As I was reading every page and analysing it I was reacting to what was written. The writting process was a reaction of what I read. Same with the exaples given along this reading. So apologies if it's not clear. I hope it is!

Has I was writing it, I understood that there are a lot of issues/limitations when it comes to software and this might be an issue for us.

In order to solve this I believe we should understand as a starter few bullet points:

- how can our softwares communicate with each other: how would the information I create in 3D data info could be of use to the Max patches you are creating

- which software does what: after deffining a method of approach how can we understand where a software process starts and ends. When do I start to give you data info and how.

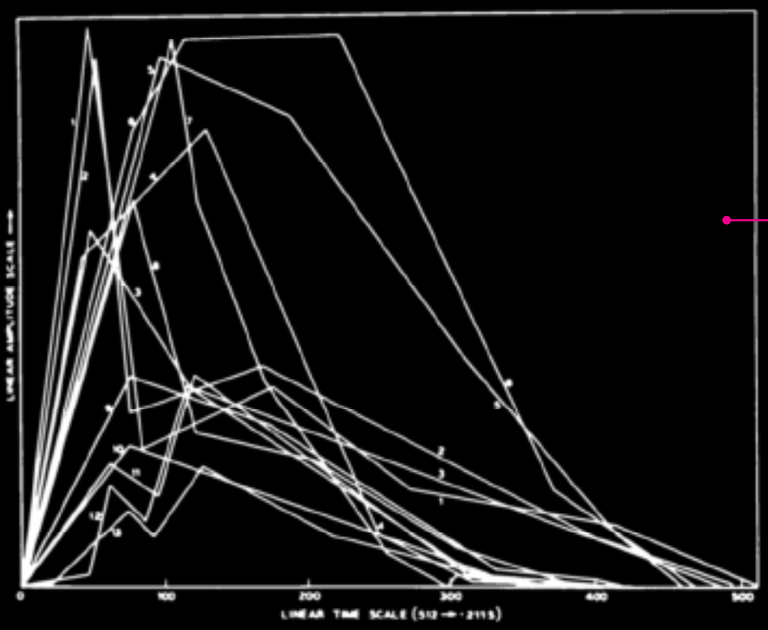
- when deciding a method of approach , which depends of the software's ability (as you explained in page 11) we need to understand if the sonic result is in any how loyal to the form/object/shape we are presenting, otherwise the relation between sound and form might be lost. No?

Nevertheless the conclusion is that we might have to have a chat via skype, because I'm not such a Max Pro as you are! :)
Meaning I might need a few 'lights' to better understand how I will be able to help you!

ps: apologies if my english is not the best, please let me know! I have no problem in people correct me :)

Conceptual Background/Relative Work:

i. Work of Jean-Claude Risset



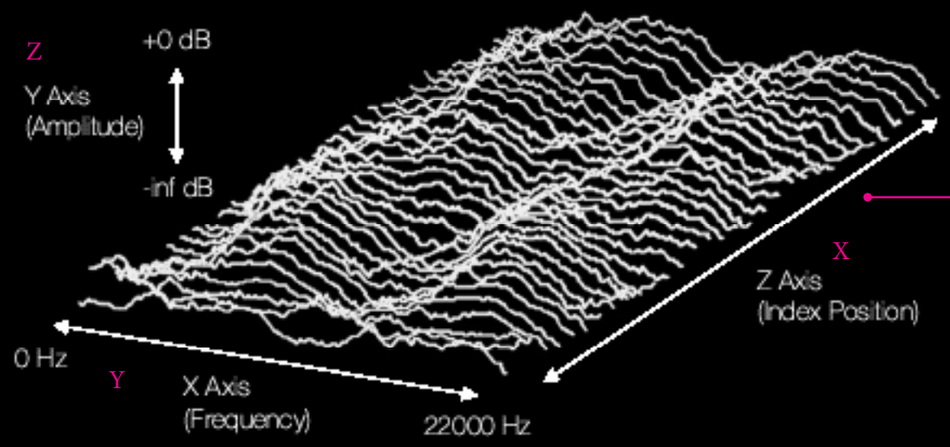
I'd been doing some research into the GRM & Jean-Claude Risset, based on his piece "Mutations" as I'd been examining the use of Shephard Tones/Shephard-Risset glissando. I found an interesting segment of information on Risset's early work in Bell Labs in the USA, where he had been trying to reproduce the sound of brass instruments through additive synthesis.

In the diagram above, each of the curves represent the amplitude path of individual harmonics within the timbre of a brass instrument.

Is this a good explanation?

https://www.youtube.com/watch?v=wGkdb6YlLgg

ii. Indexed Waveform



Above is the display from a Fairlight CMI, in the 3D waveform view mode.

This display shows the form of a recorded sample over its total duration, with each curve segment representing the amplitude of each frequency at their respective points.

I think this is a relevant existing technique that goes some way in providing a visualisation that's related to some of the ideas I will attempt to express. I've labelled each axis in the diagram with their respective representations, and I feel like this may be a good introduction to attempting to visualise the relationship between frequency and amplitude over a respective time domain.

Is this graphic something to be fix with? Or can it be questionable?
I f so I would advice you to change the axis names:

-**Y Axiz would be Z for Amplitude** (if we consider *amplitude* of a wave to be a measure of the displacement of the wave from its rest position, it will generally be calculated by looking on a graph of a wave and measuring the height of the wave from the resting position. So I automatically relate this with the architectural dimension of Height. as in the height of a building/structure to be calculated from). The 'resting position' of architectural information will be a 2D plan of the building. With 3D data info the building gains its Amplitude/Height (number of stages/floors in a building) - which is Z vector for us.

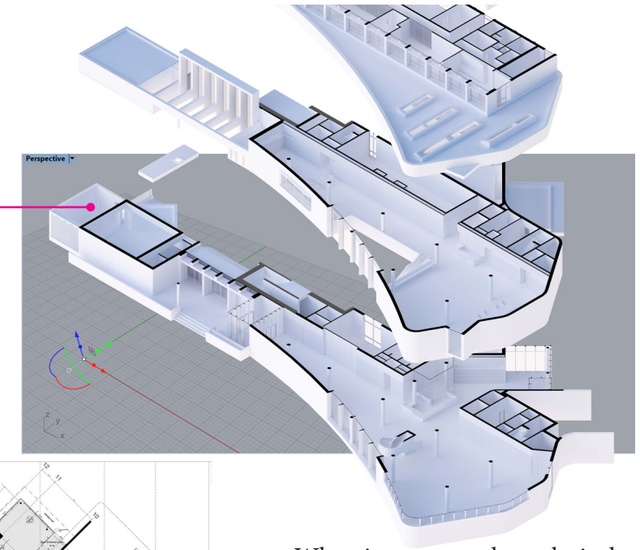
-**X Axis would be Y for Frequency**: being *frequency* the number of occurrences of a repeating event per unit of time and imagining a case where the columns of a building are disposed in X, Y direction to the positive coordinates, we can assume that the colums of this building are the structural frequency of itself (normally displayed every 6meters).

To be honest when considering you have the plan of a building drawn in X,Y you can always rotate it in the most convenient way. But I don't want to confuse you so let's just stick to the method described above, no?

- **Z Axis would be X for Index Position:** being X a representation of a timeline (if I understood it right?) It will represent the position of the building in a static structural grid which is the 'fix' established constant (which in sound will be time?). I hope I'm making sense here! So we will allocate the building by its position from the X coordinate as it's the basis of any location system. When in geometry you give a definition of a point in space you always start by defining its X coordinate. When interpreting any shape of form in space the X coordinate is always the first one to define a location, and this is why I would associate it here in this case with the Index Position.

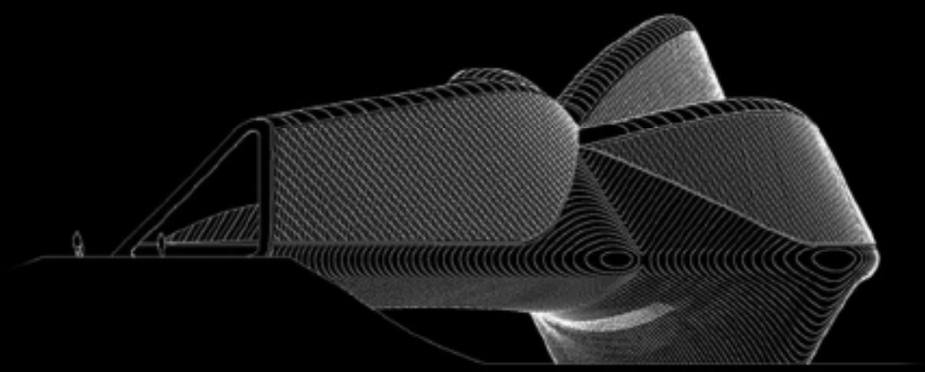
Note: I hope this makes sense, please let me know if you agree with these comments. I understand after checking out the jitter videos your choice for the vectors direction, but when it comes to architecture, this is what you will have. Please check examples below

I did this image to illustrate what I mean. When you open a software such as Rhino for example the gumball vector comes up as the one showned in red (X), green (Y) and blue (Z) colours.



When it comes to the technical drawings part we always design a structural grid to support any element's position. So here you can see the plan of the building with the structural grid. This is very useful for future consultants discussions, such as engineers.

iii. Example: Zaragoza Bridge Pavilion



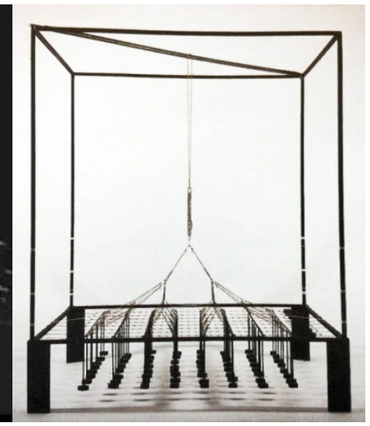
The first example that really sprung to mind when I thought about applicable structures that may fit the process is maybe a little obvious, as some of Zaha Hadid's work already evokes imagery of waveforms.

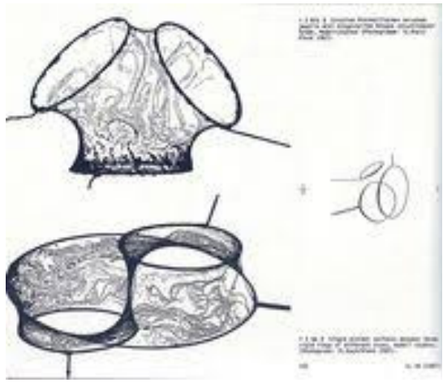
The reason I wanted to mention this example in particular is that there's a specific modulation of form across the substantial depth of the structure, which I found relative to the previous example of indexed waveforms.

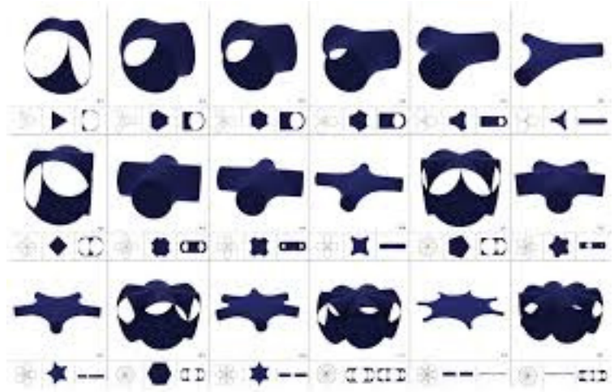
I imagine this translates to a certain amount of sonic potential as an architectural form.

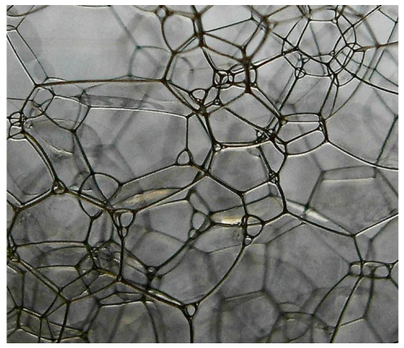
Please check out the .OBJ I left you in the 3D folder because I need to understand if its working out for you. As I explained you with a few images in the email I send you, the export method has a lot of variants so I do need to understand which one will work out in the best way with what you need to do.

Also please let me know if the project I selected seems to be a good starting point for you! Frei Otto was quite a character and an engineous mind
Check out he calculated the tensegrity of the structures... there were no computers to support these calculations at the time, so soap was the thing! Or similiarly to Gaudi calcullating the structure for the Sagrada Familia he used models in a certain scale to then calculate the structure's weight in real life.







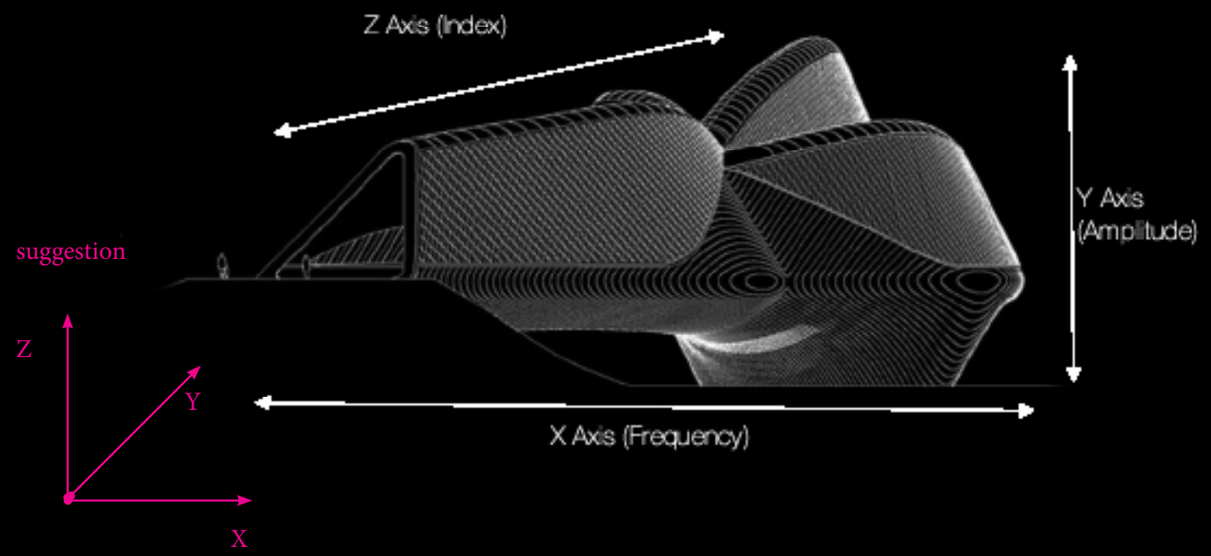


he was also a nature freak geek. he studied a lot of cases where he found answers to his structures. Voronoi Pattern. Fibonnaci Series. Mandelbroat fractals. Pneumatic examples with the soap bubble system. Tree branches ...etc..

Usefull websites for some brief introduction to Otto's work:

https://designontopic.wordpress.com/2014/02/02/catenaries-continuing-report/
https://www.youtube.com/watch?v=-IW7o25NmeA

Concept Plan:

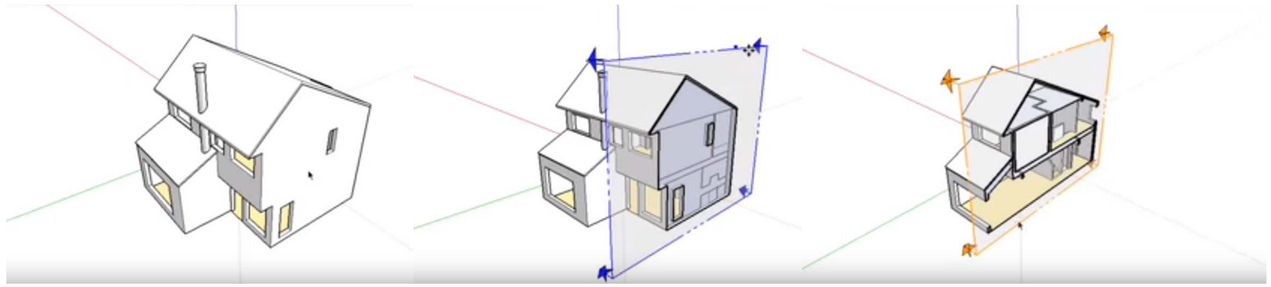


So, with the previous examples in mind, let's condense these ideas together. With a basic combination of the previous examples, I've sketched a very basic relationship above.
This simple idea is to analyse a structure by breaking it down into individual sections across the Z axis, each of these sections are treated as a distinct waveform plotted to the X & Y axes.

There are a few relationships I have in mind that I imagine produce certain results, for example:

- Linear vertices and curvature and interpolations between them.
- Number of peaks at a given point.
- Relationship of ratios between peak position.
- Open vs. closed structures
  (i.e. arches will produce sounds high in the spectrum, an open ceiling will produce greater results at the spectral extremities, columns will produce specific static blocks of frequencies)

I set out a few images to understand how can we manage to do this. In terms of plotting the material.

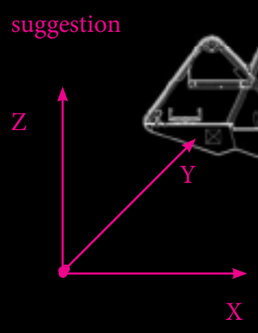


images taken from this video: https://www.youtube.com/watch?v=aPW6EKMwmjA

This is a really simple example that few 3D softwares can do these sections, though I don't know how to transport the data info as a direct link to the MaxMSP. Let's see if your jitter method works!
I can imagine that if you have the object in .OBJ and Max can cut a section on it you can get this sort of drawings, no? I was trying to explore in Grasshopper a method of doing this. What Grasshopper does is build a 3D parametric shape and allows you to modulate it with a sort of an ongoing command processing.

Note: Maybe now you can understand why I told you can rotate the X or Y axis? Nevertheless due to the nature of this process I believe you should define it and fix it yourself as the unit you would like it to represent, and what should rotate should be the model(object 3D) according to the best result, or the outcome that will sound best!

I agree with all of this, though I believe each case will be a different story and probably we will find the best way for each one has we go along..no?
Maybe a few examples in 3D would be useful for you to start with.
Should I send you a few arches as joined blocks of objects so you can explore?



The above section of the pavilion is useful to demonstrate modulations of form across the depth of the structure.

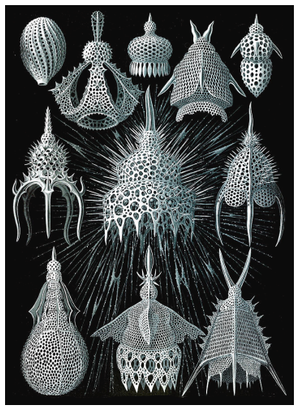
With consideration to the elements mentioned in the previous page, you can perhaps perceive how sonic content may be affected during interpolation between each indexed section over the length of a complete structure.

For example, if you examine the peaks above, as they shift/are introduced across the X-Axis, they will change their frequency pattern and amplitude curve according to their position.

I wish I could program a perpendicular plan, like the one in blue or orange in the images showned previously, that would send to the Max MSP the data info from each section. This would allow you to work with a progressive model. In my opinion if there is a software which does this it would be Grasshopper, because it allows you to set up a bunch of commands at the same time using parametrics and programming through coding.
But throughout the Forums, no one until now set up such command, because when you need a section in an object or a building, the data info just comes up. The way is mapped is more of an inherent set up of the software, not really of good use for architects or designers. Like musicians with ableton, perhaps. Maybe you will get deep down to mapp your controller if ableton doesn't recognise it. (that happen to me, because it

When I saw these images it reminded me of the Ernst Haeckel illustrations.
He used a method called Radiolaria to check analyse the plants he was studying and illustrate his book Art forms of Nature 1904.
OR
Remember the Oramics machine by Daphne Oram? With a grid and graphics of just black on white paper she could 'programme' or make the Oramics read/play a certain note.

Not sure these names be of any help but the methods used might help on process thinking?



Radiolaria work from Ernst Haeckel

His full work is public domain now, because its author rights expired...eheheh
https://publicdomainreview.org/collections/ernst-haeckels-radiolaria-1862/

'Oram was an electronic music pioneer, one of the founding members of the BBC Radiophonic workshop and the creator of Oramics - a drawn sound technique in which drawings made directly onto 35mm film stock are read by photo-electric cells and turned into sounds. Besides being a musical innovator, Oram was the first woman to direct an electronic music studio, the first woman to set up a personal electronic music studio and the first woman to design and construct an electronic musical instrument. Through his PhD research into Oram, Richards has built a Mini Oramics machine, a unique and previously unfinished synthesiser from her original designs.'

Tom Richards developed a Mini Oramics piece re modelling the Oramics machine from Daphne and presented the piece (instrument with arduino included!) about a year ago in February at the Camden Art Centre. It was quite impressive.

Implementations:

Following our extraction of plotted waveform material according to the analysis of the structure, this needs to be applied to sonic material, there are a few applicable methods that I am going to outline:

i. Resynthesis

The most obvious method is to apply this plot of X & Y axis information to the process of additive synthesis. With X being frequency and Y being amplitude as detailed above, this is then applied exactly to a series of sinusoidal waves and amplifiers located at each partial.

As a section contains more information than just the overall maximum values of each section at any given point, each line of form in a section needs to be handled polyphonically across the spectrum, which should also have the benefit of resulting in sonic material that is harmonically complex.

One potential issue with using this method solely as sound is that the final result may end up sonically uninteresting, however if you condense the sonic form to different timescales it may produce sonic objects that can be arranged together into a larger image that might produce better results.

I wish I could program a perpendicular plan, like the one in blue or orange in the images showned previously, that would send to the Max MSP the data info from each section. This would allow you to work with a progressive model. In my opinion if there is a software which does this it would be Grasshopper, because it allows you to set up a bunch of commands at the same time using parametrics and programming through coding.
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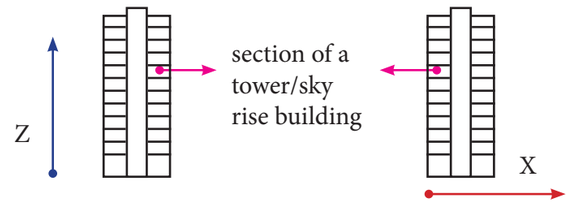
Should this building sections be transformed in continues information instead of being fixed images (frames)? Here is the situation where I try to find out how to write the grasshopper command to make this section plan a usefull tool to you. And a continues one, so Instead of having fixed images(sections) you could have a continuous sound, going back and forwards.

Note: when thinking in sections as data info I relate visually to this work: https://vimeo.com/104791733

What you are describing here is:

Can we work the plotting material as a sonic spectrum in a 'Sonic Grid' define by ourselves ? where we will pass these drawn sections through and they will be interpreted through this grid? (Sort of like the Oramics machine system).
OR
Or do we have a 'sonic dictionary' where the coordinates of each line and shapes dictate different 'vocabularies'? Working with the main proportions of a shape/form and scalling it in a whole bunch instead of small detail independent objects?

If this is what you are describing I would try to explore the second suggestion as like you said, the final result will be more interesting, though the complexity of the translation of the form changes. We need to understand how the mapping (translation) method would work, because even with timescalling the proportions of a building sometimes are not interesting at all... imagine a huge skyrise building... it would produce a techno beat when interpreted/translated on the Z axis. but not interesting at all when translated to the X axis.



btw: I tryed to open the Max files and they have few programms, as you were saying in the email, that I would need to download in order to make them work. Plus, I'm not a Mac user. (this might be important to know!)

ii. Spectral Transfer

Similar to the first method, the structure is analysed spectrally, but implemented in a different fashion that may produce more intriguing results.

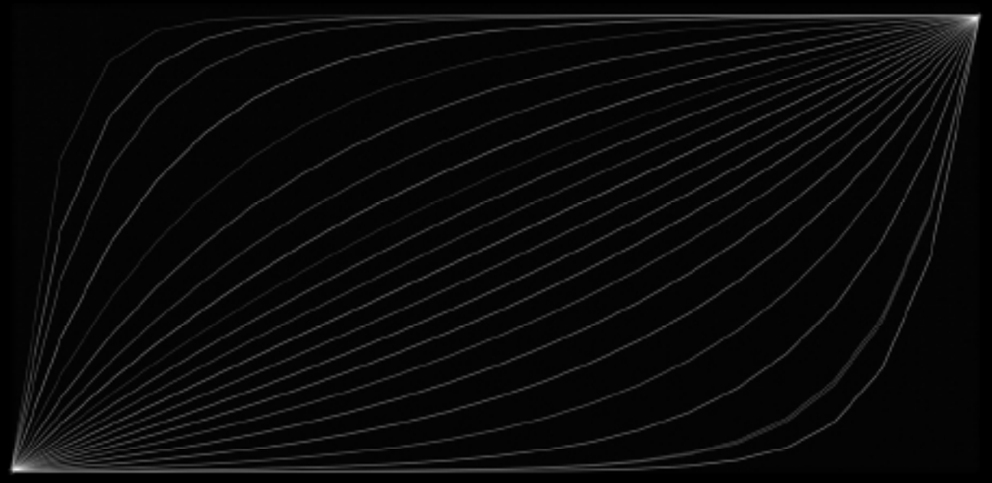
The reason I included the Risset example is related to this. His method of reproducing sounds through analysis and resynthesis introduced the idea of "Spectral Transfer" to me, where the timbral characteristics over a certain period of time are applied to another sonic object.

This is similar to how analogue vocoding works. i.e. There is a carrier signal (the sonic material which will be manipulated) and a modulation signal (the material which contains the timbral movements to be applied). The modulating signal is analysed by splitting it into frequency bands and calculating the amplitude of each of these bands at a given point.
The information from this analysis then controls the amplitude of a separate series of bands/harmonics through which the carrier signal is processed.

Through the first method of transposing a structure into spectral content, we can use that material as a modulation signal for this process.

That's why I believe we should work out/focus on the idea of having the constant section plan given data info to the Max. If we could sort out a way of making the data info of a section/image of a building to be added insteaad of just being a direct response, might do the trick!

Technical Process:



The Max patch that I showed you previously is fairly primitive in its actual function, essentially it polyphonically maps a magnitude of plotted 2D geometrical forms to the frequency range across a simultaneous time domain, somewhat similarly to the concepts discussed previously.

The biggest caveats with this current version are firstly that it is currently two dimensional, so the concept of indexing between forms across the z-axis would need to be implemented, and secondly the geometrical forms have to be plotted manually, which I wouldn't consider precise or conceptually relevant in terms of scope. I feel this current version is more of a sketch inspired by the concept of form and sound.

(Really, I'd like to be able to stay technically precise to the dimensions and proportions of the structural form that is to be represented, so any methods of scaling in order to represent this as spectral material needs to be technically correct.)

That's probably all that we need. A reading system of 2D information

I believe that when you add to the synthesis a third dimension it will sound sonically different, toug it bellongs to the same form/object/building. When it comes to architecture you have plans and sections (a plan of a building is a section on the horizontal axis - X,Y).

Either we assume that exists from the beggining and create a translation panel / mapping system that divides the 3 dimensions onto 3 different chanels - [x,y], [x,z] and [y,z]. By doing this we can probably join all the sounds created and assume that when we move the actual section plan (the one that will represent the section itself, that will allow us to create the result we want) we can from there do the additive synthesis.

But all of this will depend on the system we choose has our mapping system, either its the Oramics method or the independent line in a 3D space system. On a first instance we should choose a method and from there we can develop the idea/concept. In order to do this choice I think we need to understand which is the best process for the softwares and the potential they could offer us - to organize our data info.

I'm exploring another method with Jitter that might yield some results that might be closer to how I imagine the finished technique. Testing with a monochrome image of a plan, I'm attempting to analyse the points across the X/Y axis at which there are distinct vertices. This should then be split into a table of each point in the pixel range which can then theoretically be used to translate this into the spectral form. Once I manage to have a working version of this, it is a matter of converting the patch to work with the matrix output of a wireframe OpenGl object, which should work similarly in detecting the points in the matrix where the vertices lie via analysing the luma channel.

The difficulty with this is that will most likely be intensive to program, as a 1080x1920 grid would produce a table of over 2,000,000 points, alongside being so computationally expensive that it may end up being difficult to run in real-time, so I will need to find a method of turning this into a manageable set of data.

The advantages with this method however is that it may be easier to implement proper scaling solutions, i.e. if you know the dimensions of the planned volume size of a structure in reality, and how this is scaled in regards to the digital model of the structure, then it is fairly simple for me to scale this in Max, i.e. it would be possible to index through a form in per indexed m^2 as opposed to an arbitrary set of numerical values.

This is a good idea, toug the relation you would have would be empty area with full/filled area, the sonic outcome might not be the desirable one. When creating a location it might work, but in order to do that we should translate the information of an [x,z] axis data to a certain position [y]axis. Each position of y axis would dictate the sonic information. Are we willing to go through this route? As you accomplished to understand by Max software that its a difficult bunch of information to process all toghether, 'divide to conquer' might the way to go.

CONCLUSION:
I think we need to have a skype talk, because there is a lot in Max that I don't know and probably it will be better to understand it if you explain it to me. Apologies but I did check videos but they don't translate the 'real' issue for our problem - they just give me concepts and notions of direct commands I would need to have somebody to relate this 'notions' and commands' to the practice/function we are aiming.
I will try meanwhile to proceed with the 'section plan' method in grasshopper, because by your words I understood that Max can't relate, even with jitter, onto a 3D form. So if we process the information of a 3D object before and translate it into different axis (as described above) as data info, we might reach what we are aiming sonically.
But as I explained you, in grasshopper or 3D softwares in general this is not something the architects need to develop as it's a function that is incorporated in the software itself, so no need to 'programme' it. Architects only need the [x,z] or [y,z] of a section for the drawings .... and this is why I love BIM system! BIM allow us to do so much more, and communicate with other concultants, such as structural engineers. BIM processes the information in 3D and that is what you are trying to do sonically in my opinion.