WORKPACKAGE 1 – BIODIVERSITY AND PERCEPTION

MILESTONE 1 – MAPPING THE GAP BETWEEN BIODIVERSITY'S DATA AND BIODIVERSITY'S PERCEPTION

CONTEXT

GENERAL CONTEXT

Biodiversity is today a very-well studied subject, even if data on particular species or environment are still lacking. The general awareness about importance of biodiversity and its protection leads to a vast and divers academic work in this field.

Nevertheless, urban environments are usually less studied than other ecosystems seen as more "natural". The biodiversity of cities is often underestimate, and few species benefit from program of protection. Data regarding urban biodiversity are not frequent, but they still exist. Beside of data acquired through citizen science programs (which is the subject of Deliverable D2), some academic programs aim to register urban species, their habits, their health (subject of Deliverable D1). It also happens that some cities, not wanting to protect a species, but wanting to exterminate or chase it, request academic study of this species. The aim is different but results in terms of data can be quite the same, and could be used the same way.

Citizen science, on the other hand, is a wonderful tool for scientists. It allows to gather more data, from more different places and more frequently than a research team could do it. This powerful tool is especially important in a period of declining biodiversity, where changes have to be measured for a great variety of species and in various place. The most popular example of how scientists can use data from citizen science to obtain of global overview of a biological phenomenon is probably the case of decline of insects' population in Germany (Hallmann et al. 2017). The paper has some biases, that have already been discussed in the scientific community, but two points need to be acknowledged. First, the paper is still congruent with others, more recent papers that have address properly the biases found in the German paper (Sánchez-Bayo and Wyckhuys 2019), we can conclude that the methodology, if not perfect, produced no aberrant result. Second, the biases are mostly due to the way citizen science works. Once known, they can be easily taken into account in order to weight data and results accordingly.

Beside of these very factual and objective data, perception of biodiversity is not a very well-studied subject, probably because it is at the border of different academic fields, and it is difficult to know how to address it properly. Yet, it is an important factor that must be taken into account in a lot of urbanism, ecosemiotics, cultural semiotics, biosemiotics or zoosemiotics subjects, including very sensitive subjects like the protection or reintroduction of endangered species (see the work of Mäekivi and Magnus in the attached documents). Projects aiming to have a real impact on biodiversity issues implying close human populations should gather data about how these populations perceive the target species and include them in their program.

Biodiversity and human perception are two important aspects of urban interspecies cohabitation. But they are not often studying together, and the impact each one has on the other is not well known. Yet, in context of urban biodiversity, it is crucial to compare and confront biodiversity's data with human perception, to understand how these two aspects interact. Taking these multiple aspects into account is allowing a more detailed and precise overview of a complex semiotic situation. Considering humans and liminal animals as part of a common semiosphere, these different kinds of information are different reading grids, all necessary to

understand how individuals construct their semiosis and how they are part of this semiosphere. In this project, the world "semiosphere" is used in the sense described by Hoffmeyer "a sphere just like the atmosphere, the hydrosphere and the biosphere" (Hoffmeyer 1997).

In context of urban biodiversity, it is crucial to compare and confront biodiversity's data with human perception, to understand how these two aspects interact (as in Deliverable D4). Taking these multiple aspects into account to describe with the highest possible level of details a complex semiotical situation can also allow to find ways of improvement of the situation. Considering humans and liminal animals as part of a common semiosphere, different kinds of improvements can be suggested (sensitization, urbanism changes, biodiversity monitoring, reintroduction programs etc.). Yet, before building a solution, like a sensitization's plan can be, it is important to have to right toolkit to describe the situation, map the semiosphere correctly and, in a certain way, diagnose the different issues the cohabitation is facing.

INSIDE THE PROJECT

This project will partially follow the methodology set for a previous study (Delahaye 2021) of another urban species (*Rattus norvegicus*) in another urban environment (Paris, France). This study showed that it is possible to learn a lot of things about relationship between humans and liminals by comparing semiotic representations to factual data.

The very first step of the project was, consequently, to gather and organize these factual data and semiotic representations, to compare them and to create a kind of global mapping toolkit from this comparative analysis.

RESEARCH QUESTION AND HYPOTHESIS

QUESTION AND SUBQUESTIONS

The Case study 1 is aiming to study the relationship between biodiversity and perception of such biodiversity on different semiotic levels. The main question of this Case study is: What are the roles of liminal species in a human city?

During this workpackage, sub-questions are used to work toward answering the main question. These sub-questions were:

- What do we know about the current state of biodiversity in Tartu city, especially regarding corvids? (Deliverable D1).
- What can we learn of the voluntary interaction of humans toward corvids? (Deliverable D2)
- How is biodiversity and liminal species perceived by inhabitants of Tartu city, especially regarding corvids? (Deliverable D3)
- How the different aspects, or roles, of liminal species coexist in a human city? (Deliverable D4)
- How to properly take into account the different aspects of the liminals' semiosphere in order to improve the cohabitation between them human inhabitants? (Deliverable D5)

HYPOTHESIS

The general hypothesis a the project is that liminal species and humans have a strong semiotic relationship, built during our years of coexistence (Marzluff and Neatherlin 2006). By understanding where the tension in this relationship is, and how it can be improved, we can improve global human/animal interaction in cities. This improvement is not only a nice idealistic aim, it is also, more and more, a necessity, as cities tend to expend and biodiversity to decline.

The main hypothesis of this workpackage was that cities are perceived as an exclusively human environment. It is true that biodiversity in cities is expectedly still lower than in most natural ecosystems, yet it is present, complex and changing. So, humans and animals are parts of this ecosystems, interacting permanently with each other and strongly semiotically linked. This situation forms a particular semiosphere, and can be "mapped".

METHODOLOGY

METHODOLOGICAL CHOICES

Both sources used for the Biodiversity Data part (Deliverable 1) were analysed in order to understand several aspects of ecological behaviour of corvids, and how this behaviour can be, or not, semiotically relevant for humans:

- What is the actual density of the population? This information is important to understand the perception of corvids population from human points of view.
- Are there behaviours that could be perceived as problematic by human beings (violent, destructive, noisy)? Which ones and why?
- What behaviours can be signs of animal agency? This information will be critical for all the Exploitation deliverables.

Then, both sources used for the Citizen Science part (Deliverable 2) were analysed in order to understand several aspects of human voluntary interaction with corvids:

- Where are the corvids observed? What does it tell us about the triangular relationship between humans, corvids and city?
- When did the observations take place? What does it tell us about how this relationship is evolving through the year?
- Who did the observations? What does it tell us about the human involvement?
- Who was observed? What does it tell us about the way different species are having different semiotic power on human minds?

For the Textual Material part (Deliverable 3), two main kinds of textual materials were marked as relevant. The first is related to literature and arts, and is composed of documents indicating how these species are perceived in a symbolical and cultural way by inhabitants. The second is related to actual and day-to-day relationship between liminals and inhabitants and management of this relationship. Analysis was both on how previous authors interpreted these documents and on the lexical and semantic elements that could be extracted from them.

The next step used previous Deliverables (1, 2 and 3) to investigate different aspects of cohabitation with the context of other aspects, whereas previous Deliverables tried to focus on single aspect, excluding more or less other, in order to gather a maximum of data. In Deliverable 4, the comparative approach was preferred, in order to draw semiotic links and relationships between aspects.

The last step was a Theoretical Toolkit (Deliverable 5), mainly based on the analysis produced in Deliverable 4. It took into account the methodological choices made in the three first deliverables of Workpackage 1.

ISSUES AND PROBLEM SOLVING

Recurrent issues occurred during this workpackage, mainly:

- **Linguistic issues:**
    o In D1: the entire report Monitoring Crows in Tartu (see the link to the report in the References and links section) is only available in Estonian. If this is not a problem when exploiting raw data, this report also contains analyse and interpretation made by the researchers. They should be taken into account, because they are part of the expertise shown in this report. This was solved by requesting an interview with Marko Mägi (Institute of Ecology and Earth Sciences of Tartu), who kindly accept to detail the experimentations that lead to the report and the interpretations made of these results.
    o In D2: the citizen science program Suvine aialinnupäevik is only in Estonian, and the report itself is only in Estonian. As only few data of the report were necessary for this part of the project, this issue was solved by querying the eElurikkus data base with scientific names of the studied species. The data base gave the corresponding names in Estonian, and these names were searched through the report. As most of the data are presented in data tables, it was possible to exploit them without mastering Estonian.
    o In D3: scientific and academic works about Tartu aesthetic, wildlife or literary life are mostly in Estonian and very few works exist in English. This issue could be partially solved by direct interviews, because some works have at least a summary in English, or by translating, first the table of contents, then titles and sections, then the interesting parts of these sections with an automatic translation tool (from Estonian to English; as the Estonian-French corpus is very weak, the translation is passing by an English step that could add confusion).
- **Data access:**
    o In D1: about the project Bioveins it was difficult to know who has access, and therefore can grant access, to the data. For unknown reason, if some data of the project are already available about bees (Casanelles-Abella et al. 2021) or bats (Villarroya-Villalba et al. 2021) , it is not the case for birds. Veljo Runnel (University of Tartu Natural History Museum and Botanical Garden) did an important part of the field work in Tartu, but the Estonian coordinator of the project was Lauri Laanisto (Estonian University of Life Sciences), who explained that data regarding birds were gathered by the French team. The contact was Nicolas Deguines (University of Poitiers, France), but it appeared that the person able to grant access was if fact François Chiron (University of Paris-Saclay, France). Data was eventually obtained, but it was complicate to understand who to ask and what to request.
    o In D3: for the Tartu Government database, the language issue could not be compensated by the first or second solutions used for other documents: no translation in English was available and the city's government never answered to the requests send by emails.

POINTS OF VIGILANCE

Comparative analysis of the data and theoretical toolkit redaction found major points of vigilance to be the following:

- **Difficulty to follow specific group or individuals**: most of the liminal species are not scientifically followed and do not wear any identification system. Depending of the nature of the studied species (flying, living underground, hibernating etc.), different strategies of following, more "traditional" should be used to try to compensate this aspect.
- **Lack of data about other species involved**: semiosphere is a sum of complex interactions between various of species. When studying liminals, the lack of data regarding other species of liminals can be problematic.

- **Naming errors**: general public is not specialist. Any data coming from inhabitants (textual documents, interviews, citizen science inputs etc.) can include naming errors.
- **Geographical bias**: inhabitants are more sensitive to what is close to their living area. Registration of species, complains about overpopulation or nuisances etc. can suffer from an inaccurate geographical description.
- **"Remarkable" bias**: general public is more sensitive to what is new for them. Rare species are more registered than common one, aggressive behaviour is more related than normal one etc. and description may not be accurate to understand the reality of the interactions.
- **Resistance of semiotic links**: all semiotic relationships are not of equal resistance. This must be taken into account when investigating semiotic solutions in order to solve cohabitation issues (see Interpretation section).

RESULTS

INDIVIDUAL RESULTS OF DIFFERENT DELIVERABLE

BIODIVERSITY DATA

As it has been observed before in the Paris study of rats, liminal species, over perceived as overpopulating, are in fact quite stable.

Most of the complains are against very ethological behaviour. If some attacks can indeed occur rarely, Marko Mägi stated that, prior to the launching of the monitoring of crows in Tartu program, "90% of complaints are about noise". Additionally, Lauri Laanisto also reported observations from the Raagi cemetery, where crows are grabbing and "stealing" candles from graves, presumably in order to eat the very calorific paraffin wax, leaving them sometimes hundreds of meters astray. It would be quite understandable that this behaviour would be perceived as an aggression from grieving families.

The quick adaptation to noise generators is an interesting sign of animal agency, and of the ability to make a difference between a thing and the sign of a thing. Crows understood completely that the noise was a "deceiving sign" and are not frightened anymore. Still, they stay for a shorter period than before in these areas. The noise used in the generators was conceived to be unpleasant for them, it is possible that this change in behaviour demonstrate "comfort preferences": a kind of preference that reveals or more complex perception and appreciation of one environment.

CITIZEN SCIENCE DATA

Corvids are clearly part of the environment of the humans: frequently observed, sometimes reported. But the places of reported observations are not always matching the real places of living of these birds, meaning that their existence, in data bases, are directly linked to how humans see (or don't see) them. A point that is starting to be investigated, but with no solid results yet is that corvids are almost completely absent of the data base at some precise places where there were complains about their numbers and noises. It is possible that a liminal identified as nuisance becomes invisible as a real animal for humans complaining of it.

Observations are following seasons. If an augmentation of observations is noted at spring, during nesting season, they are also many observations in winter, even when the weather is particularly bad. No "virtual" disappearing of records is noted. Citizen science programs are popular in Estonia, and is seems that inhabitants of Tartu are even more enthusiastic. This is an important point for dissemination and sensitization: it is possible to count on a solid interest from the inhabitants about nature, animal species in cities and citizen participation to science.

TEXTUAL DATA

These results show the kind of contradictory relationship people of Tartu have with corvids. Tartu is a literary object, with strong symbolical background and a very particular gothic spirit. Inhabitants seem to be attached to the "ambiance" of their city, and corvids are an important element of this ambiance. On one hand, even if description of corvids, and jackdaws in particular, are not very positive, this does not seem to be a real problem for the people, they are not really frightened but seem to appreciate all the strong and dark semiosis gathered by the birds (they are a recurrent literary pattern). On the other hand, they complain about these birds, and it is interesting to see that, even if some aggressive or destructive behaviours are described, they are not complaining about that but mainly focused on the noise. No satisfying solution has been found, since repellents seem to be even worse than the problem they should have been addressed.

COMPARATIVE ANALYSIS

It appears that the gap between an "ideal corvid" and the biological reality of the species could be part of explanation of why corvids' observations are so sensitive to remarkable bias. The symbolical value of the species impacts the way inhabitants perceive, register and react to the materiality of the species.

Elements introduced before are probably enforced by another kind of gap, rooting in the emotional value corvids seem to have, at least for part of the inhabitants. The importance of the remarkable bias is apparently contradictory with the importance given to the nuisances.

During the study on rats in Paris, the materiality of species was also very different of the other aspects, and a gap was occurring between the symbolical value of the species and the emotional value, with an important part of participants to the study agreeing on rats being nuisances but having empathy for them and not willing that any harm was done to them. In the current project, symbolical values and emotional values seem more congruent to each other.

THEORETICAL TOOLKIT

Materiality, symbolical value and emotional value can then by compared in order to map the different semiotical relationships inside the studied semiosphere. Consistent relations are necessary. If the three aspects have no consistent elements which each other, there is most probably a problem of methodology, especially in the representativity of the chosen sets of data, or in the interpretation of those sets. Gaps are not necessarily an issue in the results, only the sign of a lack of information. Understanding the reason of the gap is more important in this situation that understanding what should be there (partially because, if it is due to a lack of interest, nothing else should be there). Paradoxes are where different aspects of the same semiosphere are coexisting on the same plan. They are the signs of very complex relationship towards another species and are great entry points for action's plans, sensitization programs or popular science events.

INTERPRETATION OF THE GLOBAL RESULTS

If most of the biodiversity's data are consistent through the groups and the years, it is also to be noted that, regarding certain extreme behaviours, like aggression toward humans, zoologists talked about "personality", indicating that the variation of behaviour can be important inside a group, and be the sign of a complex cognition and individual construction. This is slightly problematic for tentative of generalized solutions, as variation between individuals create more hazard, but it is also the sign of a rich semiosphere with which I may be possible to interact.

When comparing this previous data when the one from citizen science programs, it appears that some species, especially liminals, are not as powerful at creating meaning in human mind. The fact that some of the most common species (corvids, ducks) are wildly underrepresented in data base shows that they are perceived as "weak semiotic input". Seen more as objects components of the city than as real animals, with sensitivity and

agency, they are more easily accused of nuisances and less prone to create immediate and easy empathy or willing of protection.

This view of corvids as "objects" is directly linked to the perception that emerged from the textual material. Differences observed are more likely the sign of two different strong categories of inhabitants, having different kinds of emotional and symbolical perceptions of the corvids, but cohabitating in the same city:

- A Reification profile: inhabitants with this profile are perceiving corvids as "objects parts of the city" mostly due to their omnipresence. As urban objects, corvids are not supposed to bother them, and they are consequently very sensitive to nuisances, or what is perceived as nuisances. These people can completely, on another hand, be birds' enthusiasts regarding other species. If so, they can feed citizen science database while being subjects to the remarkable bias.
- A Sublimation profile: inhabitants with this profile are perceiving corvids as "objects parts of the city" mostly due to their contribution to the gothic aesthetic of Tartu. As atmosphere creators, corvids are perceived with a positive emotional value, including regarding aspects that can be seen as nuisances for the other profile, especially omnipresence and noises. If these people can also be birds' enthusiasts, they are still probably subjects to the remarkable bias, as they are still perceiving corvids as urban objects.

Of course, other profiles of inhabitants are possible, but these two are probably the ones with the most important influence on data.

The overlapping of these different aspects allows to draw a quite interesting map of the coexistence between humans and corvids in Tartu, and how it is a mix of different elements, various in nature and origin. It also appears that not all the semiotical links between humans and corvids have the same degree of strength, resistance or resilience.

GENERAL PROJECT – CURRENT STATE OF PLAY

IMPACT OF RESULTS

Results of Workpackage 1 are answering the main question of the case-study.

However, these results still lack details and precision. The results pointed out (see Points of vigilance section) aspects that are still uncertain or could be improved. These aspects are going to be priority focus for Workpackage 2, especially by being asked during interviews (Deliverables D7 and D9), or proposed as items in more general survey (Deliverables D6, D8 and D10).

PROPOSITIONS FOR OTHER ASPECTS OF THE PROJECT

ACADEMIC ASPECTS

Workpackage 1 will lead to the first academic productions of the project. A scientific paper (see document Paper 1) is currently in its draft state. A communication of these results will take place in the end of June, in the Gatherings in Biosemiotics 2022 (see document Conference 1). An international presentation is also scheduled in July, for the French Society of Zoosemiotics (see document International 1).

POPULARIZATION ASPECTS

During Workpackage 1, some elements of popularization aspects were launched, like the website creation (see document Communication 1) and the first communication video for general public (see document Communication 2). The end of the workpackage will lead to more popularization elements, like the first

dissemination production (see document Dissemination 1) and the exploitation document, the practical side of the theoretical toolkit developed in Deliverable 5 (see document Exploitation 1).

NEXT STEPS

Next steps to end this workpackage are the redaction of the first paper (see P1) and of the exploitation document (see EX1), the creation of the last popularization production (see DM1), and the preparation of results' introduction in conference (see C1) and to international potential partners (see I1).

ANNEXES

REFERENCES AND LINKS

REFERENCES

Casanelles-Abella, Joan, Stefanie Müller, Alexander Keller, Cristiana Aleixo, Marta Alós Orti, François Chiron, Nicolas Deguines, et al. 2021. 'How Wild Bees Find a Way in European Cities: Pollen Metabarcoding Unravels Multiple Feeding Strategies and Their Effects on Distribution Patterns in Four Wild Bee Species'. *Journal of Applied Ecology*, October, 1365-2664.14063. https://doi.org/10.1111/1365-2664.14063.

Delahaye, Pauline. 2021. 'Rats, Mice and Humans'. *Linguistic Frontiers* 4 (1): 44–52. https://doi.org/10.2478/lf-2021-0004.

Hallmann, Caspar A., Martin Sorg, Eelke Jongejans, Henk Siepel, Nick Hofland, Heinz Schwan, Werner Stenmans, et al. 2017. 'More than 75 Percent Decline over 27 Years in Total Flying Insect Biomass in Protected Areas'. *PLOS ONE* 12 (10): e0185809. https://doi.org/10.1371/journal.pone.0185809.

Hoffmeyer, Jesper. 1997. *Signs of Meaning in the Universe*. Indiana University Press.

Marzluff, John, and Erik Neatherlin. 2006. 'Corvid Response to Human Settlements and Campgrounds: Causes, Consequences, and Challenges for Conservation'. *Biological Conservation* 130 (June): 301–14. https://doi.org/10.1016/j.biocon.2005.12.026.

Sánchez-Bayo, Francisco, and Kris A. G. Wyckhuys. 2019. 'Worldwide Decline of the Entomofauna: A Review of Its Drivers'. *Biological Conservation* 232 (April): 8–27. https://doi.org/10.1016/j.biocon.2019.01.020.

Villarroya-Villalba, Lucía, Joan Casanelles-Abella, Marco Moretti, Pedro Pinho, Roeland Samson, Anskje Van Mensel, François Chiron, Florian Zellweger, and Martin K. Obrist. 2021. 'Response of Bats and Nocturnal Insects to Urban Green Areas in Europe'. *Basic and Applied Ecology* 51 (March): 59–70. https://doi.org/10.1016/j.baae.2021.01.006.

LINKS TO WEBSITES AND DOCUMENTS

Citizen science data base (calibrated for Tartu city only): https://elurikkus.ee/regions/Linnad/Tartu%2520linn

Citizen science program Suvine aialinnupäevik: https://www.eoy.ee/aed/

Citizen science program Suvine aialinnupäevik 2020 report: https://www.eoy.ee/aed/content/materjalid/aialinnupaevik_2020.pdf

Database "Tartu in fiction": https://teele.luts.ee/

Monitoring of crows in Tartu report: https://tartu.ee/sites/default/files/research_import/2018-01/Vareslaste%20monitooring%20Tartus_l%C3%B5pparuanne%2C%20leping%20M-030.pdf

Project Bioveins: http://www.bioveins.eu/

Société Française de Zoosémiotique: https://societefrancaisedezoosemiotique.fr/

"Spooky Tartu" on the blog Itching for Eestimaa:
https://itchingforeestimaa.wordpress.com/2007/02/18/spooky-tartu/

Tartu City Government database: https://tartu.ee/et/dokumendid

ACKNOWLEDGEMENTS

DOCUMENTS

Abstract for Streams conference by Nelly Mäekivi and Riin Magnus "Relations between local people and the reintroduced European mink: an ecosemiotic analysis" (PDF version of panel – 27/01/2022)