

# GRANULAR POEM PROJECT: A DIGITAL SCORE BASED ON DECONSTRUCTION OF CHINESE IDIOMS

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## ABSTRACT

We have established a reusable and iterative digital score [1] system, with Chinese four-character idioms at its core, enabling a collaboration between humans and artificial intelligence around selected idioms. Each entity engages in imagination and computation in its own unique way, facilitating spontaneous improvisation based on the mutual outputs. In this system, we have incorporated two models that we independently developed and trained: an AI-assisted modern Chinese poetry generation system and an AI-assisted piano MIDI generation system. Simultaneously, human participation in this musicking [2] process takes two forms. First, human performers interpret graphic scores designed for the selected idioms, engaging in improvisations. Second, audience representative contribute by providing real-time feedback through EEG brainwave signals, actively participating in the creative process. This system explores and expands the ways in which composers create with the assistance of computational tools. Humans and artificial intelligence, converging around a shared theme, dance in mutual reflection on the aesthetic level, making the process itself profoundly poetic. Also, it is the deep involvement of both humans and artificial intelligence that establishes this digital score and gives it its unique characteristics.

In this context, "deconstruction" refers to the process of subjecting the Chinese idioms selected in the Granular Poem Project to a series of direct and indirect processing steps, breaking them down into their constituent parts for the purpose of recombination, transformation, or reinterpretation. This process includes converting the idioms into modern poetry, musical fragments, and symbolically notated scores, as well as using these scores in improvised performances and selecting the next idiom to be processed based on brainwave activity. The aim of this deconstruction process is to reconsider and reinterpret the meaning and significance of idioms from different perspectives, in order to create new artistic forms and experiences.

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## 1. INTRODUCTION

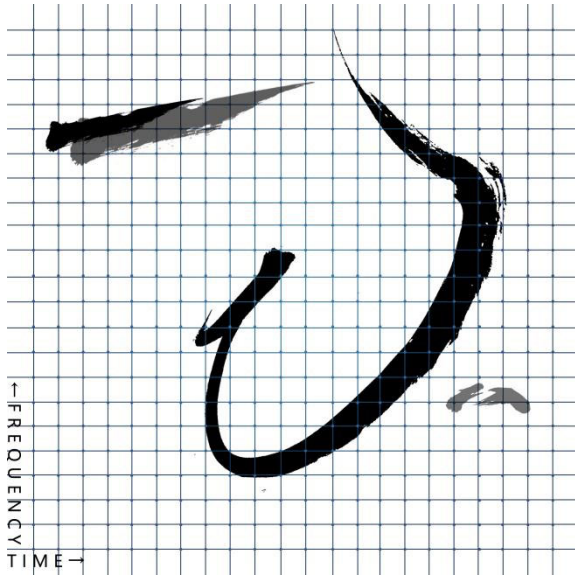
The Granular Poem Project aims to utilize a combination of technology and art, employing digital score as a medium to interpret and propagate Chinese culture. At its core, the project focuses on Chinese idioms, which constitute a unique form of fixed expressions typically comprised of four characters, each carrying distinctive meanings. Originating from ancient literary works, historical anecdotes, and folklore, idioms encompass profound cultural connotations, serving as integral components of the Chinese language and culture. In the Granular Poem Project, selected idioms, chosen as themes, provide essential material for deconstruction. The term 'granular' in the project title encapsulates the essence of its deconstructive processes.

Within the Granular Poem Project, chosen idioms undergo three direct deconstructions and two indirect deconstructions. The three direct deconstructions involve artificial intelligence generating modern poetry based on idioms, generating piano MIDI segments, and a composer disassembling and reassembling the Chinese characters' strokes of idioms into a graphic score. The two indirect deconstructions involve performers improvising based on the symbolic musical score, and audience wearing EEG devices selecting the next idiom for deconstruction based on their brainwave states during music appreciation. The multidimensional involvement of both artificial intelligence and human participants is a unique aspect of the Granular Poem Project as a musicking process.

The term "granular", borrowed from the technique of granular synthesis and incorporated into the project's title, succinctly encapsulates the deconstructive processes described above. In the realm of electronic music, granular synthesis involves generating small particles from a whole (deconstructing), which are then creatively reassembled by musicians to produce innovative sounds (poetic outcomes) [3]. In other words, the poetic essence of the term 'granular' lies in the freedom of imagination it grants to participants in this musicking process.

## 2. PROCESS OF DECONSTRUCTION

Firstly, idioms are concretely deconstructed in the process of generating poetry through artificial intelligence. Although idioms, consisting of four characters, are rich in meaning, their highly condensed form makes them abstract



**Figure 1.** Example of graphical score made of calligraphy strokes. Each horizontal grid represents 2 seconds, and each vertical grid represents a range from 200 Hz to 1000 Hz, subject to the performer's discretion and the characteristics of the instrument.

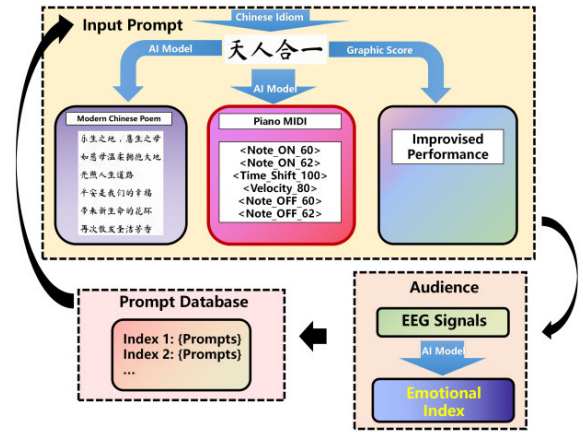
and not easily understood. With the assistance of AI, idioms are treated as seeds that grow into modern poetry, complete with concrete scenes, images, and details. This transformation from abstract concepts to tangible elements imparts poetic qualities to idioms while making them more accessible.

The second form of deconstruction applied to the selected idioms is abstraction. Idioms are transformed into MIDI events and further extended through artificial intelligence to generate audio, becoming part of a musical performance. At this point, written symbols are converted into audible sounds, marking the second level of poeticization.

The third level of deconstruction is carried out through graphical symbolization. The brushstrokes of Chinese characters in calligraphy fonts inherently possess a dynamic quality in space and time. In this project, after deconstruction, transformation, and reassembly, these strokes are placed on a canvas with frequency and time domain coordinates. Performers can then engage in improvisational play based on their understanding of music and symbols.

In the example in Fig. 1, the intensity of stroke color represents the magnitude of amplitude. The vertical position of strokes in the composition signifies frequency, while the horizontal extension of strokes reflects the duration of time. These prescriptive representations provide the performer with a space for exploration of imagination, serving as a bridge to achieve the ultimate expression of sound.

Following these three direct deconstructions, there are two indirect deconstructions by performers and audiences: firstly, performers engage in improvisational play by reading graphic score derived from Chinese character strokes.



**Figure 2.** Digital Score framework of this project. The idiom we used is “天人合一” (oneness of heaven and man) [4]. The translation of the modern Chinese poem generated with AI assistance is as follows:

*The land of joyous vitality,  
The mother of grace and favor,  
Like a gentle mother embracing the earth,  
Lighting the path of human existence.  
Peace is our happiness,  
Bringing a garland of new life,  
Once again radiating a fragrance of purity.*

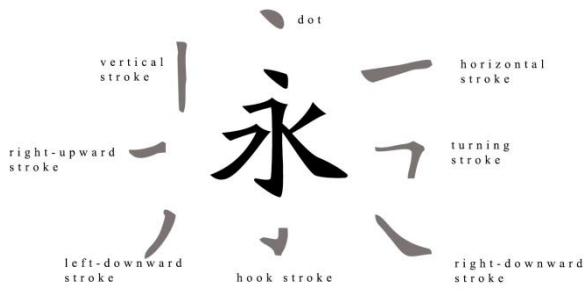
The sound produced during this improvisation, along with the sounds from the three direct deconstructions, is appreciated by the audience wearing EEG device. The audience's EEG signals, generated while appreciating the sounds, represent another indirect deconstruction of the idioms. The audience's EEG signals determine the next idiom to be deconstructed. Thus, the audience actively participates in the entire construction process of the music.

### 3. CONSTRUCTING THE SYSTEM

#### 3.1. AI-Assisted Modern Poetry Generation

We adopt Lingxi, an AI-assisted modern Chinese poetry generation system [5] to generate poetry from the input prompt (Fig. 2). The system has the following features. For one hand, it incorporates an auto-regressive Transformer language model that was pretrained on a corpus containing more than 3,000 books of Chinese novels, and was fine-tuned on more than 220,000 passages of modern Chinese poetry. For another, it features a novel Chinese word segmentation method as well as a set of novel sampling algorithms to promote the performance of the system. It also has a publicly available link (<http://lingxi.website>).

These above features provide convenience for our composition. We utilize the tokenization function of Lingxi to convert the input prompt into a series of tokens. These tokens are used as starting tokens for the language model to predict and generate remaining tokens, which is converted



**Figure 3.** The character “永(yong)” demonstrates the eight fundamental strokes. The numbers in the picture above show the writing order of the strokes.

back to a passage of Chinese poetry as the first type of interpretation of the prompt by the AI model.

### 3.2. AI-Assisted Piano MIDI Generation

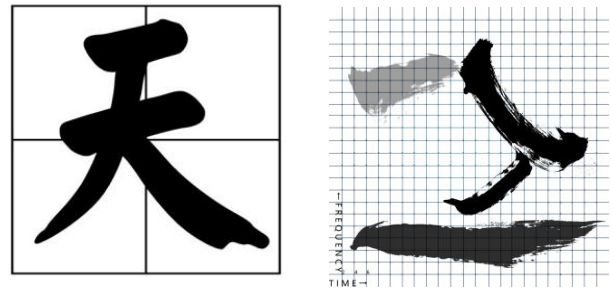
Imitating the modern poetry generation paradigm, we train a parallel auto-regressive Transformer language model on the MAESTRO dataset [6]. It is a large scale piano MIDI music corpus with performance information. With the trained language model, it can generate piano MIDI music with performance information, upon which we utilize FluidSynth (<https://www.fluidsynth.org/>) to convert MIDI signals into audio files. To form a unified framework with poetry generation, we use the paradigm of natural language to build the tokenizer for piano MIDI music. We treat each MIDI event on the MAESTRO dataset as a single Chinese word, and use SentencePiece model [7] to aggregate high frequency combination of “words” into compound words. This results in a vocabulary of 32,000 size. With such vocabulary, the input prompt of the poetry can be mapped into MIDI event(s), upon which a MIDI signal can be generated by the trained language model. The final audio MIDI music file is regarded as the second type of interpretation of the prompt by the AI model.

### 3.3. AI-Assisted Emotion Detection From EEG Signal

The audience listens to the joint performance on the stage with an EEG equipment to record and send the EEG signal to the server. In such scenario, we seek to unearth the emotional information of the audience in the EEG signal. To detect the emotional index from the EEG, we train a classification model with a publicly available EEG dataset with emotion labels. With the trained model, we may infer the emotion of the audience from its EEG signal. Then, we use the inferred emotional index to determine a corresponding prompt from the candidates set, which serves as the input of the next round of performance.

### 3.4. Graphic Score Using Chinese Brushstrokes

The basic strokes of traditional Chinese characters are eight in number, namely dot (·), horizontal stroke (一), turning stroke (㇏), vertical stroke (丨), hook stroke (㇇),



**Figure 4.** The printed form of the Chinese character “天(tian)” (left) and the deconstructed brushstrokes as score (right).

right-upward stroke (㇇), left-downward stroke (㇏) and right-downward stroke (㇏). They can be demonstrated using the character “永” (yong) in the so-called formal script [8] (Fig. 3).

Building upon these eight basic strokes, we aim to manifest the musicality and rhythmic essence inherent in Chinese character strokes by further transforming them and visually representing them in a graphic score.

For example, the horizontal stroke (一) exhibits natural variations in calligraphic writing, and if these variations are mapped onto sounds, it can evoke diverse associations and imaginations. Taking the character “天(tian)” (sky/heaven) as an example, this Chinese character consists of two horizontal strokes. The inherent length difference between these two horizontal strokes can convey different musical implications. Building upon this, through processing in software, we can make the musical trends more explicitly enhanced. Additionally, there are two more strokes, namely “撇(pie)” left-downward stroke (㇏) and “捺(na)” right-downward stroke (㇏). These two strokes exhibit a spatial relationship characterized by mutual support and opposing shapes. As these strokes undergo transformation and rearrangement on the canvas, they evolve into a prescriptive score with distinctive Chinese cultural characteristics (Fig. 4).

## 4. PERFORMANCE AND ITERATION

### 4.1. Performance Arrangement

In the Granular Poem Project, there exists an interconnected relationship among idioms, performers, and the audience, facilitated by the assistance of artificial intelligence, forming a chain of influence in the process of music-making.

Concerning idioms, we prepare a minimum of 12 idioms as a dataset for each performance. Each performance will commence with the idiom “天人合一” (oneness of heaven and man). “天人合一” is a philosophical concept rooted in traditional Chinese culture, integrating Daoist, Confucian, and Buddhist thoughts. It emphasizes the harmonious unity between humans and nature, advocating for the integration of humanity with the natural and cosmic realms.

Starting with this idiom represents the worldview of the creator.

As for performers, depending on the practical conditions of each performance, 1 to n performers can be invited to engage in live improvisation based on the graphic score. Simultaneously, the number of audience members wearing EEG collection devices can range from 1 to n.

#### 4.2. Iteration of the Project

In each performance, the sequence of idiom appearances, the number of performers along with their individual interpretations, and the quantity of audience members, each with their own understanding and interpretations, all vary based on the circumstances, providing a fertile ground for the iteration of this project.

Regarding the selection of idioms, the time allocated for the presentation and interpretation of each idiom in every performance is adjusted to 1-3 minutes based on the EEG signals from the audience. Completing the presentation of 4 idioms is considered one full performance. In other words, with a dataset of 12 idioms, if 4 idioms are chosen for each performance, there are 495 different possible combinations. Additionally, more idioms are being deconstructed and added to the dataset.

We will conduct and document multiple performances, observing how different performance combinations influence the iteration, forming a data collection as case studies for the DigiScore project.

### 5. CONCLUSION

The goal of the Granular Poem Project is to merge technology and art, interpreting and disseminating Chinese culture through the medium of digital score. At its core, the project revolves around Chinese idioms and undergoes a multilayered process of deconstruction, employing methods such as artificial intelligence, improvisational performances, and graphic score to present a unique and creative artistic experience. Throughout the process of deconstruction, idioms transition from abstract linguistic forms to concrete poetic lines, then to audible audio expressions, ultimately manifesting on graphic score. This multidimensional deconstruction not only enriches the expressive forms of idioms but also provides audiences with diverse opportunities for participation, perception, and understanding.

The uniqueness of the Granular Poem Project also lies in its fusion of calligraphy and graphic symbols, along with the interaction between performers and audiences, creating a distinctive experience of musicking. Audiences are no longer mere passive listeners but actively engage in the music creation process through brainwave signals, organically contributing feedback for the selection of the next idiom.

The project incorporates fundamental Chinese brushstrokes and elements of Chinese culture, such as the introduction of the concept of "天人合一" (oneness of heaven and man), deeply intertwining with traditional Chinese philosophical thoughts. This cultural amalgamation positions the Granular Poem Project as not only an innovative

blend of technology and art but also a modern interpretation of traditional culture.

The iterative nature of the Granular Poem Project turns each performance into a new exploration. The sequence of idiom appearances, the number of performers, and the level of audience participation all provide fertile ground for project innovation. The observations and recorded data from these performances will serve as valuable material for future research, exploring the impact and evolution of different performance combinations.

In summary, the Granular Poem Project is not just a creative practice in digital score, it is also a unique and profound exploration of Chinese idioms and their cultural connotations. Through this project, we witness the fascinating intersection of technology and art, as well as the organic fusion of Chinese and Western cultures in contemporary art. The reflections on different dimensions formed based on idioms are documented through sound, turning music into an embodiment of intellectual convergence, while also revealing the inherent poetry within [9].

#### Acknowledgments

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