## Simulation 1: Cognitive attraction vs. social learning biases

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## Environment and theoretical framework

The environment consists from a set of communities, which are modeled with reference to the Greco-Roman social institution of voluntary associations (see Kloppenborg & Wilson, 1996; Harland, 2003). The formation of voluntary associations represented a common strategy for building social identity in the fluid Hellenistic world, where the traditional social links were weakened. This led to mythic experimentation with religious ideas and practices, including various versions of the Judeo-Christian representations. Therefore, it was often argued that early Christian communities should be seen in the same framework, too (McCready, 1996; Wilken, 2003).

Communal periodical meals represented central practices in the social life of these associations and early Christian associations apparently were no exception in this respect. Communal meals including singing of hymns, praying to gods, reading from popular books or discussing sophisticated philosophical issues were situated on continuum between “secular” and “religious” domain and were subject of processes of ritualization. All these aspects formed social and cognitive appeal of given practices, which could be decisive for cultural survival of them or even of the associations conducting them.

In the center of attention of my research proposal is the question, how does happen that in the context of early Christian periodical communal meals emerged and was successful the belief in the supernatural quality of the consumed meal elements. Apparently, it was a result of the meal context, conceptualization and ritual procedure related to these elements before the meal: especially the prayers or blessings pronounced over them, but not only. From the extant literary sources we are informed about huge plurality concerning this issue. Following paragraphs aim to illustrate it with reference to some specific cognitive mechanisms and theories of ritual efficacy (*see table of pre-coded variables on the poster downloadable under this* [*link*](https://www.academia.edu/attachments/34024269/download_file?st=MTQwMzcwMDg2Nyw0Ni4zOS4xNzEuOTAsMzc2ODky&s=work_strip&ct=MTQwMzcwMDg4MCwzNzY4OTI%3D)).

At the first view, the sources suggestthat a belief in the special quality of the meal elements was in some form present since the original invention of Christian representations into the meal context (*1. Cor* 11:26-29; *Did.* 9:5; Ign., *Eph.* 20; Just., *1 Apol.* 1:66; *Trad. ap.*, 36, 37), either with or without an identification of the meal elements directly with Jesus (cf. *Did.* 9-10). Concerning substantiality of the meal (i.e. one of the aspects of its functionality), Christian gatherings appeared for a long period of time as a real and nutritionally valuable meal (see *Did.* 10:1; Tert. *Apol.* 39: 16-19). Thus this issue also can not explain the success of our pattern of interest, at least not completely. Simultaneously, the shift from the evening meal to the morning event developed divergently in different regions, but during the third century, the Sunday morning Eucharist was adopted as a central communal gathering at least in some regions like north Africa (Tert., *Cor.* 3:3; Cypr., *Ep.* 63:16).[[1]](#footnote-1)

Experimentation with meal elementswas probably a process continuing until the fourth century. Especially the restriction of meal elements on bread and water (instead of wine) is broadly documented (see detailed analysis on that topic in McGowan, 1999: 143-217). Restrictions on participating and presiding were complicated issues, too: In the early second century, the *Didache* prescribes baptism as a necessary condition for participation on Eucharist, but does not give any information concerning conditions for presiding, except instructions for wandering prophets (*Did.*, 10:7). In the same period, for Ignatius only the Eucharist under the authority of bishop is to be considered valid (Ign., *Smyr.* 8:1).

For the last example here, fixation of the prayers before and after the meals using the Lord’s supper discourse in the meal context was much more rare phenomenon than it might appear: until the time of *Apostolic Tradition* there is no text referring to the *institution narrative* as a liturgical text to be recited (see Bradshaw, 2004: 13-15). For Paul, Justin and other authors, the institution narrative had predominantly aetiological function, where these words could be related to the magical transformation of the bread and wine, but not necessary. In most relative documents the words of prayer are lacking or explicitly left to the imagination of practitioners (cf. Just., *1 Apol.* 67).

The first simulation does not take these individual features and their different combinations into consideration. It just manipulates with abstract value of cognitive attraction[[2]](#footnote-2) of possible combinations of them and distributes it among the practices conducted in the associations.

It is important here that a cognitive processing of a ritual practice consists at least from mental representing of its two basic building blocks:

1. Ritual practice’s action structure (agent, patient, action itself and related instruments), causal connections and conceptualizations of its components with reference to supernatural agents
2. conceptualization of intended supernatural outcome of it (supernatural efficacy) (*see illustration of related cognitive ritual theories on the poster*)

The optimal relationship of these two building blocks creates cognitive attraction of given ritual. In the case of frequently repeated collective rituals, if this relationship is balanced, the participants should be motivated to do the ritual in the same way over time and the associations practicing it should be less opened to adopt a new practice. On the contrary, where this balance is missing (the practice is too much or too little ritualized or the outcome is too small or too big with relation to it) the openness to adopt an innovation should be higher. This is the only entry for cognitive attraction into the model: it does not consider the role of cognitive attraction in decision making of an association because the imagined participants are not aware of it at the first view (it has an effect on them only over the time).

## Hypothesis

The goal of this simulation is just to evaluate relative importance of the cognitive attraction understood in the way described above in comparison to the role of social learning biases in horizontal and vertical cultural transmission (i.e. the process of *cultural dynamics*). It aims to test following null hypothesis and data-related prediction corresponding to it:

**H0 – Social learning biases’ hypothesis:** *The belief in a ritual efficacy of a collective ritual can be cultural successful due to the authority of person, text or community who invented it, regardless its content-dependent cognitive features*

**P0 – Prediction of the social learning biases’ hypothesis**: *The belief in the special quality of the meal elements in the context early Christian meal practices was cultural successful due to the authority of person, text or community who invented it, regardless its content-dependent cognitive features.*

The dual-inheritance theorists paid a lot of attention to the role of social learning biases in cultural transmission. In this simulation the prestige bias is implemented. The question for detailed analysis here is to evaluate how strong it has to be to outweigh the effect of cognitive attraction in given model.

## Simulations description

Key variable here is “cognitive attraction” (A) of a given “practice”. In this simulation, value of cognitive attraction of practices (turtles in our NetLogo model) is distributed randomly among "associations" (patches in our NetLogo model) on the scale 0-10, where A=0 means the most cognitively attractive practice. (It is represented by 0 because in the future versions of the simulation the scale will be broadened also to include the minus values.). The associations are here completely static elements.

Another variable is called “openness to innovation” (O). It specifies the role of cognitive attraction of a ritual practice in an association over time. If the cognitive attraction of given practice is low, then openness to innovation is increasing more dramatically over time (linearly in this model). For instance, if a practice has the ascribed cognitive attraction "10" (maximal value, minimal attraction), then openness to innovation increases for 0,1 for every tick until it reaches 1.

Openness to innovation is proportional to probability to adopt an innovation (p = 0 / 10): for instance, openness to innovation O=.1 is linked with probability p=.01 to adopt a new practice, openness to innovation O=1 (maximal value) is linked with probability p=0.1 to adopt a new practice. When the probability condition is fulfilled, the selected strategy to adopt new practice follows.

The openness to innovation is weakened by the “rigidity effect” over time. Rigidity effect aims to reflect the motivation of ritual participants to conduct the practice in the same/traditional way over time, regardless its cognitive attraction. But, when the rigidity is present, the curve of the openness to innovation is changing with dependence on the cognitive attraction value.

When an association comes to a decision to adopt a new practice in a tick, it chooses it from the one of the 8 neighboring associations. It follows here the behavioral strategy of the whole simulation run. The strategies determine how seriously it takes into consideration the prestige variable.

The prestige variable with values 0, 1, 2, 3 is distributed randomly among all associations with specified proportion (1 - 25% of associations, 2 - 12%, 3 - 3% and 0 for the rest). With dependence on behavioral strategy, prestige influences potential of an association to “infect” neighboring associations by its own practice.

First strategy (prestige\_influence: none) completely ignores prestige of neighboring associations in the process of new practice adoption: The association chooses one of them randomly, regardless of the prestige value of associations conducting them. On the contrary, in the case of the last strategy (prestige influence\_absolute) the association adopts the practice of the most prestige association. The other strategies specify the probability proportion with which they take prestige of given associations into consideration. High\_prestige\_closeness means the association do not adopt practice from association with lower prestige.

Another agents are called “prophets”. They spent random time in an association on the range from 5 to *n* weeks, before they move into the one of the neighboring associations. The maximal duration of their stay is specified by the slider. They represent the institution of the so called wandering charismatics, which are often discussed in early Christian scholarship. They bear a practice of certain value with them, which is unchangeable in current model. If a prophet is present in an association in the moment of its new practice adoption, the association automatically adopts practice of the prophet.

The simulation has been coded by Tomáš Hampejs and Vojtěch Kaše. Other ideas and more realistic functions (exponential and parabolic instead of linear) for implementation are planned soon.

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1. This development has been described by Alikin in three steps: (1) the morning gathering spread from the Sunday to other mornings, and in certain cases to all mornings of the week; (2) the morning gatherings were extended to include a Eucharist, Scripture reading and a sermon; and (3) the Sunday evening gathering with its communal meal lost its importance in favour of the Sunday morning gathering (Alikin, 2010: 93). [↑](#footnote-ref-1)
2. See McCauley & Lawson, 2002 for using this term in frequently repeated collective ritual context. [↑](#footnote-ref-2)