0. Header information. (All optional)

Date: 23 / 04 / 2020
Manuscript #: 32444
Title: Using Hilbert Curves to Organize, Sample, and Sonify Solar Data
Author: W. Dean Pesnell and Kyle Ingram-Johnson

1. Summary. Briefly summarize why you do or do not believe this manuscript would be of interest and/or value to readers of the American Journal of Physics. (Feel free to refer to passages from the Statement of Editorial Policy.)

- I would consider this manuscript to be of interest for your readers, mostly for the suggestions it makes about sonifying data. The potential of data sonification can be extremely interesting both to give a new perspective to fully viewing users and to help blind users access image data. The solutions found for the sonification itself, on the other hand, are quite rough. I think that MIDI limitations and rough timbres should be avoided to provide a more accurate and "clean" representation of the data itself.

2. Technical correctness. Is the manuscript technically correct?

- I found nothing incorrect

3. Attention to audience. Is the introduction sufficiently complete and the general level of presentation sufficiently accessible to the majority of AJP readers whose expertise will lie in other subdisciplines of physics?

- The manuscript does not introduce any overcomplicated concept and does not take for granted any advanced knowledge, sufficiently introducing all topics with the necessary information

4. Style, clarity, and grammar. Is the writing style, clarity, English grammar, etc. suitable for publication in AJP?

- I found the manuscript to be clearly readable and correctly written

5. Figures and captions. Is the manuscript sufficiently and appropriately illustrated with figures and are the figures and figure captions clear?

- Figures are appropriate and useful, captions are clear

6. References. Are the references to previous work, in this journal and elsewhere, adequate? If not, please elaborate.

- I found references to be adequate

7. Overall recommendation. Please indicate your overall recommendation here (and in the online submission form.) Your choices and their intended interpretations are:

X Accept (Meets publication criteriain current form)

8. Nature of the manuscript. (Check all that apply.) Please indicate whether the manuscript ...

... is directly applicable to the classroom in

___ introductory physics courses

X undergraduate physics major courses

X graduate physics courses

... is not directly applicable to the classroom, but provides insights and background that are likely to have a significant impact on the classroom in

X introductory physics courses

X undergraduate physics major courses

X graduate physics courses

... is not directly applicable to the classroom, but

___ of general cultural interest.

9. Additional Commentary (Please use as much additional space as you like to provide additional commentary and, if you are recommending revision, suggestions for improvement.)

As said in 1., I believe that data sonification applied to physics has a great potential for various purposes, like accessibility or monitoring. Some data sets might even be more comprehensible if sonified, rather than visualized. I would consider investigating more deeply the relations between pictures and sound: for example this paper's authors sonifies pictures by translating "clumps" of pixels in a stream of MIDI notes, following a Hilbert curves. I think this might be misleading: when our brains look at a picture, it first get a general idea of the subject (is it another person? Is it dangerous? Is it food?), and once it has a

context it looks for details to get specific information. Think about how would you describe a picture to a blind person: you wouldn't says "there is some blue, then an ear, then some hair, an eye, one big tooth, half mouth, other half mouth, another eye, more hair".. but maybe "this is a picture of a lion, with a big mane, showing teeth".

So I would consider implementing some kind of "pre-analysis" on the pictures to sonify, even a simple computer vision algorithm like blob detection could be very useful. For example, a picture (or a video) of the sun sonyfied to analyze sunspots could have a low tone corresponding to the average brightness of the whole picture, or the number of sunsposts, while single sunspots are represented via higher-pitched sounds.

For this I would also consider moving away from MIDI: it is extremely limited regarding frequency and dynamics, so it makes very difficult to represent correctly rich and complex data. Developing a simple but powerful addictive/subtractive synthesis sound engine with a specific software like Pure Data, Max MSP, Super Collider or Processing (just to name a few) would give a much greater control over sound, allowing to better represent the data.