An Introduction to Procedural Music in Video Games by Karen Collins

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An Introduction to Procedural Music in Video Games by Karen Collins describes some procedural music techniques that have been used in games and inspired by procedural composition. She also takes a look at which games currently adopt procedural music in some way and potential ways in which it could be used.

(Wooler and Brown, 2005) states that generative music as a category can be split into 4 different parts:

**Linguistic / Structural**
Music inspired by grammars in language or built using analytical frameworks

**Interactive / Behavioural**
Music that emerges from processes that are not inherently musical

**Creative / Procedural**
Music that emerges from one or more processes started by the composer

**Biological / Emergent**
Music that is not deterministic and cannot be repeated (such as wind chimes)

Brian Eno for example, describes the process of creating *Music for Airports* (Eno, 1978) as being part of “generative music” in (Eno, 1996), while Collins defines procedural music as “composition that evolves in real time according to a specific set of rules or control logics”

Thus, with an explanation of what procedural music is, Collins describes what procedural music in video games is. She first describes gameplay as being inherently procedural since many elements of gameplay are unpredictable and are individual. Therefore, it can also be argued that video game soundtracks are also procedural since the audio is different for each playthrough. By audio, Collins refers to both the soundtrack as well as the sound effects and interface sounds in the game. She claims that even music that has a fixed beginning and ending can be procedural when used in games, since if a player jumps from one area to another, the music changes.

Collins references (Collins, 2005) to define dynamic audio as “non linear, variable elements in the sonic aspects of gameplay”. She divides this into 2 categories:

**Interactive audio**
Audio events that the player has some control over. The player may time these events to occur at different times. Interactive audio includes the sound of player’s footsteps, gun shots and other music cues in the level.

**Adaptive audio**
Audio events that the player has no control over and that change according to in-game parameters. This includes location dependant music and the difference in music when transitioning between night and day.

Collins then turns to the problems that music currently faces in games, as well as problems that procedural music could face. One problem is long gameplay sessions where players begin to get tired of the music constantly repeating itself. Some players end up turning the music off or substituting it with their own playlists. To try and remedy this situation, Collins describes two solutions that she has encountered; slowly fading out the music so that it won’t repeat endlessly,
or as done in *Spore* (Maxis, 2008), the density of the instrumentation is reduced, making it easier for the listener. Another problem is the fact that music must serve a purpose in the game (such as drawing attention to something in the game) and be somewhat tied to the image and the narrative. Therefore, in order for procedural music to work properly, it must be tightly controlled.

Some games and toys are then described by Collins that use procedural or generative audio processes, such as *Otoy* (SEDIC, 1987), a musical side-scrolling shooter where the player’s actions make music, or *Second Life* (Linden Research Inc, 2003), an online virtual world where users can make their own music.

Collins then cites (Wooler and Brown, 2005) to distinguish between two types of procedural processes in game music, *transformational algorithms* and *generative algorithms*. While transformational algorithms affect the song’s structure (by for example, altering the pitches of notes or adding new instrument lines), generative algorithms create the actual musical materials themselves that form the song’s structure. Collins mainly focuses on transformational algorithms in the paper since she claims that composing effective and relevant procedural music using generative algorithms is much more difficult.

Apart from increasing the tempo of the song and adding or removing new instrument lines, Collins describes 2 other ways that transformational algorithms may be used. The first is the use of open form, inspired by aleatoric music where the playback of the music is left to the performer. In the game, the audio engine decides how to piece together the song’s elements. The second method is the use of parameters that define start and end positions and positions to loop in the song, amongst other things. Collins describes the *iMuse* audio engine made by LucasArts which is able to react and change the music according to certain conditions in the game. Collins claims that if the music can respond to player’s actions in the game, an illusion can be created where the player thinks that game can predict what the player is going to do.

One particular technique, which (Wooler and Brown, 2005) defines as *algorithmic generative music*, is used in *Ballblazer* (Lucasfilm Games, 1984). Peter Langston describes the *riffology algorithm* in (Langston, 1986) where a soloing guitar is mimicked by having the computer decide which riff to play next based on certain parameters, such as the easiest possible riff to play next, as well as how fast or how loud it should play the notes. Langston states that while the algorithm did generate music, it failed to generate interesting music. He claims that this was because it lacked melodic and rhythmic structure.

Collins states that procedural music has not been more widely adopted due to several reasons. First of all, music must be meaningful to the player in some way, and likewise with procedural music. Secondly, making procedural music tends to be very CPU intensive, and CPU resources are already eaten up by graphics, physics and AI. Thirdly, there is a difficulty in explaining to people what procedural music is and why it is valuable, especially to producers and players. However, with the increasing adoption of procedural graphics, Collins feels comfortable that game developers will eventually start to consider procedural audio as well.
Bibliography


