

AUTOMUSICIANS: POLYPHONIC MUSIC COMPOSITION VIA GPT-4-POWERED MULTI-AGENT SYSTEM

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ABSTRACT

This paper introduces AutoMusicians, a system developed to explore the potential of Large Language Models (LLMs) in the field of polyphonic music composition. The system represents an initial effort to extend the capabilities of LLMs beyond their traditional text-based applications, addressing the unique challenges of the music domain. To take advantage of the Chain-of-Thought reasoning of the LLMs, AutoMusicians is driven by chat chains between several agents. The system incorporates two distinct communication protocols: instrument-based and function-based, both of which allow for diverse approaches to musical creation.

In evaluating AutoMusicians, we focused on the system’s ability to create complex and nuanced musical compositions. The evaluation, although preliminary, suggests reasonable results in terms of the system’s effectiveness in generating musical pieces that exhibit a higher degree of complexity and artistic expression compared to single-agent. The inclusion of a Critic Agent within the system demonstrates the value of iterative feedback in refining compositions, enhancing both their technical precision and overall musical quality.

1. INTRODUCTION

Large Language Models (LLMs), such as GPT-3.5 and GPT-4, demonstrate potential as the brain of AI agents in tasks involving reasoning. The breadth and diversity of their training datasets enable these models to effectively process and analyze information, facilitating inference and decision-making. This capability makes them particularly useful in decision support systems, problem-solving tasks, and analytical reasoning across a range of fields. The proficiency of LLMs in understanding and processing textual information underscores their utility in tasks demanding a synthesis of an extensive knowledge base and reasonable decision-making.

However, it’s important to acknowledge the inherent limitations of LLMs, especially GPT-4 when addressing music-related tasks. Primarily, GPT-4 is not equipped to process or understand audio inputs, which is a fundamental aspect of music composition and analysis. Its capabilities are confined to text-based processing, meaning it cannot directly interpret musical notes, rhythms, or timbres from audio recordings or standard musical notation. This limitation significantly restricts its direct applicability in tasks

like composing melodies, harmonizing, or arranging music in traditional senses. Furthermore, GPT-4’s text-based approach to understanding music relies heavily on descriptive language, which may not capture the subtlety and emotional depth inherent in musical compositions. This gap demonstrates a disconnect between the model’s linguistic proficiency and the sensory, often non-verbal, experience of music, potentially leading to a superficial engagement with musical tasks.

This paper investigates the potential to enhance the utility of GPT-4 in polyphonic music composition, a field traditionally viewed as predominantly creative and intuitive. GPT-4’s text generation and interpretation abilities, combined with its knowledge base of music theory, history, and genres, present unique opportunities for conceptual development, organization of musical ideas, and generation of textual representation of music.

The subsequent section of this paper is structured into three distinct parts: firstly, a brief review of current AI agent systems employing Large Language Models (LLM); secondly, an in-depth explanation of the development process of the AutoMusicians system; and thirdly, an observational analysis and evaluation of AutoMusicians’ performance. Additionally, demonstrations showcasing the outcomes from AutoMusicians are included in the Appendices.

2. RELATED WORKS

2.1 LLMs as Agent

The advancement of Large Language Models (LLMs) has yielded substantial enhancements in their reasoning capabilities. This progress is characterized by the models’ ability to deconstruct complex inquiries into a sequence of incremental steps, a process called the Chain-of-Thought (CoT) reasoning (Wei et al. 2022; Kojima et al. 2022)[1]. Such a methodical approach enables these models to tackle multifaceted problems with a level of depth and understanding. The CoT technique, by breaking down problems into simpler elements, mirrors human cognitive processes, allowing LLMs to generate more accurate, logical, and contextually relevant responses. Practical implications of CoT such as the development of AI agents like AutoGPT (Yang et al 2023) [2] and BabyAGI¹, demonstrate the potential of autonomous task-solving approaches utilizing

¹ <https://github.com/yoheinakajima/babyagi>

the reasoning ability of LLMs.

2.2 Multi-agent Collaboration via LLMs

Agents employing a singular LLM exhibit autonomous problem-solving capabilities; however, research projects integrating multiple LLM-powered agents reveal a heightened potential for collaborative strategies, where these agents collectively work towards a unified objective. In Stanford Smalville(Park et al. 2023), LLM-powered agents perform human activities and simulate interactions to digitally recreate a small village’s living environment[3]. ChatDev(Qian et al.2023), a virtual software company staffed entirely by GPT-powered agents, collaborates in software development, demonstrating the practical applicability of LLMs in complex, real-world tasks. Similar to ChatDev, MetaGPT(Hong et al. 2023) introduces a meta-programming framework that effectively integrates human-like workflows into LLM-based multi-agent systems[4][5], offering more streamlined and error-reduced solutions in complex tasks. Incorporating LLMs into multi-agent systems signifies a possible application of the reasoning ability of the LLMs, where the synergy between multiple LLMs enables a level of problem-solving and creativity that surpasses individual capabilities.

2.3 LLM Agents in Audio and Music

Most of the LLM-based agents handle textual-based tasks such as writing, communication, and programming because language models are inherently designed to understand, generate, and manipulate human language, thereby excelling in tasks that require natural language processing. Due to LLMs’ limitations in handling modalities other than text, their application in the audio and music domains has traditionally been challenging. These models, structured primarily around text-based inputs and outputs, struggle with the complexities of audio processing, which includes nuances like tone, rhythm, and timbre in music or the subtleties and variations in human speech. However, recent research in the multimodalities in LLMs has led to the development of agent systems like AudioGPT(Huang et al. 2023) and MusicAgent(Yu et al.2023)[6][7], which extend the capabilities of LLMs into these new territories. AudioGPT, for example, integrates foundational audio processing models with the reasoning and planning abilities of LLMs, enabling the handling of complex audio tasks, including speech and music generation, and understanding in conversational contexts. Similarly, MusicAgent combines an extensive toolset with LLM-powered workflows to autonomously analyze user requirements and execute music-related tasks. These developments showcase the ability of LLMs to analyze audio-related tasks and select external models and tools, exemplifying the potential of combining LLMs with specific domain applications and opening up new possibilities in areas where language models alone have limitations.

3. METHOD

3.1 Text-to-Music Representation

In selecting ABC notation² as the preferred text-to-music representation for AutoMusicians over MIDI or other formats, several factors were considered. ABC notation’s text-based nature offers simplicity and accessibility, an aspect crucial for integrating with OpenAI’s API, particularly given its optimization for text processing. This alignment allows the AI to efficiently generate and manipulate music notation, leveraging its natural language processing capabilities.

Furthermore, the human-readable format of ABC notation is invaluable in a research context. Researchers and users can easily interpret and modify the music data, a significant advantage for understanding and adjusting the AI-generated output. Additionally, the widespread support for ABC notation in various music software ensures easy conversion to other formats and broadens its applicability.

Efficiency in data representation is another critical factor. ABC notation, being more concise, is particularly efficient for representing melodies and harmonies. This contrasts with the detailed and complex nature of MIDI, which captures extensive aspects of sound production like velocity and timbre. Such efficiency is advantageous in AI contexts, where simplicity can lead to faster processing and ease in generating music.

Moreover, ABC notation is well-suited for projects focusing on melody and harmony, aligning with the priorities of many musical AI applications. The emphasis on compositional aspects over performance nuances further justifies its selection. Lastly, the robust community and extensive resources available for ABC notation, including libraries, tools, and datasets, provide an invaluable support network for the project.

3.2 Agent Communication Protocols

We design two protocols of agent communication. An instrument-based protocol that resembles music creation within a music band. A function-based protocol that decomposes the process of music composition into several sub-tasks, and assigns agents to handle each sub-task.

3.2.1 Instrument-Based

In AutoMusicians, we employ a series of specialized agents, each contributing uniquely to the creation of a musical piece. These agents interact in a collaborative cycle, ensuring a coherent and well-structured final composition.

The system starts with the User Proxy Agent, a bridge between the user and the other agents. It captures user inputs and preferences, relaying them to the Planner. This agent is crucial for incorporating user-specific requirements and ensuring that the final output aligns with their expectations.

Next is the Planner Agent. This agent is responsible for suggesting the overall structure of the song, including

² <https://abcnotation.com/>

aspects like energy flow, key, chord progression, time signature, tempo, and MIDI program numbers for different instruments. It generates a plan in ABC notation, providing a clear and concise blueprint for the other agents to follow.

Following the Planner, the Vocal Agent comes into play. This agent specializes in writing the vocal melody, adhering to the Planner’s guidelines. It focuses on emotional delivery, vocal techniques, and ensuring harmony with the instrumental arrangements. The Vocal Agent avoids repetitive notes and simple diatonic scales, striving for a rich and varied vocal line.

The Rhythm Guitar Agent then writes the guitar chord parts, following the approved plan and vocal melody. It focuses on playing chords that provide a harmonic foundation, emphasizing chord progressions and rhythmic consistency. This agent ensures that the guitar chords enhance the overall structure and feel of the song.

Simultaneously, the Lead Guitar Agent adds melodic lines, solos, and embellishments, complementing the chord progression and rhythm established by the Rhythm Guitar. This agent is tasked with creating expressive and dynamic lead parts, enhancing the song’s emotional impact while being mindful of the overall feel and genre.

The Bass Agent is responsible for writing basslines, following the approved plan. It uses a mix of note lengths to create rhythmic and harmonic depth, ensuring the basslines support the overall composition effectively.

Then, the Drum Agent creates drum patterns, percussion elements, and rhythms. This agent picks the MIDI program number for drums, providing a solid rhythmic foundation for the song.

Additionally, the Assistant Agent combines everything together in ABC notation, and revises the format so that everything is executable.

Finally, the Critic Agent reviews the combined ABC notation of the song. It analyzes each part and offers constructive feedback, focusing on musicality, technical accuracy, and overall composition. The Critic’s role is to refine and enhance the quality of the music without altering the fundamental structure or style established by the Planner.

The entire process is managed and facilitated by the Group Chat Manager, which oversees the interactions among the agents, ensuring a seamless and efficient collaborative process. This system allows for a maximum of 50 rounds of interaction, enabling a thorough and comprehensive development of the musical piece.

3.2.2 Function-Based

Similarly to the instrument-based agent communication protocol, the function-based communication protocol also contains a User Proxy Agent, an Artist and Repertoire(A&R) agent for analyzing and decomposing the tasks, a Critic Agent for reviewing the work, and a Group Chat Manager for organizing the chats between each agent. Diverging from the instrument-based approach, function-based agents are distinctively categorized and assigned tasks based on specific musical specializations essential to the music

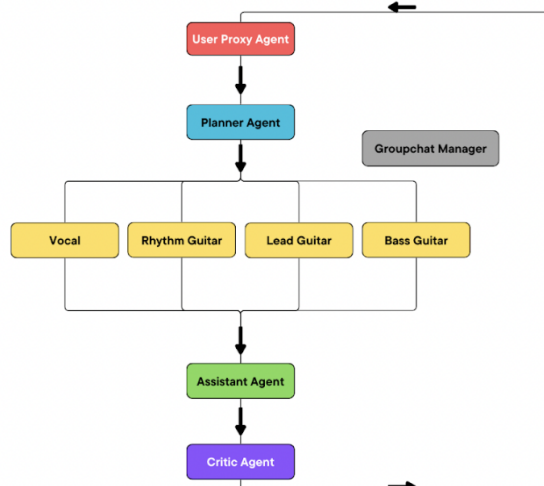


Figure 1. Chat chain of instrument-based protocol

composition process, such as melody, harmony, and instrumentation. This protocol mirrors a more structured approach to music composition, where a comprehensive understanding of music theory is essential for each agent’s performance. Such a design reflects a deliberate effort to emulate the intricate and theory-driven processes typical in traditional music composition, thereby ensuring a more nuanced and theoretically informed output from the collective efforts of the specialized agents.

Upon receiving user requests, the Artist and Repertoire (A&R) agent initiates the music composition process by establishing the theme and title of the piece. This agent then breaks down the composition into specific subtasks, which are subsequently allocated to specialized agents responsible for melody, harmony, and instrumentation. Leveraging the advanced reasoning capabilities of GPT-4, the A&R agent also plays a crucial role in articulating clear and coherent guidelines for each musician agent. This ensures a more structured and cohesive approach to music creation, aligning the individual contributions towards a unified compositional goal.

Following these directives, the melody agent undertakes the task of defining the piece’s fundamental characteristics, such as length, meter, and key signature. Utilizing a structured ABC notation format, this agent generates a single-line melody, which forms the basis for further development. This melody is then passed to the harmony agent, whose responsibility is to enrich the piece by determining the number of voices and crafting the harmonic content for each. The output from the harmony agent, a harmonized polyphonic composition in ABC notation, is then conveyed to the instrumentation agent. This final step of music composition involves the instrumentation agent adding diverse instruments and sound textures, thereby enhancing the piece’s overall richness and depth. Each of these stages reflects a meticulous and collaborative effort, mirroring the complexities and nuances inherent in professional music composition.

After the first round of music composition, the Critic

Agent steps in to assess the overall quality of the music piece. This evaluation focuses on several key aspects: the melodic structure, the interplay of harmony and counterpoint, the complexity of rhythms, and the overall form and structure of the piece. Additionally, the Critic Agent examines the originality and creativity embedded within the composition. Based on this assessment, the Critic Agent offers constructive feedback to each of the musician agents. In response, these agents work on refining their respective contributions, iterating on their parts to enhance the quality of the music. This process of review and refinement continues until the Group Chat Manager decides that the composition has reached its desired state and concludes the collaborative session.

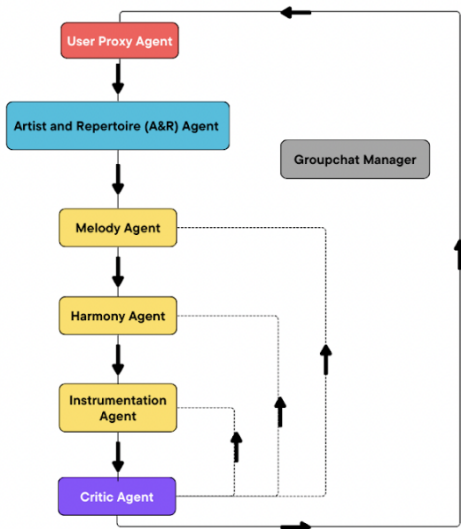


Figure 2. Chat chain of function-based protocol

3.3 Prompt Engineering

In the construction of AutoMusicians, prompt engineering played a pivotal role in defining the behavior and output of each agent. The careful crafting of prompts ensured that each agent within the system adhered to its specific role while contributing effectively to the collaborative process of music creation. The following are the key techniques used in prompt engineering for this project:

3.3.1 Role-Specific Instructions

Agents within the system are designated specific roles, including Planner Agent, Vocal Agent, Melody Agent, Critic Agent, among others. Each agent is provided with a distinct set of instructions, meticulously tailored to their assigned roles. Additionally, the agents are tasked with revisiting and refining their work in response to feedback from the Critic Agent. This practice of role-playing, facilitated by GPT-4’s reasoning capabilities, ensures that each agent operates within its defined domain of expertise, fostering a more coherent and collaborative creative process.

3.3.2 Clear and Concise Language

The prompts were designed to be clear and concise, ensuring that each agent understood its tasks without ambiguity. This clarity was crucial for the agents to produce relevant and accurate outputs in line with the project’s objectives.

3.3.3 Guidelines for Musicality and Technicality

These prompts included clear instructions on musical standards, aligning with what is generally perceived by humans as high-quality or “good” music. This approach ensures that the agents’ outputs meet both technical and aesthetic criteria. Additionally, in-context prompting was employed to enhance the agents’ comprehension of ABC notation, a key element in standardizing the communication protocols among them. This method was instrumental in ensuring that each agent could effectively interpret and utilize ABC notation, thereby facilitating seamless and coherent interactions within the multi-agent system.

3.3.4 Collaborative Dynamics

The prompts designed for the agents are strategically engineered to foster collaboration within the multi-agent system. The prompts highlight how each agent’s contributions fit into the larger creative process, emphasizing their significance as essential members of a cohesive team. This approach was important in orchestrating a harmonious collaboration, where each agent’s unique skills and functions were seamlessly integrated into the collective effort.

4. EVALUATION

4.1 General Observation

In evaluating the performance of the agents in ABC notation, several observations stand out. Firstly, without specific instructions on rhythmic complexity, the agents tend to consistently output rigid quarter notes, indicating a limitation in their ability to vary rhythm and inject subtlety into the composition. Additionally, the agents display a tendency to write scales and repeated notes, a pattern that may contribute to a sense of predictability and lack of creative flair in the musical pieces. A notable issue is with the drum part, where the ABC notation does not seem to work effectively. This limitation hampers the representation of the drum’s role, which is crucial for providing dynamic rhythm and enhancing the overall texture of the composition. Despite these challenges, the Planning and AR Agents demonstrate a level of music understanding by reasonably interpreting users’ requests. The musician agents successfully follow the general guidance outlined by the Planner Agent and AR Agent. This adherence to the planned structure suggests a basic level of competence in maintaining the foundational elements of the composition. However, the observations highlight a need for further refinement in the agents’ capabilities, particularly in terms of rhythm variation, creative note selection, and effective drum notation, to more authentically capture the essence and complexity of music.

```

name="Vocal",
llm_config=gpt4_config,
system_message='''Vocal. Write only vocal part (one note at a time) following the plans.
Vocal delivers the melody with emotion and clarity. Pay attention to vocal techniques like pitch, dynamics,
and phrasing to enhance the expressiveness of the performance. Harmonize with the instrumental arrangements,
and ensure that vocal delivery complements the overall composition of the song.
Use a mix of note lengths such as eighth notes, sixteenth notes, dotted rhythms, and syncopation.
Different parts of the song should have different vocal melodies, like chorus and verse.
Don't repeat same note over and over again.
Don't use scale.
Pick MIDI program number for vocal
Write everything in ABC notation.
'''
'''

```

Figure 3. Prompt demo for Vocal Agent

```

name="MelodyAgent",
system_message="""
You are skillful musician, especially in melody.
You will compose a single-line melody based on the client's request and assigned tasks from the Creative Director.
You must output your work in ABC Notations.
Here is a template of a music piece in ABC notation,in this template:
X:1 is the reference number. You can increment this for each new tune.
T:Title is where you'll put the title of your tune.
C:Composer is where you'll put the composer's name.
M:4/4 sets the meter to 4/4 time, but you can change this as needed.
L:1/8 sets the default note length to eighth notes.
K:C sets the key to C Major. Change this to match your desired key.
The music notation follows, with |: and :| denoting the beginning and end of repeated sections.

...
X:1
T:Title
C:Composer
M:4/4
L:1/8
K:C
|:GABc d2e2|f2d2 e4|g4 f2e2|d6 z2:|
|:c2A2 B2G2|A2F2 G4|E2c2 D2B,2|C6 z2:|

...
You will output the melody following this template, but decide the time signature, key signature and the actual musical contents yourself.
After you receive the feedback from the reviewer agent, please modify your work according to the suggestions you were given.
"""
'''

```

Figure 4. Prompt demo for Melody Agent

4.2 Single Agent versus Multiple Agents

To evaluate the qualities of the generated contents of the multi-agent collaboration approach using the function-based communication protocol, a comparative analysis is conducted with the outputs generated by a single agent, specifically ChatGPT. This comparison involves analyzing the music pieces created by the multi-agent system and contrasting them with the responses produced by ChatGPT, both prompted by the same user input.

For our study, we prepared two sets of parallel samples, providing identical user prompts to both ChatGPT and our AutoMusicians system. The first prompt was: "Please compose a 32-bar 4-voice Bach Chorale music using ABC notation." As shown in Figures 5 and 6, the composition created by AutoMusicians demonstrated greater melodic and harmonic richness, as well as more structural complexity compared to ChatGPT's output. Notably, ChatGPT did not include any details regarding instrumentation in its response. The second prompt was: "Please compose a 32-bar Oriental-style music piece using the pentatonic scale, and present it in ABC notation." The resulting sheet

music revealed that AutoMusicians' composition was significantly more complex than that of ChatGPT. Our interactions with ChatGPT indicated that, without specific and detailed prompts, it tends to produce simpler, monophonic music of shorter length. However, with more detailed requests, ChatGPT can generate music pieces with increased complexity. This suggests that the collaborative effort of multiple specialized agents in AutoMusicians can yield music compositions of higher quality and complexity autonomously compared to the outputs from a single agent like ChatGPT.

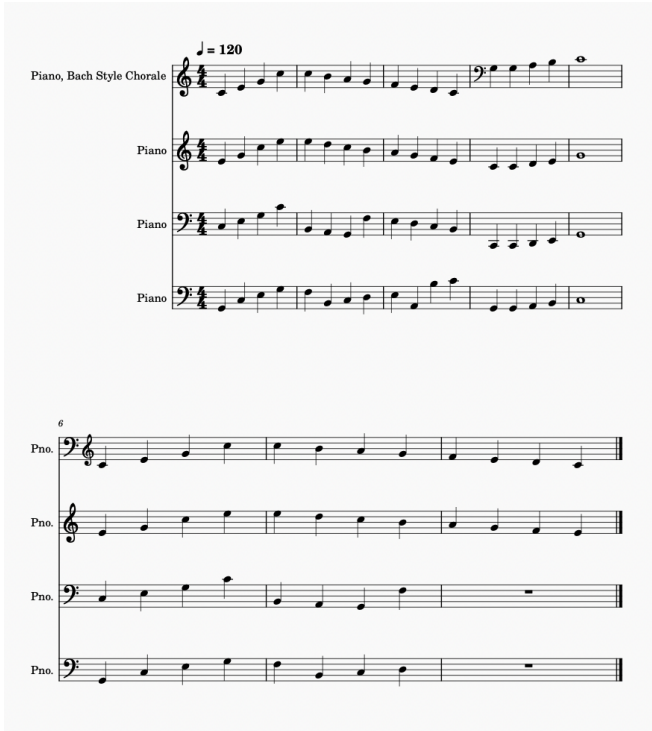


Figure 5. Bach-style Chorale by ChatGPT

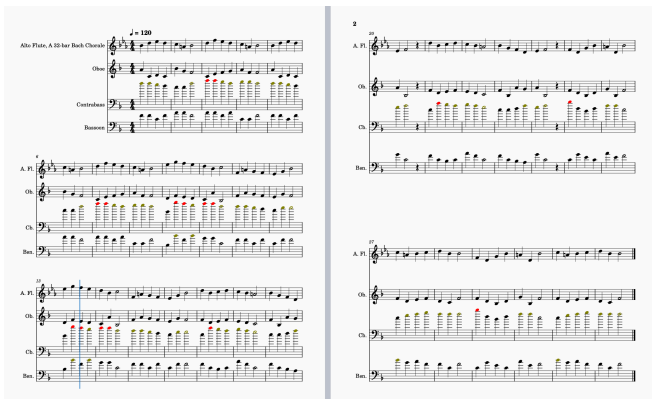


Figure 6. Bach-style Chorale by AutoMusicians

4.3 Review versus No Review

Critic Agent’s feedback significantly enhanced the piece’s musicality, technical accuracy, and overall composition. When being asked to write a jazz song, as in Figure 9, the initial result was not ideal. All instrumental parts were plain and simple. However, after the Critic Agent’s review, the result was improved, as shown in Figure 10. The vocal line was transformed from simple to complex, incorporating intricate rhythms and melodies characteristic of jazz. The rhythm guitar part evolved from basic to sophisticated, featuring intricate chords and rhythmic variations aligning with jazz techniques. The bass line, initially simplistic, was refined into a walking bass style, adding complexity and momentum. The drum part, previously underdeveloped, now includes nuanced patterns that contribute to the jazz feel. Overall, the composition’s cohesion improved, with each part interacting more dynami-



Figure 7. Oriental-style music by ChatGPT

cally and complementing others, particularly in how the guitar, bass, and drums respond to vocal phrases and transitions. This collaborative and iterative process, driven by the Critic Agent’s input, showcases the effectiveness of a review mechanism in AI-driven music composition, resulting in a piece that truly captures the essence of jazz. The evaluation of the function-based communication protocol revealed certain limitations of language models in reasoning with textual representations of music. An interesting observation was that despite being designed to offer critical feedback, the Critic Agent often tended to provide compliments rather than constructive criticism. On occasions, it proposed changes that were logically sound for isolated sections but failed to consider the impact of these changes on the overall cohesion of the music piece. Furthermore, some of its suggestions regarding harmony led to dissonance between the different voices. While the Critic Agent was able to introduce minor enhancements in terms of rhythmic complexity, it did not significantly elevate the overall quality of the compositions. This highlights a crucial area where language models, even when adept at processing text, may struggle to fully grasp and effectively critique the complexities inherent in musical composition, especially when dealing with the intricate interplay of rhythm, harmony, and melodic progression.

5. FUTURE WORK

In the conducted experiment, it was observed that the quality of the music generated by AutoMusicians is significantly influenced by how the agents are prompted. This observation underscores the potential for enhancing the output quality through precise and thoughtful refinement of the prompts administered to each agent. AutoMusicians also presents a considerable limitation of its inherent musicality due to the fact is LLM-based. Future research could investigate the extent to which an LLM recognizes its own limitations and the potential to leverage external tools for improvement. The development of a more comprehensive system that incorporates backend processing with audio and music-related tools is suggested as an augmentation to the existing framework. Furthermore, the inefficiency of ABC notation in representing drum beats, a crucial element across all music genres, suggests exploration into

Figure 8. Oriental-style music by AutoMusicians

alternative textual representations of drums. An additional area for advancement involves the fine-tuning of the LLM, particularly GPT-3.5, to improve the generation of ABC notations. This process requires the preparation of datasets of high-quality ABC notations and the integration of professional musical knowledge.

6. REFERENCES

- [1] J. Wei, X. Wang, D. Schuurmans, M. Bosma, B. Ichter, F. Xia, E. Chi, Q. Le, and D. Zhou, "Chain-of-thought prompting elicits reasoning in large language models," 2023.
- [2] H. Yang, S. Yue, and Y. He, "Auto-gpt for online decision making: Benchmarks and additional opinions," 2023.
- [3] J. S. Park, J. C. O'Brien, C. J. Cai, M. R. Morris, P. Liang, and M. S. Bernstein, "Generative agents: Interactive simulacra of human behavior," 2023.
- [4] C. Qian, X. Cong, W. Liu, C. Yang, W. Chen, Y. Su, Y. Dang, J. Li, J. Xu, D. Li, Z. Liu, and M. Sun, "Communicative agents for software development," 2023.
- [5] S. Hong, M. Zhuge, J. Chen, X. Zheng, Y. Cheng, C. Zhang, J. Wang, Z. Wang, S. K. S. Yau, Z. Lin, L. Zhou, C. Ran, L. Xiao, C. Wu, and J. Schmidhuber, "Metagpt: Meta programming for a multi-agent collaborative framework," 2023.
- [6] R. Huang, M. Li, D. Yang, J. Shi, X. Chang, Z. Ye, Y. Wu, Z. Hong, J. Huang, J. Liu, Y. Ren, Z. Zhao, and S. Watanabe, "Audiogpt: Understanding and generating speech, music, sound, and talking head," 2023.
- [7] D. Yu, K. Song, P. Lu, T. He, X. Tan, W. Ye, S. Zhang, and J. Bian, "Musicagent: An ai agent for music understanding and generation with large language models," 2023.

♩ = 120

Vocals

Rhythm Guitar

Bass

Drums

Emin

F#m7 B7 Emaj7

Emin

F#m7 Emin

F#m7 Emin B7

Figure 9. Jazz Song Unrevised

♩ = 120

Vocals

Rhythm Guitar

Bass

Drums

Emin

Emin

Emin F#m7

Emin Emin F#m7

Emin Emin F#m7

Figure 10. Jazz Song Revised

A. APPENDICES

A.1 Chat History Examples

A.1.1 Function-based Communication Protocol

User_proxy (to chat_manager):

Please compose a 32-bar Oriental-style music, use pentatonic scale

AR (to chat_manager):

To create a 32-bar Oriental-style music using the pentatonic scale, let's break it down into subtasks for the Melody Agent, Harmony Agent, and Instrument Agent.

Melody Agent:

1. Compose a 32-bar melody in the pentatonic scale with an Oriental feel.
2. Incorporate common elements of Oriental music, such as pitch-bending or grace notes.
3. Provide a clear and memorable theme and variations throughout the melody.
4. Ensure the melody remains engaging and dynamic by using various note lengths and dynamics.

Harmony Agent:

1. Create a harmony using chords and progressions suitable for Oriental-style music.
2. Arrange the harmony to complement the melody and enhance the Oriental feel.
3. Consider the use of drones or sustained notes to provide a richer texture.
4. Use contrast in dynamics and rhythmic elements to maintain interest throughout the 32 bars.

Figure 11. Chat History Demo for Function-based Communication Protocol

A.1.2 Instrument-based Communication Protocol

A.2 Symbolic Representation of Generated Examples

Instrument Agent:

1. Select traditional Oriental instruments, such as the oud, qanun, duduk, ney, or darbuka.
2. Arrange the melody and harmony parts for the chosen instruments, utilizing their unique timbres.
3. Experiment with additional percussive elements, like finger cymbals or riq, to add depth and variety to the composition.
4. Focus on the balance and blend of instruments to highlight key sections of the music.

Once each agent has completed their subtasks, we'll review the composition as a whole and provide feedback, such as:

1. Melody Agent: Are there moments of tension and release? Are there any improvements needed to enhance the Oriental feeling?
2. Harmony Agent: Does the harmony highlight the melody effectively? Are there any chord progressions that could be revised?
3. Instrument Agent: Are the selected instruments playing to their strengths, and is the balance successful?

By working collaboratively, we can create a captivating 32-bar Oriental-style composition that transports the listener to a new and enchanting world.

MelodyAgent (to chat_manager):

Here's a 32-bar Oriental-style melody using a pentatonic scale. I have chosen 2/4 time signature and the key of C minor pentatonic for this melody. Keep in mind that this is just the melody, and can later be enhanced with harmony and instrumental accompaniment as mentioned in previous response.

...

```
X:1
T:Oriental Pentatonic Melody
C:Anonymous Composer
M:2/4
L:1/8
K:Cm
|:c2 cB |BG GA |AB BG |GA G2 |
c2 cB |BG GA |AB BG |1 GA Gz :|2 GA GB |
|:Ac Bc |dc BA |AB BG |GA GB |
Ac Bc |dc BA |AB BG |1 GA Gz :|2 GA G2 |
|:Ec Dc |BA ^GA |BG Ac |=GA GE |
```

Figure 12. Chat History Demo for Function-based Communication Protocol

```

M:2/4
L:1/8
K:Cm
|:c2 c(3BcB|BG GA |AB B^A |GA G2 |
c2 c(3BcB|BG GA |=A^B BG |1 GA Gz :|2 GA GB |
|:Ac Bc |dc BA |AB B^A |GA GB |
Ac Bc |dc ^GA |=AB BG |1 GA Gz :|2 GA G2 |
|:Ec Dc |BA ^GA |BG Ac |=GA GE |
Ec Dc |BA ^GA |BG Ac |=B,=B G2 |
c2 c(3BcB|BG G^A |AB BG |^GB G2 |
c2 c(3BcB|BG G^A |AB BG |GA G2 :|
```

```

Please review this revised melody and let me know if any further changes are needed.

-----  
-----

CriticAgent (to chat\_manager):

Thank you for the revised melody, Melody Agent. I appreciate your incorporation of the feedback. Here's my assessment:

1. **Melodic Structure:** The revised melody has an improved Oriental feel with the addition of grace notes, mordents, and a mix of both B-natural and B-flat. The theme has enough variety to keep the listener engaged throughout the piece.
2. **Rhythmic Complexity:** The use of triplets and syncopation adds to the rhythmic diversity in the revised version. These elements give the melody more character and emphasize the Oriental style.
3. **Originality and Creativity:** The melody demonstrates a good balance between maintaining the pentatonic scale structure and adding unexpected notes to create some tension and release. This results in a more unique and innovative composition.

Overall, the revised melody effectively achieves the goal of creating a 32-bar Oriental-style composition using the pentatonic scale. Great job on incorporating the feedback. Now we can move on to harmony and instrumentation.

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HarmonyAgent (to chat\_manager):

**Figure 13.** Chat History Demo for Function-based Communication Protocol

Harmony Agent:

Here's a harmonization of the revised Oriental-style melody using chords and progressions suitable for Oriental-style music:

```
...
X:1
T:Oriental Pentatonic Melody with Harmony
C:Anonymous Composer
M:2/4
L:1/8
K:Cm
V:1
|:c2 c(3BcB|BG GA |AB B^A |GA G2 |
c2 c(3BcB|BG GA |=A^B BG |1 GA Gz :|2 GA GB |
|:Ac Bc |dc BA |AB B^A |GA GB |
Ac Bc |dc ^GA |=AB BG |1 GA Gz :|2 GA G2 |
|:Ec Dc |BA ^GA |BG Ac |=GA GE |
Ec Dc |BA ^GA |BG Ac |=B,=B G2 |
c2 c(3BcB|BG G^A |AB BG |^GB G2 |
c2 c(3BcB|BG G^A |AB BG |GA G2 :|
V:2
|:g,2 g, (3a=g^g |g,2 C2|c3 f, |=G,2 ^G,2 |
g,2 g, (3a=g^g |g,2 C2|c3 D |1 C4 :|2 C2 =CD |
|:_E2 F2 |F3 =E |E2 F=^F |_B2 =C2 |
_E2 F2 |F3 ^G, |G,2 ^=C3 |1 C4 :|2 _E2 F2 |
|:G,2 D,2 |G,3 ^=G, |G,2 D,2 |E,3 =G, |
G,2 D,2 |G,3 ^G, |G,2 E,2 |1 G,4 :|2 G,3 G, |
G,2 G, (3A=G^G |G,2 G^G |G,2 G,B, |^F,3 G,3 |
G,2 G, (3A=G^G |G,2 G^G |G,2 G,B, |G,3 G,2 :|
...
```

Please review the harmony and let me know if there are any changes needed or if it highlights the melody effectively.

-----  
-----  
CriticAgent (to chat\_manager):

Thank you, Harmony Agent, for providing a harmonization for the Oriental-style melody. Here's my feedback regarding the harmony and its different aspects:

1. Harmony and Counterpoint: The harmonization uses a range of chords, and their progressions are generally suitable for Oriental-style music. However, in bars 6, 14, and 22, the chords could use more distance from

**Figure 14.** Chat History Demo for Function-based Communication Protocol

the melodic line to create more tension. Consider adjusting the chords in these bars to provide better contrast with the melody.

2. Rhythmic Complexity: The harmony incorporates a degree of rhythmic diversity, with held bass notes providing a solid foundation underneath the syncopated melody. Expanding this rhythmic variety in sections with faster melodic movement or ornamentation would add interest to the harmony.

3. Form and Structure: The harmonization follows the structure of the melody well and connects the sections smoothly. The chord progressions help build a sense of forward momentum, leading to the cadences at the end of each section.

Overall, while the harmony generally supports and highlights the melody effectively, making a few adjustments to the chord choices and extending the rhythmic diversity will help further refine the harmonization.

-----  
-----  
HarmonyAgent (to chat\_manager):

Harmony Agent:

Thank you for the valuable feedback. I have made the suggested changes, adjusting the chords in bars 6, 14, and 22 for better contrast with the melody and enhancing rhythmic variety in sections with faster melodic movement or ornamentation:

```

X:1

T:Oriental Pentatonic Melody with Harmony - Revised

C:Anonymous Composer

M:2/4

L:1/8

K:Cm

V:1

```
|:c2 c(3BcB|BG GA |AB B^A |GA G2 |
c2 c(3BcB|BG GA |=A^B BG |1 GA Gz :|2 GA GB |
|:Ac Bc |dc BA |AB B^A |GA GB |
Ac Bc |dc ^GA |=AB BG |1 GA Gz :|2 GA G2 |
|:Ec Dc |BA ^GA |BG Ac |=GA GE |
Ec Dc |BA ^GA |BG Ac |=B,=B G2 |
c2 c(3BcB|BG G^A |AB BG |^GB G2 |
c2 c(3BcB|BG G^A |AB BG |GA G2 :|
```

V:2

```
|:g,2 g, (3a=g^g |g,2 C2 |c=3 f, |=G,2 ^G,2 |
```

Figure 15. Chat History Demo for Function-based Communication Protocol

```

g, _b g, (3a=g^g |g,2 C2 |c==b ==D |1 C4 :|2 C2 =CD |
|:_E2 F2 |F3 =E |_E2 F=^F |_B2 =_C2 |
_E2 F2 |F =^G, =^G, |_G,2 ^c3 |1 C4 :|2 _E2 F2 |
|:G,2 _D,2 |G,2 ^=G,2 |G,2 _D,2 |E,3 =G, |
G,2 _D,2 |G,2 ^=G,2 |G,2 E,2 |1 G,4 :|2 G,3 G, |
G,2 G, (3A=G^G |G,2 G^G |G,2 G,=B, |^F,3 G,3 |
G, _b G, (3A=G^G |G,2 G^G |G,2 G,=B, |G,3 G,2 :|
` ` `

```

Please review the revised harmony and let me know if there are any further changes or suggestions to improve the harmony.

CriticAgent (to chat_manager):

Thank you for the revised harmonization, Harmony Agent. The changes made address the feedback provided earlier. Here's my assessment of the updated harmony:

1. Harmony and Counterpoint: The changes in bars 6, 14, and 22 provide better contrast with the melody, creating more tension and interest. The harmonic support complements the melody and enhances the Oriental feel.
2. Rhythmic Complexity: With the enhancement of rhythmic variety in sections with faster melodic movement, the harmony now adds further intrigue to the composition, while maintaining a strong foundation for the melody.
3. Form and Structure: The revised harmonization effectively follows the structure of the melody, with smooth connections between sections and well-executed cadences at the end of each section. The chord progressions contribute to the sense of forward momentum throughout the piece.

Overall, the revised harmony is successful in supporting and highlighting the Oriental-style melody, and the changes made have improved the quality of the harmonization. The harmony agent can now move on to collaborate with the Instrument Agent for the instrumentation and timbre aspects of the composition.

InstrumentAgent (to chat_manager):

Instrument Agent:
Here's the 32-bar Oriental-style melody with harmony, arranged for traditional Oriental instruments. The melody is played on the oud (MIDI

Figure 16. Chat History Demo for Function-based Communication Protocol

program 24), the harmony is played by the qanun (MIDI program 105), and a subtle percussion line using darbuka (MIDI program 113) is added for rhythmic support.

```

...
X:1
T:Oriental Pentatonic Melody with Harmony and Instrumentation
C:Anonymous Composer
M:2/4
L:1/8
K:Cm
%%MIDI program 24
V:1 name="Oud" clef=treble
|:c2 c(3BcB|BG GA |AB B^A |GA G2 |
c2 c(3BcB|BG GA |=A^B BG |1 GA Gz :|2 GA GB |
|:Ac Bc |dc BA |AB B^A |GA GB |
Ac Bc |dc ^GA |=AB BG |1 GA Gz :|2 GA G2 |
|:Ec Dc |BA ^GA |BG Ac |=GA GE |
Ec Dc |BA ^GA |BG Ac |=B,=B G2 |
c2 c(3BcB|BG G^A |AB BG |^GB G2 |
c2 c(3BcB|BG G^A |AB BG |GA G2 :|
%%MIDI program 105
V:2 name="Qanun" clef=treble
|:g,2 g, (3a=g^g |g,2 C2 |c=3 f, |=G,2 ^G,2 |
g, _b g, (3a=g^g |g,2 C2 |c==b ==D |1 C4 :|2 C2 =CD |
|:_E2 F2 |F3 =E |_E2 F=^F |_B2 =_C2 |
_E2 F2 |F =^G,=^G, |_G,2 ^c3 |1 C4 :|2 _E2 F2 |
|:G,2 _D,2 |G,2 ^=G,2 |G,2 _D,2 |E,3 =G, |
G,2 _D,2 |G,2 ^=G,2 |G,2 E,2 |1 G,4 :|2 G,3 G, |
G,2 G, (3A=G^G |G,2 G^G |G,2 G,=B, |^F,3 G,3 |
G, _b G, (3A=G^G |G,2 G^G |G,2 G,=B, |G,3 G,2 :|
%%MIDI program 113
V:3 name="Darbuka" clef=percussion
|:z2z2|z2z2|z (^G2)|z2z2|
z2z2|z2z2|z (c2)|1z2z2:|2z2z (^A2)|
|:z2 (^A2)|z (_B2)|z (^G2)|z (^A2)|
z (G2)|z (^G2)|z (^A2)|1z2z2:|2z2 (^G2)|
|:z2z2|z2 (^G2)|z2 (A2)|z2 ^G2|
z2z2|z2 (^G2)|z2z2|1z2z2:|2z2 (^G2)|
z2z2|z2z2|z (^G2)|z (^A2)|
z2z2|z2z2|z (^G2)|z2 (^G2):|
...

```

Please review the instrumentation and provide feedback on the balance, blend, and overall sound of the composition using the selected instruments.

Figure 17. Chat History Demo for Function-based Communication Protocol

```
-----  
-----  
CriticAgent (to chat_manager):  
  
Thank you, Instrument Agent, for providing the instrumental arrangement of  
the 32-bar Oriental-style melody with harmony. I appreciate your use of  
traditional Oriental instruments for this composition. Here's my feedback  
on the arrangement and chosen instruments:  
  
1. Instrumentation and Timbre: The choice of oud for the melody, qanun for  
the harmony, and darbuka for rhythmic support is appropriate, as these are  
traditional Oriental instruments with unique timbres that contribute to  
the overall aesthetic. The subtle use of percussion provides rhythmical  
grounding without overpowering the other elements.  
  
2. Balance and Blend: The arrangement ensures that the melodic and  
harmonic lines are well balanced, with the oud taking prominence, while  
the qanun supports and highlights the melody effectively. The darbuka  
percussion adds depth to the arrangement without detracting from the  
melodic and harmonic elements.  
  
3. Dynamics: Although not explicitly notated in the ABC notation provided,  
I assume the dynamics will be varied throughout the arrangement. Ensure  
that there are dynamic contrasts and gradual changes in intensity,  
particularly during transitions between sections and moments of tension in  
the melody.  
  
In summary, the instrumentation and arrangement effectively support the  
Oriental-style melody and harmonization, with an appropriate balance and  
blend of traditional instruments. Take note of the dynamics for the final  
performance. Overall, this is a successful rendition of the Oriental-style  
composition.  
  
-----
```

Figure 18. Chat History Demo for Function-based Communication Protocol

Admin (to chat_manager):

make a jazz song in A minor with vocal, rhythm guitar, lead guitar, and bass.

Planner (to chat_manager):

Structure:

1. Introduction (8 bars)
2. Verse 1 (16 bars)
3. Chorus (16 bars)
4. Verse 2 (16 bars)
5. Chorus (16 bars)
6. Bridge (8 bars)
7. Chorus (16 bars)
8. Outro (8 bars)

Energy Flow:

Starts off mellow in the introduction, gradually builds up in the verse, peaks in the chorus, drops slightly in the verse, peaks again in the chorus, drops significantly in the bridge, then gradually builds up in the final chorus and ends on a high in the outro.

Key:

A minor

Chord Progression:

Verse: Am - Dm - G - C

Chorus: F - E - Am - Am

Bridge: Dm - E - Am - Am

Time Signature:

4/4

Tempo:

Moderate tempo, around 120 bpm.

Plan for Musicians:

1. Vocal: Follow the melody line, emphasizing the emotional content of the lyrics. Use dynamics to match the energy flow of the song.
2. Rhythm Guitar: Provide the harmonic foundation of the song, following the chord progression. Use strumming patterns that match the energy flow.

Figure 19. Chat History Demo for Instrument-based Communication Protocol

3. Lead Guitar: Play the melody line during the introduction and outro, and provide fills and solos during the verses and bridge.
4. Bass: Provide the rhythmic foundation of the song, following the root notes of the chord progression. Use walking bass lines to add interest and drive the song forward.

Vocal (to chat_manager):

Vocal:

MIDI Program Number: 54 (Voice Oohs)

Introduction (8 bars):

"C4/2 D4/2 E4/2 F4/2 G4/2 A4/2 B4/2 C5/2"

Verse 1 (16 bars):

"A4/2 B4/2 C5/2 D5/2 E5/2 F5/2 G5/2 A5/2 B5/2 C6/2 D6/2 E6/2 F6/2 G6/2
A6/2 B6/2"

Chorus (16 bars):

"C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2 C5/2 B4/2 A4/2 G4/2 F4/2 E4/2 D4/2
C4/2 B3/2"

Verse 2 (16 bars):

"A4/2 B4/2 C5/2 D5/2 E5/2 F5/2 G5/2 A5/2 B5/2 C6/2 D6/2 E6/2 F6/2 G6/2
A6/2 B6/2"

Chorus (16 bars):

"C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2 C5/2 B4/2 A4/2 G4/2 F4/2 E4/2 D4/2
C4/2 B3/2"

Bridge (8 bars):

"D4/2 E4/2 F4/2 G4/2 A4/2 B4/2 C5/2 D5/2"

Chorus (16 bars):

"C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2 C5/2 B4/2 A4/2 G4/2 F4/2 E4/2 D4/2
C4/2 B3/2"

Outro (8 bars):

"C4/2 D4/2 E4/2 F4/2 G4/2 A4/2 B4/2 C5/2"

Rhythm_Guitar (to chat_manager):

Rhythm Guitar:

Figure 20. Chat History Demo for Instrument-based Communication Protocol

```

MIDI Program Number: 26 (Acoustic Guitar (steel))

Introduction (8 bars):
"[CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4"

Verse 1 (16 bars):
"[CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4
[GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4"

Chorus (16 bars):
"[FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4
[CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4"

Verse 2 (16 bars):
"[CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4
[GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4"

Chorus (16 bars):
"[FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4
[CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4"

Bridge (8 bars):
"[DFA]4 [EGB]4 [CEA]4 [CEA]4 [DFA]4 [EGB]4 [CEA]4 [CEA]4"

Chorus (16 bars):
"[FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4 [FAC]4 [EGB]4
[CEA]4 [CEA]4 [FAC]4 [EGB]4 [CEA]4 [CEA]4"

Outro (8 bars):
"[CEA]4 [DFA]4 [GBD]4 [CEG]4 [CEA]4 [DFA]4 [GBD]4 [CEG]4"

-----
-----
Lead_Guitar (to chat_manager):

Lead Guitar:
MIDI Program Number: 29 (Overdriven Guitar)

Introduction (8 bars):
"A4/2 B4/2 C5/2 D5/2 E5/2 F5/2 G5/2 A5/2"

Verse 1 (16 bars):
"A5/2 B5/2 C6/2 D6/2 E6/2 F6/2 G6/2 A6/2 B6/2 C7/2 D7/2 E7/2 F7/2 G7/2
A7/2 B7/2"

Chorus (16 bars):

```

Figure 21. Chat History Demo for Instrument-based Communication Protocol

"C7/2 B6/2 A6/2 G6/2 F6/2 E6/2 D6/2 C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2
C5/2 B4/2"

Verse 2 (16 bars):

"A5/2 B5/2 C6/2 D6/2 E6/2 F6/2 G6/2 A6/2 B6/2 C7/2 D7/2 E7/2 F7/2 G7/2
A7/2 B7/2"

Chorus (16 bars):

"C7/2 B6/2 A6/2 G6/2 F6/2 E6/2 D6/2 C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2
C5/2 B4/2"

Bridge (8 bars):

"D5/2 E5/2 F5/2 G5/2 A5/2 B5/2 C6/2 D6/2"

Chorus (16 bars):

"C7/2 B6/2 A6/2 G6/2 F6/2 E6/2 D6/2 C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2
C5/2 B4/2"

Outro (8 bars):

"A4/2 B4/2 C5/2 D5/2 E5/2 F5/2 G5/2 A5/2"

Bass (to chat_manager):

Bass:

MIDI Program Number: 34 (Electric Bass (finger))

Introduction (8 bars):

"A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2"

Verse 1 (16 bars):

"A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2 A2/2 D2/2
G2/2 C2/2"

Chorus (16 bars):

"F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2
A2/2 A2/2"

Verse 2 (16 bars):

"A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2 A2/2 D2/2
G2/2 C2/2"

Chorus (16 bars):

"F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2
A2/2 A2/2"

Figure 22. Chat History Demo for Instrument-based Communication Protocol

```

Bridge (8 bars):
"D2/2 E2/2 A2/2 A2/2 D2/2 E2/2 A2/2 A2/2"

Chorus (16 bars):
"F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2 A2/2 A2/2 F2/2 E2/2
A2/2 A2/2"

Outro (8 bars):
"A2/2 D2/2 G2/2 C2/2 A2/2 D2/2 G2/2 C2/2"

-----
-----
Assistant (to chat_manager):

Here is the combined ABC notation for the jazz song in A minor with vocal,
rhythm guitar, lead guitar, and bass.

X:1
T:Jazz Song in A minor
M:4/4
L:1/4
K:Am
%%MIDI program 54 % Voice Oohs - MIDI Program Number for Vocals
%%MIDI program 26 % Acoustic Guitar (steel) - MIDI Program Number for
Rhythm Guitar
%%MIDI program 29 % Overdriven Guitar - MIDI Program Number for Lead
Guitar
%%MIDI program 34 % Electric Bass (finger) - MIDI Program Number for Bass
V:1 name="Vocals"
V:2 name="Rhythm Guitar"
V:3 name="Lead Guitar"
V:4 name="Bass"
[V:1] "Am"C4/2 D4/2 E4/2 F4/2 G4/2 A4/2 B4/2 C5/2 | "Dm"A4/2 B4/2 C5/2
D5/2 E5/2 F5/2 G5/2 A5/2 | "G"B5/2 C6/2 D6/2 E6/2 F6/2 G6/2 A6/2 B6/2 |
"C"C6/2 B5/2 A5/2 G5/2 F5/2 E5/2 D5/2 C5/2 | "F"B4/2 A4/2 G4/2 F4/2 E4/2
D4/2 C4/2 B3/2 | "E"D4/2 E4/2 F4/2 G4/2 A4/2 B4/2 C5/2 D5/2 | "Am"C6/2
B5/2 A5/2 G5/2 F5/2 E5/2 D5/2 C5/2 | "Am"C4/2 D4/2 E4/2 F4/2 G4/2 A4/2
B4/2 C5/2 |
[V:2] "Am"[CEA]4 [DFA]4 | "Dm"[GBD]4 [CEG]4 | "G"[CEA]4 [DFA]4 | "C"[GBD]4
[CEG]4 | "F"[FAC]4 [EGB]4 | "E"[CEA]4 [CEA]4 | "Am"[FAC]4 [EGB]4 |
"Am"[CEA]4 [CEA]4 |
[V:3] "Am"A4/2 B4/2 C5/2 D5/2 | "Dm"E5/2 F5/2 G5/2 A5/2 | "G"B6/2 C7/2
D7/2 E7/2 | "C"F7/2 G7/2 A7/2 B7/2 | "F"C7/2 B6/2 A6/2 G6/2 | "E"F6/2 E6/2
D6/2 C6/2 | "Am"B5/2 A5/2 G5/2 F5/2 | "Am"E5/2 D5/2 C5/2 B4/2 |
[V:4] "Am"A2/2 D2/2 G2/2 C2/2 | "Dm"A2/2 D2/2 G2/2 C2/2 | "G"A2/2 D2/2
G2/2 C2/2 | "C"A2/2 D2/2 G2/2 C2/2 | "F"F2/2 E2/2 A2/2 A2/2 | "E"F2/2 E2/2
A2/2 A2/2 | "Am"F2/2 E2/2 A2/2 A2/2 | "Am"A2/2 D2/2 G2/2 C2/2 |

```

Figure 23. Chat History Demo for Instrument-based Communication Protocol

Critic (to chat_manager):

The ABC notation provided for the jazz song in A minor is technically accurate and follows the structure and chord progression outlined by the Planner. However, there are a few areas that could be improved to enhance the musicality and overall composition of the song.

1. Melody: The melody, as written, is a simple ascending and descending scale. While this can work in some contexts, it lacks the interest and emotional depth typically associated with jazz music. Consider varying the melody, using more leaps (jumps from one note to another that are not next to each other), syncopation (emphasizing off-beats), and rhythmic variation.
2. Harmony: The rhythm guitar part is providing the correct chords, but the voicings (the order and spacing of the notes in the chord) are all root position triads. This can make the harmony sound simplistic and less rich than typical jazz harmonies. Consider using more complex chord voicings, such as seventh chords or extended chords, and varying the order of the notes.
3. Lead Guitar: The lead guitar part is also a simple ascending and descending scale. In jazz, the lead guitar often plays a more complex, improvisatory role. Consider adding more variation, using techniques such as bends, slides, and hammer-ons/pull-offs, and incorporating more chromatic notes (notes not in the key) to create a more interesting, jazz-like sound.
4. Bass: The bass part is providing a solid foundation, but could be more interesting. In jazz, the bass often plays walking bass lines, which are continuous lines of quarter notes that move smoothly from one chord to the next. Consider incorporating walking bass lines to add interest and drive the song forward.
5. Dynamics: The song could benefit from more dynamic contrast. Consider adding crescendos and decrescendos, and varying the dynamics more throughout the song to match the energy flow outlined by the Planner.
6. Lyrics: While not included in the ABC notation, lyrics are an important part of any vocal song. Consider adding lyrics that fit the mood and style of the song, and that work well with the melody.

Figure 24. Chat History Demo for Instrument-based Communication Protocol

Overall, the song has a good foundation, but could be improved by adding more complexity and variation, and by incorporating more typical jazz techniques and styles.

Provide feedback to chat_manager. Press enter to skip and use auto-reply, or type 'exit' to end the conversation:

Figure 25. Chat History Demo for Instrument-based Communication Protocol

$\text{♩} = 144$

Piano, Allegro Adventure

Violoncello

Marimba (grand staff)

6

Pno.

Vc.

Mrm.

13

Pno.

Vc.

Mrm.

20

Pno.

Vc.

Mrm.

Figure 26. Allegro Adventure, composed by AutoMusicians

2

27

The image shows a musical score for three instruments: Piano (Pno.), Violoncello (Vc.), and Mramor (Mrm.). The score begins at measure 27. The Piano part is written in a treble clef with a key signature of one sharp (F#). It features a melodic line with eighth and sixteenth notes, including some chromaticism. The Violoncello part is written in a bass clef with the same key signature, providing a harmonic accompaniment with chords and single notes. The Mramor part is written in a treble clef with the same key signature and consists of a series of rests, indicating it is silent during this section. The score concludes with a double bar line.

Figure 27. Allegro Adventure, composed by AutoMusicians