

# Honoursprogramme: Research track

## A core language with row-based effects for optimised compilation

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## 1 Introduction

My second honours project builds on top of the first honours project. During the first honours project, I worked on optimising algebraic effect handlers. My second honours project is on working towards a core language with row-based effects for optimised compilation.

I find it was a good choice to work on a very related topic for my second honours project. There are several advantages to this. First of all, both topics are advised by the same professor, Tom Schrijvers. He is always available and offers good constructive criticism. In addition, his style of advising fits my needs. Another advantage is the fact that I already had previous knowledge. For example, I know which authors to look up when I need to search for new papers. These aspects make it such that I can start delving deeper into the research world. These aspects are a big reason why I could submit my work to the *ICFP Student Research Competition*.

Of course, there are also some disadvantages. During the intermediary meetings of the honours programme, I noticed that several students are working on projects outside their knowledge base. Someone was working on a project within the Department of Mechanical Engineering while his knowledge base lies within Computer Science and Electrical Engineering. In other words, these students could experience research within another field of Engineering Science and thus broaden their knowledge base.

In addition, I have several interests outside of Computer Science. Doing both honours projects with professor Tom Schrijvers meant that those interests could not be explored. However, it is not possible to do everything. Thus my choice was between broadening my knowledge and going deeper within a single topic. I am happy that I chose to continue to do an honours project with professor Tom Schrijvers since it was very interesting to be able to go deeper within a single topic.

## 2 ICFP: Student Research Competition

I had the opportunity to submit my work to the Student Research Competition of ICFP (International Conference on Functional Programming). For this, an extended abstract of 2 pages had to be submitted. It was interesting to have to write the entire extended abstract, as compared to writing some sections during my previous honours project. There are a lot of aspects to think about such as the structure of the paper, using the right words, etc. Thus, this belongs to the **Written communication** competency.

## 2.1 Conference reflection

After the paper was accepted, I went to ICFP to attend the conference. ICFP 2017 was held in the Mathematical Institute of Oxford University. Just prior to my first honours project, I attended IFL (International Symposium on Functional Languages, 2016, Leuven) but ICFP was a lot bigger in terms of people attending.

During the conference, I was able to meet a lot of researchers from all over the world. This means that I was exposed to a lot of different research topics. A lot of the authors that I referenced during my honours projects were also attending ICFP. This was interesting since I could have more in-depth talks about algebraic effect handlers. I attended a lot of talks that were given. I was able to expand my knowledge of the theoretical and mathematical foundations of computer science a bit. I got to see which subfields are being actively researched aside from algebraic effect handlers. The talks were also interesting to see how scientific presentations are done. It was interesting to how the researchers inserted humour and how they kept the content "simple" in order to not lose the audience.

Right before the main conference, the PLMW (Programming Language Mentoring Workshop) was being held. This event is meant specifically for future or young researchers. This event was interesting in several ways. First of all, a lot of different research topics were covered to show what kind of research is being done and allowed me to look further than just algebraic effect handlers. Most interesting was the panel discussion at the end. At this panel, you could ask questions (about academia or industry) to several experts. These events definitely gave me a clearer sight on the field of programming languages.

I attended a hands-on tutorial about Concurrent Programming with Effect Handlers. This tutorial was part of the co-hosted conference CUFPP (Commercial Users of Functional Programming). This tutorial truly made me aware just how powerful algebraic effects and handlers can be, and how active the research field is.

For the Student Research Competition, I had to give a poster presentation. A jury consisting of several leading experts in the field selected three finalists. I was among the three finalists and thus had to give an presentation at the main conference. This was the climax of my honours project (although my honours project was not finished yet). It was really cool to be able to give a presentation at the main conference. In the end, I managed to win the bronze medal.

## 2.2 Time management

During my previous honours project reflection, I mentioned how important time management was. This was mainly due to the fact that I had to combine the honours project with following courses. I did not experience time management issues like this during this honours project. However, regarding ICFP, I had a lot of deadlines. The deadline to submit the extended abstract and the maximum duration of the talk I had to give, are two aspects where time management was important.

## 2.3 Implementation

The type system that was designed has been implemented in the Eff programming language. The implementation is written in OCaml. The implementation spans about 19 files with 408 blank lines, 548 comments and 1982 lines of code. The total count for the entire compiler is 71 files with 1206 blank lines, 1757 comments and 6899 lines of code. My implementation consists of a type inference engine. Thus, I had to rewrite large parts of the existing compiler and throw away the previous type inference engine.

My goal with the implementation was to first implement the inference engine. After this, I wanted to adapt the optimisation module to work with the new type system. However, making a new type system, going to ICFP, implementing the inference engine and adapting and experimenting with the

optimisation module was too much. In the end, I did not adapt and experiment with the optimisation module.

## **2.4 Conclusion**

To conclude, I'll quote a sentence from my previous reflection: "something that definitely needs to be said is that I'm proud of what I've accomplished during this honours project". I have learnt a lot about research and myself. I never expected to be able to actually win a bronze medal at the ICFP Student Research Competition. I think that the ICFP Student Research Competition was a great way to end my honours project and complete the honours programme.