Social information use and cultural transmission in bumblebees

A Data Management Plan created using DMPonline.be

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Project abstract:

Social learning and copying others underlie in large part the cumulative cultural evolution and technological progress that is unique to our species. Over the last decades, however, examples of social learning and even long-lasting cultural traditions have been discovered throughout the animal kingdom, not just in vertebrates but even in insects. Bumblebees have emerged as a particularly attractive model system in this field, having been shown to be capable to learn even abstract and quite complex tasks through social learning. In the present project, I will use bumblebees to address some major outstanding questions in the field of social learning and cultural transmission in insects. Specifically, I will 1) study how social information modulates the exploration of alternative foraging options, i.e., the exploration-exploitation tradeoff, and 2) test if relatively simple learning mechanisms enable them to display seemingly complex cultural transmission biases, such as disproportionally copying either the most common or the most rewarding strategy (conformist & payoff-biased transmission). To test these hypotheses, I will make use of innovative robotic flower arrays, which will enable me to individually track all flower visits and allow me to document social learning and cultural diffusion in unprecedented detail.

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Social information use and cultural transmission in bumblebees
Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

No existing or personal data will be used. Production and design of new robotic flowers will produce a number of different file types including a Zip-compressed archive file for Autocad Fusion360 (.f3z), stereolithography CAD files (.stl) for 3D-printing, Gerber files (.gbr) for printed circuit board (PCB) design and a bill of materials (BOM). The firmware consists of a source file (.cpp), different header files (.h) and an INI-file (.ini) to configure the software. The experimental output will primarily consist of datasets about foraging behaviour, which will be stored mainly as csv-files (.csv) and/or Excel documents (.xlsx). Other research output will contain analyses scripts (.R) and manuscripts for publishing.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

The responsible person to preserve data at least 5 years after the end of the research is Prof. Tom Wenseleers. During and after the research, data will be kept on the lab's two QNAP NAS systems, which communicate over a secure connection and are backed up daily. Final analysed data and code will be published in the Dryad database upon final publication, where it probably will remain indefinitely. All scientific publications will be accompanied by the relevant raw data and datasets deposited in public repositories.

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

NA

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

NA

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

NA

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DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

Social information use and cultural transmission in bumblebees
GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

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FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	**Description**	**New or reused**	**Digital or Physical**	**Digital Data Type**	**Digital Data format**	**Digital data volume** (MB/GB/TB)	**Physical volume**
Robotic Flowers	Software and construction files.	Generate new data	Digital	Software + other	.cpp, .h, .ini, .f3z, .stl, .gbr	<100MB	NA
Exploration-exploitation trade-off	This dataset will be generated with *Bombus terrestris* colonies (one per replicate) foraging in an arena with single robotic flowers augmented with RFID readers, in which three colors will represent different reward qualities.	Generate new data	Digital	Experimental	.csv	<1GB	NA
Olfactory learning	This dataset will be generated with *B. terrestris* colonies (one per replicate) foraging in an arena with single robotic flowers augmented with RFID readers, in which three nectar scents will represent different reward qualities.	Generate new data	Digital	Experimental	.csv	<1GB	NA
Multiple colony - NBDA	This dataset will be generated with mu *ltiple B. terrestris* colonies at once foraging in an arena with single robotic flowers augmented with RFID readers.	Generate new data	Digital	Experimental	.csv	<1GB	NA
Conformity bias	This dataset will be generated with *B. terrestris* colonies (one per replicate) foraging in an arena with composite robotic flowers (left/right choice) augmented with RFID readers.	Generate new data	Digital	Experimental	.csv	<1GB	NA
Payoff bias	This dataset will be generated with *B. terrestris* colonies (one per replicate) foraging in an arena with composite robotic flowers (left/right choice) augmented with RFID readers.	Generate new data	Digital	Experimental	.csv	<1GB	NA

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

NA

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

Robotic Flowers

For all the different aspects of building these robotic flowers (Arduino firmware, 3D-printing, PCB construction, Node-RED), each with specific accompanying data types, there will be a README.txt file as well as an overarching README.txt file that encompasses the several smaller explanations to frame the whole within the research project.

Exploration-exploitation trade-off

I will adopt a comprehensive approach to capturing accompanying information. This will include creating README.txt files that provide detailed documentation on the gathered data and its structure (CSV files). Additionally, procedures used during data collection, including any relevant metadata such as timestamps, location, and experimental conditions will also be part of this file. Next, clear figures of the setup will also be kept together with the data.

Olfactory learning

I will adopt a comprehensive approach to capturing accompanying information. This will include creating README.txt files that provide detailed documentation on the gathered data and its structure (CSV files). Additionally, procedures used during data collection, including any relevant metadata such as timestamps, location, and experimental conditions will also be part of this file. Next, clear figures of the setup will also be kept together with the data.

Multiple colony - NBDA

I will adopt a comprehensive approach to capturing accompanying information. This will include creating README.txt files that provide detailed documentation on the gathered data and its structure (CSV files). Additionally, procedures used during data collection, including any relevant metadata such as timestamps, location, and experimental conditions will also be part of this file. Next, clear figures of the setup will also be kept together with the data.

Conformity bias

I will adopt a comprehensive approach to capturing accompanying information. This will include creating README.txt files that provide detailed documentation on the gathered data and its structure (CSV files). Additionally, procedures used during data collection, including any relevant metadata such as timestamps, location, and experimental conditions will also be part of this file. Next, clear figures of the setup will also be kept together with the data.

Payoff bias

I will adopt a comprehensive approach to capturing accompanying information. This will include creating README.txt files that provide detailed documentation on the gathered data and its structure (CSV files). Additionally, procedures used during data collection, including any relevant metadata such as timestamps, location, and experimental conditions will also be part of this file. Next, clear figures of the setup will also be kept together with the data.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

We will use the metadata standard of the Research data repository that will be chosen at publication, for example Dryad or RDR (by KU Leuven).

3. Data storage & back-up during the research project

Where will the data be stored?

During and after the research, data will be kept on KU Leuven OneDrive as well as on the lab's two QNAP NAS systems. Final, analysed data and code will also be published in the KU Leuven RDR database upon publication, where it probably will remain indefinitely.

How will the data be backed up?

The QNAP NAS (Network Attached Storage) is a storage device that provides a centralized and secure way to store, backup, and share data over a network. This way, the data will be backed up daily.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

Most of the output data of this project will consist of Comma-Separated Values (CSV) files. This is a simple and widely used file format for storing and exchanging data between different software applications. Their small file size makes them an efficient option for transferring and storing large datasets. The available storage on the QNAP NAS systems (currently 25.8 TB free space) should be more than sufficient.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

Access to the physical storage device will be limited to authorized personnel only, as the lab can only be entered by scanning a badge. The QNAP NAS systems use encryption technology and communicate over a secure connection, which ensures safe storage and prevents unauthorized access.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

As all data storage systems are already in place at the lab, no costs are expected.

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All data generated in this project will be preserved on the lab server (QNAP NAS) for at least 10 years.

Where will these data be archived (stored and curated for the long-term)?

For long-term data archiving, repositories such as Dryad or the KU Leuven Research Data Repository (RDR) will be used.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

There are no costs expected.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in an Open Access repository

If access is restricted, please specify who will be able to access the data and under what conditions.

NA

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

Candidate repositories include the KU Leuven RDR, Dryad or others depending on the journal guidelines upon publishing.

When will the data be made available?

Upon publication of research results.

Which data usage licenses are you going to provide? If none, please explain why.

Creative Commons Attribution 4.0 International (CC-BY-4.0)

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- No

What are the expected costs for data sharing? How will these costs be covered?

There are no expected costs.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Kamiel Debeuckelaere

Who will manage data storage and backup during the research project?

Kamiel Debeuckelaere

Who will manage data preservation and sharing?

Tom Wenseleers

Who will update and implement this DMP?

Kamiel Debeuckelaere