

Procedural Audio Challenges & Opportunities

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Overview

- What is it ?
- What are the opportunities ?
- What are the challenges ?
- How can we deal with them?



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What is Procedural Audio ?

Generation of audio assets at run-time with a model
Using parameters coming from the game engine

For the 3 main areas of game audio:

- Sound effects: real-time sound synthesis (e.g. SoundSeed)
- Dialogue: speech synthesis (e.g. Phonetic Arts)
- Music: algorithmic composition



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What is Procedural Audio ?

It's all about creating **asset models** rather than assets:

- sfx synthesis model
- voice model
- composer / piece model

In some regards, similar to 3D models in graphics



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Opportunities

- Fight repetition (e.g. footsteps, impacts)
- Reduce memory footprint (e.g. wind, ocean waves)
- Have more control:
 - evolving sounds (e.g. car engine, creature vocalizations)
 - better response to physics (e.g. rolling, sliding, scraping)
 - better response to motion controllers (e.g. whooshes)



Opportunities

Procedural audio can also be used when:

- It's impossible to generate all the assets
 - vast universe
 - too many combinations
- Requirements are only known at run time
 - sounds generation based on user-defined content



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Challenges

- It is harder to implement than sample playback
 - CPU cost higher and/or non linear
 - requires low level DSP programming
 - must interface more closely with other subsystems
- It is harder to debug
 - more complex, more sources of bugs
 - harder to pinpoint what's going wrong

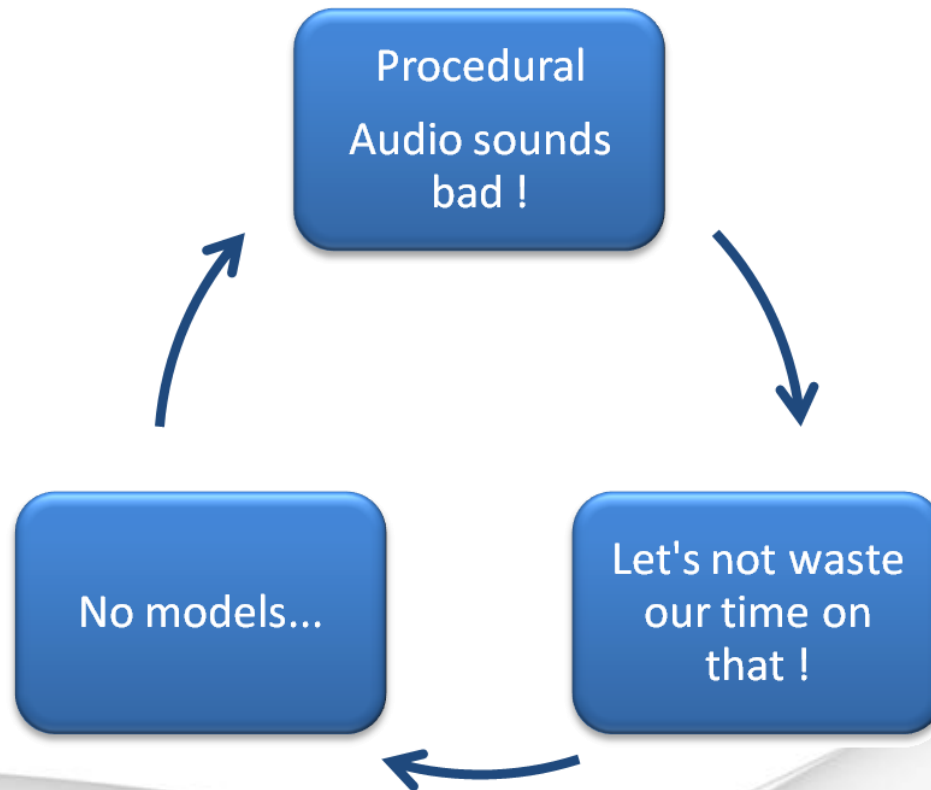


Challenges

- Pipelines are not ready. Mostly due to lack of:
 - trained sound designers / programmers / testers
 - adapted tools / run-time
 - ready-to-use models:
 - don't know how to do it !
 - results not “convincing” enough
 - not enough time to research the model
 - no collaboration within the industry



Lack of models : a vicious circle



Where can we get models ?

Ready to use Procedural Audio models:

- easy to use but...
- limited to available models from the developer
- limited to what parameters they allow
- limited to the idea the creator of the model has of the sound

Examples:

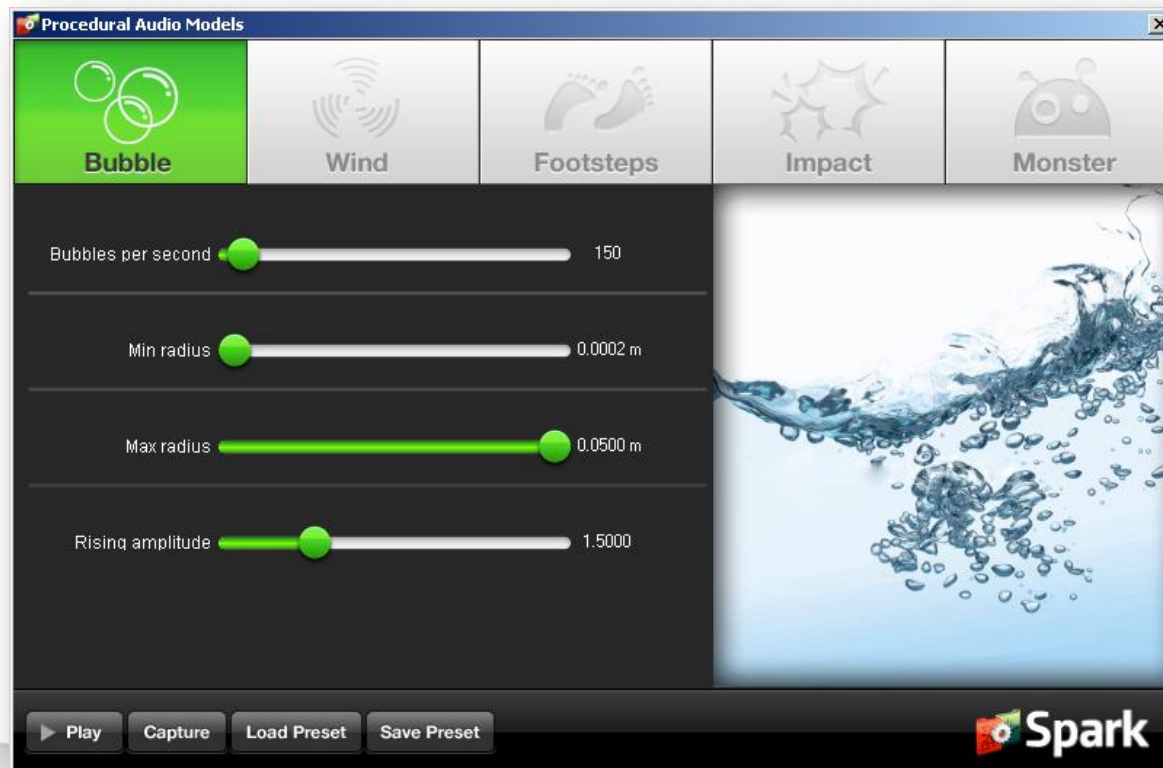
- Staccato Systems already in 2000...
- WWISE SoundSeed series
- your audio programmer's brain



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Demo: Spark



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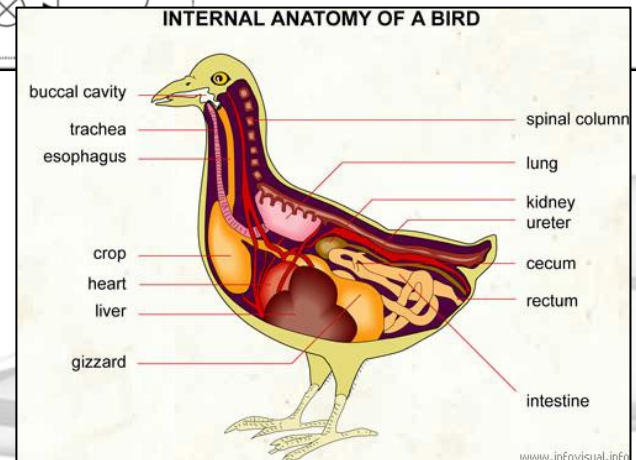
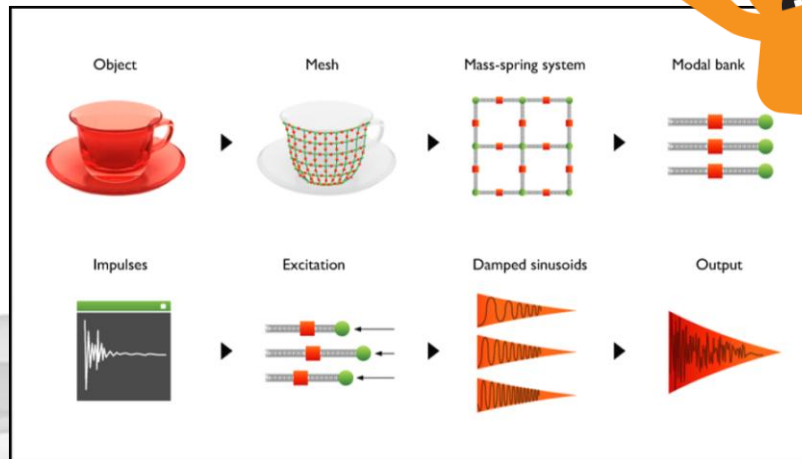
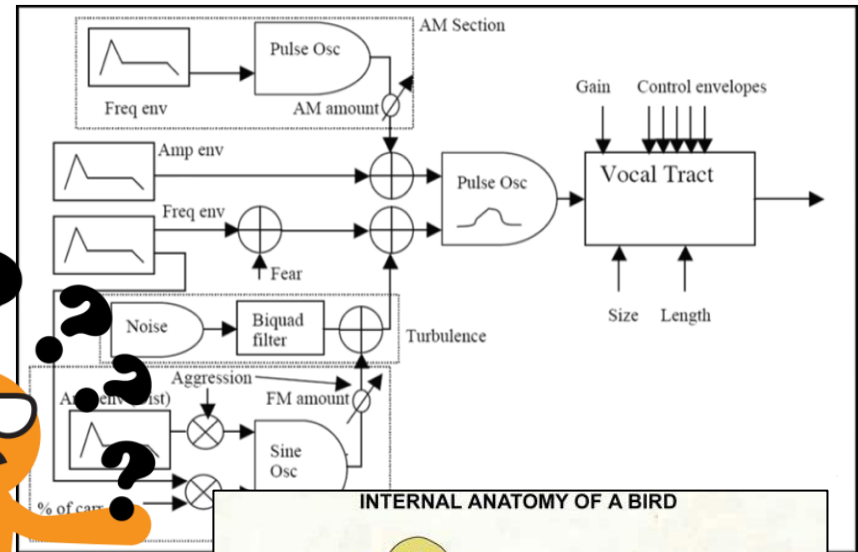
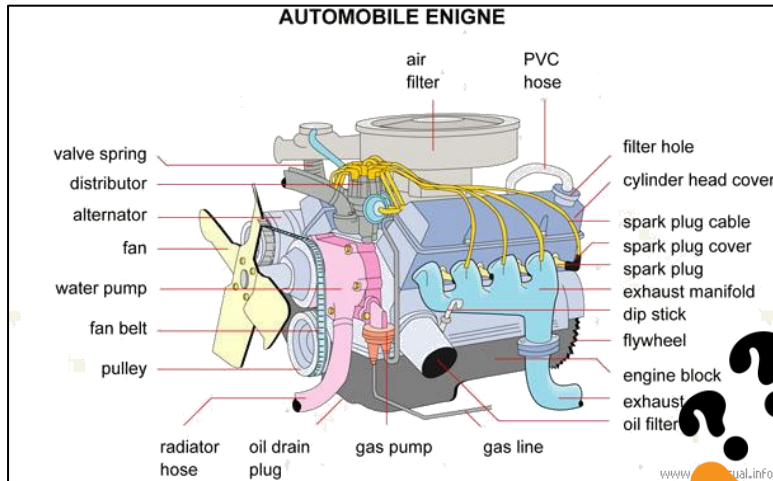


Implementation with Patching

- Tools such as Pure Data / MAX MSP / Reaktor
- Sometimes hard to understand and inefficient due to the granularity of operators
- Bottom -up approach
- Requires knowledge in audio synthesis, mechanics, animal anatomy, physics etc...



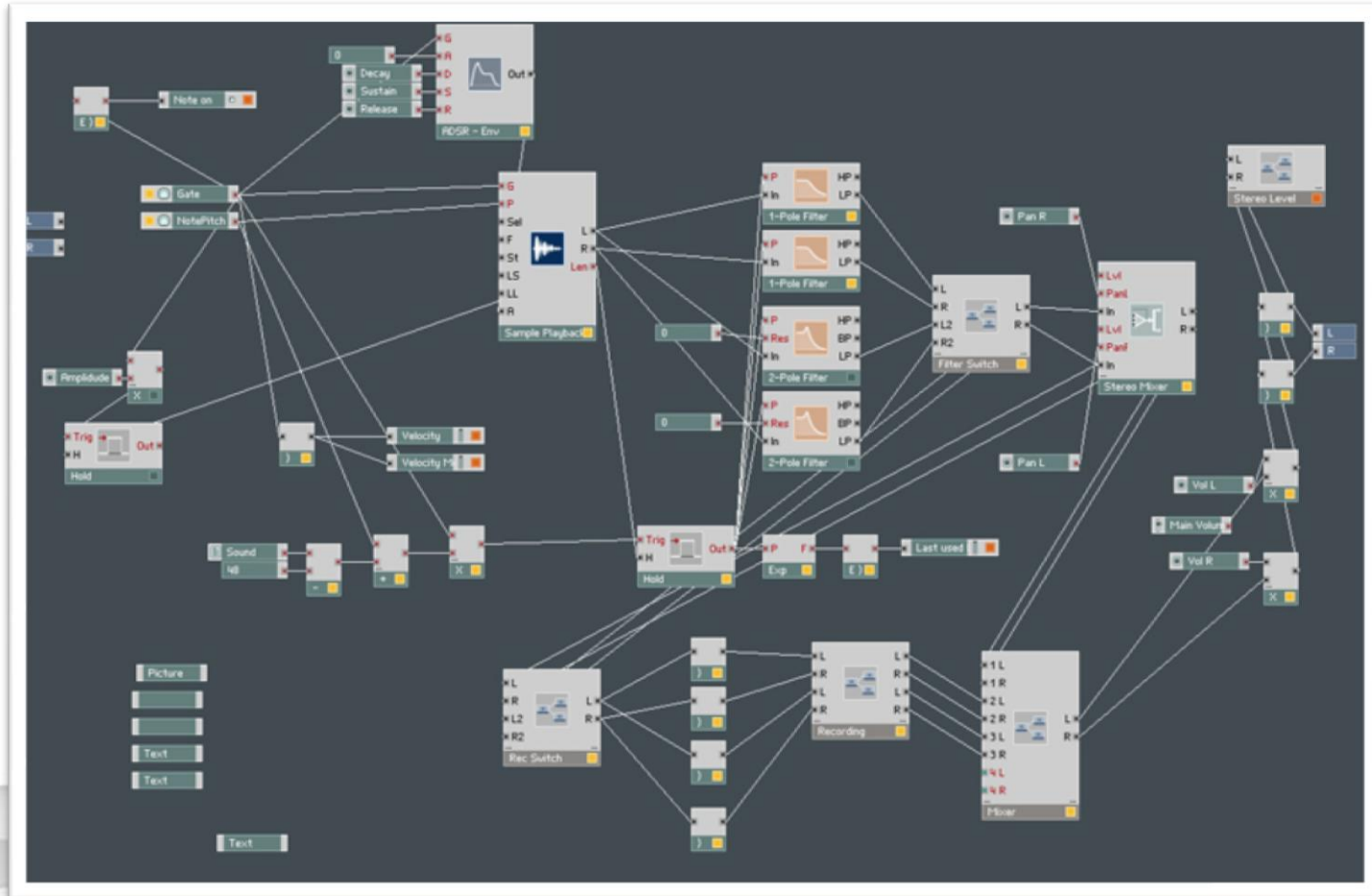
Sound Design 101



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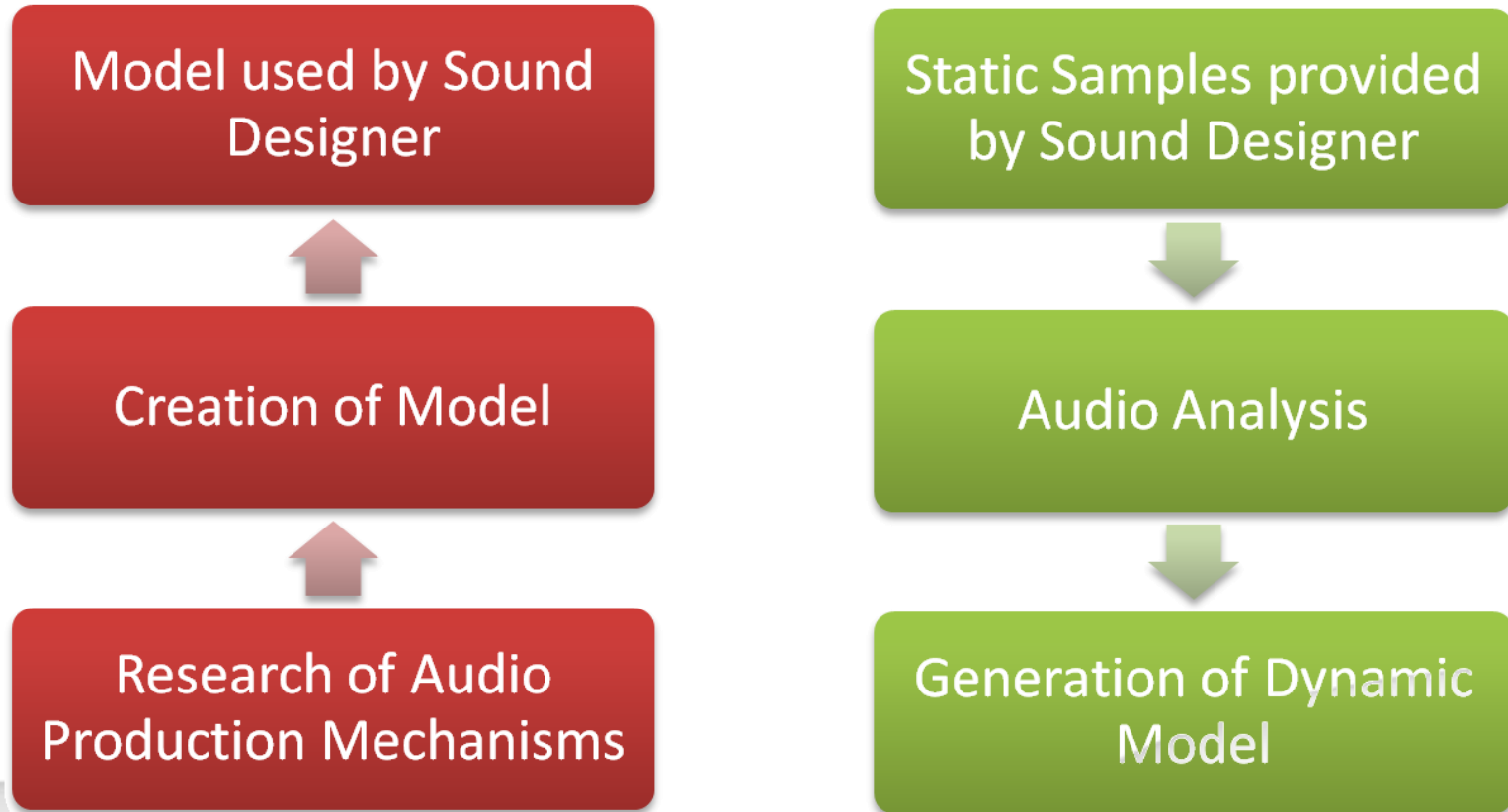
A “simple” patch in Reaktor...



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Another Approach ?



The top-down approach...

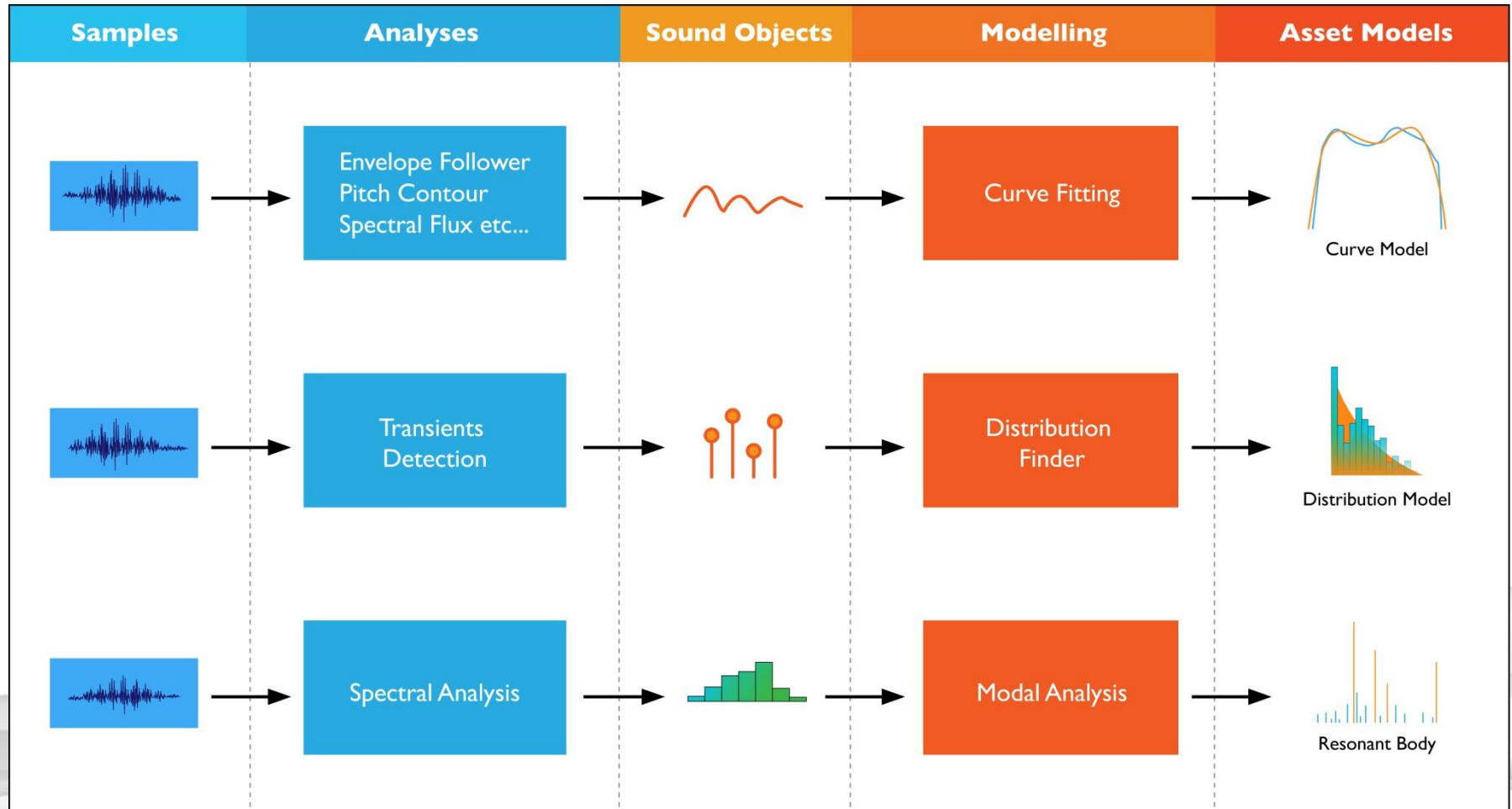
- allows the sound designer to create a dynamic model from a static sound
- without having an extensive knowledge of synthesis / sound production mechanisms
- without having to rely on third party models
- what makes it possible is...



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Audio Analysis



Because we are using analysis...

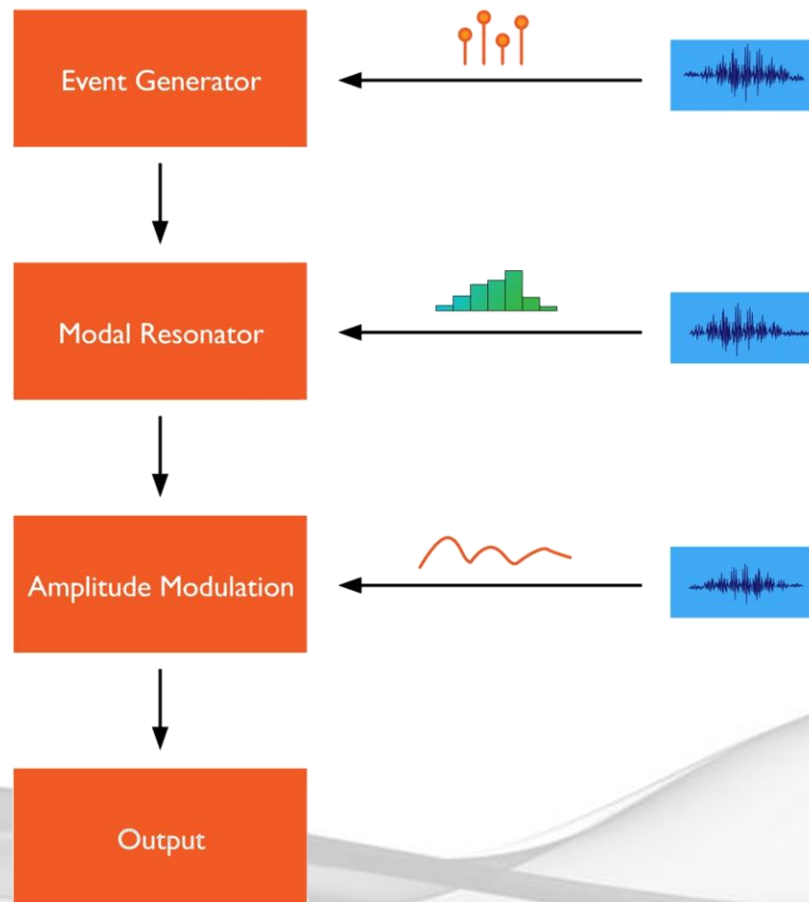
- We can use our own sounds as basis for a model
- The modules can implement more complex behaviours
- We can have a smaller number of modules (solves issues related to granularity)



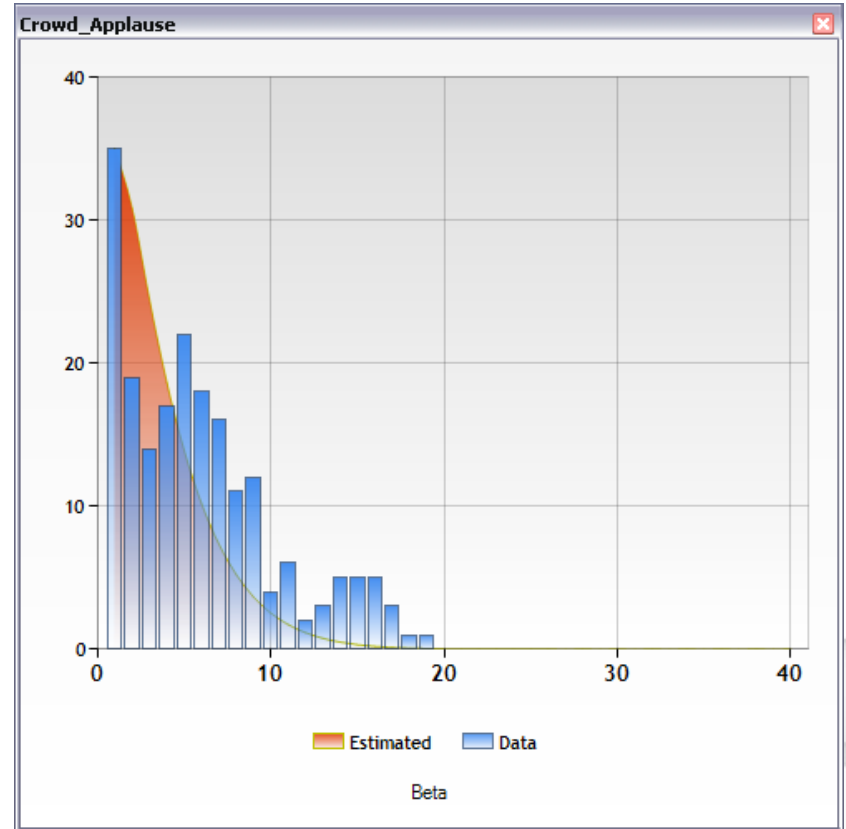
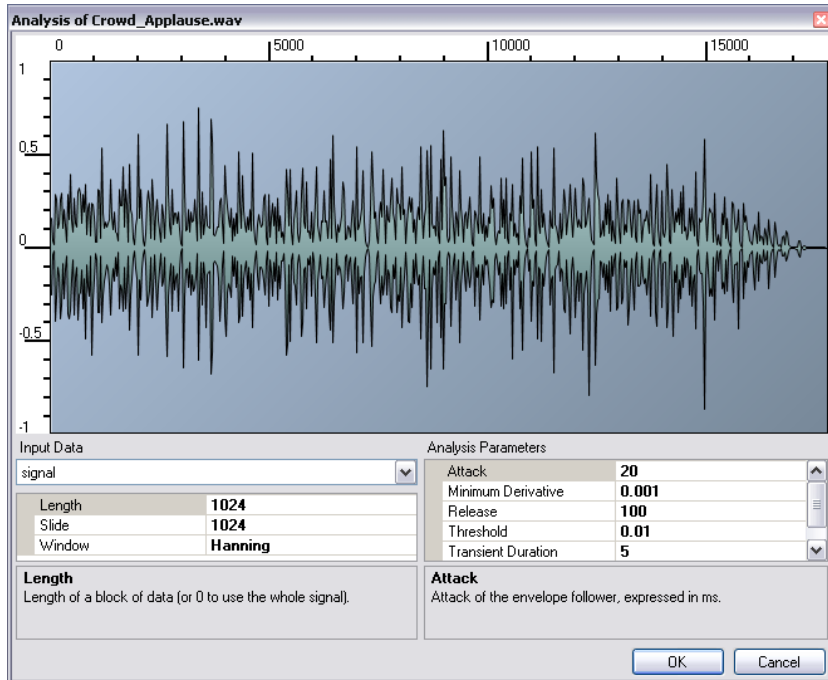
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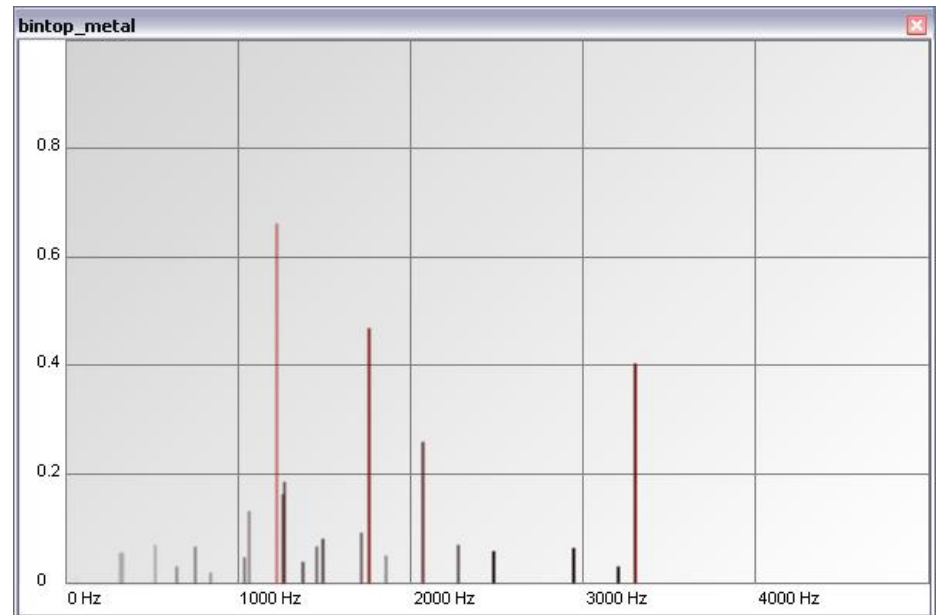
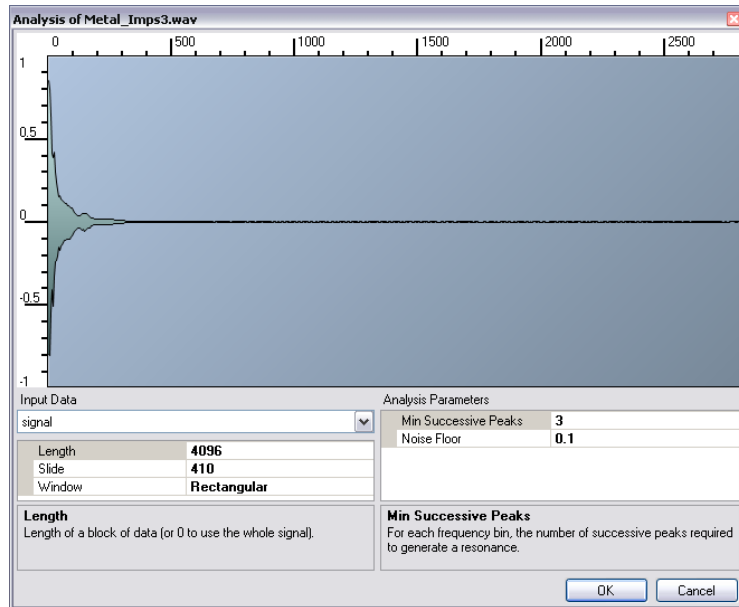
Example: debris / impacts



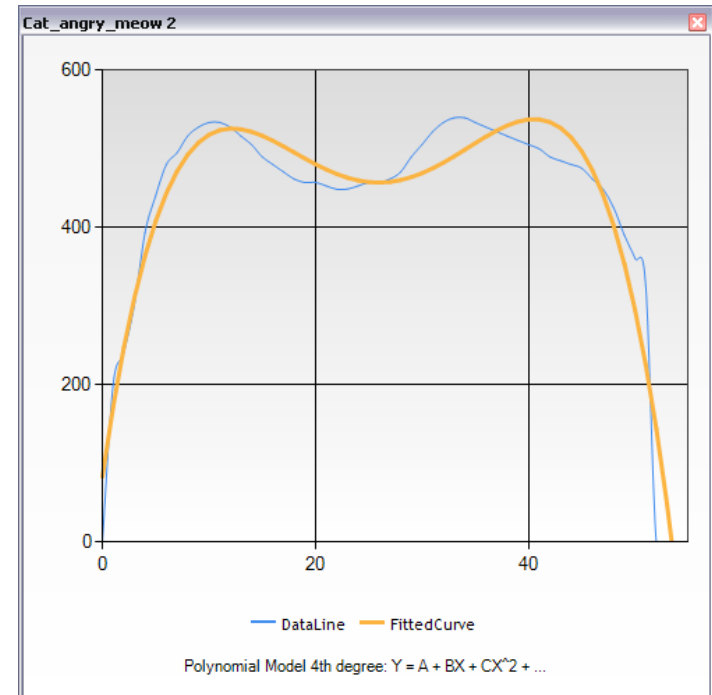
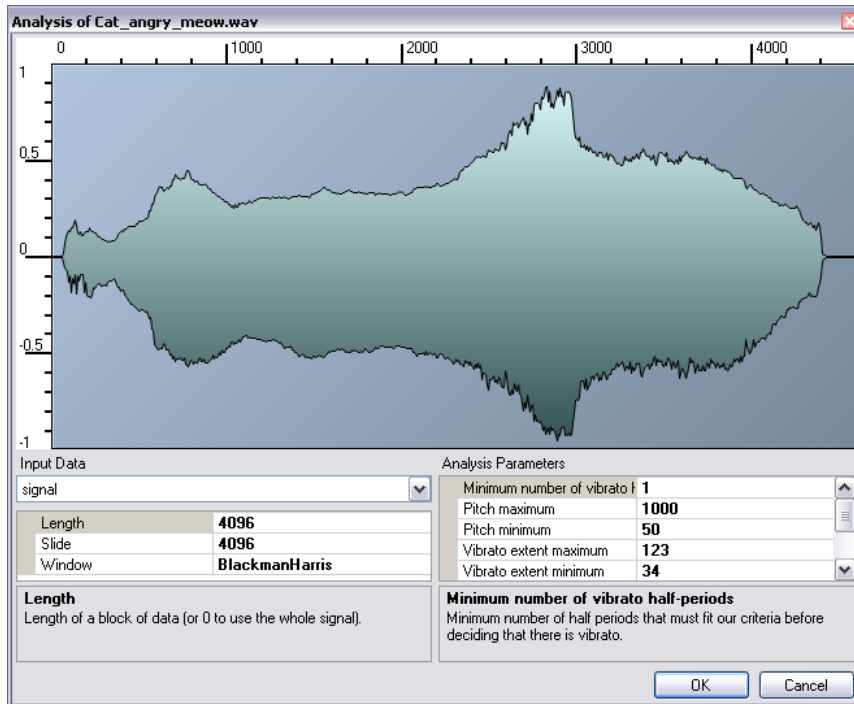
1 - Distribution Model



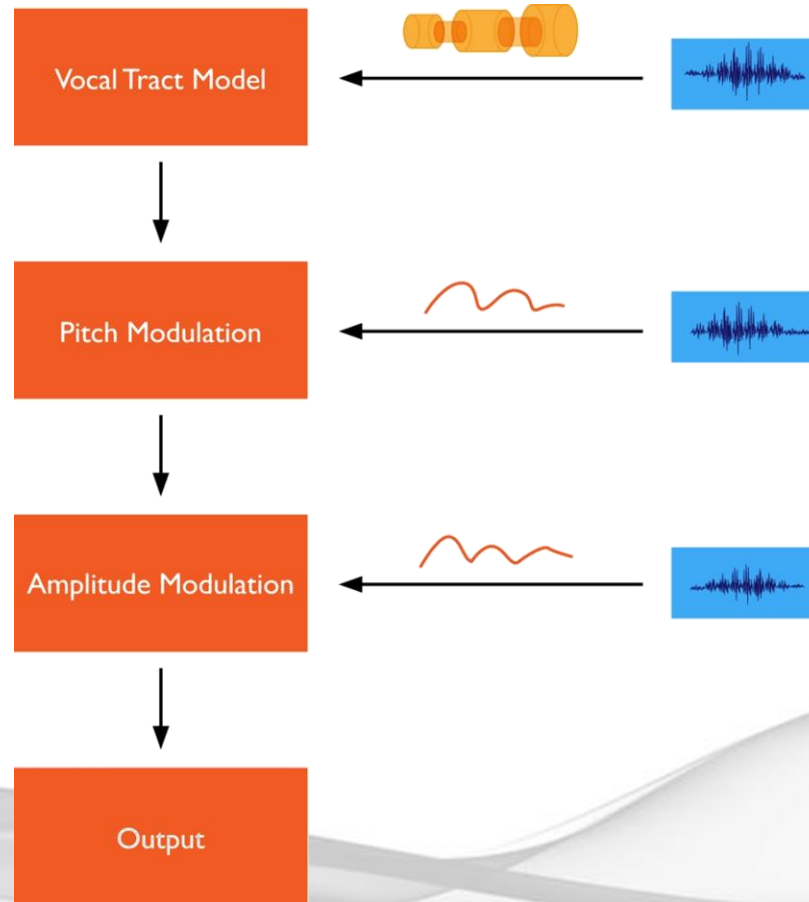
2 - Impact Model



3 - Curve Model



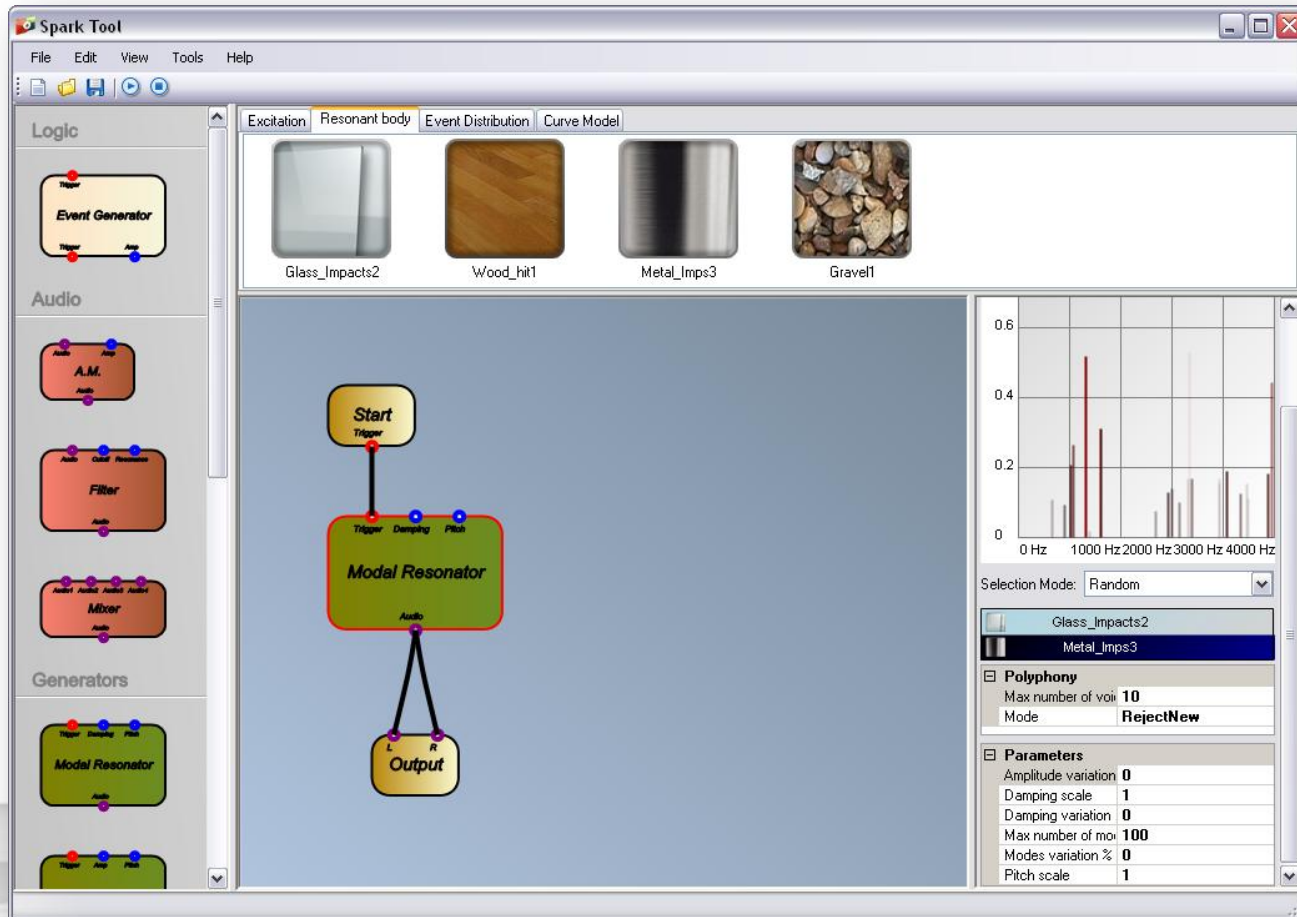
Creature Vocalisations



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Demo: Spark Tool



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Conclusion:

it's all about the models

We need better ways to create them:

- from the designer's sound (top - down approach)
- using better tools (importance of audio features extraction)
- while educating teams across disciplines

To progress, we also need:

- a game industry procedural audio working group
- more collaboration with academia
- to share models across the industry



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Thank you!

Any questions?

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