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Telling Stories on Commoning with Design of Models and Simulations

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Abstract | This paper will present learnings from a 4-year SNSF-funded research project (2018-2021), exploring commoning initiatives through regular exchange with three housing cooperatives from Switzerland. In close cooperation with them, we developed four agent-based models as visions for dividing up work needed to care for common spaces and resources in a sustainable way. We affirm computational modelling as a design praxis that can address commoning as a world-making activity, and explore mechanisms that would challenge or restore the stability of community life simulated in this way. Our models are not to be understood as prediction-oriented systems, but rather as a process of designing thinking tools, or toys by which we are creating ways of being. What kinds of controls can prevent extraction of resources from the community? What personal strategies bring more harmony to the group and how much does individual behaviour affect it? We address these questions and propose some preliminary conclusions about the entanglements of labour with value extraction in commoning activities that are best addressed through stories.

Keywords: commoning, computational modelling, urban neighbourhood, experimental design, storytelling

1. Assumptions and Modelling of Sustainable Living in Housing Cooperatives

Contemporary questions on destruction of habitat and future governance can be viewed as a crisis of distribution of resources. Commoning initiatives propose to radically rethink this. Commoning is an emotional and laborious activity pursued as a form of resistance to rampant privatization on one hand, and the perceived hegemonic governance of the state on the other. Indeed, commons-based economy and commoning are proposed by many as an alternative to neoliberal consolidation of economies, a resilient form of governance (Bollier & Helfrich, 2015; Gibson-Graham et al., 2013). The work we discuss in this text is an exercise in depicting simple aspects of governance in an imagined community. We expose the power of computational modelling, and by it also the power of design to contemplate outcomes of social dynamics and community-based rules. In *Designs for the Pluriverse*, Arturo Escobar (2018) speaks of the necessary reorientation of design in order to address what he identifies as two most urgent problems: destruction of our habitat and the crisis of modernity (civilizational model).

Commoning is the starting point in exploring design of agent-based models (ABM)[1] in our 4-year SNSF-funded research project (2018-2021). We understand model-making as an 'ontological' process of designing tools for a pluriverse, which in Escobar's terms (and in terms of his sources, HCI researchers Terry Winograd and Fernando Flores), is always also about creating ways of being. The capacity to develop and visualize long-term visions is a recurrent process in which communities design their world, which designs them in return, as pointed out in theorizations of ontological designing (Willis, 2006).

The modelling process described here is informed by our regular exchange with three Swiss housing cooperatives in the form of workshops: Warmbächli from Bern, LeNa from Basel and NeNA1 from Zurich. The three initiatives are part of a wider movement, Neustart Schweiz, which promotes reorganisation of living and habitation around the principles of sustainability, economic independence and degrowth. The foundation and philosophy of these initiatives is informed by the utopian novel *bolo' bolo*, a proposal for radical rethinking of ways to live together that focus on the self-organisation of neighbourhoods. Searching for an ecologically and socially sustainable way to overcome the aforementioned contemporary crisis, Swiss author Hans Widmer, under the pseudonym P.M[2], tells stories about a distributed network of 'bolos' (neighbourhoods), inventing new words for new concepts of sharing and cooperating in a future society. P.M. 's vision abandons our current 'planetary work machine', in favour of degrowth and lifestyle that is negotiated with others. The cooperatives we work with do not yet live together, but they have negotiated some of the rules for future living together based on these stories. It can be hard to imagine how their unconventional, anti-capitalistic, community-driven ideas about self-organised, sustainable living will unfold.

The starting point in our modelling process is the question of shared work - ways to keep track of voluntary work contributions and a story about an important figure in one well-known housing cooperative from Zürich. The story goes that there was a certain Iris, who became central to day-to-day issues in the community. Everyone believed in her judgement and her conflict management capacities. The others did not need to know how she arrived at her conclusions; she was simply always fair. We heard this story at one of our workshops, and decided to model an entity that would know how to best distribute tasks, keep track of what was done and maintain the community harmony. This distribution of work became the main ambition in development of our models, under the common name of *Ämtli Management System* (AMS).

We created four agent-based models that simulate a community of 50-200 people who use and maintain a common. In the models we represent people as agents who are able to either work or rest. Our models articulate concerns about ways to divide up work by keeping track of how much time individuals dedicate to common tasks, as well as different (centralizer or decentralized) ways to communicate across the community. We simulate two paradigms of control: driven by individual agency (agents acquire and accumulate the right to rest once they complete a task) and collective agreement (a common pool of working hours that agents divide evenly, which we refer to as time-banking). We also explored two ways of assigning tasks: through a centralized communication system (like an AI-powered Whatsapp group/COVID-19 tracking app) and through agents' own simulated movement across space, taking up tasks in their proximity. The resulting four models are: Time Accumulation (TA), Time Banking (TB), Spatial Time Banking (STB) and Spatial Time Accumulation (STA), as illustrated in Fig. 1 below. The first two models (TA&TB) are problematizing the distribution of tasks in time, while the second two models include space in a twofold manner: as a parameter of proximity to the resource that needs to be managed, and as resource itself, which gets used up through the agents' movement.

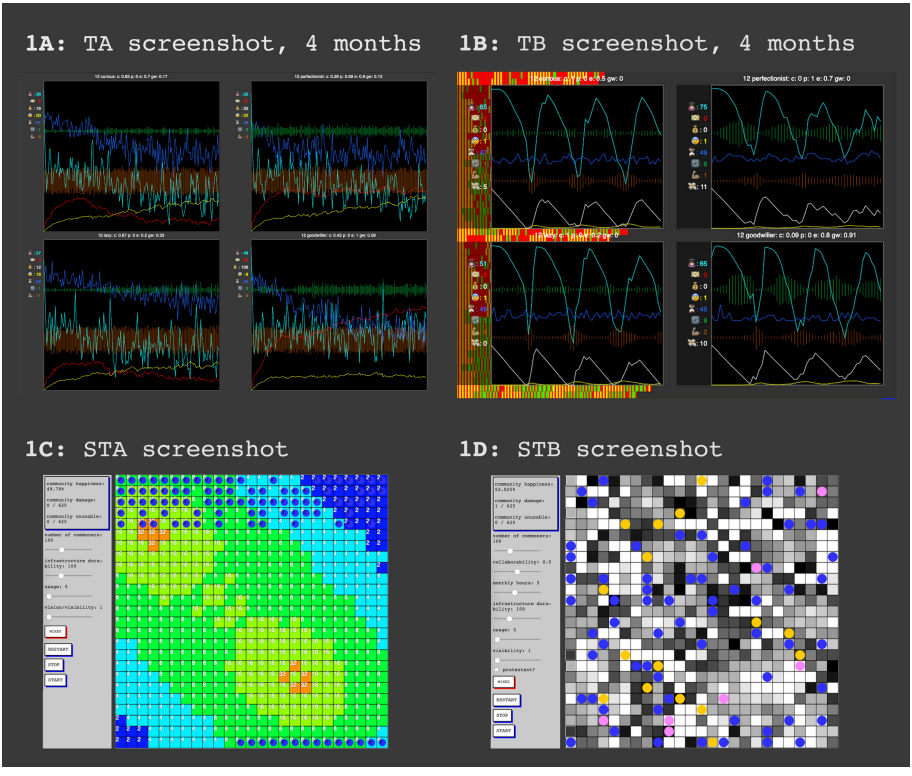

Figure 1. The four models: Time-accumulation (TA, top left), Time-banking (TB, top rights), Spatial Time-accumulation (STA, bottom left) and Spatial Time-banking (STB, bottom right)

What kinds of controls can we have in order to prevent extraction of resources from the community? How is communication articulated in the model: centralized or decentralized? What personal strategies bring more harmony to the group and how much can individual behaviour affect it? How does putting value on work subvert regulation (or the other way around)? We will address these questions by offering two perspectives on the models: the first one, *from tragedy to comedy*, is about the community balance and control mechanisms that disrupt it or restore it. The second perspective is questioning *individual strategies* and their capacity to significantly affect the model.

2. Commons: From Tragedy to Comedy

Let us try to imagine a housing cooperative living in a building they designed for themselves. Their main concern in this story is the distribution of care and maintenance tasks, in a similar way to how chores have to be distributed within a household. How could community

members fairly distribute such tasks in a community of over 200-300 people? What if part of such negotiation resulted in a control mechanism by which commoners are allowed to refuse a task if they have earned enough **resting time** by working, de facto creating a time market with working hours as input and resting time as output? We will refer to this resting time as **time-coins** with the ambition to emphasize the interchangeability of one's labour contribution.

In the first agent-based model, the Time Accumulation-based (TA) *Ämtli Manager,* we started from an idea of a system that could allocate tasks to agents in a fair and efficient manner. The external global indicator of community *harmony* and *happiness*[3] is the level of stress, represented cumulatively for the entire community (see Fig 1A, yellow line). For each task they would do, agents would 'earn' some time-coins (see Fig 1A, red line) that they could use the next time they are called to do a task. Agents could therefore refuse to work in order to rest, or they could decide to swap the assigned task for another one they prefer doing.

The TA simulated community was working without major disturbances. Indeed, it was hard to perceive anything interesting in its operation until we started thinking about disruption. Then, by putting a limit on the number of time-coins, we started to observe some emergent behaviour. By adding such a limit, we could emphasize the possibility for agents to be 'greedy': accumulating most of the time-coins and never taking any rest. When initiating a simulation with a quarter of the community composed by such 'greedy' agents, the irreversible tipping point would emerge after a certain amount of time: community stress would increase toward its maximum value.

Such tipping point could be described as what Garrett Hardin would call the *Tragedy of the Commons* (1968). This drama has been developed by the author following the writings of Darwin, Adam Smith's *Wealth of Nation* and a pamphlet written by a young mathematician named William Foster Lloyd, in which the author, more than criticizing the common in itself, wants to warn against overpopulation and its disruptive effect on the commons. The conclusion of the article is a call for "abandoning the freedom to breed" (Hardin, 1968, p. 1248). How Hardin envisions such tragedy is similar to what happened in our model by programming agents that want to maximise their gain and limiting the resource of time-coins. The herdsmen described by Hardin ruin shared common land by adding too many animals to their herd: "[f]reedom in a common brings ruin to all" (p. 1244). In a similar way, because the number of time-coins is finite, not using them becomes a form of privatisation of the common. Therefore, the freedom of the agent to accumulate as much time-coin as possible results in the tragedy for the others, as the time-coins accumulator agents remain untouched by such drama.

A different way to keep track of time would be to measure labour contribution as time, and form a common time-bank: a practice already in use by some of the communities we worked with. In time-banking, each person has a certain amount of time to contribute to the common tasks each month[4]. When we articulated individual contribution in terms of a fixed,

and equally distributed time contribution, such as we did in the TB model (see Fig 1B), without much surprise the simulated community was operating smoothly. We then tried to problematize such a system by introducing 'schedule stiffness': instead of distributing the hours over the month, the agents would be 'selfish' and decide to use their working hours at the beginning or end of the month. Nevertheless, even such a configuration, in which agents would be sometimes forced to execute tasks outside of their planned schedule would not lead to any disruptive tipping point.

With the first two models we learned that, even though we tried to destabilize our simulated community's sense of fairness and satisfaction using similar mechanisms - competition over the way the agents use time - it was significantly more difficult to get the TB model out of balance and reach a recognizable tipping point by which the state of the model would change. By comparing those two modes of keeping track of and commoning time we could observe that the simulation of time banking system is more resilient to the pressure of a possible tragedy caused by behavioural traits of individual agents.

2. 1 The Disruptive Power of *Value*

The second version of models explored the use of space where the agents live, providing a new perspective on community dynamics. Contributing previous interest in common tasks distribution and work being done, we included space across which the agents move as an abstract resource that localizes work. Each cell represents a part of the common land that is used by the agent stepping onto it, and needing some care work whenever it gets used up. Instead of being called by a centralized system to execute a task, agents could decide which task to pick by randomly walking on a grid world (Fig.2).

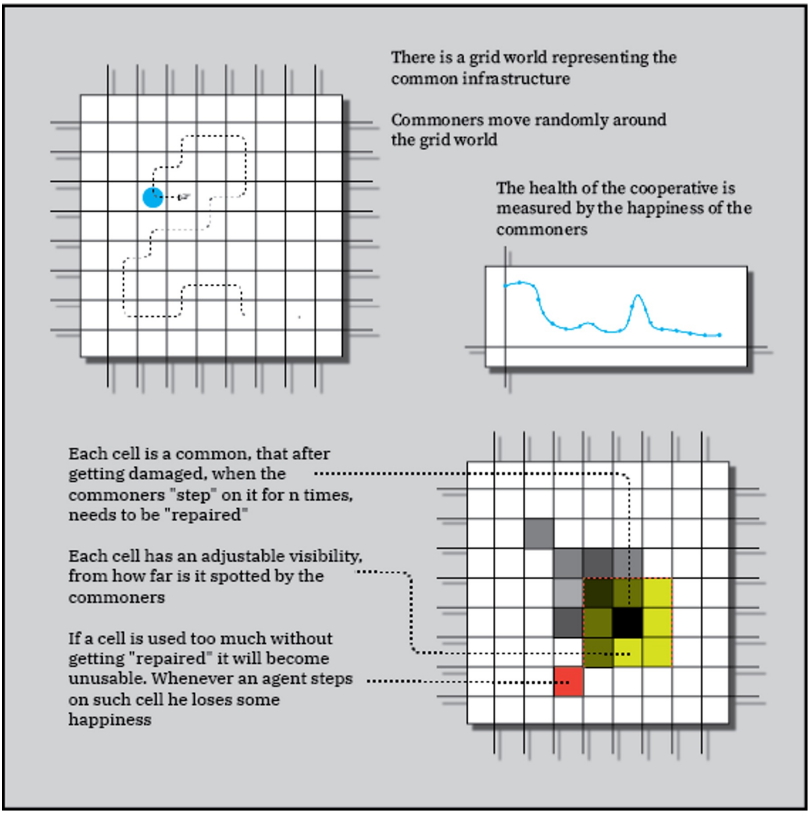

Figure 2. Diagram of actions in the STB and STA models

The main difference between the two new models is that in the Spatial Time-accumulation (STA, see Fig 1C) model the value of the task is distributed in an exponential way creating a sort of value landscape, while in the Spatial Time-banking (STB, see Fig 1D) model repair work is counted evenly across all cells. The development of strategies according to different behavioural traits has been left out in these two models. Therefore, the re-enactment of the *Tragedy of the Commons* through the time-coin system was not possible. Nevertheless, other forms of disruption have emerged in these systems. An interesting emergent behaviour could be observed by the comparison of the two simple models: how the attribution of value to repair work would influence the movement patterns of the agents. Opposite to the STB where the agents move randomly across the grid-world, in the STA the agents tend to congregate toward the cells with higher value, despite being programmed with a similar random walk algorithm. Instead of reproducing the *Tragedy of the Commons*, a community striving for highly retributed tasks was operating without disruption, because there was no limitation on the accumulation of such value. The most interesting behaviour

that emerged in such a model was the fact that the agents would be nudged toward certain parts of the common grid space, while leaving part of it untouched. To conclude, as soon as we introduce resource repair value, it becomes a way to control the movement of the agents. This is not an effect we would like to affirm, but we recognize the potential of that mechanism to regulate the system in which agents would otherwise move freely, and we would need to signal that some resources require more attention or work.

The STA model can thus be a powerful tool to envision going through moments of disruption in the community. In a real community, where everything is working really well, we could imagine such disruption when COVID-19 hits, or acid rain and shortage of food happen, things over which we do not have any control. If then the community would continue to practice the same self-organized way of doing things, it might experience bigger problems, or even disappear. By adding value to things that are of critical importance in such moments - whichever is the best way to decide on this - we get actually a powerful way to regain control in a crisis. The question is, of course, when does one exert this power of controlling, and what they do with it, as it was well shown in the otherwise average Hollywood production, *Our Brand is Crisis*[5].

3. What can an agent do? Individual Strategy and Impact

The two families of models discussed so far (TA&TB and STA&STB) have shown us how community dynamics plays out in terms of global conditions, such as the use of their time (accumulation or banking), general strategies ('greedy' or 'stiff'), measured as the level of stress across the community. We will now look at the models from the perspective of individual contribution and the possibility for any personal strategy to have a significant impact on the community.

3.1 Overworking agents

We described the conditions in which the TA model produced stable simulations: without limits on time-coins and particular balance in individual agent strategies. We will now zoom into the ways in which individual strategies and behaviours change the balance and impact the simulated community. In the first prototype of this ABM we implemented the possibility to adjust the behaviour of the agents according to four parameters: curiosity, perfectionism, endurance and goodwill. Here is where the above-mentioned traits influence the decision making of the agents:

- *Curiosity* describes how heterogeneous the working history of an agent is: an agent with more curiosity will be more likely to accept a task different from the one previously done
- *Perfectionism* is the opposite of curiosity: it is the tendency to do the same task over and over until the agent is very skilled in such a task

- *Endurance* describes the resistance to stress; these agents tend to rest less
- *Goodwill* describes agents that tend to take task with higher value[6]

According to how such traits were balanced within the community, agents' micro-decisions were able to create a tipping point in the simulation. We already described how 'greediness' of so-called *goodwill* agents affects the whole community, through privatization of time to rest. One could of course build in some sort of regulation into this system, prescribing the necessity to take a break (like we have with the obligation to take vacation days in current year prescribed by the employer). A more interesting way to counter the perceived *tragedy of commons* would be for other agents to adopt the least *enduring* behaviour, and thus to rest whenever they can, which reduces overall stress even if it does not lead to 'earning' more time. We could also observe that *perfectionist* agents tend to overstress, because they would take preferred tasks from one another. Maximising the counterbalance parameter - curiosity was not found to have a significant effect on the level of stress in the community.

The TA model setup was initially conceived as a sort of a provocation: to articulate commoning through an economy of exchange. The provocation was addressed to the notion of commoning perceived as the stabilizing agent in the otherwise wild neoliberal economy, driven by individual greediness. By negotiating the exchange among agents, we imagined that they could possibly reach a sustainable form of stability. It is possible that we proved this wrong by coding the behaviour of the greedy agent. The ambition was to say that the exchange can be something that can be made explicit, as opposed to being considered a form of privatization. Accordingly, the exchange of time for rest is not necessarily best expressed as accumulation. It was initially supposed to be the way to compensate for having the choice to work or not work. We then observed that we could run simulations in ways in which accumulation was not possible, and agents were still getting overworked. The exchange can thus be expressed as balancing out or as an accumulation mechanism, which can both be articulated with the expectation for the system to be fair, as long as markets are free. Markets have of course never been free in actual reality.

3.2 Vision and Collaborability

The inclusion of space as a resource, and more importantly as a factor that determines how agents learn about and take up tasks, provides another way to look at the same system. This step in our modelling process (STA&STB) brought out different ways in which the simulated community tends to get out of balance. The emerging tipping points were around what we called 'vision' and 'collaborability': how much of the surrounding space can an agent perceive, and how likely they are to share a task. If, on one hand, an agent has a large field of 'vision' - if one sees too many things that need to be repaired, this raises the level of stress, of feeling overwhelmed. While in the first models (TA&TB) we had sort of a centralized system that tells agents what to do, in this second version, (STA&STB), the assignment to a task is deregulated by an agent's individual decision. We do this by taking into account the agents' closeness to places where there is a task to be done. If the agent

actively 'finds' tasks, then we are in a decentralized system in which the initiative and also the personal strategy of agents matter. This imaginary agent can be a super sensitive person who sees a lot around themself, or have a very narrow vision, and not see so much. The agent who perceives too much work to be done is more easily overwhelmed by attempts to repair and collaborate with others. With 'collaborability', we did the opposite of problematizing things: we tried healing. We proposed that whenever an agent shares a task with somebody, they become more *happy*: a person's vision becomes also the way in which they collaborate more or less easily with others.

When 'collaborability' and 'vision' are not tuned properly, the simulation shows a rapid decrease in the general happiness of the community. In its technical appearance such emergent phenomena are linked to the fact that higher vision means that the agent is more aware of its surroundings, and therefore sees more tasks to be done, leading to more stress, and also more conflictual situations in which the agent has to negotiate collaborations with more or less success. With a larger field of 'vision' and 'collaborability', the agents do many tasks, and they are generally happier. Of course, there are a lot of other problems in this simulated community, but there is some sort of incentive in doing things together. The unhappiness resulting from poor tuning of collaboration and vision can be interpreted outside of its technical reality. We could question the role of vision as awareness of the surrounding as a possible stress inducing factor. In counterbalance, collaboration counts towards increasing 'happiness', a healing mechanism that promotes working with others.

4. Telling Stories on Commoning with Design

Our work on models as thinking toys creates a channel for communication between imaginary reality and *real* reality - what a community envisages to do, and then makes a plan, an agreement (artificial) and how we perceive that plays out (reality), Despite the ambition to report on this and write proper ODD protocol (Grimm et al., 2010) and other ABM-specific techniques (concept model, data structure and flow diagrams), there have always been a lot of unspoken assumptions and rules that surface more strongly when we think about narratives and stories. Conversely, the observations we made of our models are the result of artificial interactions, purely constructed, showcasing emergent phenomena that are completely made up. How are they feeding back into 'reality'?

In her ethnographic work on the concept of number, Helen Verran praised storytelling as 'reliable ways of managing complexity'. She explored how numbers are conceptualized by different people involved in science education, and the need for keeping stories - rather than stable and fixed theories - in play. The powerful storytelling method of Anna Tsing, discloses the entanglements of microworlds such as the life of a mushroom, woods in a forest and migrant workers from Vietnam. These accounts keep the threads entangled, able to unfold in any direction. By constructing entanglements between people and resources, between rules and control, between individual agency and community-based outcomes, stories on

commoning promote a different kind of complexity and even encode the relationships across ideas, collaborations, complications, and matters. Storytelling, when done masterfully, engenders convergence of actors around shared interests and such as the demand for ecosystem maintenance, typical for Neustart Schweiz commoning initiatives, and inspired by Hands Widmer's writing in *bolo'bolo* (P. M., 1983) and *Neustart Schweiz – So geht es weiter* (P. M., 2008).

We have seen how our modelling process reduces complexity of everyday life into observable patterns and what we can learn from it. We couple this with observations of narratives that create or flow out of this work, such as the *tragedy of commons*, or the *prisoner's dilemma* and try to tell simple stories. Without wanting to go into the discussion on complexity and realism of our models, which is well described by Batty and Torrens (2001), we aspire to create bridges between real-world narratives on commoning , such as the story on Iris, and future imaginaries. What stories can we tell with ABMs?

The two generations of models demonstrate how individual behaviour can be constrained (or not) by a regulatory mechanism, bringing the simulated communities into a harmonious or disrupted state. Individual behaviour in the TA model affects the stability more significantly than in STA and STB models - agents who tend to overwork cause an overall increase in stress, with no control mechanism to counter that. In TB, no specific individual or group behaviour strategy seems to be able to importantly disrupt the system. TB is therefore less dependent on individuals. Conversely, the best way to manage the common in STB appears to be through rules on the level of the common (common hours per month) and not on the side of individuals (individual work or collaboration strategy). By changing where regulation is placed in our models, we displace the perception of its imaginary problems.

One of our intentions is therefore to challenge the idea that value or incentive in modelling is inherently bad or that it only leads to exploitation or injustice. There is clearly a need to channel this control or value assignment towards some positive outcome for the community. Significantly, in a community where the numbers of people who have a say is much lower than in more general society, it is easier to decide when control is needed: to implement regulation from time to time.

The four models discussed in this text operate as *catalysts for thinking through* two distinct *systems of governance:* accumulation and banking. We consider keeping track of time-accumulation (TA) as a system of community governance that is attuned to making individual contribution - both in terms of freedom and responsibility - more pronounced. Time-banking, on the other hand, is a system of keeping track of time that pertains to community governance through commoning time, and other resources, which appears to be harder to influence by individual strategies, and harder to destabilize in general. This other way of articulating community governance opens the discussion towards more global disruptive measures, such as the introduction of value in STA.

The other important distinction we addressed with this modelling process is communication across the community - how is information shared and how we model this. The initial idea was to decentralize decision making, which is a typical use case for the type of computational modelling we work with. Nevertheless, although we did not programme a central intelligence explicitly, there had to be a central intelligence of some kind in the models that were focused on time only (TA&TB): information centrally available to all agents about which tasks are calling and how much they are worth, made for an immanent centrality of an imaginary Iris. In the second iteration of the models (STB&STA) the space articulates decentralization. Not everybody can be in the same place at the same time, and not everybody knows about what is going on in each cell of the model. Without the space as a factor, there is no constraint to everybody knowing that a task is urgent or that it has this value.

Stories we tell with our models are not neutral. This problem is recognized already in the ABM research. Hamill and Gilbert (2015) show this well with their modelling work on cow grazing in alpine pastures. They challenge the practice of modelling the *tragedy of commons* based on the *prisoner's dilemma*[7], a narrative of a real-life situation that brings into the play more than just the self-interest of rationally behaving agents. When abstracted to represent an economic behaviour (the best way to optimise one's profit), half of the work is already done by the ethical qualities of such a setup, in which both prisoners are actually guilty and not particularly equipped to cooperate. The importance of stories is often overlooked in modelling endeavours, where mechanics of modelled interactions and their cross-compatibility have primacy over the meaning of such tales. The overall morale or context of the story is rarely questioned. Can we say in all seriousness that it is 'neutral' to model common based on the prisoner's dilemma? Cooperation, which is impossible for prisoners, is indeed allowed and even explicitly appreciated in commoning, even if it is not clear how exactly cooperation emerges. We concentrate on these moments of cooperation not as prediction or prescription, but as valuable examples of how things could unfold. Our preferred scope of contribution therefore remains in the domain of fiction, hoping to inspire and engender deeper understanding of these engagements rather than write definitive guides as to how people should live together or solve immediate problems. The communities we work with did not gather around efficient rule-making systems but around shared reading of *bolo'bolo* and *Neustart Schweiz*. Our models can hopefully help write new stories, new episodes of commoning.

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[1] Agent based models (ABM) are software-based simulations that are composed of two abstract categories, agents and environment. By coding the interaction between agents and environment into an algorithm it is possible to model various natural or social phenomena. From the modelling of the crystallisation of salts to the flocking of birds, ABMs are used to explore the complexity of systems, and also to observe emergent behaviours. Rather than starting from a deterministic theory of the system as a whole, agent-based modelling works from bottom up and enables expected and unexpected patterns of behaviour to emerge. In terms of studying communities, such simulations are good at showing how individual actions contribute to and depend on the community as a whole.

[2] P.M. are supposedly the most common Swiss initials, suggesting a dose of anonymity and generality for the author's proposal

[3] We use "happiness" here not as a reference to emotion, nor as a normative concept, but rather to describe a more or less harmonious situation, which in our models is expressed by an abstract value we named "happiness".

[4] Such a system for example is in use for composting in a site in the Sankt Johann area in Basel. This composting site requires that each member contributes each month with a couple of hours of work in order to churn the organic waste inside the composting bins. This system therefore balances individual contributions in terms of hours that needs to be contributed on a monthly basis. Instead of a monetary reward from their labour the commoner here is granted the exemption of waste taxes, as they do not use the public waste management service.

[5]Our Brand is Crisis features Sandra Bullock in the role of a political consultant who helps the controversial and corrupt president of Bolivia get re-elected with the campaign about crisis matched only by his powerful charisma (and fist), only to start campaigning against him after the victory https://www.imdb.com/title/tt1018765/

[6] In our ABM, the tasks with higher value were the tasks that nobody wanted to do, therefore the term *goodwill* describes an agent who "sacrifices" themself into doing less preferred tasks

[7] Prisoner's dilemma is a classical Game Theory example for rational behaviour of two people trying to maximise their own profit, which most likely results in both of their loss. See more here https://www.investopedia.com/terms/p/prisoners-dilemma.asp