Holistic Strategies for Problem Solving

Team Projects

Musical Systems: Executive Summary

If we have learned anything this term, it is that systems thinking is a powerful strategy for problem solving. Problems that might be improved by taking a systems approach include everything from climate change, to homelessness, crime, and education. This last one requires special attention, for the traditional education system fails to teach much by way of the system thinking skills needed to solve these complex problems. As a result, the vast majority of people have no idea what systems thinking is and therefore fail to grasp how powerful a tool it can be. Nor do they want to.

Show someone a causal loop diagram and their eyes glaze over. Point out the figures on Harder House windows and they will assume it to be too complicated for them to understand, perhaps remarking on how pretty they are. But it is that final comment, that attraction toward beauty, that we intend to exploit.

Though not everyone can understand the scientific jargon sprinkled throughout systems thinking, or has the experience to understand social examples, everyone listens to music. As Patrick Rothfuss says in *Name of the Wind,* “Words have to find a man’s mind before they can touch his heart. And, some men’s minds are woeful small targets. Music touches their hearts directly, no matter how small or stubborn the mind of the man who listens.” Music, therefore, is a good bet for spreading an intuitive knowledge of systems thinking.

There are many directions to take this task, from creating a music generating algorithm to interactive musical interpretations of known systems, but they all begin with the same four steps. These steps are analogous to the four fields of conversation described in Shuford, who adapted them from Isaacs. We begin in the move/follow field, where we attempt to understand the sound-making software with the goal of telling the computer what sound to make (move) and the computer makes it (follow). Once this has been accomplished the next step is to create interacting sounds, sounds which respond to each other. As in the move/oppose field, these sounds react to each other rather than simply following the steps laid out for them, and are defined in relation to others as much as by their own properties.

But this move/oppose framework of sounds “listening” and reacting to other sounds, or *patches* as the sound generating objects we used are called, is not enough to truly embody a systems perspective. The next challenge, therefore, is to create a closed loop, a patch which eventually listens to itself in a *reflective* manner, which responds not just to another patch but to its own previous states. Finally, finishing out the Shuford/Isaacs analogy with their fourth field of conversation, a system of patches with these reflective properties should be able to generate novel systems of sound which may or may not be considered musical. In this way, we succeed when the notes of a song enter into a generative system of dialogue with each other.

In order to achieve what we might consider music instead of noise, it was important to look at how human generated music acts as a system. Looking at a song as a system from the Lendaris lens of levels and angles, we can consider a song to be a supra-system, though of course the song can also fit into a system of songs that make up an album, or the system of the environment around the person listening to it. But for our purposes, the song is the suprasystem. The song is then made up of a system of verses, and the verses are made up of systems of phrases, which are made up of notes. If we so desired, the note as voiced by a physical instrument can be thought of as being made up of a system of frequencies, although in our case, we are using computer generated sine waves which have just one frequency per note--and thus we end our submersion into the musical subsystems. But music isn’t just about the collections of sounds, it is also about the silence and the lengths of the sounds, the lyrics that speak to the feelings the sounds create and much more. Thus, we find different angles from which to view this system of sounds in rhythm, melody, harmony, and lyrics.

But simply identifying the levels and angles is not enough. To truly grapple with the question of how a song is a system, we would ideally run some analysis on “good” music, perhaps creating a causal loop diagram or other interpretations to understand the interactions of the elements. This would be an ideal next step for anyone looking to create a music-generating algorithm. Once one can identify common relations and influences between elements, then we can generalize and create rules for our generating system.

One example of doing this was when we attempted to create a music-generating algorithm which would take a four note motif and then change and replay it according to systems rules. This insight of replaying four notes in a consistent relation to each other came from our own general musical knowledge. A more analytic way of searching for patterns could yield a wealth of informative rules.

Another possible direction is to build an interactive musical “playground”--an environment that allows “players” to interact with a musical system, and see how changes and tweaks affect the system’s output. In this way, interacting with systems becomes intuitive, as a player’s interactions with the playground are at once integrated into the complexity of the system, and rule-bounded to keep the experience comprehensible. The application of rules can lie anywhere on a broad spectrum. Some formations could be rule heavy, as with the four note motif generator, which would allow people new to systems thinking to experience how changing one part of a system can affect other parts. A rule heavy playground therefore lets the player see what happens when one messes with the parameters of a system.

But as we know from Meadows, changing the parameters of a system changes much less about the system than almost any other form of system intervention. Imposing fewer rules on the system and thereby allowing the player to experiment with more aspects of designing the system would allow them to experience more about a system than when all the rules are already imposed by the designer.

In terms of the Shuford framework for understanding our musical system, the patch we ultimately developed didn’t fully realize the generative dialogue stage that we had at first envisioned. The patch is composed of multiple independent components, check. Those components do respond to human control and input in a move-follow sense, check. We were also able to get reactive connections between different parts of the patch, where one element is listening to another element and changes its own behavior in response to the behavior of the other. This reactivity to context aligns with the move-oppose stage, check. We were even successful in producing a patch that reflects on its past choices - choosing new notes to play according to notes it had already played. Reflective elements, check.

As we have seen throughout this class, however, effective complex systems are rarely built, they are usually grown. All of the features we built have been successful, and taken together they provide us with the basic components required to assemble the truly generative musical system we set out to create. Allowing these components to grow into a real complex system turns out to be non-trivial, and it just takes time.

It began with a conceptualizing a simple song as being a system, but the systems thinking paradigm informed far more than the algorithm we originally hoped to create. The system was our own team working toward an understanding of musical systems. The system was the process of learning the programming language in which we hoped to create. The system was the greater society in which we seek to spread the shared vision of systems thinking itself.