand. This is illustrated in Figure 10, bar 2. Here, both hands use their own x-y axis, moving in a heterophonic-like manner: one hand uses a ruler to scrape up and down over a large cluster of strings, while the other moves a glass jar up and down the lowest C and C-sharp strings.

Figure 10. An excerpt from Transcription 2 of *across the plane* illustrating the use of separate x-y axes for each hand



[22] This is in line with many of the examples already discussed, where manipulations of the strings (the y-axis) are often placed above the five-line stave (the x-axis).

Despite the appearance of reducing all activity to either being vertical (y-axis) or horizontal (x-axis), a variety of different parameters can be mapped using this notation. In listing some of these, it is worth stating that this notational model is still temporal based, with the performer reading left to right through time. These parameters include:

1. Object. This will reflect the position, placement, and manipulation required to achieve the following four parameters. The object could be the performer's finger, palm, or the use of an implement (for example, Fig. 10 demonstrates the use of a glass jar on the lower axis and ruler on the upper axis).
2. Direction. For the y-axis, this is either up or down, for the x-axis, left or right.
3. Speed. This is indicated via the gradient of any cluster or line, or the density of individual noteheads or pixelated figures.
4. Range. This is indicated by the vertical space of any cluster, line, or notes.
5. Pressure. This can be indicated via traditional dynamics or by using a graphic. One such graphic could be a shaded box, in which fully shaded indicates maximum pressure and completely unshaded indicates minimum pressure (see Fig. 11).[23]
6. Temporal space. This can be indicated via rhythmic notation, time signatures, and tempo markings, or via space-time notation.[24]

Figure 11. Pressure could be notated via a graphic or by regular dynamics. Illustration: J. Bragg.

Figures 12 and 13 illustrate how many of these parameters are mapped upon each axis. On the y-axis (Fig. 12), letter A indicates the use of a ruler (object), with letter B indicating direction, speed, and range. The direction is downward, the gentle gradient indicates a slow speed, and the thinness of the line indicates only a small surface area (range) of the ruler is to be used. At letter C, the speed and surface area increase, moving upward then downward again. On the x-axis (Fig. 13), the hand is used (letter A) to perform a narrow cluster (range) at letter B, slowly moving up the keyboard or strings.[25] At letter C, the cluster swells and quickly moves back down, leading to dense pixelated-like figures, rapidly thinning out and moving to the highest extreme. In both of these examples, the accompanying axis is left out to ensure simplicity. Additionally, pressure and temporal indications are left out. One could see how dynamic markings or graphic indications could be placed below each axis to indicate pressure, with a time stamp or the use of stems and beamed rhythms above to indicate movement through time.

Regarding the position of the hands, like the traditional grand stave, it is preferable for the top x-y axis to engage the right hand, and the lower x-y axis, the left hand. However, the

[23] This style of notation is used in Díez-Fischer's *one poetic switch* (see fn. 15).

[24] Where the horizontal spacing of a given note or line is directly related to its perceived duration (a short distance results in a short duration, a large distance results in a longer duration).

[25] Without the y-axis it is ambiguous if this is upon the keyboard, the strings, or another region of the piano.

Figure 12. An example y-axis demonstrating a variety of different musical parameters. Illustration: J. Bragg.

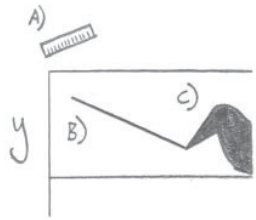
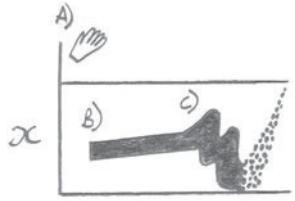
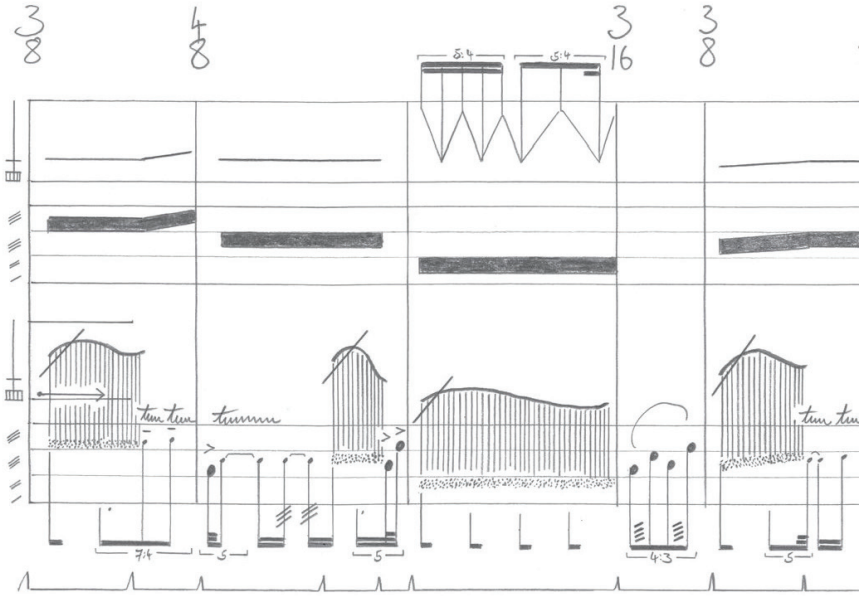


Figure 13. An example x-axis demonstrating a variety of different musical parameters. Illustration: J. Bragg.



performer is free to switch between hands to better fit performative material as needed. In some instances where it is unclear as to which hand should perform which x-y axis stave, it may be simpler to display each based upon a hierarchy of layers. This can be seen in Figure 14, where the lower x-y axis functions as a primary layer while the upper x-y axis provides a secondary, distorting and supporting layer. Although one could play the top line with the right hand and the lower with the left, I personally prefer using my right on the more detailed, lower x-y axis. In circumstances of ambiguity like this, I have opted to keep the primary layer within the lower x-y axis and use the upper x-y axis for secondary layers. This is similar to how Crumb notates strumming of strings in the lower circle of Figure 3, whereupon activity inside the piano is often notated above and keyboard activity is notated below.

Figure 14. An excerpt from Transcription 5 of *across the plane*



Transcription as a Model

In analysing the effectiveness of this notational model to generate new ideas, re-think performance technique, and act as a useful and coherent notation, I adopted a model of transcription. Through transcription, I could generate a new work for solo piano through a process of improvisation, using the x-y axis as a mapping space for material, and in the creation of a final notational space. This involved:

1. Generating musical ideas and possible departure points for improvisation. This uses the x-y axis as a lens in which to view material upon the piano.
2. Testing these ideas out on the piano and ensuring playability.
3. Video-recording a performance of these improvisations.
4. Referring to the recording and video, using the x-y axis model to notate the results.

The process of translating an improvised or composed work ('the musical imaginary') into a graphical and instructive resource (the score) requires breaking musical matter into a number of 'chrono-acoustic categories' determined by the transcriber.[26] Transcription, therefore, is contingent upon the musical parameters that the transcriber wishes to convey. This process is a key component of Julio Estrada's compositional practice, upon which a three-dimensional trajectory of frequency (pitch), harmonic content (timbre), and amplitude (dynamics) is used to map musical material.[27] The resultant transcribed multi-dimensional score becomes a new version of the original, from which a new musical performance is rendered. This is comparable to the process I undertook in creating *across the plane*. The parameters I wish to convey are largely derived from the x-y axis notation, that is, the vertical and horizontal movement of material across the piano. As previously discussed, this notation also includes documenting the object used, speed, range, pressure, and the addition of pedal action and emphasis of attack (via articulation). The temporal aspect is notated either via space-time notation, with time indications given in seconds, or via more traditional means using Western rhythmic notation, with bars as containers of certain rhythmic activity and the use of a tempo indication. Lastly, it should be added that this procedure of transcription involved varying degrees of compositional impulses, with adjustments, extensions, and extractions made throughout the process. Through listening, re-listening, tracing of movement, and innate imperfections of memory, the result is a highly personal refraction: a new work that is both dependant and independent upon the original improvisations.

The resultant work is eight miniatures (transcriptions), each exploring an array of performance techniques, objects, preparations, and ways of navigating the geography of the piano. The work also explores the type of material that I outlined in the introduction, that is, microtones, glissandi, timbral transformations, destabilisation, and distortion.

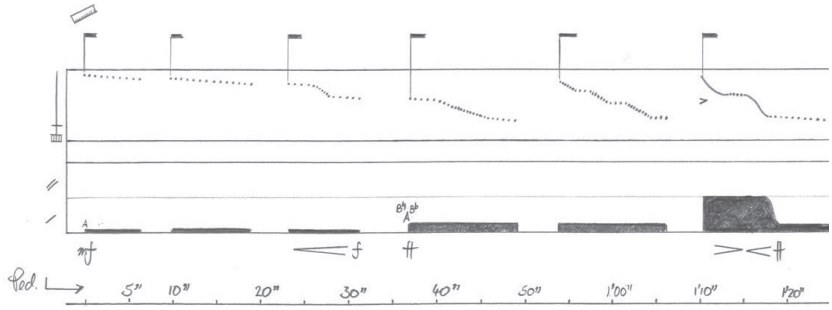
Examples from *across the plane*

Building upon my earlier work, *Nest of gravel* (2020), I make significant use of scraping actions using a small plastic ruler. With the x-y axis notation effectively conveying the placement, movement, and interaction of the ruler with other activities, I discovered a variety of distinct

[26] For discussion of these terms, see Julio Estrada, 'Focusing on Freedom and Movement in Music: Methods of Transcription Inside a Continuum of Rhythm and Sound,' *Perspectives of New Music*, 40.1 (2002): 70.
[27] Estrada, 'Focusing on Freedom and Movement,' 78.

musical figures that this seemingly simple object could perform. In exploring this potential, Transcription 1 (see Fig. 15) begins with a slow 'biting' upon each groove of the lowest string of the piano. At the third figure, the speed of this movement begins to increase, thereby losing the sonic isolation of each groove and creating a sort of slippage. This progresses to an increasing band of strings, from a cluster of three to the entire range of the monochord strings, the result of which is a cacophony of buzzing tactility. Throughout this transcription, only one x-y axis is used, with the focus being upon the movement of the ruler across the strings. Time stamp indications are given to allow for open containers of time, in which the performer executes each scraping gesture.

Figure 15. An excerpt from Transcription 1 of *across the plane* illustrating the use of a ruler upon the strings



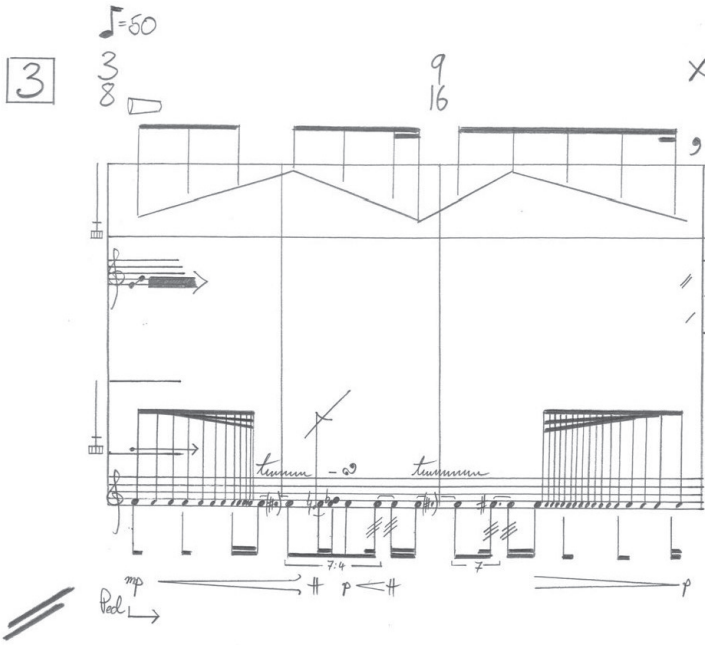
Transcription 5 (see Fig. 14, earlier) brings together two axes, with the upper hand engaging the ruler to distort the keyboard-based notes of the lower hand. In this transcription, the upper x-y axis features the exploration of a more dynamic two-dimensional space, with both x- and y-axis in states of change (see both 3/8 bars). Here, both the vertical position and the horizontal position of the ruler change as the cluster of pitches mute and distort the keyboard-based notes on the lower x-y axis. As the ruler is moved, a subtle transformation of timbre occurs as different harmonic nodes are engaged, and a subtle scratching occurs upon the strings. Like the previous example, this transcription does away with the traditional five-line stave in favour of one that maps the different regions of the strings. As seen in both x-axes, the lowest space indicates the lowest region of the piano, the monochord and bichord strings (as illustrated by the single and double dashed lines); the middle space indicates the first set of trichord strings; and the upper space indicates the next set of trichord strings (illustrated by triple dashed lines).[28] The result is an x-axis that navigates a freedom of pitches based upon register and the geography of the piano, demarked by the beams. If these regions were ignored, it is likely that some performed notes, those of which have the strings running underneath the beam, will be out of reach and therefore undistorted by the ruler.

Transcriptions 3 and 7 use the drinking glass to further explore the destabilisation of pitch, creating a glissando and significantly altered timbral identity of the keyboard. In both of these transcriptions, the upper y-axis indicates the vertical movement of the drinking glass, while the upper x-axis indicates the pitch range affected. The lower y-axis indicates the use of the

[28] Each of these regions is demarked by the beams inside the piano. It is important to know the make and model of the piano one is writing for, as each will have slightly or significantly different geography.

keyboard, while the lower x-axis uses a traditional five-line stave.[29] In Transcription 3 (Figure 16), an activation of pitch and rhythmic material, compounded by the glissandi of the rolled drinking glass, contributes to a highly ornamental texture.[30] Here, activity is focused upon two axes: the upper y-axis of the right hand and the lower x-axis of the left hand. The upper y-axis indicates the rolling of the drinking glass up and down the strings, with the accompanying x-axis determining which strings this should affect. As this x-axis position does not change, an arrow is used to indicate that this continues with the axis that is then cut away. The lower y-axis indicates the keyboard, also using an arrow and then cut away, leaving the lower x-axis to contain the majority of activity.

Figure 16. An excerpt from Transcription 3 of *across the plane*



The entirety of *across the plane* uses a variety of objects, both upon the strings and keyboard, all of which further expand the timbral identity of the piano. In addition to the ruler and drinking glass (used both as a preparation and to create a glissando effect), other objects include a small glass jar with grooves (a timbral glue between the scraping of the ruler and glissandi of the drinking glass), a curved and smooth metal tool that is brushed lightly up and down the strings, and the fingers and palms. With the decentralisation of the keyboard as only a subcomponent of a single axis, the use of objects and different materials—not only upon the strings, but upon all available surfaces of the piano—becomes a focus. As a result, all transcriptions make use of the inside of the piano, with only the last transcription using certain pitches free from manipulations or preparations.

[29] For the use of specific pitches, the traditional five-line stave likely remains the most effective.

[30] I argue that ornamentation is a behavioural phenomenon rather than an object-based one. That is, ornamentation is not defined by the use of individual figures and historic gestures, but by a behaviour of active, compact, articulating, and organic musical ideas. This forms a significant component of my forthcoming doctoral thesis at the University of Huddersfield.

Reflection

An x-y axis notational model redistributes the geography of the piano away from the keyboard and towards the body of the instrument. It enables multiple parameters to be displayed coherently within a two-dimensional space and allows for a more exploratory navigation of the piano. For myself, it has rekindled a passion for writing for, and improvising on, the piano. However, like the historical notation models outlined earlier, an x-y axis also preferences a very particular set of activities and techniques, while falling short for others. Some of these shortcomings include:

1. Exclusive keyboard-based activity. In this scenario, the score would be needlessly prescriptive, and would need to indicate the y-axis as only engaging the keyboard before it is cut away.
2. Extensive preparations. A list of each preparation, its position, and string designation will still be required as in many of Cage's works.[31] For a scenario where almost every string is prepared, the y-axis would need to be prohibitively larger with exhaustive amounts of information displayed.
3. Custom multi-parametric notation. This notational model preferences parameters aligned with movement across the piano, with the addition of relatively unintrusive score elements such as dynamics, pedal markings, graphics, rhythmic information, time signatures, and articulation. Where parameters such as finger pressure,[32] the use of multiple objects, their weight and tilt, or the use of other body parts are desired, this notation may be unsuitable.
4. Performativity. This notational model is still predicated upon a concert scenario in which the performer is stationed at the piano, and in which activity is confined to the piano. For physical actions not directly contained within the piano, such as elements of theatre, dance, or movement, the use of graphics or symbols may need to be employed outside of the x-y axis. Illustrations and instructions such as those found in the aforementioned *101% mind uploading* by Elena Rykova could be placed above the x-y axis, or they could entirely replace it where needed.

Despite the inability of the x-y axis notation to fit all purposes, in reality, no notation does. Each notational model preferences a certain archetype of performance technique and cultural normality, with embedded aesthetics, styles, genres, and sensibilities. The goal for this model is to reorient performance and compositional possibilities on the piano, embrace the entire body of the instrument, and more personally, to discover a way to map the types of musical materials that I am interested in.

About the Author
Jakob Bragg is a composer, educator, and researcher undertaking a PhD at the University of Huddersfield, UK. He holds a Bachelor's degree in composition from the Queensland Conservatorium, Griffith University, and a Master's degree in composition from the University of Melbourne.

[31] See, for example, Cage, *Bacchanale*.
[32] See, for example, Adrian Kleinlosen, *...tönend bewegt…*, YouTube, https://youtu.be/ExpepmyDVsM.