

Tracking Down the Musical Habitus of the Machine

Johannes Treß,

University of Education Freiburg, Germany

Abstract

AI-based applications and content have become integral to our everyday lives, increasingly permeating the field of music education e.g. through algorithmically sorted listening recommendations, AI-generated lesson plans, or audio content on platforms like TikTok and YouTube. These tools rely on machine learning and deep learning, which, despite their statistical foundation, are deeply entangled with social structures. This paper explores the concept of a "musical habitus of the machine," examining how AI-based content inherits classifications, dispositions, and structures in music education. Three examples are analyzed: lesson planning with ChatGPT, image generation via Midjourney, and song production using Suno.ai. The findings highlight that the uncritical use of AI-generated content in music classrooms threatens the diversity of music education, potentially leading to a global homogenization of musical practices. The paper also suggests strategies to preserve diversity and agency in the face of these transformative processes.

Keywords

Digital habitus, music education, AI, bias, critical ed-tech

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I-based applications and content are increasingly woven into the fabric of our daily lives (Bearman and Ajjawi 2023) and therefore impact the realm of music education, as well. This influence is evident in the use of algorithmically-curated recommendations, AI-generated lesson materials, and audio content on platforms like TikTok and YouTube (Seaver 2022). The growing influence of software algorithms on our daily social actions, thoughts, and tastes is no longer a surprise. With the advent of more and more diverse AI-generating software solutions and the promises of commercial providers to simplify or even fully automate tasks such as lesson preparation, songwriting, or image generation, the field of music education is poised for significant transformation (Hadi Mogavi et al. 2024).

As this paper will demonstrate, Pierre Bourdieu's scientific vocabulary offers profound insights related to AI and music education, highlighting the urgent need for empirically grounded knowledge and reflection amid complex socio-technological entanglements of humans and algorithms. Drawing on Bourdieu's oeuvre, the paper explores the concept of "musical habitus of the machine" as it emerges from AI-generated content, examining how embedded music specific classifications, dispositions, structures, and traces impact music education. Employing an ethnographic approach to algorithms (Seaver 2017), three pertinent examples will be analyzed: music lesson planning with ChatGPT, AI-based image generation via Midjourney, and song production using Suno.ai. The analysis is followed by further discussions of possible ways of tackling these transformation processes.

Habitus, Field and Capital: Theoretical Foundations

In response to the call for this special issue, the following insights focus on the relationship between Pierre Bourdieu's theoretical framework, music education, and AI technologies.

Habitus as a Fundamental Principle in the Work of Pierre Bourdieu

The concept of habitus is central to the sociological work of Pierre Bourdieu, one of the most influential sociologists of the 20th century. Although the term itself is part of a discourse that goes back much further (Sterne 2003), we owe Bourdieu the sharpening of theoretical and analytical tools that help us to understand and explain the social world and its mechanisms of power (Swartz 1997, 100–03). Bourdieu refined the concept numerous times (Maton 2012). In one of his later works, he defines habitus as follows:

The conditionings associated with a particular class of conditions of existence produce habitus, systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them. Objectively "regulated" and "regular" without being in any way the product of obedience to rules, they can be collectively orchestrated without being the product of the organizing action of a conductor. (Bourdieu 1990, 53)

According to this definition, habitus refers to the deeply ingrained routines, skills, and schemes that individuals acquire through their life experiences. It is a system of lasting structure that functions at a pre-conscious level, guiding thoughts, perceptions, and actions in a way that is often taken for granted and deeply ingrained in the human body (Bourdieu 1990, 54). At the individual level, a range of actions is made possible within the limits set by one's habitus, facilitating a type of freedom that is contextually constrained (Rehbein 2016, 89). The concept therefore addresses the interplay between individual agency, collective interaction processes, and social structures, providing a framework for understanding how social practices, norms, and power relations are incorporated and reproduced across generations (Edgerton and Roberts 2014, 198). Bourdieu (1977) also emphasizes that emerging habitus are a product of collective history and objective structures (like language, economy, or educational systems) that individuals internalize through socialization.

It is important to mention that the concept represents two sides of the same coin. By "structured structure," Bourdieu (1990) refers to habitus as a system that is structured because it is the result of socialization and influences from specific social conditions. In this context, Bourdieu also speaks of the so-called "opus operatum" (52) as the result and objectifiable dimension of habitus. Habitus in the sense of a "modus operandi" (Bourdieu 1990, 52) or as "structuring structure" implies that it influences how individuals act in the present world (and future), thus contributing to the reproduction of social logics. As mentioned earlier Bourdieu's praxeological approach, emphasizing the interplay between social structures and individual agency, has significantly influenced various academic fields (Maton 2012).

Habitus in Context: The Roles of Field and Capital

In addition to habitus, Bourdieu's concept of field illustrates how social practices are structured in different spheres of life. A field, as defined in Bourdieu's theory, is a structured social space in which individuals and groups interact according to a particular set of rules, norms, and power relations (Bourdieu 1984, 226). Fields, such as those of art, science, education or technology, create their own boundaries and are characterized by a unique logic that governs social interactions within them. Each field is somewhat autonomous and is characterized by internal struggles for influence, power, and authority. Importantly, the fields are not isolated; they are interconnected and overlap with others, allowing influences and resources to flow between them. In these fields, capital—resources or assets that individuals and groups accumulate and use—is essential for navigating and influencing social hierarchies (Swartz 1997, 62). Inside the fields, actors position themselves based on relative forms of capital. Bourdieu distinguishes several types of capital: economic capital, which includes material resources such as money or property; cultural capital, which includes intangible assets such as education, knowledge, and aesthetic preferences; social capital, which refers to social connections and networks; and symbolic capital, which represents prestige and recognition that confer authority within a field. The

value of each form of capital varies according to the specific logic of the field and influences the possibilities for action and influence of an individual or group (Swartz 1997, 75).

The interplay of habitus, field, and capital offers a comprehensive view of social behavior (Bourdieu 1984, 103). Habitus, the deeply ingrained dispositions and practices that individuals develop through socialization, enables actors to instinctively navigate fields. However, within the boundaries of each field—and through the resources available as capital—habitus finds expression and is either strengthened or challenged.

The Habitus Concept in Music Education

One of the first prominent references to Bourdieu's concept of habitus in music education is the work of Rimmer (2006, 2010, 2012). He focused on how musical taste and practice are socially conditioned. Drawing heavily on Bourdieu's work, he elaborated that, as a concept, musical habitus "provides a means of explaining how individuals' relationships to music and their associated embodiment of cultural capital ... enduringly connect to factors associated with their socialization and social locations" (Rimmer 2012, 306). The studies he presented (2006, 2010, 2012) emphasized the role of early life experiences, family and educational backgrounds, and broader socio-historical contexts in shaping musical dispositions. The high relevance of embodied knowledge as a component of habitus, which Bourdieu pointed out several times, proved to be particularly relevant for musical practice and music education related questions. According to Prior (2011), the study of musical habitus also focused on questions "around the enculturation of the musically adept body—a body in which specific musical competences are sedimented through processes of socialization" (130).

While the studies cited so far are more concerned with the enculturation of existing norms, practices, and knowledge, Hall's (2015) work dealt with the emergence of musical habitus of choir boys. She clearly emphasized the transformative power of habitus for choir boys: "The innovative possibilities of habitus are suggested by the boy's creative abilities to dip in and out of cultures narratives of masculinity" (55).

The volume Bourdieu and the Sociology of Music Education, edited by Burnard, Trulsson and Söderman (2015), offered a comprehensive and multifaceted insight into the range of music education research drawing on Bourdieu's concepts and considerations.¹ In the introductory chapter (Söderman et al. 2015), the editors presented major areas through which they categorized the field of music education research with reference to Bourdieu: "Musical Taste and Identity" (5), "Musical Fields" (6-7) and "Musical Rules and Logics" (8-9). The authors emphasized that a music education based on Bourdieu's theoretical foundations places topics such as "social justice, equality, gender, cultural production, power, taste and transformative practice" (10) at the center. By integrating a wide range of musical cultures and practices-including Western classical music, popular music and world music-Burnard and Trulsson (2015) reflected, for example, the cultural hybridity of modern societies and promoted musical inclusivity. Sagiv and Hall (2015) suggested that musical learning only becomes meaningful when connected to students' personal interests and experiences, while opportunities for composing and improvising offer ways to foster creativity and self-expression. At the same time, a music education that drew on Bourdieu's theories suggested a focus on intercultural dialogue and the dismantling of gender stereotypes, with music as a medium for empathy and social justice that at best empowers students to question norms and explore different identities (Hall 2015).

Habitus, Technology, and AI

Even if Bourdieu (1998) only occasionally dealt with technology and aspects of media studies, his work has often been the starting point for sociotechnological questions about the use of technology. Sterne (2003) already emphasized in the early 2000s that the reference to Pierre Bourdieu's social theory can be of great value for technology research. He argued for a "social praxeology of technology," whereby he attached great importance to understanding technologies as "particularly visible sets of crystallized subsets of practices, positions and

dispositions in the habitus" (Sterne 2003, 386). Consequently, many studies in the field of technology research examined human habitus regarding technology use (Costa, Burke, and Murphy 2019; Czerniewicz and Brown 2013; Papacharissi and Easton 2013). Seaver (2017) conceptualized algorithms as integral to culture, shaped not only by rational procedures but also by institutions, people, and the everyday sensemaking as in every aspect of cultural life. This view contrasts with canonical technology-centered perspectives that understand algorithms as abstract procedures outside of human-centered cultural fields.

AI technologies are often at the center of scientific debate on researching algorithmic systems, as they rely on vast amounts of human-created data for training, encompassing text, images, and other media from diverse sources like books, websites, and databases (Hristova 2023). These datasets, often containing billions of examples, enable models to recognize patterns, context, and relationships. The scale of data is critical for the AI's ability to generate meaning-ful and contextually relevant outputs, as it learns by identifying statistical probabilities within these massive corpora. The dependence on immense, curated data highlights both the complexity and human-driven foundation of generative AI development (Airoldi 2022).

The increasing pervasiveness of algorithmic systems in all areas of life is described as "algorithmic culture," for which, according to Hristova (2023), Bourdieu's habitus concept is particularly relevant for deeper understanding. Airoldi's "Machine Habitus" (2022) and Romele's "Digital Habitus" (2024) consequently highlighted the remarkable similarity between AI systems and Bourdieu's concept: While the habitus concept originally focused on human actors, both authors concentrated on the theoretical differentiation of the habitus of algorithmic software systems, which are consequently also referred to as "eminently social animals" (Airoldi 2022, 4). Expanding on Bourdieu's habitus can be defined as the set of cultural dispositions and propensities encoded in a machine learning system through data-driven socialization processes. Since such dispositions and propensities derive from patterns in humangenerated data, they reflect social and cultural regularities crystallized in the machine-readable data contexts used for training and feedback" (113).

Given the expanded concept of machine habitus, it is imperative to consider its implications for music education. This raises the question: What internalized dispositions, schemas, and socio-cultural regularities are encoded in AIgenerated data that bear significance for music education? This inquiry examines a phenomenon, which, building on Airoldi's (2022) definition, can be termed the *musical habitus of the machine*.

Theoretical Underpinnings: Tracing Habitus—Uncovering Dispositions

The various perspectives on habitus discussed above show that Bourdieu's oeuvre provides valuable perspectives that are also of great importance for music education. But even if his theoretical tools offer promising scientific potential, Costa et al. (2019) pointed out that "uncovering habitus is not a straightforward task" (21). The authors mentioned challenges in translating the broad concept into concrete analytical tools and the need to establish diverse methods and definitions of dispositions tailored to the respective research questions. Christin (2020) also stated that the scientific analysis of algorithmic systems and their inherent opacity is a major challenge, since they deal with "complex sociotechnical assemblages involving long chains of actors, technologies, and meanings" (898).

The concept of habitus is closely linked to the question of acquiring and maintaining values, norms, and societal structures. In other words, talking about habitus invokes the processes of socialization and thus also individual and collective learning processes (Nash 2003, 53–54). Accordingly, research referring to Bourdieu's work placed particular attention on the analysis of "durable, transposable dispositions" (Bourdieu 1990, 53), which, according to Bourdieu's definition quoted above, represent an essential ingredient of habitus.

The word "disposition" is frequently used by Bourdieu in various ways, leaving its precise meaning somewhat open. One definition he provided states that it expresses first the result of an organizing action, with a meaning close to that of words such as structure; it also designates a way of being, a habitual state (especially of the body) and, in particular, a predisposition, tendency, propensity or inclination (Bourdieu 1977).

Since the present article focuses on the analysis and differentiation of generative AI data and its specific features, I deal with non-human actors. A focus on the embodied dispositions of habitus in the original sense is therefore unfeasible (Airoldi 2022).² Instead, the specific products generated by AI-based algorithms are regarded as "results of an organizing action" (Bourdieu 1977, 214) that can be interpreted as documents of the habitus of the machine. As already indicated, the inherent generative structures of AI algorithms are abstracted from an extensive data set using comprehensive machine learning processes (Airoldi 2022, 35).

From an analytical perspective, the question now arises: How to trace such a musical habitus of the machine? Seaver (2017, 1) pursued a research approach described as "ethnography of algorithmic systems." Airoldi (2022), too, elaborated on several "research directions for the sociology of algorithms" (151) and proposed "follow the algorithm" and the "machine habitus' dispositions" as one way to analyze "their outputs and predictions to explore how they 'see' the entangled users" (153). Christin (2020) drew on Seaver's (2017) ideas and proposed a strategy that she described as "algorithmic comparison" in order to "shed light not only on the uses of algorithmic systems but also on their inner workings, regardless of how opaque and proprietary they are" (908). By analyzing similarities and differences between algorithms in different contexts, this strategy showed how specific conditions and social factors influenced the functioning and outcomes of algorithmic systems. This approach enabled the identification of patterns and deviations caused by technical and cultural factors and contributed to a deeper understanding of both the general and context-dependent properties of algorithms (Christin 2020).

Following the considerations presented here, various types of AI-generated data were subjected to open coding using qualitative content analysis, followed by a comparative analysis, as described by Kuckartz and Rädiker (2023). This analytical approach facilitated the systematic identification of contrasts and similarities within the data corpus. The combination of open coding and comparative analysis provided a structured framework for comprehending the complexity and diversity of AI-generated content, yielding profound insights into the "predisposition, tendency, propensity or inclination" (Bourdieu 1977, 214) of AI-generated data products with relevance for music education.

Analysis of AI-Generated Content Related to Music Education

The overarching areas of application selected are music lesson planning with ChatGPT, AI-generated images with Midjourney with relevance to music education, and the AI-driven music production platform Suno.ai. The data for this text comes partly from a qualitative interview study on using ChatGPT for music lesson planning (Treß 2024) and from a university seminar with music teacher training students in the summer semester of 2024. The three specific application areas were selected to ensure a high degree of relevance to classroom practice. Both lesson planning and the production of images and visual materials are often described as promising AI applications for the planning and implementation of lessons (Van Den Berg and Du Plessis 2023). The AI songproduction platform Suno.ai was included in the sample to ensure a high degree of data diversity.

In the selection of examples, particular attention was given to choosing samples that were generated with very short and preferably open prompts, providing as little contextual information as possible beforehand. This approach is based on the premise that such open prompts leave a wide range of possible meanings to the AI system, which the algorithm then fills in according to its specific dispositions and the respective machine habitus (Airoldi 2022, 33).

Music Lesson Planning with ChatGPT

ChatGPT is an advanced AI-based text generation platform built on large language models and transformer architecture (Kasneci et al. 2023). The platform processes user-inputted text prompts using a sophisticated model trained on extensive text datasets. This model learns to recognize linguistic patterns, styles, and contextual relationships within the text data, enabling it to generate coherent and contextually relevant texts that align with the semantic content of the input prompts. Although ChatGPT was publicly introduced only two years ago, teachers already consider it to have an irreversible impact on all areas of education, such as classroom learning, assessment, administration and lesson planning (Bower et al. 2024; Van Den Berg and Du Plessis 2023).

The following lesson plans³ serve as an empirical basis for a detailed analysis in this article.

Section	Activities	Time
Introduction	 Greeting and roll call >- Warm-up activity: Listen to a short piece and note observations 	10 minutes
Theory Instruction	 Basic music theory concepts: - Notes and clefs - Note values Time signatures > - Introduce Circle of Fifths and distribute handouts 	15 minutes
Practical Application	 Reading music: - Hand out simple sheet music - Practice reading and clapping rhythms - Demonstrate notes on keyboard/piano - Melody composition: - Break into small groups - Compose a simple melody 	20 minutes
Conclusion	- Groups present their melodies - Recap key points - Assign homework: Practice reading a short piece of music	15 minutes

Music Lesson Plan Table

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Figure 1: ChatGPT prompt: "Plan a music lesson in a regular school"

The first example of a music lesson proposed by ChatGPT focusses on "Basic music theory concepts" (see Figure 1), and the didactic structure adheres to a standardized format. It begins with an introduction, followed by theoretical input, then progresses to "Practical application" of the taught theory, and concludes with a presentation, recap, and a homework task. ChatGPT does not define a specific age group, even in the more detailed chat version of the lesson outline. Although the lesson starts with an open listening exercise, it becomes evident in the subsequent sections that the content provided by the AI is exclusively focusing on "note values," "clefs," "time signatures," and the "circle of fifths." All these contents point to a strong orientation towards Western classical music theory (i.e., conventional forms of notation, time and meter, and functional harmony). It is assumed that the students have acquired basic music theory and practical knowledge in fifteen minutes and are able to sight-read both rhythms and melodies, as is planned in the next phase. Additionally, the use of a piano or keyboard is suggested during this phase for students to compose their own "simple" melodies in groups using the knowledge they have gained. From a didactic perspective, this example predominantly reflects a teacher-centered approach structured according to instructional logic. The exception to this is the planned group work during the application phase. To make matters more complicated, the duration of the lesson phases specified by ChatGPT appear to be far from sufficient for the acquisition of such complex and prerequisite music theory and practical knowledge-especially for learners with little or no prior musical knowledge and skills.

Time	Phase	Content	Methods	Materials
0-5 min	Greeting and Introduction	Welcoming the students and a brief discussion about known musical instruments	Class discussion	-
5-10 min	Introduction	Introduction of the four main groups of musical instruments: string, wind, percussion, and keyboard instruments	Teacher presentation, class discussion	Pictures of instruments
10- 25 min	Presentation of Groups	Explanation and examples of instrument groups: 1. String Instruments (violin, viola, cello, double bass) 2. Wind Instruments (clarinet, flute, trumpet, saxophone) 3. Percussion Instruments (drums, xylophone, cymbals) 4. Keyboard Instruments (piano, organ, accordion)	Teacher presentation, audio examples	Laptop, projector, speakers, pictures
25- 35 min	Activity - Instrument Quiz	Matching sound samples to instruments using a worksheet	Individual or pair work	Worksheets, audio examples
35- 40 min	Practical Experience	If available: viewing and trying out real instruments	Practical activity	Instruments or pictures of instruments
40- 45 min	Conclusion and Summary	Recap of key points, open Q&A session, announcement of next lesson	Class discussion	-

Lesson Plan for a Music Class

Figure 2: ChatGPT prompt: "Plan a music lesson in a secondary school"

The second lesson example proposed by ChatGPT, based on the prompt "Plan a music lesson in a secondary school," focuses on imparting knowledge about musical instruments. While the first example provided only the sections, activities, and the estimated time in a table, the lesson plan in the second example is more detailed. It includes the methods and materials, along with the times, phases, and content for each part of the lesson. From the user's point of view, the different levels of detail are not comprehensible.

Like the first example, the lesson begins with a brief welcome and introduction, followed by the teacher-centered explanation of different instrument groups. An application phase follows, including a quiz, and the plan concludes with a summary and recapitulation of the learning content. Regarding the content, this lesson focuses on classical Western instruments. Although the categorization of the "four main groups" (strings, winds, percussion, and keyboard instruments) might allow at least some interpretive flexibility, the specific instruments listed by ChatGPT are almost exclusively from the Western classical music tradition. Additionally, the structure of the lessons, the didactic framing of individual phases, and the predominantly teacher-centered approach reflect a rather traditional understanding of teaching and learning.

The analysis reveals that ChatGPT presumes a significant level of prior knowledge among students, often underestimating the time required for complex, long-term learning processes (e.g. sight-reading) by suggesting disproportionately short learning periods for these phases.

Al-Based Image Generation via Midjourney

Midjourney is an advanced AI-based image generation platform based on generative adversarial networks or diffusion models (Ho et al. 2020). These models learn to recognize patterns, styles, and contextual relationships within the visual data, enabling them to generate images that match the semantic content of a user's text prompt. The use of image-generating platforms such as Midjourney plays an increasingly important role in both the teaching of different subjects and the planning of lessons, and it is impacting everyday teaching in schools, similar to AI-generated text data (Chiu 2023).

The image material analyzed comes from an AI-focused seminar on music teacher education, held at the University of Education in Freiburg in collaboration with the Freiburg University of Music. Students used the software Midjourney to generate music education-related images based on prompts they created in small groups. These images were later discussed and evaluated in a plenary session.



Figure 3: Midjourney prompt: "music education in school"

In the first example, a series⁴ of images was generated by students using Midjourney based on the prompt "music education in school."⁵ The musical instruments listed in the second lesson plan above also appear in this visual representation. The examples exclusively show string instruments (predominantly violins), keyboards, woodwind and brass instruments (albeit in oddly modified and varied forms, as seen in the top left image), as well as classical guitars. The students depicted in the images, with their clothing, neat appearance, upright and highly focused postures, and predominantly directed gazes towards sheet music or music stands, suggest musical habitus shaped by a well-educated middle-class background. These images visualize musical practices that adhere to the Western classical ideal of performing and reproducing existing works with traditional instruments.



Figure 4: Midjourney prompt: "A dinosaur in music classroom"

The second example series of images suggests a clear contrast to the first image series. The prompt to imagine "a dinosaur in music classroom" exhibit a significant predominance of pianos, string instruments, and sheet music. In three of the images, a dinosaur is depicted holding a conductor's baton in its forepaw, prominently highlighting another element of Western classical art music-the conductor as the central guiding figure that provides essential knowledge to a large ensemble of musicians and conveys it in a compelling manner for everyone by the baton. The depicted habitus is also reminiscent of a long-obsolete yet still extremely powerful image of the Eurocentric, romanticized, and inevitably lonely artistic genius.⁶ The preference for Western classical music evident in ChatGPT's lesson plans above is unmistakable in the images generated by Midjourney, highlighting a profound bias in favor of Western classical music. Even though only a limited selection can be shown here, I have created a large number of music education images in various contexts over the past few weeks and months with Midjourney. Almost all these images consistently feature an overwhelming presence of string instruments and piano keyboards in numerous forms, shapes, and colors. Even when explicitly prompted to exclude such instruments, a complete omission of Western musical

instruments appears nearly unattainable for the image-generation algorithm of Midjourney.

Song Production Using Suno.ai

The third application discussed here focusses on the AI-based song generation platform Suno.ai. Even though the generative algorithms of Suno.ai differ from text and image generating systems, the fundamental dependency on large amounts of training data and the pattern recognition based on it is similar (Yu et al. 2024). The promised potential of generative music production platforms is already finding its way into scientific articles, albeit largely without critical scrutiny. Moreover, the promise is already being incorporated into the lesson plans and music education strategies of individual associations (NAfME 2024). Since the software environment features the generation of audio data, an analysis presented in text form must remain incomplete. Nevertheless, to get a comprehensive picture of the platform, certain areas of the Suno.ai website are considered below. I also examine the results of a comparative sound and music analysis of some of the system's song products, which were created together with students in the above-mentioned seminar.

SUNO About Team Blog

About

Suno is building a future where anyone can make great music. Whether you're a shower singer or a charting artist, we break barriers between you and the song you dream of making. No instrument needed, just imagination. From your mind to music.

Figure 5: Screenshot of Suno.ai's About webpage

Even a glance at the *about* section of the website reveals highly relevant information. The software company's mission statement shows remarkable parallels to current core concerns in music education. In metaphorically charged language, the company presents itself as a pioneering songwriting platform that enables agency, empowerment, and accessibility for anyone without being dependent on previous musical experience or knowledge (see Figure 5).

Make a song



Figure 6: Homesite and trending charts of Suno.ai (on November 24, 2024)

The home website of suno.ai initially presents itself to the registered user in a familiar format, as the design and arrangement of the individual content is strongly reminiscent of established music streaming services (e.g., Apple Music and Spotify). Various functions and menus can be selected in the left-side area, while already generated songs and statistical background information (likes, playback count) are displayed in a tile design in the middle area. More detailed context information on a selected song is displayed on the right (style, genre, lyrics, etc.). The song content on the website is organized using different subheadings and categories (trends, playlists, genres, etc.).

🕈 Suno	Custom V3.6 V Lytoad Audio			
Home	Enter your own lyrics or describe a sono and			
Create	click Generate Lyrics			
Library				
Explore (BETA)				
Search				
	A Make Random Lyrics 0/3000			
	Instrumental φ Style of Music φ			
	phonk blues 80s			
50 credits	pop rock emotional 0/120			
Subscribe	Title 😡			
What's New? (20)				
Help				
About	Create 🖈			

Figure 7: User interface of Suno.ai in custom mode

Even if the service initially looks like a music streaming provider, the "Create" menu tab indicates that the platform is not just about the reception, but also about the AI-supported generation of music. The button therefore also leads to a multi-section input interface that initially offers the option of formulating a voice-based "Song Description" prompt. In addition to this text input field, there are also two selector switches on the page. The "Instrumental" selector switch positioned below the input field is used to specify the production of a music file without vocals or lyrics. The second selector switch positioned above the text input field opens the so-called "Custom" mode, which reveals several other input fields. Here the user is offered various options for a more differentiated description of the desired end product. The "Lyrics" field offers the option of entering one's own lyrics as the basis for the song to be created. A button below the field also offers the option of having lyrics created automatically ("Make Random Lyrics"). In the field below, the user has the option of defining musical genres or "styles" as a guideline for the track to be created. The style examples presented here show a clear orientation towards established popular music genres ("phonk," "blues," "pop rock") but also include chronological references ("80s") and the effect potentially triggered by the generated music ("emotional"). Finally, a title for the track can be defined in the last free field above the "Create" button.



Figure 8: Suno.ai's explore mode

Regarding the actual purpose of suno.ai, the generation of songs from a text prompt, the general public's assessment of the results is remarkably positive. Brian Hiatt (2024) of the rollingstone.com blog described the results as "shockingly convincing songs" (2024, 1). A comprehensive evaluation of the sonic dimension of Suno.ai's products is beyond the scope of this article due to the vast number of songs available in diverse stylistic combinations (see Figure 8). However, an analysis of selected song products revealed several tendencies regarding inherent dispositions of Suno.ai's musical habitus. Regardless of the chosen genre, the analyzed songs exhibited a very high degree of "loudness" (Vickers 2010), resulting in a significantly heightened perceived loudness. This compression minimized the differences between the loudest and softest parts of the track, potentially reducing the overall dynamic expressiveness of the music. Vocals usually appeared to be layered, which led to a high sonic density regardless of the genre selected. This sound aesthetic created a rich and textured vocal sound, but also led to a somewhat artificial impression in most examples, which is also described in the literature as the uncanny valley (Männistö-Funk and Sihvonen 2018). In a lot of songs, the vocals were also more or less obviously oriented towards an autotune aesthetic (Phillips 2021). Both vocals and solo parts such as string, brass, synthesizer, or guitar parts often featured digital

artifacts and noise elements reminiscent of MP3 compression effects. These artifacts highlight the high amount of digital processing involved in the production.

While AI-based text and image data revealed a clear tendency towards Western classical musical dispositions, concepts, subjects, and lesson content, Suno.ai's musical habitus consisted of a strong orientation towards contemporary popular music culture through the design of the website and the possible style and genre criteria for the generation of songs. Accordingly, most of the trending songs listed on the home webpage and the so-called new styles that the service offered via it's explore webpage follow mainstream genre logic (e.g., rock, electro, soul, trap, metal, vapor jazz). Furthermore, the generated songs are presented primarily as personalized and endless abundance of consumer goods across the entire platform.

Comparative Discussion of the Interpretation Results

At first glance, the impressive results achieved by AI software in terms of text, image, and music data are undeniable. However, the positive first impression is put into perspective in view of the analysis presented here. First, it is important to note that the various AI technologies are not characterized by a single habitus of the machine, but by different habitus in the plural, since each technology has its own "cultural dispositions and inclinations" (Airoldi 2022, 113). As for direct applications in the field of music education, ChatGPT and Midjourney exhibited a hierarchical and mechanistic perspective on music teaching and learning. This tendency manifested in the structure of lessons (lesson plans, teacher-centered approaches, and knowledge transfer) as well as in the dispositions embedded in Midjourney's visual materials regarding music educational practice (homogeneous ensembles and imagery focusing on conducted performances). This interpretation confirms Selwyn's (2019) statement that "technologies carry implicit assumptions about what education is, and in whose interests education operates" (103), even when, as with the technologies discussed here, they were not primarily designed for educational purposes. In addition, ChatGPT and Modjourney produced a high amount of Western classical content. This disposition became evident in the learning content suggested by ChatGPT as well as in the instruments depicted by Midjourney. Additionally, the musical practices presented largely center on the reproduction of preexisting works. This emphasis is highlighted by the presence of musical artifacts such as batons and music stands as well as by the frequent inclusion of scores, sheet music, and musical notation in both text and imagery.

In contrast, Suno.ai primarily exhibited a concentration on popular music culture, which is evident not only in the design of the online platform but also in the content it produces. At the same time, there is also a clear tendency towards standardization regarding the heavy focus on stereotypical genre labels and the dispositions embedded in the songs' sonic aesthetics.

Hristova (2023), referencing Bourdieu's concept of habitus, noted that such a standardization tendency in the algorithmic technologies can lead to habitual adjustment effects concerning listening habits and user preferences. The author implied that the content's repetitive and narrow focus may shape and limit users' tastes and preferences, potentially leading to more and more constrained musical experiences: "Here technology continues to condition the habitus through the enforcement of taste: a taste is implied, habituated, and further amplified through the use of filter bubbles that favour more of the same" (Hristova 2023, 111).

In the case of Suno.ai, this standardization process may lead to a reinforcement and consolidation of musical preferences in two significant ways. Firstly, the platform's design closely resembles established streaming services, which could result in users gravitating towards familiar styles. Secondly, the "Create" page further promotes adherence to existing style and genre conventions through its prompt-based selection of specific, pre-existing styles during the content generation process. Consequently, the platform suppresses idiosyncratic style combinations or creative thinking beyond genres and conventional classifications, both at the interface level and within the algorithm's software architecture. Romele (2024) also concluded that the repetitive and continuous interaction between individuals and digital algorithms may lead to "flattening individuals into their own sameness" (128). Such a development, which is triggered and continually shaped by musical habitus of machines, would inevitably increase existing inequality and discrimination against non-dominant or marginalized forms of musical practice. Moreover, this dynamic is likely to be exacerbated by the increasing prevalence of algorithmically governed interactions. Eynon (2023) differentiated the concept of "algorithmic bias" and emphasized that the specific opacity of algorithmic systems poses a fundamental threat in the context of teaching and learning processes in formal education (254).

Another significant aspect arising from this analysis is the efficiency-driven emphasis on products over processes, which could profoundly influence the conceptualization of professionalization in music education. The sole focus on product-level outcomes may obscures the complex processes involved in planning and designing music educational formats and classroom materials as well as composing songs. The platform economy emphasizes the rapid reusability and consumption of digital mass products, overshadowing the nuanced engagement required for meaningful educational practice (Selwyn 2019). With the global hype surrounding artificial intelligence, educators and students alike are asking themselves whether they can afford to ignore these technological tools without being left behind (Hadi Mogavi et al. 2024). In an era marked by teacher shortages, shrinking school budgets, and reduced support for the arts, such efficiency-driven educational models pose a serious and realistic threat to music education as a whole. Such a dynamic is culminating in a "hegemony of algorithms" (Bost and Wang 2016, 34), in which the influence of technology is becoming omnipresent and increasingly shaping practices and standards in all educational fields. This criticism is all the more important given that all the services discussed here require at least a personalized user account and, in the medium term, a subscription payment model in order to be used. The dominance of a few global tech giants and their lack of transparency regarding the underlying principles guiding the development and marketing of such systems aggravate the problem. The comprehensive impact of such concentrations of power also means that people across the board feel powerless in the face of such powerful transformation processes. In this context, Romele (2024) states: "Instead of claiming a greater right in terms of participation, social groups and cultures passively accept innovations in and the implementation of AI systems as planned and carried out by experts" (140).

Consequences of Musical Habitus of Machines for Music Education

In music education, addressing the challenge of transforming traditional hegemonic practices into more inclusive approaches remains a formidable task for educators across the globe. The stabilization of musical habitus of machines that are focused on a few musical practices (whether Western classical or mainstream pop) therefore also threatens the diversity and breadth of music education worldwide (Hess 2020; Varkøy 2017).

Against the background of Bourdieu's conceptual tools at the center of this text, the interpretation results illustrate how the field of music education can be reshaped by the influence of AI tools such as ChatGPT, Midjourney, and Suno.ai. These findings suggest that generative AI systems contribute to the intensification of social stratification by reinforcing the reproduction of "objectified and institutionalized cultural capital" (Swartz 1997, 77).

Such technological transformation processes are also closely linked to capital shifts. The privileging of Western classical music reflects the strengthening of cultural capital, while the polished aesthetics of AI-generated outputs consolidate symbolic capital by associating these tools with professionalism and legitimacy (Sagiv and Hall 2015, 113–14). Economic capital is becoming a decisive factor, as subscription models restrict access to these technologies based on financial means, thus reinforcing inequalities within the field of music education. Social capital is similarly affected, as algorithmic systems encourage interactions that align with standardized outcomes, marginalizing collaborative practices that deviate from these norms (Benedict and O'Leary 2019, O'Leary 2023).

The discussion emphasized how algorithmic systems influence musical taste and change the learners' habitus. By reinforcing familiar patterns and limiting diversity, these systems contribute to symbolic violence, as they stabilize dominant musical norms and marginalize less established forms of expression. Furthermore, the growing influence of efficiency and market-oriented thinking in the educational context redefines creativity as something that can be measured and optimized. This trend risks undermining the autonomy of music education by aligning it too closely with economic objectives, leaving less room for critical, aesthetic and cultural exploration (Powell et al. 2017).

How to Escape the Musical Habitus of the Machine

In view of the alarming perspectives that have emerged in the discussion, the question arises as to how a small and already marginalized school subject like music could escape this "coming wave" (Suleyman 2023). In the following, I present several strategies and approaches that demonstrate how music education may actively engage with the seemingly unstoppable process of technological transformation through AI technology. The ideas are based on studying McQuillan (2022) and Selwyn (2019), whose general considerations regarding critical approaches to AI I apply to music education. An artistic perspective on the implications of increasing technologization offers unique and promising opportunities for critical discourse and active participation in shaping socio-technological transformation processes far beyond the field of music education. Rather than writing about a technological change that encompasses all areas of life from the perspective of a marginalized school subject, music education could play an exceedingly influential role in interdisciplinary discourses such as critical media education and the (re-)attainment of agency in the post-digital age.

Promoting a Critical Approach to AI in Teacher Training

AI data reflects historically entrenched issues in music education, or as Holly Herndon puts it: "Well, AI is just us" (McDermott 2020, para. 24). However, this "glimpse into the data mirror" provides us with an opportunity to become aware of the dispositions ingrained in AI-generated data—dispositions that reflect our own practices, the dominance of certain educational approaches, instruments, and institutionalized forms in teaching and learning. This offers critical perspectives for students on highly relevant music educational, ethical, and socio-political issues (e.g., racism, inclusion, marginalization of minorities and their musical practices). It also provides an opportunity for a critically constructive engagement with AI technologies, starting with confronting preservice music teachers with technical background knowledge of how AI systems work, including their limitations and socio-political implications, as well as refuting the notion that AI is inherently superior to human judgment.

Promoting the Appreciation of Human Creativity, Artistic Practice and Subversive Ways of Technology Use

The music classroom appears to be an ideal setting for emphasizing the uniqueness of human perception in experiencing emotional depth and originality in music-regardless of whether it was generated with or without AI support. However, it is also essential to address critical questions regarding the authenticity and (legal) authorship of artistic products. The exploration and discussion of AI and technology-critical forms of musical expression and corresponding artists also proves to be a fruitful field for engagement in music education. Borkowski (2023) shows, for example, how different female musicians actively engaged with AI-based voice assistants in their work. He concluded that such "artistic practices therefore problematize the narratives of tectonic paradigm shifts and sensory revolutions" (Borkowski 2023, 149). This could also include encouraging students to hack and repurpose AI tools creatively. Using AI-generated outputs as raw materials for artistic transformation could be a fruitful starting point to developing counter-narratives that critique or subvert dominant AI-driven narratives. Students could even be empowered to use art as a form of resistance.

Fostering Collective and Collaborative Approaches

Encouraging collaborative projects and community building among students can help resist the individualistic and competitive nature of AI-driven metrics (Selwyn 2019, 69). These activities emphasize teamwork and collective creativity, fostering a supportive educational environment. Andrejevic and Selwyn (2023) pointed out that this does not necessarily have to go hand in hand with AI abstinence, instead calling for a discussion about "communityoriented automation" (229) in the classroom.

Advocacy for Ethical Discussions and Structural Changes

Ethical discussions about AI's implications, including bias, surveillance, and data privacy, should be integrated into the curriculum. Educators should promote awareness of policy and regulatory issues surrounding AI and advocate for changes that protect artists' rights and ensure ethical AI development. The importance of fair working conditions and job security for artists and educators should also be emphasized in this context.

Conclusions and Outlook

In this article I examined the dispositions inherent in AI-generated data relevant to music education and music classroom practice and first delineated and elaborated on Bourdieu's theoretical tool set. Subsequently, through a concretization of the musical habitus of the machine, three distinct types of data were qualitatively analyzed to uncover embedded dispositions and recurring patterns. The analysis revealed that AI-generated data tends to present a relatively narrow conception of music, which perpetuates longstanding inequalities and marginalization, potentially leading to the homogenization of music education content and practices. This critical reflection showed that there is a lot of potential to support teacher development, encourage critical thinking about technology, and improve teacher training and practice in music education.

Even if the first steps towards dealing with the music educational consequences of machine habitus have been taken, further questions need to be asked. These issues range from copyright and property rights, which have already received considerable attention, , to the possible marginalization of nonverbal and embodied aspects of musical practice. Given that AI technologies often focus on text-based inputs and language processing (Yildirim and Paul 2024), there is a risk of oversimplifying musical practice and overlooking the rich nuances of diverse performance traditions and implicit knowledge. To promote more open and inclusive musical habitus in machines, music teachers and music educators should be involved in the development and training of AI systems, as well as in critical reflections on their potentials and challenges in music education. This collaborative approach could ensure that AI tools reflect a diverse array of musical practices.

Furthermore, cultivating critical AI literacy among educators is essential for responsibly engaging with these technologies (Kress 2003; Leander and Burriss 2020). It is also crucial to continually reassess the role of AI in music education, ensuring its use aligns with educational and ethical objectives rather than market pressures. It is now evident that the scientific community should reconsider its role in perpetuating the "modernist technological acceleration" (Bock et al. 2024, 17), by constantly introducing new technologies and developments into practice as the norm. Increasingly, teachers at the grassroots level are expressing a "a desire for deceleration" (Bock et al. 2024, 17) and for reasonable "technoskepticism in schools" (Pleasants, Krutka, and Nichols 2023). Music education must assert its own priorities, resisting the commodification of education and ensuring that technological tools enhance rather than overshadow the learning experience. In this regard music classrooms could serve as spaces that inspire students to thoughtfully explore the dynamic relationship between technology and musical expression. By fostering a critical and constructive attitude towards technologies such as artificial intelligence, music education can empower learners to creatively question and overcome existing technological dependencies, rather than perpetuate them.

About the Author

Johannes Treß is a music educator, researcher and composer/performer specializing in post-digital music education, maker music education, AI in music education and creative musical practices. He is co-leader of a project on post-digital music teacher education. His dissertation from 2022 on group improvisation in music education was graded summa cum laude and his scientific work has also received numerous awards. Since May 2023, he has been junior professor of music at the University of Education, Freiburg. Treß studied school music with a focus on jazz/pop and performs internationally as a saxophonist, live electronics musician, theatre musician and composer.

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Notes

¹ A detailed presentation of the articles published in the volume would go beyond the scope of this article, so only the texts that explicitly refer to the habitus concept are presented in the short summary. For a further list of diverse music education references to the habitus concept, see also Hall (2015, 47).

² There is already a discourse on the question of the embodiment of algorithmically mediated human-machine interaction that should not go unmentioned here (Kim and Seifert 2006; Vear 2022). However, this article focuses on the analysis of AI-generated data material.

³ Although the teachers developed and worked out some very elaborate and detailed lesson plans with ChatGPT during the interview sessions (Treß, 2024), for reasons of better comprehensibility and exemplarity, only tabular lesson plans created by ChatGPT are presented and analyzed here.

⁴ By default, Midjourney outputs four image variants for a single prompt. For the first example, two screen series of two identical prompts were selected, as two groups of students formulated the same prompt as input in parallel.

⁵ The prompts in Midjourney typically start with the command '/imagine (...)'.

⁶ However, the subject conceived by the students can also be understood as an allegorical metaphor, portraying the Western and particularly Eurocentric musical habitus of the classical-romantic genius as a long threatened and endangered species (much like the dinosaurs themselves).