# Science and Technology Group Annual Report FY2024

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## 1  Introduction

My research is focused on proof theory, a subfield of mathematical logic. I investigate ordinal representation systems, which are the main tools in the ordinal analysis of mathematical theories, and which play an essential role in gauging the proof strength of axiom systems or particular mathematical theorems the comparative strength of which might be of interest. Besides contributing to the deeper understanding of classical ordinal representation systems, my main area of research is the investigation of representation systems derived from so-called elementary patterns of resemblance, which are of interest in their own right as they present combinatorial structures the properties of which give rise to mathematical theorems of great proof strength.

## 2  Activities and Findings

During my second year as an STA I presented my accepted paper at the conference *Computability in Europe 2024* in Amsterdam, gave a talk in the logic seminar at Ghent University, and subsequently further developed the theory of fundamental sequences with Bachmann property for classical ordinal notations to become applicable to larger notation systems. A preprint of my results is currently under review for journal publication and available on arXiv. I have begun a collaboration motivated by the application of my recent results to the theory of Goodstein principles, see below.

## 3  Collaborations

A collaboration with researchers from Ghent University (Belgium) and the University of Barcelona (Spain) on Goodstein principles of higher complexity started in Fall 2024, with the aim to apply my results on fundamental sequences to the theory of Goodstein principles, which recently advanced significantly.

## 4  Publications and other output

G. Wilken: *Fundamental sequences based on localization*. L. Levy Patey et. al. (Eds.): CiE 2024, LNCS 14773, pp. 324-338, July 2024. This paper was presented at the conference *Computability in Europe 2024* in Amsterdam, The Netherlands, on July 12th 2024.

G. Wilken: *Introduction to Patterns of Resemblance.* Informal seminar talk at Ghent University, Belgium, on July 17th 2024.

G. Wilken: *Fundamental sequences based on localization*. Extended version of my CiE paper above including complete proofs and a generalization to extendible notation systems. Under review for journal publication.
Available on arXiv: https://doi.org/10.48550/arXiv.2410.15953