Social Learning Strategies and Factors

# Rise of dairy pastoralism:

The reviewed article mainly discussed the origins of the dairy pastoralism culture origins in the eastern Eurasian steppe, and emphasized the importance of the non-vertical transmission of said cultural trait.

Along the article it is shown that a reasonable amount of inspected individuals did in fact consumed dairy products, which suggests the trait of pastoralism was in the repertoire of the inspected group. It was mentioned that the actual genetics of the individuals were changed to support dairy consumption.

Along the article it was shown that even though the Eurasians were involved with pastoralism, their DNA contains a very small number of genes of the ethnicities that were known to have discovered the usage of pastoralism (the Western steppe herders).

Main takeaways – cultural traits may affect the genetic composition of a group, and can also be transmitted by social learning methods (copying etc..) without almost any vertical transmission at all.

# How culture evolves and why it matters:

In the given article, a lot of cultural transmissions are mentioned, and their part in cultural evolution.

Its goal is to present the similarities to genetic evolution, but mainly the differences between the two.

One of these main differences is the fact that cultural traits are transmitted not only via vertical transmission, but can be transmitted by oblique transmission, horizontal (peers), and even vertical in the opposite direction (acquiring traits from the descendants); while most of these forms of transmissions rarely occur in genetic transmission, if at all.

Another major difference is the element of choice – in genetic evolution there is none. In cultural evolution, however, choice has an important part. Factors like conformism, prestige and success biases are strongly involved.

Main takeaway – cultural transmission, although very similar to genetic transmission in some ways, is a lot more complicated, and has many factors involved. Biases worth mentioning are the conformism bias, the success bias, and the prestige bias. Conformism bias is well defined, but the borders between the other two are not always clear. Moreover, the biases are not necessarily distinct. (more on that later)

# Evolution of vertical and oblique transmission under fluctuating selection:

This article mainly discusses the contest between vertical and oblique transmission of a single dichotomous trait, under different environmental changes dynamics.

The models suggested are of different variations of environmental changes, and how they influence the result – stable fixation/stable polymorphism/local stabilization of some sort etc.

Main takeaways – under rapidly changing environment, the gene that increases vertical transmission is disfavored, while reaching a stable rate when the changes are less frequent.

However, this rate is greatly different from the rate that maximizes the mean fitness. This surprising result suggest that the rules of cultural transmission might be more different than initially thought.

# The roles of cultural leaders in the transmission of preferences:

Here in this article, the main goal is to tackle the issue of how and how much cultural leaders may affect the fixation or polymorphism of a certain cultural trait. In this article the trait is dichotomous, and mostly referred to, for the sake of clarity, as the choice between being religious or secular.

The model in this article try to examine the interactions between cultural transmission inside the family (vertical only) and outside the family, which is then distinguished to two types – passive and active.

While the passive role models are just being picked randomly (by say a naïve child), the active role models would be the cultural leaders discussed – individuals with an agenda to assimilate the community to one of the two options.

Main takeaway – in equilibrium there will not be a complete assimilation to either of the sides, and diversity is guaranteed. (although amounts may change depends on the “strength” of the leaders, and the weight of the passive or vertical transmission)

The approach of distinguishing between passive and active oblique transmitters might be interesting to be further explored.

This model also incites a not-so-related question – if the type of oblique transmitters might vary, why not also the type of the trait? It could be interesting to investigate the interactions of displayed transmissions, but with several traits, where each of them has a different bias (for example – maybe food preference is more biased to vertical transmission than political viewpoint?)

# Matriarchs as repositories of social knowledge in elephants:

In this article an interesting phenomenon is examined. It is written that in several types of elephants, there is an elephant in each group of elephants that is used to store certain social knowledge, and is more proficient in using it to survive.

The experiment describes several groups of elephants, some with their eldest female individual included, and some without it (the Matriarch)

In the experiment, it is shown that the groups with the Matriarchs are expected to better defend themselves versus hostile/foreign groups, and on the other hand being more social with familiar/friendly groups. Both abilities indirectly affect the fitness – when better alerted, the group of elephants will survive better/longer. With increased socialism, the group can thrive better.

Main takeaway – This article, like many of others, support the claim that social learning is usually favored in matters of survival. It also addresses a type of bias, which might be either prestige or success or a combination of the two; the distinction is not specified. The eldest elephant (which might be interpreted as prestige) is also the most experienced (which suggests the elephant to be more successful), and when absent – the fitness of the group decreases. This might indicate that the competition between the success and the prestige biases are not necessarily fully distinct. They might affect each other or intersect in a single individual, and maybe vacillate.

# Social learning in fruit flies:

The experiment described in the revolves around the success and conformist biases, and their interactions with individual learning.

Several experiments are made to examine how fruit flies pass information regarding oviposition sites. It is shown that flies without previous experience tend to choose the same sites as experienced flies, even though both optional sites are equally rewarding.

Furthermore, it is shown that the information is passed between the flies even without the experienced and the naïve encountering flavored sites together.

Main takeaways – there are many takeaways and conclusions regarding flies, but several could be generalized and furtherly modeled. It seems that when individual learning is cheap, individuals might choose to not socially acquire knowledge. After information is shared, if some decisions might seem irrelevant, the social knowledge slowly perishes.

However – when continuingly introducing naïve members, the knowledge is preserved.

Lastly, it is shown that even when individual learning is cheap, it might still be better to the group to be conformist biased.

Some of these conclusions may derive from flies’ experiments, but they are supported by more generic models. Will be further discussed later.

# Chimpanzees copy dominant and knowledgeable individuals:

This article describes an experiment made on chimpanzees, trying to understand what are the factors for copying each other, and under what circumstances.

In the experiment, several “high-ranked” monkeys were chosen to be taught by humans how to operate a certain food-rewarding tool. The monkeys were observed under various changing scenarios, and several conclusions regarding chimpanzees’ social transmission were deduced:

* **Copy when uncertain** – when lack experience, the monkeys observed and copied to achieve food. The more experience they gained, the less influenced by social knowledge they became.
* **Copy when of low rank** – there were indications that high-ranked monkeys gave less weight to social information when choosing initial action. Moreover, it seems that high-ranked monkeys are more likely to change their strategy after frequent usage of a certain one.
* **Copy when of low-rank** – the monkeys who observed the most were the low-rank naïve monkeys, who observed the high-ranked monkeys. Monkeys of the same rank were less likely to observe.
* **Copy knowledgeable** – monkeys observed experienced individuals more than they observed lower or same rank as themselves. However, a clear conclusion whether attendance was greater at knowledgeable individuals’ manipulations, or at the high ranked-ones.

Main takeaways – many of the phenomenon observed in the experiment partly correlates with some human behaviors.

In here we see a clear distinction between success bias and prestige bias, and how they interact with asocial learning (although neither is defined generically).

# The Driving Forces of Cultural Complexity

The goal of this article was to understand what are the factors that makes a culture of a species complex.

The model didn’t involve fitness at all. Not in terms of reproduction nor of death of individuals – every individual had a constant percentage of dying every generation, and when a new individual is born, it is born completely unrelated to any of the existing individuals.

In the model, several strategies of social learnings are tested, to see which one is favorable, and to help understand what scenarios and factors could aid or prevent further complexation of the culture, under the assumption each individual as a finite capacity of cultural traits it can acquire.

Main takeaways – several strategies were tested, and the one seems to be the best for cultural complexity is the **“best-of-k”** which is essentially an individual picking **k** individuals and assembling its trait vectors from the traits it didn’t acquire yet.

This tactic seemed to beat both a prestige biased strategy (1 role model is chosen, and every individual using this strategy copies the chosen individual), and the success biased (choosing out of k individuals the one with most traits, and copy it)

Many conclusions derived from the model results, but one was particularly interesting – the success and prestige biases are not necessarily the only options, and might get a new meaning once the individuals have more than a single trait, and maybe even further expanded if the traits weren’t dichotomous. More on that later.

# Social Learning Strategies Tournament

The goal of the reviewed tournament was to try and find a winning strategy of learning (both social and asocial) under specific complex conditions (environment)

The tournament introduced a multi-armed bandit dilemma, with 3 possible actions the agents could pick from:

* Innovate – an asocial learning tactic. Rewards with an accurate prediction of reward
* Observe – a social learning action. Gather noisy predictions of K agents using Exploit
* Exploit – get the reward.

The pricing system in this model is time – when all the actions costs the same. (1 “turn”)

This means that unlike many other models, asocial and social learnings cost the same.

Main takeaways – even with the usual concept of asocial learning costing more than social learning gone, the winners of the competition used a strategy mostly Observe based, with a very low percentage of Innovations. Furthermore, it seems in order for the Innovate only strategy to beat the Observe-based strategies, Observe predictions should be as noisy as to 50% error, and of a very low K. (observe very few other agents)

Although the social learning suggested here isn’t biased in the direction of success or prestige, the suggested point of view as to how it is defined (error-sensitive and time-costs) could help with further research of said biases.

# Personal thoughts and open questions

From the collections of articles there isn’t a clear definition rising of what are the biases that drive social learning, not in a generic enough way at least. Moreover, the models suggested are sometimes combination of several biases, and there is not always any attention to the distinction of them.

Some common conclusions from the articles:

* Success is mostly considered as experience/knowledge/broad repertoire
* Prestige doesn’t seem to have a clear definition, and in some cases defined by conformism (that may be a completely different bias)
* Using almost any type of social learning is preferred, but not necessarily comply with optimal fitness
* Cultural transmission isn’t always modeled with a vertical option, what might suggest a generic approach regarding social transmission

From those conclusions and several personal thoughts, there are some questions/wonderments regarding the very nature we view cultural transmissions:

* Although sometimes there can be some distinction between success, prestige, and conformism biases, there not always completely different, and a more generic model might need to include some way to combine them as non-distinct parameters.
* The biases could be separated to several categories, which weren’t addressed in the mentioned articles:
  + The target-dependent-only biases – these will be the success and prestige bias. Although they’re not always clearly defined, it seems the consensus is that it is only affected by parameters of the observed individual, and nothing else (knowledge of the specific observed individual, his age, etc.)
  + The community-dependent bias – the conformist bias isn’t affected at all by the features of the observed individual at all, only the other individuals that observe it.
  + A new approach that isn’t addressed in the articles, but might still be relevant – the self-dependent-approach, i.e. the similarity bias: this might not be relevant to other species, but in humans it is sometimes clear that we choose to observe and learn from someone that reminds us of ourselves in several aspects. (in model view, this could mean copying the individual with most similar traits in his repertoire, and copying the gaps, creating somewhat unified-culture wise society)
  + There might be more biases that might not appear in other species, and might be taken into consideration investigating a phenomenon
* Another point worth mentioning is the effect of the biases on the traits. In most articles the affect is similar for any kind of trait, and they’re all treated the same – i.e. eating habits have the same probability to be learned from the parent as their political preferences. This might not be the case in the human world, and not even the case in general. It might be worth investigating a case where each of the traits in the traits vector (a single trait organism isn’t relevant for these matters) have different biases for any given bias. (for example, eating habits are more likely to be transferred vertically, while equation-solving is more likely to be oblique)
* Since the biases are not always well-defined, here are some suggested definitions:
  + Success must be measured against a specific trait. There is no individual that is simply “successful”. For example – an individual who is especially good at swimming (swim fast) have a high value in the “swimming-spot” of its trait vector. This will require the trait vector to not be limited to Boolean values only, rather than natural/real scale.
  + Prestige is more vague and interchangeable across literature, but in general its common feature is to be observed by many, while not necessarily being successful as defined above. There could be several ways to define such bias, such as:
    - There are specific traits that are “prestigious traits” (i.e. charisma), which makes a specific individual be observed only because these specific traits in its trait vector are of high value.
    - Any uniquely high-valued traits could might have an “halo effect” (if a person can solve equations extremely fast, some might assume he is smart, and therefore successful in other domains)
    - These two suggested definitions could be combined – every possible trait has 2 scales – a success scale and a prestige scale. These scales aren’t necessarily independent. It might be reviewed in a way that the higher the success value is (swim fast), there is some transformation to its prestige. The transformations could vary between traits or traits’ categories. (sports for example – if an individual is extremely successful at swimming, it might be considered successful at running, but not as much at politics etc.)
  + Conformist bias might also be expended from simply being a scalar. Each trait might have a different conformist bias, in addition to each individual’s general conformist bias (for example, an individual might have a general conformist bias of value **x**, but its probability to acquire politics simply out of conformism might be different then its eating habits)
  + Similarity-bias, if exists, could be measured simply by comparing trait vectors. Many techniques might be relevant.