

# ARPiano: Efficient Music Learning Using Augmented Reality

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**Abstract.** ARPiano uses a MIDI keyboard and a multi function knob to create a novel mixed reality experience that supports visual music learning, music visualizations and music understanding. At its core, ARPiano provides a framework for extending a physical piano using augmented reality. ARPiano is able to precisely locate a physical keyboard in order to overlay various objects around the keyboard and on individual keys.

**Key words:** Augmented Reality · Piano · Learning · Education · Music

## 1 Background and Related Work

Traditional music learning focuses on reading symbols in the form of sheet music. However, these symbols are abstract and there is no intuitive correlation between the symbol and the note that it represents. Additionally, when playing piano the feedback is mainly auditory, not visual. Current theories of learning show that using multiple modalities (ie auditory and visual) in learning is an effective strategy to form mental constructs and schemas [1–3].

Current software like SmartMusic [4] and Synthesia [5] try to facilitate music learning by creating visuals and providing performance statistics. SmartMusic



**Fig. 1.** ARPiano can provide a visual representation of played notes.

uses a microphone to analyze a player's performance, but it relies on sheet music and does not offer a more intuitive musical representation of the song. Synthesia, like ARPiano, renders songs in the form of a piano roll but does so on a traditional 2D display, requiring the user to look back and forth between the keyboard and the display.

### 1.1 ARPiano

ARPiano supports music learning, visualizations and understanding by using Augmented Reality to precisely overlay useful sprites and annotations on top of the piano. ARPiano aims to facilitate visual music learning by providing a deeper connection between the song the user is learning and what they are seeing. ARPiano visually renders a song in the form of a sequence of cuboids where the length of the rectangle represents the length of the note and the position relative to the keyboard represents the note value (similar to popular music rhythm games like Guitar Hero). This piano roll representation of a song allows users to play simple melodies without needing to learn sheet music.

ARPiano also allows for music visualization and music understanding. Music visualization is accomplished by emitting a sprite from the physical key location whenever the key is pressed. This provides the user with a visual counterpart to what they are hearing and allows them to better see patterns in the music. Additionally, while the user is playing, ARPiano is able to augment the interface to point out specific musical artifacts, such as chords, which aids in music understanding.

## 2 Conclusion

Before augmented reality, adding visual learning functionality to instruments required expensive hardware and visuals were limited to that hardware. With augmented reality, there is no limit to the type and position of objects that can be rendered on the keyboard. We believe this opens the possibility to rethink the way we approach music learning.

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