

## **Altruism, Religion and Irrationality – Emergence of Cultural Cooperation** **Dominating Innate Altruism Under Intermittent Evolutionary Pressure**

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We study how the intermittency of evolutionary pressure on groups could lead to the emergence of cultural altruism supported by religious beliefs and linked to self-serving perceptions as a dominant substitute or complement for innate, genetic altruism. In culturally founded altruistic behavior, religious beliefs seem to play a key role. Within an evolutionary framework where mankind has lived in small groups, regularly exposed to pressure from both nature and competing groups, other-regarding preferences can evolve both at a genetic and a cultural level, yielding an equivalent cooperative behavior. But religious beliefs and practices, distorting perceptions and conclusions and absorbing time and potentially other resources for cultus, can imply extra fitness cost compared to pure genetic altruism. Genetic altruism could thus dominate in a simple, homogeneous environment, and the apparent evolutionary stability of distortionary religious beliefs and practices is a first element we focus on.

A second element is what social psychology calls the common trait of cognitive self-serving bias: humans consistently exhibit an irrationally increased receptivity for information that maintains and enhances self-satisfaction. Whilst the intra-group dominance of this bias as an unconscious behavioral strategy can readily be explained in specific frameworks, it has been identified as unstable in an environment where evolutionary pressure favors immune groups that prevent individuals' benefits from the bias.

In a simple framework with an intermediate level of evolutionary pressure on groups, both traits, religiousness and self-serving perceptions, reduce fitness also when they can evolve simultaneously, and are crowded out by innate altruism. Yet the bias towards self-comforting beliefs has also been shown to provide an explanation for the tendency of people to become more religious during lean times – where the promise of heavenly justice provides comforting relief from material deprivation –, while prosperous societies become less believing. We take this effect into account in a dynamic framework to investigate upon the evolutionary emergence and stability of religious beliefs, self-serving perceptions, and innate altruism.

We model numerically individuals living in groups in an evolutionary environment with intermittent inter-group pressure, costly religion that enhances altruism, costly self-serving perceptions, as well as innate altruism. The two irrational traits build a tandem that dominates a more rigid altruism ingrained in a genetic code. In dire times, when extra-group pressure is strong, humans believe more firmly and exhibit a higher level of altruistic behavior, increasing the group's fitness. During periods with lower external pressure their faith weakens, reducing cultural altruism, which during these times is a dominant evolutionary strategy as within-group fitness has temporarily a higher weight in the overall reproductive success. The mechanism provides a potential explanation for the emergence of costly but evolutionarily stable religion and perception bias. More generally, it illustrates the need to account for evolutionary heterogeneity not only across space but also across time in order to capture potential fitness benefits malleable cultural traits can have over more slowly evolving genetic traits.

The main model relying on an environment with intermittent inter-group competitive pressure, we provide an extension to kin selection and intermittent pressure on individuals and kin.