PROCEDURAL RHYTHM GENERATION FOR THE HIERARCHICAL WAVE FUNCTION COLLAPSE MODEL

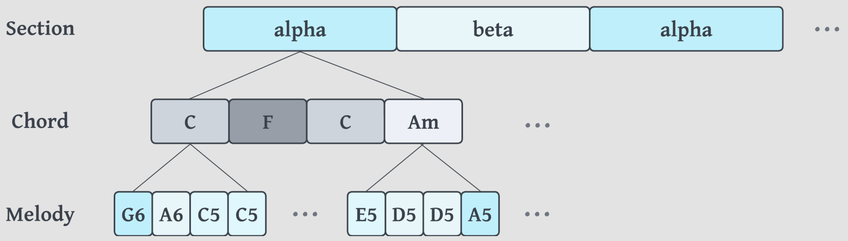
Author: Ágnes Anna Mikó
miko@student.tudelft.nl

Supervisor: Rafael Bidarra

PREVIOUS WORKS

Wave Function Collapse (WFC)
constraint-solving algorithm inspired by quantum mechanics that generates content by iteratively collapsing a grid of cells to definite states based on input sample constraints

Hierarchical Wave Function Collapse (HWFC)
introduces a hierarchy of canvases, some composed of meta-cells that inherit constraints from the ones above them [1]



RESEARCH QUESTION

How can we integrate rhythmic patterns into the Hierarchical Wave Function Collapse model?

1. What exactly is rhythm, and what essential constraints define it?
2. How have other music generators approached the modeling of rhythm?
3. What techniques can enable more flexible rhythm creation?
4. Considering its application as a tool, what would be an intuitive visual representation of rhythm?

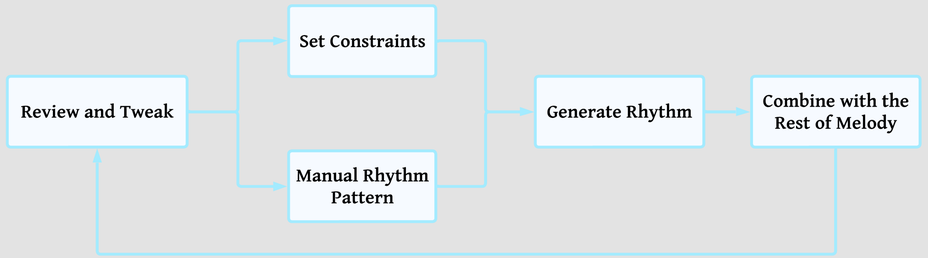
THE GOAL

- explore the procedural generation of rhythm
- not necessarily to adhere to the WFC algorithm
- align it with the mixed-initiative approach of ProceduraLiszt [2]

THE REPRESENTATION OF RHYTHM

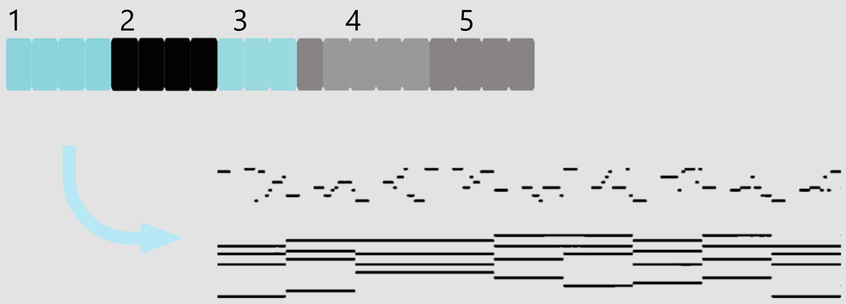
How do we define rhythm?
A pattern of variable-length duration notes and rests, summing up to the value determined by the time signature, loosely connected to the underlying beats of the meter.

What constraints describe it?
- the time signature
- the meter - with strong beats evenly spaced throughout
- the weight of the meter – the likelihood of longer notes on strong beats
- the note values - the pool of values to generate from
- the melody length - the number of notes in a measure



RESULT

- Like in MIDI editors, users can drag and select where notes or rests appear within the measure.
- Many constraints to adjust that affect the rhythm generation.
- If the measure has empty spaces, the algorithm fills in the rest of the rhythm, which can vary over each measure.



DISCUSSION

- rhythm is generated independently from the melody, the model could benefit from a relation between the two
- the model does not cover cases of syncopated rhythms or polyrhythms.
- the algorithm could be adapted to WFC and handle note values as durations in superposition and determine which cells to collapse according to the constraints,

CONCLUSION

This research explored what rhythm could mean within the context of procedural music generation and that of HWFC, improving an existing tool for mixed-initiative music creation.

REFERENCES

[1] Varga, P. P., & Bidarra, R. (2023). Procedural mixed-initiative music composition with hierarchical Wave Function Collapse.
[2] Varga, P. P., & Bidarra, R. (2023). ProceduraLiszt. https://proceduralisztdevs.github.io/proceduraliszt/#/proceduraliszt/