

3D Animation of Barendregt's Lambda Cube

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1 Status report

1.1 Proposal

1.1.1 Motivation

The Lambda cube is a fascinating visualisation of how a combination of three different type systems can be added on to the simply typed lambda calculus. Despite being such an interesting concept, there is a relative lack of available learning resources online. The motivation of this project is to create a website that uses a 3D animated cube to teach you more about how the type systems interact at each node.

1.1.2 Aims

The aim of this project is to create a website that is a more effective introduction into the lambda cube than what currently exists on the internet now. This will be achieved by using the interactive medium to its fullest extent, letting the site's user explore the cube at their own pace, in whichever order they see fit, as well as using the 3D space to help show how the spatial relations of each calculus.

1.2 Progress

- Learned the fundamentals of the Elm programming language, as well as the GLSL and MathML languages and the plugins used to integrate them with Elm
- Created an animated, navigable rendition of A cube
- Designed and programmed the web interface to host the animation and information about each node
- Reading about the untyped lambda calculus, as well as on several of the type systems so that I will be able to write the explanation at each node.

1.3 Problems and risks

1.3.1 Problems

- I had a small setback when I initially started to create the animations using an animation library for haskell, but I realised that this was a bad way to go about the problem, so switched to using elm + GLSL.

- There is also sometimes a relative lack of information available about specific calculi in the cube, simply because there has been less research into their use. This can sometimes make reading about them a difficult process.

1.3.2 Risks

- A potential risk I could have with testing the efficacy of the website is finding a suitable trial group, as they should be familiar with the concepts, but not have any in depth knowledge about lambda calculus
Mitigation: I have been reaching out to people who I know took the programming languages course in their third year to ask if they would be available for the trial
- It would be difficult to gather quantitative data proving that the website is an improvement relative to the currently available learning resources

2 Plan

- Week 1-3: Have a finished first version of the website
- Week 4: Run the user trials and gather feedback
- Week 5-7: implement the feedback provided by the trials group, deliver the first draft of the writeup to my supervisor
- Week 8-10: implement my supervisor's writeup feedback

2.1 Ethics and data

Options for ethics:

This project will involve tests with human users. These will be user studies using standard hardware, and require no personally identifiable information to be captured. I have verified that the ethics checklist will apply to any evaluation I need to do. I will sign and complete the checklist.