Human-Wildlife Conflict Mitigation on the Ground

Present and Future Scenarios of Conflict-free Environments!?

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Abstract

Based on our research in the Okavango Delta, Botswana, which began in 2017, we describe our LionAlert system. It protects inhabitants and their cattle from predators (in this case lions) via cell phone alerts and thus aims to mitigate the local Human-Wildlife-Conflict. The technical development was accompanied by various on-the-ground measures and activities. While we conduct user-oriented and participatory research in the real setting by means of a Grounded Design (GD) approach, we continuously reflect on our own attitude as researchers. Here, we present a socio-technical solution strategy to underpin this future-oriented methodology by means of storytelling. Against the background of a design fiction utopia, told from a Western perspective, current real events of a Western society are then critically reflected and dystopian approaches are shown.

Keywords

Human-Wildlife Conflict, Lions, Botswana, Grounded Design

1. Introduction

Throughout the history of humanity, the relationship between humans and wildlife has been characterized by neighborly coexistence and cooperation, but also mutual threat, exploitation and fear [6, 12, 26, 29, 34]. In research, the latter aspect is called Human-Wildlife Conflict (HWC) [13], which extends across lakes and oceans [16] and even into the skies [20]. This conflict encompasses innumerable situations and species, ranging from the most diminutive of insects to big mammals [24]. While humans expand their habitat and attempt to control nature to their benefit, these encounters often lead to fatal consequences for the wildlife.

The African continent is possessed of an enormous variety of unique wildlife and specific ecological habitats, a large proportion of which are tremendously fragile. At last count, 133 species of animal in Africa were on the critically endangered or endangered list and 104 species of plant [35]. All of this amounts to a pressing and complex challenge of not only local but global significance [30]. It forms the backdrop of our research work, which focuses upon one instance of HWC: the conflict between cattle farmers and lions (*Panthera leo*) in the Okavango Delta in northern Botswana. Specifically, in the villages of Seronga, Gunotsoga, Eretsha, Beetsha and Gudigwa with a total population about 5,000 people and 16,500 cattle [38]. At the time of writing, at least 12 different prides of lions were occasionally encroaching upon the study area as part of their routine movement. The prides were made up of a minimum of 28 known adults and 15 cubs, giving a total of 43.

Most inhabitants rely upon subsistence farming, and their social standing traditionally depends very heavily upon how many cattle they own [9, 38]. Right now, the herding culture depends on the wealth of the farmer, if they can afford a herder and a stable enclosure (kraal) in which to keep the cattle at night. Since lions are afraid of human beings and encounters are very rare, the herder is an assurance that the cattle will not be attacked by any predator. But since many inhabitants cannot afford herders and/or kraals, they let their cattle graze in the Delta at day and often night and let them roam freely, where they might become prey for any predators. Circumstances that made positive change within the last few years since the LionAlert system is

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implemented and joined by a communal herding program on site. However, despite these support measures, there are many reasons why Batswana are often still not able to gather their herd every day. One big issue here is mutual trust, a factor that was evident both between the Batswana and towards the government and us researchers. However, those who kraal their livestock light fires next to it during the night, own dogs for protection, or hang things in the trees that rattle when the wind blows. While the first is often done inadequate, as the fire is too small or too far away from the kraal, the latter doesn't scare predators away. Dogs, on the other hand, are a good solution, but not everyone can afford them and has sufficient knowledge to train them.

For the Batswana[1], destruction of fields by elephants, loss of livestock by lions or other predators or the accidental but rare death of humans by wildlife actors are the most challenging moments of their current lives [19]. Since the 1960s, inhabitants are no longer allowed to live within the Okavango Delta due to its proclamation as a National Park [4]. As a result, old practices of living with wildlife have been lost, as have identities as hunters and fishermen. Those who live close to its edge suffer from the lack of food and personal security, with a hunting ban within the area and an increase in the lion population being linked to that [6, 22]. This is why the outskirts of national parks, the areas where wild animals are protected, have become hot spots for conflicts with larger animals, especially predators [6]. For all these reasons, people have moved further and further away from their natural environment. This has also been caused by the introduction of compulsory school education [27], which has led to a loss of knowledge of appropriate herding in the delta over the generations. However, people who are older or work as field guides have a more refined sense and appreciation of wildlife.

Efforts have been made to reverse some of the more serious outcomes of HWC or to prevent issues from arising in the first place. Increasingly, HWC has also been recognized as an arena within which technology might have a role to play [17, 28]. Here our research comes into place.

2. Research Approach and Setting

Community-based resource management has rarely been linked to ICT so far [40]. We are following an on-the-ground approach called Grounded Design (GD) [33] at the intersection of HWC and Animal-Computer Interaction (ACI) [23]. GD promotes situational understanding by using ethnography [1, 14], participatory design (PD) [15] and action research [18] in collaboration with all relevant stakeholders relevant for solution generation to experience the respective lifeworld of the end user target group [8]. The latter are the most relevant within the design case study, as they can be considered as experts of their own everyday life. Nevertheless, the view has to be extended to their respective social environment [10, 33, 37]. The process of knowledge generation is therefore holistic and interactive. Furthermore, it is an iterative design process, which allows for a stepwise build-up of understanding, whereby the ostensible problem is enriched by context and causes are uncovered [33]. Holistic data collection in this context includes not only demographic, socio-economic and/or technical data, but also insights into how people think, feel and act, as well as the interactions between people and lions, but also between human actors themselves. With this in mind, opportunities and challenges of technical solutions were explored within the existing context in three study phases in 2017, 2018 and 2020, comparable to the design case study construct which consists of an exploratory, a design/prototyping and an evaluation/appropriation phase [39]. Local inhabitants of the conflict area were then addressed in the co-design process with different stakeholders to arrive at a solution that enables alternative action strategies which are more suitable in and beneficial for the Global South. Implementing such strategies on the ground can be enormously challenging, both logistically and relationally, with them sometimes depending upon the complicity of local populations with wildly divergent interests [22, 36].

[1] Inhabitants of Botswana (singular: Motswana)

To try to mitigate some aspects of the conflict between human settlers and the population of wild lions in the northern Okavango Delta in Botswana, a GPS-based lion alert system was designed and deployed so that lions could be tracked using a GEO tracking system and livestock owners were warned on their mobile phones whenever a lion was close to their pastures or village. Alongside of this, a variety of conflict reduction strategies were implemented from educational meetings to a communal herding program. In addition to this, understanding social practices of users and how these evolved alongside the technology is instructive for the system iteration and for identifying how future approaches to mitigating HWC might be developed. Our results suggest that solutions need to be built upon a proper understanding of a range of considerations, including human knowledge, orientations, thoughts, feelings, practices, interests and goals, also their digital infrastructure, accessibility, and digital ecologies. Further on animal behaviors, and environmental factors. Also, they have to protect the interests of humans, livestock and predators in equal measure. To address the HWC and its solutions by design and ensure sustainability of its outcome, it is also important to take into account the oral culture and collective history of the inhabitants with predators, especially lions. In relation to this, the warning system clearly has a role to play, but its effectivity is limited and it will need to be supported by on-the-ground-activities that fill gaps as education, livestock caring support and economic empowerment. By integrating multiple stakeholders and methods as well as focusing on sustainability, conservation and co-existence we gain a holistic perspective that corresponds with Arturo Escobar's work that follows values which are associated with inclusion, participation, collaboration, understanding, respect, sacredness and the always-recurrent cyclic renovation of life [11].

3. Just a Utopia!? Storytelling based on a grounded tech-supported System

If we think of Seronga as the largest of the five villages at the northern Okavango Delta and its already emerging future as an economic hotspot in the area, the LionAlert system and the ongoing measures to change irritated/conflict-promoting perspectives and social practices on the ground represent a promising opportunity to stabilize and sustainably maintain the acutely threatened ecosystem. Even more people will encounter wildlife in the future, fueled by the expansion of the tourism industry. Mutual protection is therefore a priority against the background of a secure and positive experience of outdoor activities in open-air settings – for inhabitants just as for visitors onsite. For this, a successful cohabitation of the diverse species is fundamental and secures both life and economic prosperity against the background of successful interaction. If we think about what could emerge on the basis of LionAlert, hopeful utopias emerge in our minds. In the following, we would like to present and critically reflect on one of these in excerpt by means of the methods of Design Fiction [3, 25] and storytelling [31]. Here our existing LionAlert system is the basis for the extended WildlifeAlert described below. We are using implications for future work on a holistic design idea involving many aspects of locals' daily life, education, farming, cattle management, economy, ecological awareness and dealing with wildlife and the ecosystem.

4. Smart City beyond the conflict

The TIMEtraveller, May 27th, 2045: Smart City beyond the conflict by Timothy Woods

More than a touch of wilderness in the Delta that has remained wild, here where my heart is free from the commonplace of the West. The clocks are ticking slower in the heat. Sand is shimmering under my feet as we jump off the back of the shuttle van. Four weeks on the ground in the real everyday life of modern Batswana. The farmers' culture has been preserved here, while tech-supported networking and organization has eliminated their hardships of the old days. Even from a distance, we see the busy seed drones scurrying across the fields, which Ayanda has

ploughed by machine. She could buy her food in the supermarket around the corner, but this is for others to do. Ayanda wants to preserve the tradition of her ancestors, the identity of the original Batswana, who have always been self-suppliers, farmers, herders. She has studied agricultural sciences and completed tourism certificate courses. For her open field, she gets generous grants from the Wildlife Department and the local tourism authority. Besides sharing her knowledge with tourists and local schools, she also shares her harvest with the local municipality; delivering to supermarkets and the local caring community, to which she herself belongs. The Delta caring community "DeltaCare" corresponds to a solid local and neighborhood network, which is based on solidarity-based mindfulness and assistance on the one hand, and on good integration into higher-level institutional and organizational structures on the other. Ayanda is one of the younger ones who pick up the older – still slightly less educated – Batswana as she is capable of catching up with others who are more vulnerable. DeltaCare is one of the many successful follow-up projects to LionAlert, the pilot research project in the Delta that quickly took on a lighthouse function due to its strong focus on user participation during the whole development process.

After our visit to the fields, we head to Bogo, one of Seronga's main herders. Before that, however, we stop briefly at the local kgotla, the marketplace of Eretsha village. This is where the citizens' warning station is located. Connected to a local power module and server, it ensures that all locals receive predator warnings even if they experience technical or network issues – although compared to earlier times, these have become very rare. The network connection has been expanded and stabilized, not least to accommodate the increasing number of tourists visiting the delta. The warning station comes in the form of a tablet which is placed centrally in every village and maintained by trained locals. It can serve as a means to receive warnings visually and acoustically, while it can be connected to external devices like sirens or flashing lights, meant to both warn locals and scare away predators. Sadly, we can't experience them live. We don't want to get the citizens in an uproar.

We continue with the shuttle transport to Bogo's – deep into the delta. He has been a herder for over 40 years, taking care of over a hundred animals with four other herders, and has experienced the old – less smart – times, and the beginnings of the return of communal herding. He is happy to see us and greets us friendly in Setswana. Our smart translator app simultaneously translates acoustically and in writing into English. The smartphone is still the leading technology in the Delta. While herding, Bogo uses it to keep an eye on everything: the delta, the cattle on his plot and the wildlife in his area. He can monitor his herd's health via the app and keep track of upcoming checkups and vaccinations. His main app WildlifeAlert signals him acoustically and, if clicked, also visually who is moving where. While for him the predators are particularly relevant for the protection of the cattle, which he can observe as well, for the field guides it is the colorful diversity that the tourists want to see - the role determines the output. Each role in the community is linked to specific data to protect wildlife from being misused, but also humans with regard to potentially dangerous encounters. Herders and field guides can see the position of certain animals, farmers who do not go out in the open grassland only receive warnings if dangerous wildlife is near to prevent poaching. While many species are no longer endangered because of successful conservation efforts, they still form an indispensable cog in the machine that is the ecosystem. Due to the care of well-trained, professional herders who are supported by technology and educational processes that led to an increased understanding how to behave with wildlife the cattle-predator clash can nowadays be ruled out. In his smartphone, Bogo also has a digital grazing plan that allows him to easily check where to lead his herd next. It is also synchronized with other herders who take care of nearby herds. This helps sustainable land usage and avoid overgrazing, while keeping the cattle satisfied and healthy.

Bogo also has a holo app in his smartphone that allows him to visually duplicate himself in case predators show up. He can also turn up the volume and his voice signal. Holo stands for hologram visualization, but also for holistic as the cycle of the ecosystem with all its actors is constantly depicted and kept in balance by every community member in interaction with the

wildlife through technology. Predators are at least as smart as their human neighborly environment and the adjoining villages, but humans are still avoided by the animals; they are shy and behave instinctively to protect themselves. To prevent them from becoming accustomed to conflict solution options, Bogo's holo app nevertheless has a few functions at the ready, where he can decide whether he picks them manually or turns on the rotating autopilot. These include different images and sounds with alternating brightness, rhythm and content. He himself prefers to rely on technology here, he explains to us, because in potentially dangerous situations he tends to freeze instead of the adrenaline making him faster. His holo app has bailed him out before, when it was the integrated hologram fireworks with according sound effects that sent the wild dogs running.

Our last stop for today is the mobile butchery. We meet Bogo's buddy Ditheei a little deeper in the delta, still in Bogo's plot, where 19 cattle are shot today. Ditheei is a hunter by profession and looks after the stock of cattle shot for the meat industry. A well-aimed, muffled hit sends them crashing to the ground. Not for the faint-hearted, but gentler than ever for the animals. They have to be butchered here, because the local beef from the well and healthily nourished animals is not only part of the lucrative export to the West, but above all part of the tourism business. The Okavango Delta has previously been a foot and mouth disease zone and exporting meat was strictly forbidden. With improved healthcare and supervised grazing, however, the spread of this disease has been ruled out. Organic, free-range, home-grown meat is more popular than ever. Butchering takes place strictly according to plan visualized through a calender app. Each plot counts various cattle from different families. The calendar takes into account the rearing of new calves - a sustainable and fair system in which everyone participates. Herders like Bogo have the cyclical calendar in mind. It includes not only death, but also the life of the cattle, which are well taken care of through the digital grazing plan.

The day is coming to an end for us and we are heading back to Seronga Camp Resort. An evening of good food, wine and holo art awaits us before we head back to the Delta tomorrow. There we will visit the village school in Eretsha, where Muriel will teach us how to use the holo app. After our training session we will go back to the Delta on a tech-safari and use the holo app and its various functions live ourselves. Using it, we are educated about the practices of cattle and wildlife, learn about the local flora and its links to humans and animals. We again accompany Bogo and the others herding at the end of the day and listen intently to the singing of the predators at night. – *End of travelogue.*

5. Too much utopia? A critical reflection

The view into the year 2045 underlines a utopia in which technology in combination with social practices and sustainable ecology (here: smartphone including holo app) keeps an entire ecosystem in balance. Wildlife, tourism and community management are organized via apps that consolidate and promote human-wildlife relationships through data sharing and the transmission of differentiated knowledge bases and help to sustainably control cattle populations. Ecological and communal management promotes economy in the process. Data sets are transparent but secured in a role-specific manner. The holistic design of the Smart City beyond the conflict has given the Batswana the opportunity to preserve their culture, e.g., traditions and customs, values and norms, under the sceptre of progress, and to present them to the world in a different light: not needy, but strong and in balance with their environment, as pioneers of good, ecological and sustainable agriculture as well as successful, intergenerational community in action. Wow. That sounds a bit too good to be true, right? In the following, we would like to name some important aspects that could hinder the success of such a utopia or accompany it at present as well as afterwards.

Indeed, as such an interconnected system would require a highly stable infrastructure, which is currently not given in the Okavango Delta and far from becoming reality. This would require a massive budget which needs to be justified by a huge advantage for the local economy such as

increased tourism. It is possible that tourist interests would nudge the local government into supporting such comfort, but it would simultaneously lead to an increased inflow of Western influence, which could leave larger footprints than desired based on the current neoliberal ideal of Western societies [5] where sustainability is mostly linked to economic aspects [2] . One could argue that this is already happening, though at a slower pace, and that change is not to be stopped. However, it would have to be in the best interests of and benefit the local population, initiated and supported by them, instead of overlooking opinions and ways of life that are no less justified or acceptable than ours. We have observed how the "old ways" of taking care of cattle – i.e., leaving them for days out in the open grassland without supervision – have persisted, making people virtually helpless even after years of receiving lion alerts. We have seen how skepticism and rumor have kept many from participating in the communal herding program where they would have to entrust their animals to someone else. This has led to the question to what extent we can, and have the right to, influence local practices, even if it is for the benefit of wildlife who do not have a voice themselves. If people do not want change, are we really in the position to impose it on them or influence them into accepting it after all? Especially if we consider colonial history and the negative impacts that may come with change, this is a tough question to answer. Moreover, both the lion and the overall ecosystem, which is kept in balance by its existence, are of not exclusively local but global importance.

Development often leaves behind the already vulnerable ones. This also applies to technological developments. Those who are not fast enough to adapt, especially the elderly, are quickly passed over, just like nature. While older people are safe within the caring community regarding their survival, development has to take their needs into account and make sure they do not feel overwhelmed or even superfluous within the smart app-based holo utopia. Their skills, knowledge, and the stories they have to share are valuable to the community and need to be integrated as a central part to ensure social inclusion. Enabling digital participation regardless of age and education is a challenge that technical developments must face. At the same time, cattle, that are mostly still used for ploughing fields, would lose their "job" if machines take it over. Will they still have a place in the local economy once the number of tourists increases and overruns the farming sector? So far, they can be seen as a source for high-quality and affordable meat that may become a part of an increasingly conscious, mindful nutrition. However, we cannot foresee the market development that can also be dominated by other, cheaper foods imported from other countries. It could also be that more cattle are needed as soon as demand increases, leading to intensive agriculture. Strengthening the local export value will increase wealth, but we know from history that this can lead to first a gap between rich and poor and second further exploitation of nature and a drift away from it as the promotion of cattle herds and their export to other countries will most likely correspond to the current neoliberal and thus capital-oriented model of the Western world that does not focus on sustainability but on continuous growth. Even more land degradation [21] as well as a further aggravation of the current climate crisis [32] would be the result, which would be neither locally nor globally desirable. Botswana would need to follow a different economic model instead if this is not to happen, to stop the race of economic growth and ecological literacy.

It is worth mentioning that the design fiction presented here is imagined by us as external researchers, even though it is based on local stakeholders' opinions and experiences in the field. Therefore, it is derived from our own subjective worldview and what we consider best for the context in question. Emotions often accompany the researcher – consciously and unconsciously [7]. Against this backdrop it would be interesting to develop different versions of our utopia with different stakeholders and compare how they envision the future of their living area and country. Indeed, we tried to get a glimpse on this during our last field stay in 2020. Participants answered that they expect their villages to grow and gain more inhabitants, houses and shops. They also expect the tourism in their area to increase and offer more job opportunities, while others told us, the opposite by saying, that there will be even less employment in the future. It was also pointed out that more young people will leave their villages to find work elsewhere. They expect a better infrastructure due to the paving of the main road leading through the delta, a bridge built

over the Okavango River in Shakawe, thus offering more opportunities for business and development; more stable electricity in the villages and more solar panels for private use. One participant could imagine the automation of ploughing. Moreover, the market prize for beef would be higher than today, making their cattle even more valuable. Last but not least they think that more and better education is on the future agenda. Six of 21 participants had no answer to the question how to envision the future. These results show that people's imagination is limited to what they already know. Technology is hardly considered in the remarks of our participants on site, as its use is hardly widespread.

Finally, we would like to point out the fact that there is a strong focus on a combination of different devices within the utopia described. Here the question arises whether such a massively networked construct of a social order, which is dependent on a continuously functioning technical infrastructure, makes sense at all in such a wild ecosystem? The danger of a total failure here - in the Delta, surrounded by wildness and their kind - could cost human lives in the worst case. How could an analogue warning system here counteract potential dangers if the existence of a certain technological standard is accompanied by habits that would soon push the current caution of the inhabitants into the past?

In summary, our design fiction is facing hurdles in local infrastructure, while also imposing Western views which could overwrite existing local culture, identities and practices, exclude certain groups, and worsen economic and ecological issues. Therefore, we could also ask these questions: Which role might technology and datafication play in a future to improve the relationship between humans and the natural world? And can technology coexist with the current exploitation of mother nature for cutting-edge technology (e. g., eMobility, new generations of smartphones, etc.)?

6. Conclusion

The utopia told above has some characteristics of a dystopia as well, if we do not take care of all groups taking part in it, are not careful to include local attitudes and lifestyles and don't take a step back as Western researchers. By following a holistic design approach with reference to the work of Arturo Escobar and its values of inclusion, participation, collaboration, understanding, respect, sacredness and the always-recurrent cyclic renovation of life [11] as an overall framework where Grounded Design [33] is embedded, this holistic perspective on on-the-ground settings becomes even more future-oriented. It adequately considers the needs of all relevant stakeholders by cultivating an inner attitude of the researchers to solve a problem holistically. Perspectives and social practices are thereby made perceptible, understood and collaboratively changed with the consent of the end-users of ICT in a careful and sustainable way, whereby irritations in interactions – here within the relationship of humans and lions or wildlife in general – can be brought back into balance. The iterative process of exploration, design, evaluation and appropriation constantly uncovers causes and reactions. This also has a preventive effect against misconceptions and misimplications that could lead to renewed irritation of social practice on a long-term basis, making the vision of a more conflict-free future more tangible.

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