

Musical Ornaments

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Halfaya Research

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Outline

- A look toward the future
- Music Tools
- Equivalences
- Ornaments

Sources:

- <https://github.com/halfaya/MusicTools>

Eventually all the arbitrary programming languages are going to be just swept away with the oceans, and we will have the permanence of constructive, intuitionistic type theory as the master theory of computation—without doubt, in my mind, no question. So, from my point of view—this is a personal statement—working in anything else is a waste of time.

CMU Homotopy Type Theory lecture 1, 52:56–53:20.

What will programming look like in 50 years?

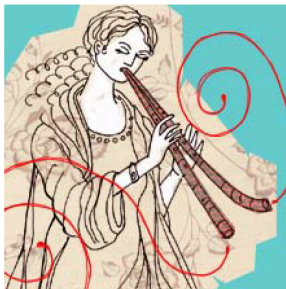
- My hope: Dependent Types or a successor (cubical?)
- Convergence of math and computer science
- Functional Programming, Algebra of Programming
- Who does the programming?

How do we get there from here?

- Add dependent types to an industrial-strength language (Haskell)
- Make a dependently typed language (Agda, Idris) practical to use
- Learn how to program using dependent types
- Many theoretical and practical advances are still needed

The Haskell School of Music

— From Signals to Symphonies —



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Look vs Time (1997)

A musical score for a piece titled "Look vs Time (1997)". The score is written for four staves, all in 4/4 time. The first three staves are for a piano, and the fourth is for a drum set.

- Staff 1 (Treble Clef):** Features a melodic line with eighth and quarter notes, including some beamed eighth notes.
- Staff 2 (Treble Clef):** Features a complex texture of chords and triplets, with some notes beamed together.
- Staff 3 (Bass Clef):** Features a melodic line with eighth and quarter notes, mirroring the rhythm of the first staff.
- Staff 4 (Drum Set):** Features a rhythmic pattern of eighth and quarter notes, represented by 'x' marks on a single line.

Music Representation à la Euterpea

```
data Pitch : Set where  
  pitch :  $\mathbb{Z} \rightarrow$  Pitch
```

```
data Duration : Set where  
  duration :  $\mathbb{N} \rightarrow$  Duration
```

```
data Note : Set where  
  note : Duration  $\rightarrow$  Pitch  $\rightarrow$  Note  
  rest : Duration  $\rightarrow$  Note
```

```
data Music : Set where  
  note : Note  $\rightarrow$  Music  
  _::_ : Music  $\rightarrow$  Music  $\rightarrow$  Music -- sequential  
  _||_ : Music  $\rightarrow$  Music  $\rightarrow$  Music -- parallel
```


Conclusion

Goes here.