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Modelling the COVID-19 epidemic – student paper recognised for new insight

Tobie Steyn (left) and Tyler Kantor (right) Photo: Je'nine May/UCT

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A paper that explored the applicability of knowledge of chemical reactions, specifically batch reaction kinetics, to model COVID-19 has been recognised by the University of Cape Town (UCT) Department of Chemical Engineering as one of the best papers in their year.

The thesis, "A Heterogeneous Compartment Model for the Dynamics of COVID-19 in South Africa", by Tobie Steyn and Tyler Kantor came from their supervisor Professor Klaus Möller's – the head of the Process Modelling and Optimisation group – interest in and research on COVID-19. Wanting to know how South Africa fared against the rest of the world, Möller wrote code to plot approximately 20 countries every day, followed data from Johns Hopkins

University, and was then introduced to PhD candidate Leen Remmelzwaal's dashboard, Corona Stats (previously known as COVID-19 Stats SA).

He used this to keep himself, friends and colleagues abreast of the evolution of the epidemic. Given his knowledge of modelling chemical processes, Möller became interested in finding out more about epidemic modelling and began "playing around with some of the basic models, none of which worked really well". This led to him proposing a final-year chemical engineering project around the idea of treating epidemic modelling in the same way one would model a sequence of reactors with many chemical species. And then, as the proud supervisor put it, "along came Tobie and Tyler, and the rest is history".

With Möller's guidance and the in-depth data from Remmelzwaal's dashboard, Steyn and Kantor approached epidemic modelling from a different viewpoint and provided new insight.

Möller explained that a unique feature of their model is that "it is able to distinguish the dynamics of the population fraction that never gets infected from the dynamics of the infected population, simultaneously"; other models only consider the dynamics of the fraction of the population that is infected.

"Much needs to be done before this model can be used for large-scale simulation and prediction, but the concepts explored here have been shown to be effective in epidemic modelling," Möller continued.

Steyn and Kantor's paper, and Möller's supervision, were recognised by a departmental selection committee. According to Möller, the diversity and novelty of the project helped the paper stand out.

He applauded Steyn and Kantor for the "quality and thoroughness" of their work, noting that it had been one of the best projects he'd supervised in a long time. "It's important to study processes that impact our people; and as engineers, we do that through building mathematical models of the events in the hope that we would be better informed and prepared, and thus reduce the impact of these epidemics on the people," said Möller.

Remmelzwaal, who made his data available throughout, said Corona Stats was proud to be associated with the research of Möller, Steyn and Kantor. "It continues to be our pleasure to support academic projects such as this one by providing COVID-19 data via the website's application programming interface (API) without any cost to the students and staff," said Remmelzwaal.

He added that Corona Stats endeavours to continue offering a free version of the API licence to students so that they can use reliable and screened South African COVID-19 data to develop innovative ideas for modelling and predicting the spread of the virus.

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