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The evolution of animal societies

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Modern science is above all a social endeavour. The biggest scientific achievements have been and still are the result of the cooperative effort of international groups of scientists. Such cooperative efforts span across many levels of scientific practice: from dividing the necessary tasks to successfully finishing a project, to more abstract collaboration like sharing and discussing scientific ideas. It is, thus, paradoxical that the way scientists are evaluated is more and more focused only on individual success. The way that authorships and credits are assigned in publications is full of grey zones and dependent on implicit social norms that vary from field to field. I would like to start acknowledging all the people who shared some of their time with me to discuss scientific ideas related and unrelated to this thesis. One way or another all those discussions have shaped the way that I have come to think of animal societies, and the way the models presented here have been built.

The person whom I had more discussions with about animal societies was my supervisor Ido Pen. Ido certainly deserves a lot of the credit for bringing this thesis to a happy end. In all honesty, I had my reservations when Franjo proposed me to apply for grants to do a PhD with Ido. He does not strike as a very friendly type of guy. And, he is not. He is, however, a very good theoretician, and has a very sharp mind. The four years as his PhD student were not an easy ride. As for most PhD students, life was full of frustrations and disappointments, with an occasional and ephemeral sense of progress. Now that I am on the other side, I must say, I feel honoured to have been supervised by Ido: a man with great talent to model biological problems and to make politically incorrect jokes. Thanks very much Ido, I have learned a lot from you.

I would also like to thank Franjo, first, for giving me the opportunity to join his group during my masters. Franjo introduced me to theoretical biology, and supported my decision to pursue a PhD in Groningen. It was thanks to him that I managed to remain in Europe and continue applying for PhD positions, when migratory problems were making it difficult. After some of those applications failed to give any fruits, he together with Ido decided to support my ideas. Also, along these years Franjo's criticism has made me a better writer (I hope he agrees).

Chapters 5 and 6 have been the fruit of the collaboration between Groningen

(theoretical biology) and Bern (behavioural ecology). I would like to thank Michael Taborsky for allowing me to be part of that fruitful collaboration; and for sharing his knowledge about the *pulcher*. Also, thanks for the very good times in my visits to Bern, and in the multiple workshops and conferences where I met the Bernese crowd, these have all been scientifically very inspiring.

Sander van Doorn deserves a very special mention. I am deeply thankful to Sander, not only for his involvement in chapter 5 and 6, but because he is a very inspiring scientist. Sander, it has been a pleasure to work with you, a brilliant theoretician and a truly curious and honest person. Thank you for being relentlessly willing to help and advice young scientists. Also, thanks for making the volleyball team a reality. I am sure you guys will eventually be champions.

Chapter 4 is the fruit of my visit to the famous Barron Colorado Island. I would like to thank Bill Wcislo for giving me the opportunity to work at his lab in Panama, also for sharing his knowledge and views on the evolution of eusociality.

I thank Guy Theralauz, for allowing me to visit his lab in Toulouse. Unfortunately, the work we developed there could not be part of this dissertation. However, I truly hope to go back to model the evolution of dominance hierarchies, a subject of high relevance for the evolution of eusociality.

I was very lucky to work together with two fantastic master students during my project. Gil and Vivek, I am very honoured to have been your daily supervisor. You are both hard-working and very clever students, and I expect great things from you.

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I must first thank my beloved paranimphs, Linda and Alex, not because they have

been any good at being paranimphs. They have actually not done much. But because, they have been dearest friends, with whom I have shared valuable moments. In other words, thanks for putting up with me for so long. True friendship certainly crosses language and cultural barriers.

I first arrived in Groningen to pursue the top masters in evolutionary biology. In that first step in the Netherlands, despite the big difference in culture and weather, I eventually felt at home. I owe that homey feeling to a group of distinctively peculiar group of people. Hernan, Adriana, Jordi, Lotte, Rienk, Froujke, Michiel and Alex thanks very much for the good and the bad. A special mention is due to the Latin crowd of that year top masters cohort: Hernan, Adriana, and the Dutch honorary members, Jordi and Linda: I am truly grateful for finding a family in the least expected place.

I met a lot of interesting people throughout my years in the theoretical biology group (nowadays known as TRES). All of them contributed to a challenging and inspiring place to work. Running the risk to forget somebody, I would like to mention them: Bram, Aniek, Ana, Ruth, Ivan, Thomas, Leif, Kuke, Lei, Thijs, Leonardo, Alberto, Margarete, Stefany, Yagmur, Joke, Richel, Leonel, Rampal, Nancy, Freek, Albertas and Helen. A few people deserve a special note: the social evolution crowd: Lucas, Piet and Jordi (you are also mentioned twice in my thesis) for all the valuable discussions; I truly hope that our scientific paths cross in the future. David and Marina! Thank you for all the beers, BBQs, and in general for the good times. Ingeborg, you are definitely an invaluable member of the group, and an awesome person, thanks for making the daily routine happier.

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Barro Colorado Island is certainly a bizarre place. I do not recommend people going there for too long. But if you have to, you should let yourself go into the madness. I was reluctant to do so. In the end, it only took good company to change my mind. Thanks to Sam, Sandra, Eli, Ninon, Lauren, Kristen, Shauin, Lilian, and Adam for that. Also important, I could not have completed my dataset without the help of Kate Ihle, Quinn McFrederick, Lizzette Jimenez and Paola Galgani.

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