All for one and one for all: proverbs, prosociality, and the evolution of cultural norms

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"...humans are conditioned by their own mood and that, when in a cooperative mood, they reciprocate cooperation" (Dercole, Rossa, Piccardi, 2019).

"Proverbs fulfill the human need to summarize experiences and observations into nuggets of wisdom that provide ready-made comments on personal relationships and social affairs."

(Wolfgang, M., 2007)

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Declaration

I confirm that my submission is a result of my own work except where it forms an assessment based on group project work and that I have complied with the Department's guidance on multiple submission. In the case of a group project, the work has been prepared in collaboration with other members of the group. Material from the work of others not involved in the project has been acknowledged and quotations and paraphrases suitably indicated.

Acknowledgements

Being a part-time, remote, and much older student (dare I say ancient) is challenging. Carrying out research under those conditions has been daunting, and at times, I very nearly gave up. My family and friends stood by me, supporting whatever decision I made: They are a wonderful group of people, and I am lucky to have them. However, to explore such a fascinating subject as human behavior, evolution, and proverbs is a privilege, and so I continued.

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United we stand, divided we fall; one for all, and all for one.

Abstract

Proverbs have a deep history and wide cultural use. The simplicity and metaphorical nature of proverbs obfuscates the importance of these pithy statements of wisdom in cultural evolution. This systematic and exploratory study looks at the part that proverbs play within the context of evolutionary group behaviours across cultures. The data for the exploration came from the most well-known proverbs in six countries and an International Database of Proverb Types, the Matti Kuusi database. These data were systematically collected and analysed, mapping each candidate proverb against one or more of nine behaviours. The chosen proverbs formed the data for analysis in the three study streams. Stream one used the Matti Kussi database of proverbs as the data feed to explore the cultural overlap of proverbs that reflect behaviour across six world regions. Stream two performed a similar task but used proverb data from the most commonly known proverbs (paremiological minimum) of six countries. A third temporal stream used proverb data from the first two streams to explore if proverb frequency changes during times of conflict, specifically World War Two. The results of stream two showed compelling evidence of cross-cultural use of proverbs that map to behaviours. The results from stream one were less compelling; however, this may be due to the unverified data from the Matti Kuusi database, as opposed to the more systematically verified data from the paremiological minimum. Stream three needs to be explored further as the analysis is highly qualitative, with results that open more questions than answers. Future, more quantitative work that explores the temporal aspects of proverbs within a cultural evolution frame, would provide another dimension to the work. As the proverbs tell us:

"The truth will out." "Many hands make light work."

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Introduction

Human beings are a talkative species. We gossip, chat, and package our ideas in neat little idioms and sayings. I was raised in an Anglo-Irish family where our behaviour was managed using short, concise sentences that acted as a proxy whip: "cheats never prosper", for example, encouraged us always to tell the truth and "shy bairns, get nowt" translates to "you need to ask to get something, so do not hold back." As such, human language is a central part of how we admonish or encourage certain behaviours and is used to form collaborations with our kin and non-kin.

Proverbs are neat linguistic packages used to present advice and encourage certain behaviours. For example, "A stitch in time saves nine" means that it is a good idea to sort out problems promptly; " When in Rome do as the Romans do" encourages people to conform and to keep within the confines of accepted behaviour and social norms. Numerous studies explore proverb origins, classification, and meaning. Furthermore, as proverbs are often a reflection of a culture, their use in an educational setting is an area of exploration; also, proverbs provide a challenging way to learn a language from both a spoken and written perspective (Ravshanovna et al., 2020).

As such, proverbs play a part in the lexicon of cultural norms. Research in evolutionary anthropology has turned a lens on how cultural norms evolve and how prosocial norms spread (Ehrlich & Levin, 2005). Game Theory is a popular method used to explore the evolution and change over time of social norms. A paper that used game theory models to look at processes underlying cultural inertia and norm change, found variances between cultures; the results identified factors in norm stability under certain conditions. (De, Nau, & Gelfand, 2017).

Another example of research into changes in social norms is found in Amato et al.'s 2018 paper that explored how language norms shift over time. The paper sought to explore norm changes in the context of cultural evolution using modifications in language, such as the Americanisation of British English over time; notably this study relied on data taken from around five million written texts, published between 1800 and 2008, and analysed using Google nGram (Amato, et al. 2018).

This thesis, is based on language in the form of proverbs used as 'in-the-wild' data; proverbs provide a natural laboratory to test behaviours and associated group evolution mechanistic theories; proverb use in everyday context, is more naturalistic than artificial economic games and also fairly tractable and convenient as proverbs distil the shared ideas and collective wisdom into relatively discrete cultural units. These elements make proverbs easier to study than other forms of linguistic communication or observed behavioural interactions. Proverbs are also a widely spread type of linguistic vehicle, providing potential for evaluation across more than one country.

To begin the exploration of the role that proverbs play in the evolution of group cooperation, we must turn to the established research cooperative behaviour in groups of kin and non-kin. What are the behaviours that drive group cooperation; are these behaviours used to underpin and cement group formation and management? Do proverbs reflect these behaviours?

The view that evolution comprises "mechanisms" is used as a basis for this research; mechanism is a term used throughout this study to reflect its use throughout science and engineering. A mechanism can be viewed as a pathway or process that leads to an outcome. In the context of this study, mechanism is defined as:

> “A mechanism for a behavior is a complex system that produces that behavior by the interaction of a number of parts, where the interactions between parts can be characterized by direct, invariant, change-relating generalizations” (Glennan, 2002).

This study relies on previous research into evolutionary mechanisms involved in cooperative behaviour as applied to humans (Sloan Wilson & Sober, 1994; Heinrich & Boyd, 1998; Nowak, 2006; Smaldino, 2014; Smith, 2020). The study uses evolutionary mechanisms Kin Selection, Direct, Indirect, and Generalised Reciprocity, and Cultural Group Selection (CGS), identified using evidence from the research corpus. These mechanisms, and some of the debates surrounding them (particularly CGS), will be described in due course. However, the thesis is based on the association of proximate behaviours and ultimate mechanisms, as discussed in the literature. This literature search and analysis has resulted in the identification of nine behaviours: Cheat deterrence, honesty, Tit for Tat, Tit for Two Tats, conformism, reputation, nepotism, pay it forward, and altruistic punishment. Proverbs are mapped to these behaviours, the results are used as a foundational basis for analysis in this study.

1.1 Game theory models vs. naturalistic signals

In the world of cooperative behaviour in the evolution of groups, a 1982 book by Maynard Smith sums up the importance of using Game Theory to study the evolution of cooperative behaviour via an Evolutionary Stable Strategy (ESS):

"*Evolutionary game theory is a way of thinking about evolution at the phenotypic level when the fitnesses of particular phenotypes depend on their frequencies in the population."* (Maynard Smith, 1982)

Attempts to model how group behaviour evolves are often based on Game Theory (Axelrod, 1980,1981; Kiyonari, 2000; Fehr, 2002; Scata, et al., 2016; Askitas, 2018; Srivastava & Zhang, 2021). *Game theory* is a useful mathematical modelling tool that provides insights into strategies under given conditions. The concept was developed by mathematicians, John von Neuman and Oskar Morgenstern in 1944 (von Neuman & Morgenstern, 1944). Axelrod then developed the highly influential "Prisoner's Dilemma (PD)," a two-person game used to describe possible mechanisms in the evolution of cooperation (Axelrod, 1981). Axelrod's initial paper describing the Prisoner's Dilemma was followed by a similarly influential paper (Axelrod & Hamilton, 1981): the Prisoner's Dilemma game pitted players against each other within the context of conflict (defect) and cooperation. For example, the game typically comprises two prisoners who have committed a mutual crime. Each prisoner is isolated and encouraged to confess. Neither knows how the other prisoner will react, but are offered the following: if both confess they both go to jail for five years; if neither confesses, both go to jail for one year; if only one confesses they go free, but the other goes to jail for ten years.

Prisoner 1 Prisoner 2	Confess (Cooperate)	No confession (defect)
Confess (Corporate)	(5,5)	(0,10)
No confession (Defect)	(10,0)	(1,1)

Table 1: Outcome chart for classic Prisoners Dilemma

The "contests" are designed to elicit a reaction of one participant (player) to the actions of another. For example, the Tit for Tat (TFT) strategy was one of several strategies; the TFT

strategy won a series of tournaments run by Axelrod; the possible evolutionary stable strategy (ESS) outcomes of the tournaments also included: always defect; always cooperate, and random. According to game theory, "always defect" was the expected outcome, as it is a safe strategy that cannot be exploited. However, this strategy does not consider cooperation, where the pay-off is higher if an opponent cooperates, or as one popular proverb in the USA suggests, "*united we stand, divided we fall*." During the Prisoner's Dilemma tournament, Tit for Tat won out as it matched the previous player's strategy, defect-defect, cooperate-cooperate. Since then, variants and subtler games have been modelled with further strategic outcomes, including the forgiving, Tit for Two Tats (TFTT), where players only defect after an opponent defect twice in a row. Game theory modelling has provided lab-based mathematically evidenced data to resolve some of the complex interplay of group behaviours (Javarone & Marinazzo, 2017). However, there are criticisms of game theory that include laboratory settings causing humans to “misfire” behaviours that cloud the results. However, more naturalistic explorations of group behaviour that use data 'in the wild' are seen less often in the literature. This project hopes to change this by applying 'in-the-wild' data, in the form of proverbs, to the debate on linguistic vehicles involved in stimulating, encouraging, and discouraging group behaviours associated with acknowledged evolutionary cooperation mechanisms. However, the results from this more naturalistic approach to the evolution of cooperative behaviour in groups will call upon the hypotheses tested by Game Theory models as a basis for discussion and analysis. (West, et al., 2011; Medda et al., 2021)

1.2 What are proverbs and how might they modify human behaviour?

In a 2015 evaluation of evolutionary psychology, Tooby and Cosmides state this:

> "The mind is not like a tape recorder, passively recording the world but imparting no content of its own. Domain-specific programs organise our experiences, create our inferences, inject certain recurrent concepts and motivations into our mental life, give us our passions, and provide cross-culturally universal frames of meaning that allow us to understand the actions and intentions of others. Consequently, they play a key role in determining which ideas and customs will easily spread from mind to mind and which will not." (Tooby & Cosmides, 2015)

Humans also use words to encourage certain behaviours; proverbs are part of the tool humans use, with examples being "An eye for an eye, and a tooth for a tooth" or "Honesty is the best policy." As such, the proverb is arguably one of the most effective ways to rapidly convey a piece of wisdom, to send out a warning or encourage accepted morality, and to establish and enforce social norms.

As far as answering the question, "What is a proverb?" Lord John Russell, in 1850, described proverbs as "The wit of one and the wisdom of many". The paremiologist Norrick, defines a proverb as “The proverb is a traditional figurative saying which can form a complete utterance on its own.” De Gruyter differentiates proverbs from other linguistic packages such as ‘proverbial phrases and idioms. He describes idioms as being distinct from proverbs as they are used with proverbial phrases that have “figurative meanings,” as such, idioms, are not typically able to be understood from the words alone, e.g., “drop the mic. As such, a proverb is a staple of cultural communication that exists across multiple cultures and can cross cultural

boundaries (Norrick, R. N, 2015; Buja, 2018; Weber et al., 1998; Charteris & Black, 1995; Minkov, 2012).

In evidence of this, proverbs are found across all continents (Matti Kuusi). Proverbs are generally the spoken word; however, evidence of proverbs can be found in Ancient Sumerian texts; an example being "Tell a lie; then if you tell the truth, it will be deemed a lie" (Kramer, 1963); proverbial wisdom persists - a similar proverb to this Ancient Sumerian proverb is found within the most frequently used proverbs in Somalia, "Your previous lies damage your present truth."

The structure of a proverb is such that it is memorable, much like a slogan. As such, proverbs are pithy statements that are easy to remember, and many carry emotional weight to aid memory (Tyng et al., 2017). I would argue that there is a similarity between the proverb and marketing slogans generated by copywriters, who in the modern context will spend thousands of hours and often millions of dollars on developing the right slogan – as Nike said, "Just Do It."

Proverbs are ubiquitous and used across society, in songs ("One bad apple"), by parents to control children's behaviour ("Shy bairns get nowt"), in socio-political discourse, etc: politicians famously use proverbs and slogans to encourage voting behaviour. One such famous election slogan, "Do not swap horses in the middle of the stream", is attributed to Abraham Lincoln, who used it to encourage voters to vote for him and to not change leaders during the turbulence of the American Civil War.

The question arises, can proverbs provide data to demonstrate that cooperative behaviours are selected for in a group? Are these proverb data consistent across cultures? For example, are there strong signals in the proverb data to show that behaviours, evidenced as important in group evolution from game theory and other studies, found in the most frequently used proverbs in the

six countries? If so, could this be an indicator of the use of proverbs to control and encourage certain behaviours, and, which behaviours have stronger signals in the proverb data? Importantly, are these signals consistent across cultures?

Alternative hypotheses such as selfish and spiteful behaviour within groups could potentially add an additional layer of complexity to the analysis. Research shows mixed outcomes on the question of "Is selfish behaviour favoured within a group." (Adami & Hintze, 2013; Testori, et al., 2022). For example, a paper that used game theory to explore selfish behaviour in learning compared "selfish learning," whereby an individual behaves in a self-interested manner with a learning rule called "fairness-mediated team learning"(FMTL). The FTML players had to "promote fairness" by optimising payoffs within the group to prevent themselves from being exploited by the selfish learners. The results show that FMTL players are favoured and selfish learning is unstable in classical two-player repeated games (McAvoy, et al, 2022)

It is worth noting that the research carried out above was performed using game theory or variants of game theory. This project will attempt to explore if "in the wild" proverbs act as way to encourage social norms that lead to the cooperative behaviour needed to enforce evolutionary mechanisms of group cooperation. And if these signals exist, are they consistent across the countries included in this study?

1.3 Alternative methods to extend the use of folklore as data

A paper by Michalopoulos and Meng Xue explored how to extract folklore-based information. The researchers performed an extensive exploration of "motifs" used in oral traditions, like folktales, to describe geographic and social attributes covering trust, risk-taking, and gender norms. Folklore was used to identify the importance and societal models of mode of subsistence,

family structure, political centralization, and others. The researchers intended to challenge precious studies shortcomings including incomplete ethnographic sources, the absence of proxies of historical norms and the uneven coverage of groups and attributes and measurement error. The study set out to mitigate these errors using a variety of methods, including large sample sizes – the research created a catalogue of oral traditions across 1,000 groups, and machine learning and human classification methods. Norms towards cheating (tricksters) in folklore found a quantitatively meaningful correlation showing that cheaters were consistently punished across countries. Proverbs were not part of the corpus of folklore in the study, but some of the same methods of interrogation could potentially be applied to the proverbs in the MKDB. For example, specific words could be used to identify common proverb themes. (Michalopoulos & Meng Xue, 2021)

2. Literature Review: Developing social norms and the transmission of ideologies

The ultimate or proximate mechanisms behind the evolution of cooperation in groups continues to challenge researchers; ultimate being used to reflect the fitness consequences of a trait or behaviour, while proximate refers to the underlying mechanisms behind the trait or behaviour (Phillips, et al., 2011)While cooperation in groups is an ultimate question, the behaviours discussed in this study form the proximate mechanisms that I suggest are driven by the use of proverbs within large scale societies. The ultimate-proximate mechanisms discussed below, are used to set the scene for the analysis of proverbs within the confines of behaviours associated with group cooperation and non-cooperation.

2.1 Overview and taxonomy of proximate and ultimate mechanisms used in this study

Discussed proximate mechanisms

Multi-level selection (MLS): A framework for selection that covers the array of organizational levels from genes to groups. MLS incorporates CGS and Kin Selection

Altruistic punishment: An individual may punish noncooperators at a cost to themselves to benefit the group

Norm psychology: Implicit and often explicit rules of a society or group that govern the behaviour of the individuals.

Discussed ultimate mechanisms

Cultural group selection (CGS): The evolution of cultural traits that benefit the group and outcompete other groups without those traits. CGS includes:

Kin selection: Cooperation between related individuals and the associated traits, like nepotism, that improve the overall fitness of those related individuals. Decomposed by Hamilton in the equation **rb – c > 0,** where -c relates to direct fitness and rb to indirect fitness.

Reciprocity: Prosocial behaviours that lead to cooperation. Includes reciprocity variants, direct (repeated pairwise interactions based on outcomes of previous interactions), indirect (occasional or one-off interactions, based on knowledge of the outcomes of others), and generalised reciprocity (interactions based on how the actor was generally treated by others.)

2.2 Proximate Mechanisms

The cooperative individual and multi-level selection

Human groups are complex, to say the least. Groups are comprised of varying roles that interact in hierarchies and across inter-related nodes, that go way beyond pairwise interactions (Battison, et al., 2016). Exploration of the selective behaviours working at the group level are a work in progress. However, certain evolutionary models and associated behaviours have provided a firm grounding for further research into the cooperative individual either through kin-selection or a group-level selective process. Multi-level selection (MLS) theory has provided a framework outside the black-and-white, altruists vs egoists model afforded by group selection theory. MLS focuses on selection within-groups – here, selection favours non-cooperators more than altruists, and between-groups – selection favouring groups with more altruists. The net result being that if

between-group selection is strong (or within group selection weak) then altruism will spread. (Price, 1972; Smith, 2020))

However, MLS continues to elicit debate around whether it is equivalent to kin selection. The general view is that the two are different sides of the same coin; that is, they offer alternative views of the same thing using a different perspective and should be applied as appropriate to the problem. (Smith, 2020

In terms of proverbs role in MLS, the concept of "MLS thinking", whereby MLS Theory can be used as a "unifying theoretical framework" that can expand new areas of research, seems appropriate: A 2008 paper set the scene for using an MLS thinking approach to the evolutionary exploration of human cultural activities, by including dance, art, and literature in the study. (Sloan Wilson, Vugt, and O'Gorman, 2008)

Costly punishment / altruistic punishment

If social norm behaviours are encouraged using conformist transmission, then enforcing those norms when violated relies on punishment of offenders. A social dilemma experiment by Yamagishi found that participants were less likely to cooperate without effective sanctioning. However, other outcomes of the project were even more interesting. During the experiment, cooperation within a system that worked on sanctions provided opportunities to defect. However, the subjects were found to cooperate more fully to maintain the sanctioning system if the gain for cooperation was large enough. The study concluded that "the implication of these findings is that as the social dilemma takes on a more serious tone, people become more willing to cooperate in providing a change in the system which addresses the dilemma problem" (Yamagishi, 1988). Continuing studies into the effect of punishment on the evolution of cooperative behaviour have

found that indirect and direct reciprocation are used depending on the circumstances (Boyd & Richerson, 1992). One model exploring this, found that altruistic punishers dominate a population of contributors, defectors, and nonparticipants. The study even found that under certain conditions, a punisher can enter a group and create a stable evolutionary population comprising entirely of punishers (Fowler, 2005).

More recent studies continue to explore the reality and complexity of altruistic punishment. One 2013 study, "Do humans really punish altruistically? A closer look," identified envy and not moralistic anger as being the driver for altruistic punishment; interestingly, the study found a non-statistically relevant amount of punishment took place across the experiments. The researchers cast doubt over previous research that associated altruistic punishment with *altruistic benefit-delivery systems.* (Pederson, et al., 2013)

Notably, a study that looked at the details of altruistic punishment questioned the validity of the behaviour. (Pederson, et al., 2013) However, the study presents limitations associated with the focus of the research, i.e., the third-party punishment game. The participants were also restricted to the USA and students or mTurk users.

All of the above noted complexity in defining altruistic punishment means that finding proverbs that reflect this behaviour is challenging, but some form of warning proverbs that encourage ostracism of social norm violators is expected in the proverb data. However, the implications of costly or altruistic punishment reflected in proverbs should manifest in an increased frequency of cheat deterrence and honesty; altruistic punishment if conditions warrant, for example, during wartime may be more easily identified and frequency increases during times of conflict may be more likely.

Social norms as seen through the lens of norm psychology

Social norms work at the group level and use mechanisms to emphasise behavioural standards and prevent norm violations. Proverbs may be one of the mechanisms used for adherence to social norm behaviours as well as for the threatened punishment of norm violators, for example, a popular Korean proverb and one my Irish father would wield to warn naughty children of the result of misdeeds, is "Cheats never prosper" (Korean: "치트는 절대 번성하지 않습니다" chiteuneun jeoldae beonseonghaji anhseubnida).

Social norms are used to build institutional frameworks reflecting social rules, such as taboos, and to define gender and sex stereotypes and roles in society. Primary behaviours associated with social norms are conformism and imitation.

Conformity and "conformist-biased transmission" have been postulated as the primary driver of large-scale human cooperation (Boyd & Richerson, 1985). Conformist transmission describes the disproportionate frequency at which individuals are likely to copy a common "trait or traits", e.g., imitate social norms in a population (group), i.e., "majority rules." This propensity to copy or imitate plays out on social media platforms daily; platforms such as Twitter (now X) acting a form of 'super-group' where bands of individuals fight out their own version of social norms across the platform. Social Media Influencers (SMIs) use social platforms to exploit the urge to conform, advertising their "social norm," albeit modulated by elements such as perceived lifestyle, trustworthiness, and prestige (Acerbi, 2020; Cabeza-Ramírez, et al. 2022). Notably, there is a move towards smaller "group chats" in the digital domain, with WhatsApp, Signal, and Telegram apps being used to form more privacy-enhanced and intimate groupings, where the

elites, politically motivated, scammers, and angry mob are not welcome – or at least they form their own groups. (Mehner, 2022)

The conformist transmission model, heralded by Boyd and Richerson, provides a "heritable" reason for cultural variation between groups that is based on the "dual-inheritance model" of genes and culture. This model encompasses the idea of multi-level selection as it layers individual level selection with that of the group; Boyd and Richerson in their 1985 book defining culture as:

> "*information affecting phenotype acquired by individuals by imitation or teaching*" (Boyd & Richerson, 1985 and 1992)

Boyd and Richerson postulated that conformist transmission is responsible for in-group similarities and out-group differences; conformism is an important behaviour identified in human communication. Tomasello in his book "Natural History of Human Thinking." Tomasello talks of "shared intentiality" and the collaborative activities of humans (Tomasello, 2014) that eventually led to human language. Conformist behaviour explored in the use of language would help language to evolve, as Tomasello explains:

> *"modern humans not just acquire instrumental actions by observing others, as did early humans, but actively conform to the behavior and norms of the group, and even enforce conformity on others through teaching and social norm enforcement."*

Tomasello goes on to describe how:

> *"Conformity is imitation fortified by the desire to coordinate with the normative expectations."*

A 1998 paper on conformist transmission explored how selection of certain psychological mechanisms leads to conformist transmission under a broad range of conditions (Henrich & Boyd, 1998). The paper set out four conclusions that deal with conformist transmission as being fundamental to social learning. Importantly, the fourth conclusion draws in conformism and punishment of non-conformists as two sides of a coin:

> *"Conformist transmission, third-party punishment, and multiple local optima all provide logically possible explanations that are not mutually exclusive. All three processes may, in fact, create and maintain intragroup similarities and intergroup differences. Further research should focus on detailing and differentiating these processes."*

In 2016, researchers found "substantial" reliance on conformist biased social learning. The study also identified a correlation between group size and conformist transmission with increased group size predicting increased social learning. The conclusion of the study was that "conformist transmission is a central component of human social learning" (Muthukrishna, et al., 2016). Recent studies show that conformity and group cooperation is complicated, "*conformist transmission generates a population-level process that creates and maintains group boundaries and cultural differences through time is not always true.*" (Molleman. et al., 2013; Krebs Denton et al., 2020).

Circling back to the Henrich & Boyd 1998 paper, conformism can be encouraged in a positive way, but it can also be enforced using punishment. There is even an idiom in the UK that describes the social exclusion of norm violators, the excluded being described as having been "Sent to Coventry." The punishment of norm violators, i.e., those who step outside the constraints of the expected traits within a group, was explored in a recent paper that focused on

direct punishment (confrontation) and indirect punishment (gossip and social exclusion). The paper found a complex landscape of norm punishment that included costly punishment, direct confrontation, gossip, and social avoidance (Mulho, et al. 2020). The researchers found that an important function of punishment is to deter future transgressions; proverbs may well fit this bill acting as a deterrent for those who intend to cheat on others or step outside the confines of social norms; proverbs are a potentially powerful way to convey the importance of " he who digs a pit for others falls into it himself. " As a pithy and memorable method of communicating ideologies and social norms expectations, it is likely that proverbs will be used as vehicles of conformist thinking and be present in high frequencies in the proverbial data.

However, ensuring conformity using proverbs is one side of the group cooperation equation; the counter-mechanism to enforce norm behaviour is punishment of norm violators.

Before jumping into the dynamics of group behaviour, it is worth looking at the application of social exchange in the enforcement of norms.

Norm psychology works to crystallise the notion of social norms as a driving factor in the development of cooperation in non-kin groups. Humans have evolved to remember and emulate norm behaviours that offer benefits to groups and help them to thrive: "Genetic evolution has expanded our domain-general capacities to learn and remember" (Fagot & Cook, 2006; Holland, 1992) and "tweaked our attentional and motivational processes" (Heyes, 2022). A review sets out the five challenges of large-scale human cooperation that theories of evolution of group cooperation must account for: (Chudek & Henrich, 2011).

1. **Scale variation**: impact on cooperation when group size expands beyond smaller familial groups.

2. **Domain variation**: context specific and self-reinforcing norms.
3. **Rapid intensification and expansion**: the impact of global events such as the agricultural revolution can provide the environment to allow large-scale cooperation to evolve.
4. **Species difference**: the existence of cumulative cultural evolution that has not yet been observed in non-human animals.
5. **Non-cooperative behaviour**: mechanisms such as reputation will maintain culturally transmitted behaviours even if they do not benefit others in the group.

A proxy for imitation is to conform to a social norm. Therefore, it is expected that there will be strong signals in the paremiological minimum that encourage conformity with social norms.

2.3 Ultimate Mechanisms

Cultural group selection (CGS)

CGS as an evolutionary mechanism includes accurate and rapid social learning, conformist social learning, punishment of deviant behaviours, and 'one-to-many' transmission, which may play a role in proverb frequency. The two theories mentioned in the 2012 paper by Tomosello, demonstrate how groups with more altruists will outcompete other groups, with imitation a secondary mechanism to propagate altruistic acts. The paper also discusses the concept of "mutualistic collaboration" (with social selection against cheaters) as a pillar of CGS (Tomosello, et al., 2012).

CGS has been added to this study, even though debate continues about the underlying proximate drivers behind CGS, to help capture a rounded view.

In particular, CGS is associated with several meanings, causing confusion. Indeed, in a 2011 paper looking at misconceptions in CGS, confirms that kin selection and group selection are two sides of the same coin with respect to optimising inclusive fitness. However, the authors point out that the debate over CGS is focused on simple models (West, et al., 2011). In terms of CGS and the other evolutionary mechanisms in the study, proverbs are used as a means to transfer tradition, solve conflict, and strengthen the feeling of community. Punishment of norm violators and cheats is a feature of many proverb, e.g., "Cheats never prosper" and this driver of punishment is recognised as an "enforced mechanism behind cooperation" (West, et al., 2011; Penfield & Duru, 1988; Zhao, 2012)

CGS was included in this study to capture the association of proverbs within a culture. Proximate mechanisms associated with a type of CGS, "normative CGS" are included. Smith describes normative CGS as a "plausible theory for large-scale human cooperation" and notes that theories predict that individuals should punish norm-breakers even without any direct fitness benefits. (Smith, 2020)

CGS is built upon MLS, the premise being that behaviour that benefits a group can evolve via cultural mechanisms that work to stabilise individual behaviour in these groups. This behaviour then differentiates between cultural groups, facilitating selective pressures. CGS is predicated on cultural traits and does not depend on genes: Groups with more cooperators should outcompete groups with more non-cooperators. The result is a positive feedback loop where proximate mechanisms, like conformism and social norm punishment, encourage group cooperative behaviour. However, as Smith points out in a 2020 paper, social learning mechanisms may not fully explain cooperative behaviour. Smith describes three variants of CGS:

Maladaptive - proximate mechanisms are based on social learning - conformism and prestige-bias – individuals use these behaviours "blindly" i.e., behaviour is used irrespective of the individual pay-off. Smith notes that "the evidence for widespread conformism– a key mechanism for stabilising group behaviour– is rather weak." He goes on to point out that the evidence for adaptive CGS is lacking.

Normative – proximate mechanism is norm psychology and norm enforcement is behind the punishment of norm violators. Smith notes that it is in an individual's self-interest to cooperate when norm violation results in punishment. The notion of free-riders who benefit from altruistic punishment comes into play. However, the proposed solution of this extending to cooperation in large groups is that competition between groups develops a "cooperative equilibria." Smith suggests that normative CGS offers a feasible theory for large-scale human cooperation.

Neutral - unspecified proximate mechanisms. Does not require social learning and/or a norm psychology to stabilise group behaviour (Smith, 2020).

Notably, Smith points out that:

> "Although both conformist and prestige-biased social learning strategies and a norm psychology are plausible mechanisms for explaining group differences in cooperation on which equilibrium selection can act, the evidence in support of these mechanisms is far from conclusive."

Sharing the same or similar values and beliefs as your peer group is something that most humans are intrinsically aware can have a positive impact on their social status. As a child, I was seen as "different" with the result that I spent my playtime alone and rarely played in groups of children. As a life-long non-conformist I can attest at a personal level of the difficulties of not being "part

of the crowd." But this deeply held belief that being a conformist is a way to feel connected to the wider group has evidence outside our own folk beliefs. The development of cultural traits is a crucial point of debate that connects evolution, behaviour, and the evolution of cooperation in groups: Richerson and Boyd define culture as "*information capable of affecting individuals' behaviour that they acquire from other members of their species through teaching, imitation, and other forms of social transmission*" (Richerson & Boyd, 2008).

In this study, CGS is assumed to be an ultimate mechanism behind proverb use in non-kin societies (Heyes, 2018). If CGS and its associated behaviours hold true, altruistic punishment and conformism strategies should play a major role in proverb transmission, with consistently higher frequency of use of proverbs encouraging these behaviours across the PM of the six countries.

However, as noted, debate and misunderstanding of CGS continues to challenge the proximate mechanisms behind the role of CGS in group cooperation.

Conflict and cooperation in the context of CGS

Richerson, et al., has suggested that CGS supports large scale conflicts, and that strong cultural norms drive cooperation, offering evidence of large raids carried out by the Turkana, the raids consisting of non-close-kin and multiple sub-territories (Richerson. P., et al, 2014). CGS and pro-sociality are strongly correlated; a paper that explored intergroup competition and prosocial behaviour in a business setting, concluded that companies that encourage cooperative behaviour and adherence to group norms within a CGS context, were more successful (Francois. P., et al. 2014). Conflict is a central theme in human history as is cooperation. Evidence of conflict plays out on the world stage, with wars, civil wars, and civil unrest raging across many parts of the

world. It is not just physical wars that are causing conflict, geo-economic warfare is in the World Economic Forum (WEF) top ten threat list of global threats, which also includes the erosion of social cohesion (WEF, 2023). Cooperation is an inherent quality of conflict, after all, you need to have a cooperative citizenship that can support, often despicable acts, in the name of war. The dynamics of conflict and cooperation has been explored though the lens of cultural evolution by Peter Turchin in his book Ultra Society, where he refers to the close relationship between conflict and cooperation:

> "On my cultural evolution analysis, cooperation and warfare were both critical in the transition from small-scale to large-scale societies…they are the yin and yang of social evolution – two seemingly contradictory, yet mutually independent forces." (Turchin, 2016)

Stream three in this study will attempt to explore the frequency of use of proverbs during times of conflict, specifically, World War Two. In terms of evidence for changes in group behaviour / social norm adjustment during periods of change and / or conflict a recent study into the emergence of new social norms during the Covid-19 pandemic has an interesting perspective (Diekmann, 2022). The paper talks about coordination vs. cooperation situations and highlights the influence of perceived risk in acting cooperatively with respect to new social norms such as vaccination or mask wearing; "in situations of cooperation problems where self-interest is not in accordance with general welfare, the prospects that norms will be followed voluntarily are low." In other words, the picture is complicated and moral judgments may be overridden by self-interest.

Kin Selection

It is likely that humans started life living together in small-sized groups comprising kin-related members; evidence from DNA studies points to strong kin-relatedness amongst group members of prehistoric groups (Kuhn, et al., 2018).

Irrespective of group residential make-up, it feels natural to help our relatives; an example in modern group dynamics is workplace nepotism, i.e., providing preferential treatment to family members, such as offering a job to a relative acts as a proximate mechanism behind of nepotism. Nepotistic behaviour is still alive and kicking and according to a recruitment industry study, uppermost in the mind of Gen Z, i.e., persons born between 1997 and 2012 (Milkround, 2020).

However, research has found that nepotism, is more prevalent in smaller family run businesses (Kaushal, et al., 2021); this finding may be an important side note as the group size may determine the importance of kin selection over non-kin selective evolutionary processes.

Kin selection favours traits that improve the overall fitness of related individuals. Hamilton's inclusive fitness theory, the foundation of kin selection, shows statistically why altruistic cooperation may be favoured between related individuals:

Hamilton's rule

$$rb - c > 0$$

Where:

r = relatedness

b = The benefit gained by the reciBarnt of the altruism

rb = Indirect fitness effect

c = The cost suffered by the donor of the altruistic behavior (direct fitness effect)

Inclusive fitness is a combination of direct and indirect fitness and describes both the process and the purpose of Darwinian adaptation. The success rate of passing on genes to the next generation is a measure of inclusive fitness and is tied to cooperative behaviour that benefits the recipient at the expense of the person who performs the behaviour (see the Hamilton quote below). Altruism forms a foundational behaviour that promotes inclusive fitness; thus, altruism in related individuals is termed kin selection. According to a review article exploring misconceptions in the evolution of human cooperation, inclusive fitness theory, also known as the direct or neighbour modulated fitness method, offers effective ways of analysing the evolution of social behaviour. (West et al., 2011)

Kin selection is recognised as a strong driver of cooperative behaviour and countless studies have shown compelling evidence for Hamilton's rule that underpins kin selection (Dawkins, 1976; Grafen, 1982; West et al., 2007; Bourke, 2014).

A quote from Hamilton's inclusive fitness theory highlights the pillar of the law:

> "*an animal acting on this principle (altruistic behaviour) would sacrifice its life if it could thereby save more than two brothers, but not for less*." (Hamilton, 1963)

In other words, altruistic behaviour would evolve if the indirect benefits derived from altruism are greater than the direct fitness costs. However, reproductive costs are something that can be difficult to calculate. After all, if a larger non-kin group is stable because of the establishment of strong prosocial behaviour within the group, then group members will benefit from this

generalised stability and improved reproduction and overall improved fertility from better conditions will follow.

As such, kin selection continues to cause debate on explanations for the evolution of altruism. A paper that evaluated theories of the evolution of altruism, identified 89 altruism models, 46 of which were based on Hamilton's framework. However, the remaining 43 used alternative mechanisms. (Kay, Keler, Lehman, 2020) The most common alternative theory was spatial selection, pioneered by Martin Nowak, who describe spatial selection as this:

> *Spatial selection means that clusters of cooperators can prevail: Neighbors help each other. Group selection occurs if there is competition between groups: The members of a group help each other. Kin selection is based on interactions between close genetic relatives: Brothers help each other, for example.*[1]

In terms of proverbs, kin selection exhibits similar behaviour to direct reciprocity, with proverbs being passed between family members to enforce expected behaviours amongst kin groups. As proverbs tend to be used widely across society, we should expect to see the relative frequency of nepotistic signals at a lower frequency than non-kin.

Encouragement of positive behaviour amongst kin may use nepotism, but there is also a notion of group nepotism, where a group members act as pseudo-kin.[2] However, this idea of pseudo-kin may prove difficult to tease apart when looking at proverbs that encourage nepotism.

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[1] Martin Nowak personal website, Research: https://www.martinnowak.com/research

[2] There is a concept of 'group nepotism' (Jones, 2000). Further discussion on Group Nepotism can be found in the section on "Behaviours – definitions."

Non-kin and group cooperation

A 2011 paper on contemporary hunter-gather residential patterns, explores the likelihood that cumulative cultural evolution came about because of the interactions of non-kin. The analysis involved 32 modern day hunter-gather bands and found that less than 10% of members were made up from primary kin and around 25% were non-kin; other members were distantly related or related by marriage (Hill, K.R., et al, 2011).

Cooperative behaviour in non-kin situations is demonstrated every day when people choose to behave in altruistically ways towards strangers. I was recently reminded of this when I watched as a young mum pushing a pram was allowed to jump the queue by people in front. This form of altruistic behaviour, that negatively affects the giver for no direct benefit to themselves, is a central part of the exploration of what underpins cooperative behaviour in groups. If kin selection is the primary driver of group cooperation, then why do we see non-kin members of a group help each other out so frequently? Trivers developed the idea of reciprocal altruism (reciprocity) in non-kin groups back in the 1970s (Trivers, 1971). Since then, researchers have attempted to develop models that drive the evolution of cooperative behaviour within groups of non-related persons who are often strangers. An important note and confounding factor is that "kinship" is a diverse term and that cultural kinship is not the same as biological kinship Research exploring the notion of kinship in worldwide cultures see kin in non-biological ways that are often fluid. (Carsten, 2003)

In populations that have limited migration or dispersal, relatedness between individuals may be relatively high. (West et al 2011) However, humans are increasingly living in larger, often vast groups, that interact, in the main, cooperatively. Large groups are more likely to contain

unrelated individuals that must interact. Therefore, any kin selection forces will be, by definition, diluted within these larger, non-kin related group; yet still, cooperation within non-kin groups is commonplace; opening a shop door for a stranger; giving money or time to a charity; letting a car go in front when in a busy lane, offering shelter to Ukrainian refugees. Nonetheless, discourses around human group cooperation, in particular, cooperation between non-kin communities, has been hotly debated since Darwin first postulated that non-kin cooperation was a conundrum in his book "The Descent of Man" (Darwin, 1871):

"*many a civilised man, or even boy, who never risked his life for another, but, full of courage and sympathy, has disregarded the instinct of self-preservation, and plunged at once into a torrent to save a drowning man, though a stranger*."

Debates about group cooperation continue to thrive in the evolutionary anthropology community. The debate is not if cooperation has an evolutionary basis but how that manifests itself in broader groups of individuals, especially with respect to those that include non-kin. Models associated with non-kin group cooperation are still evolving and new ideas often build upon previous generations of evolutionary thinking. This continued conversation around the evolution of human cooperation draws upon theories of inclusive fitness and group selection as applied to kin and non-kin (Wynne-Edwards, 1962; Maynard Smith, 1964; Hamilton, 1964; Fisher, 1930; Haldane, 1932; Trivers, 1971; Sober & Wilson, 1998; Richerson, et al., 2016).

Models include for the good of the group through differential survival in cooperators as opposed to non-cooperators (Wynne-Edwards, 1962), multi-level selection, whereby group level (between-group) benefits outweigh those at the individual level (within-group) (Okasha, 2006),

and direct competition between groups (Boyd & Richerson, 1990). In the latter case, the theory indicates that territories and resources are won by groups containing more cooperators.

The proverbs used in this study are taken from a broad cohort of users across an entire society. Factors such as limited dispersal causing high relatedness are unlikely to have an effect.

Indirect, direct, and generalised reciprocity

Reciprocity is a debated proximate cooperation mechanism, subdivided into direct, indirect reciprocity, and generalised (DR, IR, GR). There The primary model used to evidence direct reciprocity is the repeated Prisoner's Dilemma, a game theory model mainly using N-player prisoners' dilemma games. This model is a staple method used to establish mathematical evidence for group behaviours such as defect or cooperate (Axelrod, 1994; Yao & Darwen, 1994).

Moreover, this method has provided evidence for complex scenarios of cooperation:

"*Under suitable conditions, cooperation based upon reciprocity can develop even between antagonists*." (Axelrod, 1994).

Models have demonstrated how IR can lead to cooperation (Nowak & Sigmund, 1998). For example, the research by Nowak and Sigmund used image scoring to establish a reputation system. The system demonstrated that cooperation evolved when people applied positive discrimination to those with higher scores.

Conditional cooperation is dependent on factors such as reputation, moral expectations, social pressures, kinship, and strategic positioning. Individuals recognise each other and act accordingly. The ‘Tit-for-Tat’ game theory model famously explores this. A variety of evidence

exists to show this mechanism occurs in human cooperation, including antisocial punishment in prosocial groups and human generosity in one-shot encounters (Gachter, 2009, Delton, 2011).

A 2012 paper by Tomasello et al. describes two main theories of the evolution of human cooperation: the "Big Mistake Hypothesis" and the "Cultural Group Selection Hypothesis." Notably, both theories depend on altruism: the former shows the development of cooperation in small kin-related groups, with altruism being a proximate mechanism as a group's size increases. The latter is based on the idea that groups with more altruists will outcompete other groups; imitation is considered a secondary mechanism to propagate altruistic acts.

The 2012 Tomosello paper extended the debate using their 'Interdependence Hypothesis', based on a mechanism termed 'mutualistic collaboration' (with social selection against cheaters). This hypothesis was designed to bridge the gap between small-scale cooperation in early human societies and the larger-scale group-level cooperation of modern humans. The authors conclude:

"*The key ecological change was one that made individual human beings interdependent with one another for subsistence, which led naturally to helping those on whom one was dependent. This required the development of cognitive skills for putting one's head together with others in acts of mutualistic collaboration and communication*." (Tomasello et al., 2012)

Further still, a 2020 article by Vlerick distinguishes between biological and psychological altruism (Vlerick, 2020). The paper uses evidence from neurology, anthropology, and developmental psychology to explore proximal effects on altruism and group selection. The author concludes that social norms and punishments are used to govern altruism:

"*social norms and punishments that govern our societies and the reasoning processes we unleash on the evaluation of moral norms and decisions*."

Altruistic behaviour as defined by DR, IR, GR, encapsulates a series of behaviours that encourage cooperation. The deterrence of cheats, honesty, Tit for Tat/Tit for Two Tat, and reputation-related behaviours have all been found to be associated with DR, IR, and GR. The section on "Evolutionary mechanisms of group cooperation and associated behaviours" identifies specific research into this area of group evolution. Regards the use of proverbs to encourage certain types of behaviours, known cooperative behaviours are expected to be reflected in the proverb sets used in this study and proverbs are expected to link to altruistic, prosocial behaviour.

In addition, Pay it Forward and acts to reward reputation as a driver for generalised reciprocity have been studied within an organisational group setting (Baker & Bulkley, 2014). The researchers found evidence that paying it forward had a more substantial influence on generalised reciprocity than rewarding reputation. As such, a stronger signal of proverbs with Pay it Forward sentiments would be expected when compared to reputation-focused proverbs.

A paper exploring the impact of memory constraints on the effectiveness on direct reciprocity, concluded:

> "Individual memory constraints are responsible for the decline of direct reciprocity." (Righi, 2018)

Worth noting is a 2009 paper on costly punishment in cases of direct reciprocity looks at strategies including generous-tit-for-tat (TFTT?) using game theory. The paper concludes that generous TFT (TFTT) prevails (Ohtsuki and Nowak, 2009).

An important question that may be addressed during this study is: are proverbs, by their nature, easy to remember snippets of information, able to circumvent this constraint? The memorability

of a proverb allowing their echo to follow a person, like an ear worm, to continually play on emotions and actions in the real world.

Indirect reciprocity is a mechanism that uses social norms to encourage cooperative behaviour. As noted in a 1998 book by Nowak and Sigmund, "indirect reciprocity is a consequence of direct reciprocity occurring in the presence of others."

Reputation also plays a central part in indirect reciprocity as observed by Nowak and Sigmund (2005). Reputation is itself intrinsically linked to behaviours such as honesty; indirect reciprocity is linked to several underlying behaviours that contribute to the overall cooperative behaviour of non-kin groups (Szamado, 2021). These include:

Honesty is an important factor that promotes indirect reciprocity. Strong signals for this in proverb use would be seen in the form of higher frequency of use of certain proverbs, such as those encouraging honesty and those controlling otherwise anti-social behaviour.

Research using image-scoring strategies found evidence that reputation was a stable strategy for group cooperation (Nowak and Sigmund, 1998). A critique paper by Leimar and Hammerstein influenced by Sugden's findings that 'good standing' is an evolutionary stable strategy, criticized image-scoring, finding fault in a failure to truly represent the strategic interests of an individual. Instead, the research explored the concept of good standing' as per Sugden, concluding that:

> "standing strategy is a rather robust implementation of indirect reciprocity" (Leimar and Hammerstein, 2001).

Another possible area of exploration is the use of proverbs to keep track of indirect reciprocity. An example of this would be the establishment of 'proxy kin' or a 'band of brothers' effect,

developed through the encouraged use of certain proverbs within a community that encourage good standing amongst non-kin. It is expected that pay it forward behaviour will be seen in the paremiological minimum, e.g., “one good turn deserves another.”

Generalised reciprocity is presented here for completeness. Patterns of positive or negative co-operative behaviour are repeated, described as “paying it forward” (Zhongqiang, et.a., 2020). Proverbs might be a way to create a chain of positive behaviours that can be passed across a large population quickly. One of the questions that will be explored in this project is:

> “Does evidence exist of generalised reciprocity echoed in proverbs during certain historic periods where there is a need to work together for the greater good.”

As a prosocial behaviour device, proverbs are an ideal conduit to encourage the transmission of positive co-operative behaviour amongst a non-related, generalised population.

> “Generalized reciprocity is thought to be less cognitively demanding than direct and indirect reciprocity, as it does not require individual recognition, keeping track of the actions of others, or a scoring system to assess reputation or to select the best reciprocators.” (Mijola, 2012)

3. Research question

The foundation for the study is dependent on identifying a link between well-known proverbs and behaviours. This opens up potential biases and inaccuracies in interpretation and proverb-behaviour associations. The section on biases and the discussion explore these issues in more detail. A limited cross-cultural analysis will be performed to look for signals that a proverb may be used to influence behaviour. The frequency of signals across the six countries used in the study provides a framework to answer the question:

What is the likelihood that proverbs are used by humans to encourage or discourage certain types of behaviour associated with group cooperation; are these proverbs found at similar frequencies across those cultures ?

Frequency of use is a proxy indicator of the popularity of a proverb as well as a proxy for the success of the proverb in that culture.

In an attempt to explore the frequency of specific proverbs associated with behaviours, the proverbs of six countries will be evaluated; by identifying signals within the proverb data, i.e. associating proverbs with the nine identified behaviours, it is hoped that the relative frequency of proverbs-behaviour will become clear

The study will also explore if certain types of proverbs are found at a higher frequency during times of conflict, for example, is there a higher frequency of proverbs encouraging altruistic behaviours (Bernhard, et al, 2006); if so, what types of group behaviour do those proverbs potentially encourage? In this instance, this latter study will be exploratory and qualitative, but provide a framework for potential further exploration.

4 Methodology

4.1 Introduction

This study will not review any random mutations or transmission chains of a proverb over time, as in the Brexit example. Instead, the investigation will be both systematic and exploratory, using proverb data from across the world. The project is split into three streams: Stream one looks at prosocial proverbs across cultures; stream two explores the popularity of prosocial proverbs across six countries; stream three uses prosocial proverbs identified in stream one and two to see how proverb frequency of use changes over time, in line with historic events such as World War Two.

4.2 Research streams

The first two streams take proverb data from two recognised sources, then sifting through the thousands of proverbs in these sources for evidence of their use in challenging or encouraging specific behaviours.; each of the identified proverbs are mapped against one or more of the nine behaviours. This is done across various cultures. In doing so, the project hopes to identify any cross-cultural effect of proverbs as related to behaviours associated with group cooperation.

Stream three takes samples of the identified proverbs, each representing one of the nine behaviours. Google nGrams is used to evaluate these data for a temporal exploration. A note must be made that stream three analysis is qualitative and restricted by nGram limitations, as detailed in this methodology.

Proverbs were collated and rated using Excel. The raw data can be downloaded from Durham Collections.[3]

4.3 Proverb sources and data sets overview

This project will explore the evolution of cooperation in groups within the context of the widespread use of proverbs in societies across the world. To achieve this, proverb data sets are taken from two key sources that feed streams one and two. The same proverb data is used to populate the proverb list for nGram analysis in stream three. The two key sources of proverbs are the following:

- The Matti Kuusi Database of proverbs[4]
- The Paremiological Minimum of six countries

Instead of using Game Theory to explore mechanisms such as altruism in behaviour and cooperation (Srivastava & Zhang, 2002; Scatà, 2016), this project will use data generated from proverbs used in the real world as a naturalistic signal of the deliberate promotion of cooperative behaviour in groups. Commonly known proverbs will be analysed to generate the data needed to evaluate signals displaying the encouragement of nine behaviours as mapped to five evolutionary mechanisms of group cooperation.

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[3] Morrow, S. (2023): All for one and one for all: proverbs, prosociality, and the evolution of cultural norms. Durham University. (dataset). DOI: http://doi.org/10.15128/r1c534fn998

[4] American cultures are not viewed as separate from European influence in the MKDB (Hrisztova-Gotthardt, 2015).

4.4 Behaviours referred to in this study

To develop the evidence needed to test out the hypotheses this project reflects the current established evolutionary mechanisms and associated behaviours believed to help form cooperative groups. This study uses several of the evolutionary mechanisms evaluated by the studies mentioned in the introductory chapters of this thesis. (Trivers, 1971; Dawkins, 1976; Grafen, 1982; Axelrod, 1994; Boyd & Richerson, 1996; Sober & Wilson, 1998; Bourke, Nowak, 2006; Richerson & Boyd, 2008; Tomasello et al., 2012; 2014; Richerson, et al., 2016; Kuhn, et al., 2018). The recognised mechanisms of group cooperation are associated with core behaviours identified in key research into group behaviour. This mapping of behaviour to evolutionary mechanisms allows the project to analyse proverbs and link behaviours associated with the proverb; some of these proverbs may be common across cultures, some may reflect multiple behaviours. The situation is admittedly complicated by interpretation of meaning across different cultures. This study's remit is not to evaluate the proposed evolutionary mechanisms and behaviours. As such, the research corpora has been used to set a baseline of which behaviours are relevant within the evolutionary landscape – see the section below on "Coding of behaviours."[5] Linking proverbs to these behaviours is not without its interpretation challenges. However, there has to be a starting point that can at least open debate.

[5] The Greenbeard model may be influential in the evolution of cooperation and could be viewed as a propagation mechanism for proverbs; those who use the same proverbs are part of the 'Greenbeard clan'. However, this is also outside of the remit of this study but could form an interesting adjunct study.

4.5 Coding of behaviours

For ease of analysis, each of the identified behaviours associated with the mechanisms of group cooperation was hand-coded from A to I (see Table 1 below)

These codes were used to make the review and association of behaviours easier and quicker, as there were 376 proverbs with an evolutionary association (PEAs) from the PMs and Matti Kuusi to review. Each proverb was given one or more of these codes to show which behaviours were candidates for association with the proverb. For example, the popular Korean proverb, "Crime doesn't pay" (범죄는 돈을 지불하지 않습니다 in Korean) was assigned codes A and B to show the proverb has an association with behaviours that encourage cheat deterrence and honesty. This was repeated for each proverb in the six PMs; the exercise was repeated for the Matti Kuusi DB PEAs (proverbs with an evolutionary association).

Behaviour	**Code**
Cheat deterrence	A
Honesty	B
Tit for Tat (TFT)	C
Tit for Two Tats (TFTT)	D
Conformism	E
Reputation	F
Nepotism	G
Pay It forward	H
Altruistic punishment	I

Table 2: Hand-coded list of behaviours and key for charts in this thesis

4.6 The association of proverbs and behaviours in this study

The MKDB and PMs were used to establish an abbreviated lists of proverbs with an evolutionary association. Each proverb was assigned one or more of the nine behaviours within the identified mechanisms of group cooperation. For example: 'Cheats never prosper,' a proverb in the Korean PM, was assigned the behaviours:

- Cheat deterrence
- Honesty

In the MKDB, the proverb "Better give than take," was assigned the behaviours:

- Tit for two tats
- Pay it forward

The related evolutionary cooperative mechanisms were linked to each proverb based on the associated behaviours for cross-reference (see appendix 2). For example, in the case of 'Cheats never prosper' the evolutionary mechanisms that represent this proverb are:

- Indirect reciprocity
- Direct reciprocity

4.7 Coded behaviours and proverbs

The following behaviours, as associated with the evolutionary mechanisms, were coded according to the following evidence:

Behaviour A: Cheat deterrence

"One bad apple spoils the barrel"

Proverbs may be used to deter potential cheating within a group. Cheat deterrence proverbs should encapsulate a negative view of cheating behaviour, encouragement of the punishment of cheats, and encourage people to take a dim view of a cheat, and so deter their own potential ability to cheat as well as others in a group. The use of proverbs as a means of cheat deterrence fits in with the punishment of cheaters that is found to be effective in maintaining cooperation among humans (Fehr & Gächter, 2002).

Proverb examples: proverb examples include "*Cheats never prosper*"; "*There's no honor amongst thieves*"; "*One bad apple spoils the barrel*."

Expected outcome: Proverbs with a cheat punishment message may be a novel way to balance the conditions needed for cooperation in both smaller non-kin and larger groups. It is expected that cheat deterrence will be found across all the countries studied.

Behaviour B: Honesty

"Honesty is the best policy"

Honesty is an intrinsic social norm reflected in moral structures across religions, political structures, and cultures. It can be argued that honesty is the bedfellow of trust, and therefore, underpins successful group relationships. Indeed, a paper on the evolution of honesty in higher-order social networks, identified a tendency for honesty to persist. However, the researchers found a decrease in morality as group size increases, suggesting that morality and honesty evolve if individuals interact in small groups compared to the size of the network. (Kumar, et.al., 2021).

Proverb examples: examples of honesty-driven proverbs include '*Honesty is the best policy*,' '*The truth will out*,' and '*Virtue is its own reward*.'

Expected outcome 1: proverbs that recognise the importance of honesty are expected to be found in the PMs of the six countries.

Expected outcome 2: proverbs with honesty at the core of the message may be seen at a lower or similar frequency of proverbs that deter cheats.

Behaviours C and D: Tit for Tat (TFT) and Tit for Two Tats (TFTT)

"Do unto others as you would have them do unto you"* and *"Forgive and forget"

Tit for Tat (TFT) was the winning game against several other game theory strategies, such as "always cooperate' or 'always defect' in the famous Axelrod's Prisoner's Dilemma tournament in 1980. The Prisoner's Dilemma game was based on the principles of starting out cooperating and then repeating whatever an opponent does in subsequent rounds (Axelrod, 1980). Tit for Tat is a behaviour that has features to help sustain group collaboration and encourage positive prosocial group behaviour, and:

- Encourages cooperation
- Punishes defection
- Responds optimally to the behaviour of an opponent.

However, the evolution of cooperation is said to include a "ratchet" effect that can help to increase cooperative behaviour over time. As such, Tit for Tat has been described as a "fundamental mechanism that provides this rachet" (Axelrod, 1984).

Tit for Two Tats (TFTT) is a strategy that offers a mechanism for forgiveness, which may prove to be crucial in the evolution of group cooperation; like TFT, the first move is to cooperate and only defect if the opponent performs two defections in a row. Proverbs encouraging forgiveness would act to develop a more generous TFT behaviour.

Proverb examples: some examples of TFT and TFTT proverbs are (respectively) "A*ttack is the best defence'*(TFT) and '*Do unto others as you would do unto yourself*' (TFT); '*Let bygones be bygones'* (TFTT), and '*Forgive and forget*' (TFTT).

Expected outcome: in terms of proverbs encouraging group behaviour through TFT and TFTT mechanisms, I would expect to see the use of such proverbs in the PM of all six countries used in this study.

Behaviour E: Conformism

"When in Rome do as the Romans do"

Conformism is how 'social norms' are enforced. Group norm behaviour is encouraged through actively promoting conformist behaviour in the group and is enforced through cheat deterrence and punishment of anti-social behaviour (Heinrich & Boyd, 1998; Cremene & Cremene, 2021). TFT strategies have also been shown to play a part in conformist behaviour (Dong et al., 2015). This overlay and complex nature of behaviours will be discussed later as it can obfuscate findings. However, it is generally accepted that conformism is associated with reducing risk for the individual within a group or for 'normative influence' to increase the likelihood that group members will accept an individual (Deutsch & Gerard, 1955). An interesting game theory experiment examined conformism in social dilemmas (Dong et al., 2015). The experiment used a repeating prisoner's dilemma (PD) game and used the repeated *m*-person public goods game (PGG) based on a set of conforming strategies. The results from the experiment show that conformists "choose the average strategy of the other players in their group." Results from the research also concurs with the theory that TFT strategies are essential for the emergence of cooperation in a non-cooperative population. The researchers found that TFT stopped non-

cooperative strategies from invading the group if a critical value of rounds was played. **Proverb examples:** examples of conformist proverbs include "*United we stand, divided we fall*," and "*When in Rome, do as the Romans do*," and "*Don't rock the boat*."

Expected outcome: conformism is likely to be a strong signal as the behaviour is used to establish cooperation within a group; it should, therefore, be seen at high levels across the proverbs of all the PMs of the six countries. The Matti Kuusi database of proverbs should reflect these results with similarly high levels of proverbs that encourage conformism.

Behaviour F: Reputation enhancement

"You are judged by your actions not intentions"

A good reputation can precede an individual, setting up the dynamics within a group for positive influence on the behaviour of others that can encourage cooperation within a group. In a modern context, this type of reputational influence or "signalling" is used to great effect on social media; for example, "social media influencers" are instrumental in encouraging others to make decisions based on their perceived reputation alone. The success of influencer marketing is evidenced by the value of the industry, which was worth around $16.4 billion in 2022.[6]

Many studies have examined the importance of reputation in group cooperation (Nowak & Sigmund, 1998; Fu et al., 2007; Gallo & Yan, 2015; Gross & De Dreu, 2019; Schmid et al., 2021). One study into the effect of reputation on behaviour in group cooperation used rumours as a reputational marker (Nakamaru & Kawata, 2004). The paper defines *rumours* as spreading or

[6] Statistica, Influencer marketing market size worldwide from 2016 to 2022: https://www.statista.com/statistics/1092819/global-influencer-market-size/

starting a reputation; the paper also explores the use of rumours in cheat detection. The researchers developed classes of people who created and spread rumours: ADVISOR, LIAR, HONEST, and GOOD. The results show that an ADVISOR could use rumours to stop a LIAR (a population of dishonest players) from exploiting co-operators. This linking of behaviours, and influence of one behaviour on another, is an important point to note as it can cause an impact on interpretation of results, the distinction between behaviours being fuzzified. This will be discussed later.

Conversely, in a 2005 paper by Suzuki and Akiyama, the researchers used social dilemmas to explore the effect of reputation on groups of varying sizes; the researchers concluded they could not "perfectly explain the formation and maintenance of cooperation in large communities solely by the effect of reputation," and that frequency of cooperation decreases with increasing group size.

Proverb examples: examples of proverbs that reflect the importance of reputation include "*A good name is better than a precious ointment*." and "*You are judged by your actions not intentions*."

Expected outcome: proverbs promoting the importance of reputation are expected to be found within the PM cohort. However, in this study the PMs reflect an entire country, but cannot be associated with specific group type or size. To understand the influence of proverbs promoting reputation within a group, the group size and type, e.g., work-based, political group, etc., should ideally be considered. This is outside the remit of this study. Instead, a generalised view of reputation-based proverbs will be carried out at the country level, with no granularity to reflect group size. However, a study that used pro-reputation proverbs within different group sizes and types would make an interesting separate study.

Behaviour G: Nepotism

"Blood is thicker than water"

Human kinship brings an "axiom of amity," i.e., you can rely on kin to help you out in times of need (Fortes, 1969; Maynard Smith, 1964). Associated with kinship is nepotism, a behaviour that promotes positive outcomes, such as providing jobs and resources based on relatedness or close kinship. (Mateo, J., 2002) Thus, nepotism can be said to be connected by genetic relatedness through kin selection. It is worth noting that some researchers give a robust argument for the existence of group nepotism, even though group nepotism is acknowledged as complicated by ingroup and distantly related individuals. (Jones, 2000). Jones discusses three models of group nepotism and states that "selection favours genes that lead individuals to imitate common behaviours." Jones concludes:

> "*In all models of group nepotism, some group members collectively impose costs on themselves to provide benefits for others, even when there are no return benefits in the offing."*

This study will not include group nepotism, except as intrinsically captured in some of the behaviours such as Pay it Forward and Altruistic Punishment.

Proverb examples: some proverbs encouraging nepotism include "*Charity begins at home*."

Expected outcome: signals of nepotism in proverbs should exist, but at a lower frequency than proverbs with TFT and conformism signals. While Jones highlighted TFT and conformism in the paper on group nepotism, it should be noted that nepotism is complicated by a larger group size.

Behaviour H: Pay it Forward

"Kindness begets kindness"

Pay it Forward describes a behaviour whereby acts of kindness are passed to others down the line; "I help you; you help someone else." Importantly, Pay it Forward is a recognised behaviour that drives indirect reciprocity (Watanabe et al., 2014).

The conditions for paying it forward were explored in research that looked at the intersection of paying it forward alongside greed and equality; the researchers conducted five experiments to see if these variables impact paying it forward. The results of the experiments concluded that being treated fairly from the outset was more likely to result in Pay it Forward behaviour. However, notably, the Pay it Forward behaviour was not necessarily equitable (Gray et al., 2014).

A study on Pay it Forward vs rewarding reputation found that positive emotions and mood motivated reciBarnts to Pay it Forward. The study was carried out in a workplace environment, which may be analogous to non-kin group cooperation. The study also concluded that conversely, rewarding reputation was driven by "self-interest and strategic action."

> "*Contrary to expectations, we found that the mechanism of paying it forward had stronger and more lasting effects than the mechanism of rewarding reputation"* (Baker et al., 2014).

Baker et al., noted that other studies concurred with this finding, pointing out similar work on positive emotions, mood, and prosocial behaviour (Bartlett & DeSteno, 2006; DeSteno et al., 2010; Fredrickson & Cohn, 2008; McCullough et al., 2008; Sheldon & Lyubomirsky 2006).

Proverb examples: some examples of proverbs that encourage pay it forward behaviour include "*Kindness begets kindness," "One good turn deserves another,"* and *"You reap what you sow."*

Expected outcome: in non-kin groups, proverbs encouraging Pay it Forward behaviour would be expected to be seen at high levels in a PM. However, the complicated environmental conditions that belie behaviour that encourages this complex mechanism of kindness to others may obfuscate the results.

Behaviour I: Altruistic punishment

Altruistic punishment concerns individuals agreeing to pay a cost to punish non-co-operators. Metering out punishment on behalf of other individuals who have been mistreated, even when the punisher has no chance of benefiting via reciprocity or benefits to kin (Quervain et al., 2004) forms the mechanism behind altruistic punishment. Quervain et al. studied the basic mechanisms of altruistic punishment. The study concludes:

> *'Our results support recently developed social preference models, which assume that people have a preference for punishing norm violations and illuminate the proximate mechanism behind evolutionary models of altruistic punishment.*'

Altruistic punishment differs from cheat deterrence in that it encourages an individual to take on a cost, at their own expense, for the group's good. Whereas cheat deterrence tries to stop cheating behaviour before it happens, altruistic punishment deals with cheating behaviour after it has occurred; both can act to encourage prosocial behaviour and prevent theft and similar anti-social behaviours from occurring.

It is noted that during this study, and in general, understanding the subtleties of altruistic punishment can be tricky; it was noticeable that few proverbs were attributed to altruistic

punishment. This could be due to the difficulty in interpreting the behaviour itself or could be simply that proverbs are often precognitive in nature, pre-empting behaviours. Altruistic punishment is based on real-time response to a wrongdoing. It may be that proverbs are more adapted to behaviours such as honesty and cheat deterrence to prevent the need for altruistic punishment.

Proverb examples: *"The walls have ears"* is an example used to encourage altruistic punishment, the proverb suggesting that if you do something wrong, the general populace will be watching and listening, in readiness to respond with punishment.

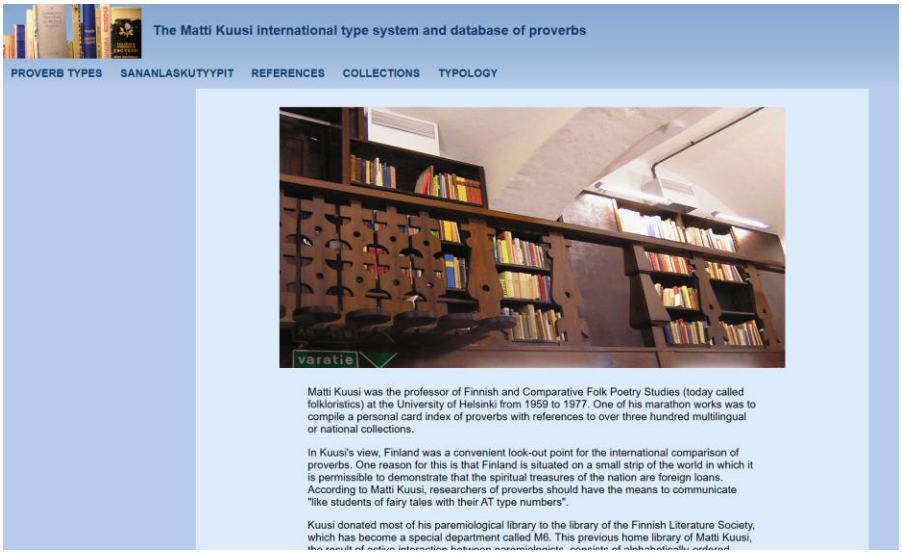
Expected outcome: a study found evidence for the maintenance of cooperation only if altruistic punishment conditions are favourable with a low cost for the punisher with a high impact on the punished (Martijn & Arno, 2008). I expect to see proverbs that reflect altruistic punishment increase in frequency under certain conditions. To test this out, Google nGram analysis of proverb data under conditions, such as war, may provide an insight.

5. Methodology: Study streams

The three streams are stand-alone. However, each contributes to the goal of this project, building up a picture of the part that proverbs play in encouraging behaviours within a geographic region, individual country, or during a time of extreme conflict.

The three study streams are as follows:

5.1 Stream one: The Matti Kuusi database



The proverb data derived from the Matti Kuusi database will be used to explore cross-cultural patterns of behaviour across six regions of the world.

The Matti Kuusi database (MKDB) was compiled by Professor Kuusi who specialised in Finnish and Comparative Folk Poetry Studies at the University of Helsinki. The MKDB contains around 8,300 proverbs from across the world.[7] The database is a systematic index of global proverbs and

[7] Sources of proverbs in the Matti database Kuusi: Proverb sources

was developed to help in proverbial explorations and research and defines and reflects the themes and structures of proverbs and linking these proverbs to geographic locations.

As described by Outi Lauhakangas, Matti Kuusi began with the premise that "*Every proverb and proverbial phrase is a sign of a certain situation or a certain relationship between objects."* (Lauhakangas, 2001)

The database uses a system of classification to group the proverbs as well as link a proverb to a geographical location. Within the MKDB, each proverb is classified and linked to a geographic area(s) the proverb is found within a classification structure:

1. Main division
2. Subdivision
3. Subbranch

For example:

The practical knowledge of nature/NATURAL ELEMENTS/A1a water and fire as natural elements

Geographic areas identified in the MKDB

G = global type (e.g. EAIO)

F = Finnish or other related Baltic sea cultures

E = European in general

En = Northern Europe

Ew = Western Europe including North and Latin America

Es = Southern Europe

Ee = Eastern Europe

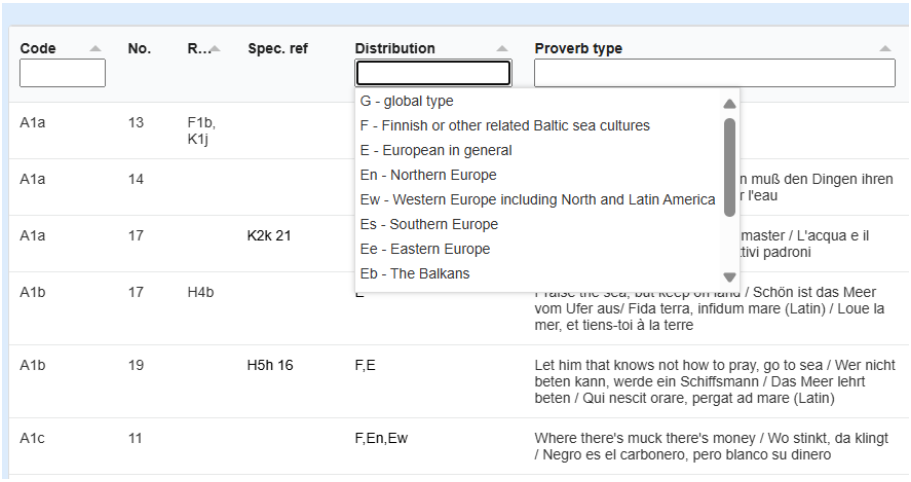
Eb = The Balkans

A = Sub-Saharan Africa

I = Islamic cultures

O = older Asiatic (Orient) cultures

P = The Pacific area



The MKDB provided a rich source of proverbs. Proverbs were chosen from this corpus that fitted the criteria for encouraging behaviour. Each proverb was manually associated with an evolutionary mechanism of group cooperation, and one or more of the nine behaviours was associated with the proverb. The logic for sourcing proverbs from the MKDB for inclusion in the data analysis began by referring to the classification system used by Matti Kuusi. This classification system is extensive and covers many areas. A strategy that I used to work through the over 8,000 proverbs was to:

1. Take a proverb isolated from the PM of a country and find it in the MKDB.

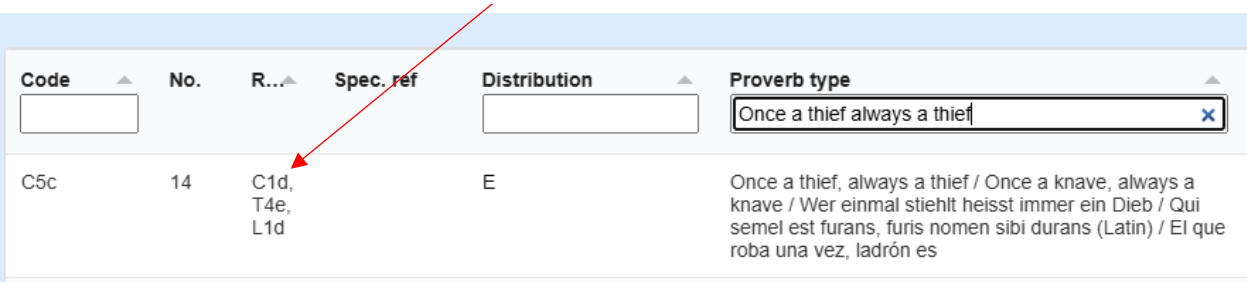
2. Enter this proverb into the search field of the MKDB
3. Once found, I then used the classification of that proverb to check all other proverbs that came under that class.
4. If a proverb within that class fitted the criteria for inclusion as a proverb fitting one or more of the behaviours, then it was included.
5. The proverb was then associated with one or more of the nine behaviours.

An example of this methodology is shown below:

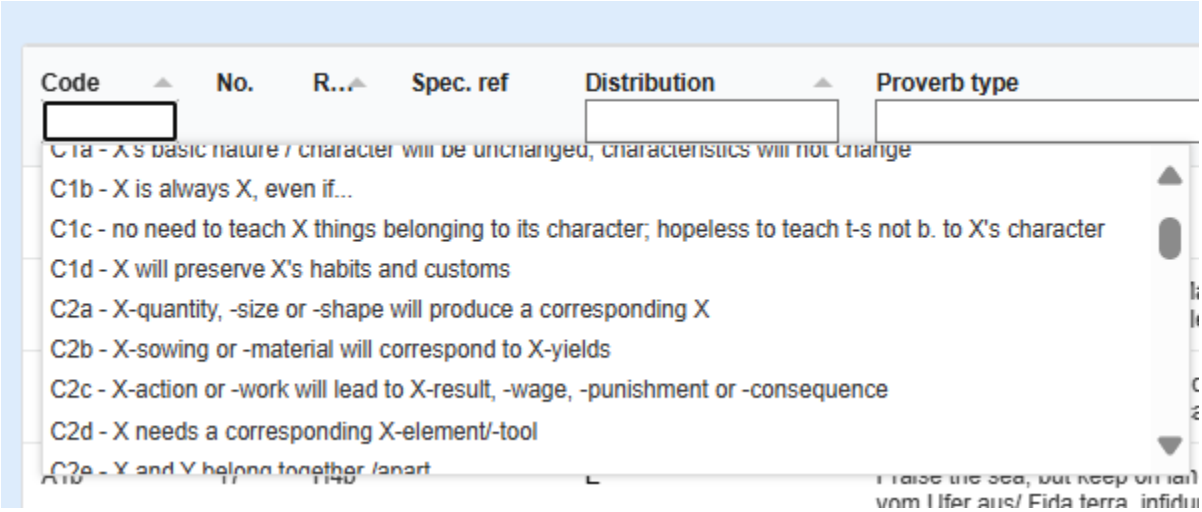
1. Proverb identified using the USA PM: “Once a thief always a thief.”
2. The proverb was entered into the search field of the MKDB to ensure it was included.
3. The topology code(s) that were applied to “Once a thief always a thief” by Matti Kuusi were identified, for example:
    a. C1d X's basic nature / character will be unchanged; characteristics will not change.
4. A search was then carried out for all other proverbs under this class. This produced a list of proverbs under this same classification, for example:
    - Nature draws more than ten oxen
    - Fair words and foul deeds
    - Better to be than to seem good
    - Great minds think alike
    - He that serves a community is controlled by everyone, rewarded by none
    - They are welcome that bring a present

Association of a known proverb from a PM

Typology code for proverb



Pick the code from the drop down list and look up all proverbs that come under the typology code for that associated proverb



Using this system, I was able to isolate **125 proverbs** that displayed evidence of one or more of the nine behaviours used in this study.

Stream one methodology and proverb analysis

The Matti Kuusi Database (MKDB) and associated classification system were used to map proverbs to evolutionary mechanisms and behaviours. The proverb data were split into six global areas of proverb distribution as covered by the MKDB. These included proverbs assigned as being 'global' in distribution. The areas covered by the data are:

- Global
- Older Asiatic
- Sub-Saharan
- Islamic Cultures
- Wider Europe
- Finnish + Baltic Sea

The methodology to identify proverbs that matched behaviours followed these steps:

1. Using the MKDB classification system, a class associated with group cooperative behaviour and evolutionary mechanisms was identified. Initial identification of proverb classes that fitted the evolutionary context of this study was achieved by using proverbs from the PM of the six countries that showed clear evolutionary context; for example, "Honesty is the best policy" from the USA PM is a clear indicator of the social norm of honesty. This proverb was entered into the MKDB, and the class related to this proverb was identified. All proverbs within this class were then checked to see if they fit the remit of association with behaviours.
2. The MKDB was searched to find all proverbs associated with behaviour using this method.
3. Each proverb within this class was either added to the list of included proverbs or excluded as outside the remit of the five mechanisms/nine behaviours.
4. Each included proverb was listed in a spreadsheet, and one or more of the nine behaviours.

5. Using the map of evolutionary mechanisms cross-referenced to behaviours, one or more of the five evolutionary mechanisms were associated with the proverb.
6. These behaviours and evolutionary mechanisms associated with each proverb were tabulated. (See Table 1)
7. This was repeated for proverbs representing the list of geographic areas.
8. These results were used to generate graphs to display behaviours and evolutionary mechanisms within each geographic location.

Stream one data analysis

Visual analysis was performed by generating bar charts, showing the relative frequencies of the following across the six regions:

- Five evolutionary mechanisms
- Nine behaviours

Using these relative frequencies, a visual analysis was performed on the data for the two data sets. The analysis allowed the identification of any obvious outlier regions.

5.2 Stream two: The Paremiological Minimum

Stream two proverb data was derived from the Paremiological Minimum of six countries will be used to explore cross-cultural patterns of behaviour across these six countries.

The Paremiological Minimum (PM) is based on the idea that certain proverbs are more commonly known than others. The idea of a set of proverbs known by most people in a society has a long history. "…the Paremiological Minimum, a set of core proverbs that a full member of society should know" (Mieder, 2004, 2008).

The notion of a Paremiological minimum was first proposed as a tool to understand the widespread nature of proverbs in a culture by Grigorij Permjakov, who described a PM as "the minimum composition of proverbs and other stable sayings known to all native speakers of the Russian language" (Permjakov, 1973). Studies that explore the relative popularity of proverbs in a culture look to define an empirical list of the most frequently used/commonly known proverbs. The result is known as the Paremiological Minimum (PM) of a given country or region; this provides a list of the most well-known proverbs in society, often also showing the frequency of use; this PM forms the basic idioms of speech, adjusted to, and overlaid by, cultural references a PM, therefore, offers an insight into the proverbs used in each society and how these proverbs are used in that society, e.g., to encourage/reward/admonish certain types of behaviour. It is the Paremiological Minimum of six countries that will form the data source for analysis in this project. It is worth noting that not every country has a PM.

This study uses the PM of six countries to find signals of certain behaviours associated with evolutionary mechanisms of group cooperation.

For the purposes of this study, the proverbs for analysis were chosen using the Paremiological Minimum (PM) from the following six countries:[8]

- Slovenia (Meterc, 2016)
- Czech Republic (Čermák 2003)
- USA (Haas, 2008)

[8] The PMs were identified through research of available literature, cultural projects, and linguistic research projects.

- Spain (Centro Virtual Cervantes website)
- Somalia (Kapchits, 2002)
- North Korea (Leece, 2009)

PM availability and study timing were the two factors in country choice. For example, the UK does not have a dataset capturing the paremiological minimum at the time of writing. I also attempted to choose PMs from as wide a spread of countries as possible, to have examples from Africa, USA, Asia, and southern and central Europe.

What is a paremiological minimum and how is it calculated?

Proverbs are used widely within most cultures and throughout history. Studies that explore the relative popularity of proverbs in culture look to define an empirical list of the most frequently used proverbs at a point in history. The result is known as the paremiological minimum (PM) of a given country or region; Grigorij Permjakov first developed the concept of a PM in 1971. A PM provides a list of the most commonly known proverbs in society, sometimes showing the frequency of use, and can give an insight into why these proverbs are popular:

> "Thus, every adult member of a culture knows a certain number of proverbs depending on age, sex and conversational skills" (Taylor, 1985).

A paper on paremiological minimum (Durco, 2014) provides insight into how the PM originated and evolved. Durco talks about the origins of the paremiological minimum in 1931; sociologist Albig gave a group of students 30 minutes to write down all the proverbs they could remember. Since then, the study of proverbs has used several methods to capture the paremiological minimum, including the frequency of use of a given proverb in the PM; no established standard methodology is used. The United States PM used in this study uses the proverb generation test alongside a proverb familiarity test; students from four regions of the USA took the tests, which

involved writing down every proverb they could think of in twenty minutes and then answering questions on the familiarity of proverbs (a list of 315 proverbs were offered). The Slovenian PM used in this study was based on analysis using a mixed range of ages using questionaries to test respondents on the familiarity of proverbs and establishing the frequency of use.

It is worth noting for the data analysis in this study that proverb collection and presentation to text for a PM is complicated. This complexity begins with the identification of proverbs for use in tests, methods including exciting proverb dictionaries or capturing proverbs from respondents in a study. The resulting paremiological minimum may contain inaccuracies and potentially miss important proverbs that would be useful to include in this study.

Paremiological Minimum collections are assembled using a variety of techniques. An example of one such technique used to determine known proverbs is to give individuals within a cohort the beginning of a proverb and see how many can complete the proverb, e.g., “a stitch -– -– – – “ is completed as “a stitch in time saves nine.” As mentioned, it should be noted that proverbs are not set in stone and wax and wane in use and popularity over time. This is apparent when checking out the frequency of proverb use over time, using Google nGram searches.

However, the determination of a PM also comes with some issues. A paper by Grzybek and Chlosta explored the complex nature of Paremiological Minimum calculation and how the chosen corpus can impact the concepts of proverb knowledge and proverb familiarity. The study provides a method of empirical analysis in determining the Paremiological Minimum (Grzybek & Chlosta, 2009). Therefore, this project cannot guarantee that the PMs used will be accurate, but they give an insight into popular proverbs used in a country. Several Paremiological Minimum analyses have been carried out to minimise potential inaccuracies using the PM from six countries.

Proverb translation and variance within the PM of the six countries

Five of the PMs identified were in the native language of the country. For purposes of this study, as it is written in English, as English is the only language I speak fluently, I translated the proverbs into English using one of two methods:

- Using an Excel plug-in translator[9] - Slovenia, Spanish, Czech Republic
- Translation performed by paper authors – Somalia, North Korea

The translation was sometimes imperfect, and a degree of interpretation was needed. For example, the Spanish translation of '*La mona se vista de seda, mona se queda'* translates literally to '*A monkey may dress in silk but remains a monkey*.' However, this phrase can be interpreted as the familiar English proverb *"You can't put lipstick on a pig'*. Also, proverbs can present variations that can confound the development of a PM. For example, '*You can't get blood from a stone'* has a variant '*You can't get blood from a turnip'* (Grzybek & Chlosta, 1995).[10] Similarly, there may be dialectic or cultural versions of familiar proverbs, for example, in the UK "*Shy bairns get nowt*" is a northeast England version of '*If you don't ask, you don't get*.' These nuanced differences in interpretation were noted as I worked through the proverb collections; I often had to turn to online forums to work out the meanings of some proverbs.[11] However, the

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[9] Translate My Sheet V52, Joey Bronner

[10] A degree of common sense and general knowledge of proverbs was used to interpret some of the proverbs translated into English.

[11] I used a variety of Spanish language forums to try and find meanings for some of the more difficult-to-interpret Spanish proverbs. Examples of forums and websites used include Antimoon (https://www.antimoon.com/forum/t6720.htm) and LawlessSpanish (https://www.lawlessspanish.com/expressions/proverbs/)

papers that presented PMs of Somalia and Korea went some way to attempt to provide meanings for the proverbs.

It is important to stress that a degree of interpretation of proverbs was required; this was especially the case with the Matti Kuusi database as a proverb corpus, as the proverbs were interpretations of non-English language proverbs, and so an element of 'lost in translation' is to be expected.

Analogous proverbs were also a feature of the study. Some examples of analogous proverbs and interpretations include:

- 'Honesty is the best policy' is analogous to 'You've cried wolf too many times' and 'he who takes a lot ends up with little' and 'Honesty is not treated with empty hands' and 'A promise is a promise.'
- 'Blood is thicker than water' is analogous to 'Blood is not water.'
- 'United we stand divided we fall' is analogous to 'all for one, and one for all' and 'If people support each other, they do not fall'
- 'Modesty is a beautiful virtue' is analogous to 'Stop blowing your own trumpet! 'and 'Gains are shameless.'
- 'Do unto others as you would do unto yourself' is analogous to 'He who digs a pit for others falls into it himself' and 'Do not trust he who gossips with you about others' and 'he who takes a lot ends up with little'

The fundamental basis of the research was to identify proverbs associated with the nine behaviours. Selection bias was inherent in this choice, although attempts to minimise this bias were attempted by cross-referencing PM proverbs against the Matti Kuusi database classification system. However, the Matti Kuusi database will have selection bias inherent in this classification

system design. The classification system was not designed to reflect evolutionary tenets, and so a lack of tight-fit cross-referencing will also compound errors woven in from selection bias.

Stream two methodology and proverb analysis

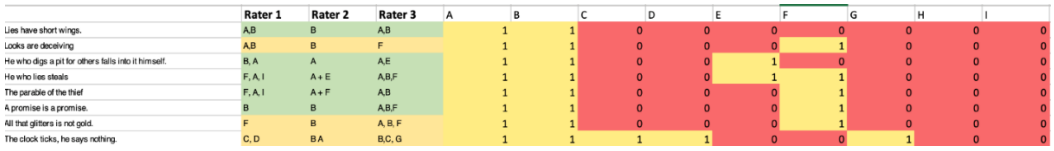
The proverbs isolated from the PMs of the six countries were analysed and linked to specific behaviours as seen through the lens of evolutionary group cooperation.

Each chosen proverb was assigned:

1. One or more mechanisms of group cooperation
2. One or more associated behaviours linked to the mechanisms[12]
3. Two raters repeated step two above.
4. The behaviours associated with the proverbs from each of the raters were tabulated and used to generate graphs to display the results.
5. Because there were often multiple behaviours associated with a proverb, and because of variations between the three raters, the results were expanded in the spreadsheet showing 1 for presence of the behaviour and 0 if no presence of a behaviour was found.

[12] Beneficiaries of these behaviours were identified to help validate the behaviour choices.

The image below shows an example of how the results were tabulated to build a picture of the common behaviours across the proverbial data.



	Rater 1	Rater 2	Rater 3	A	B	C	D	E	F	G	H	I
Lies have short wings.	A,B	B	A,B	1	1	0	0	0	0	0	0	0
Looks are deceiving	A,B	B	F	1	1	0	0	0	1	0	0	0
He who digs a pit for others falls into it himself.	B, A	A	A,E	1	1	0	0	1	0	0	0	0
He who lies steals	F, A, I	A + E	A,B,F	1	1	0	0	1	1	0	0	0
The parable of the thief	F, A, I	A + F	A,B	1	1	0	0	0	1	0	0	0
A promise is a promise.	B	B	A,B,F	1	1	0	0	0	1	0	0	0
All that glitters is not gold.	F	B	A, B, F	1	1	0	0	0	1	0	0	0
The clock ticks, he says nothing.	C, D	B A	B,C, G	1	1	1	1	0	0	1	0	0

Image 1: Snapshot showing proverbs with assigned behaviours

Stream two data analysis

The six countries were mapped to each of the nine behaviours, on a per behaviour (single variable) per worksheet basis. A contingency table was generated for each behaviour A to I,

And each table imported into SPSS to run a Chi-square test of independence on a per behaviour basis.

The results were then used to assess the likelihood that the null hypothesis can be rejected, and that an behaviour is found at consistent frequencies across countries.

	V1	Yes	No	total
1	Slovenia	32	17	49
2	CR	17	15	32
3	USA	31	17	48
4	Somalia	32	12	44
5	Spain	26	15	41
6	Korea	18	10	28

Image 2: Contingency table example: behaviour A

The tabulated data presented a list of one or more behaviours mapped to each proverb.

Bar charts were generated using these data. The charts offered an at-a-glance view of the most common group behaviours influenced by the PM proverbs. The bar charts were:

used to:

1. Identify any commonalties in terms of appearance of certain proverb types in the six countries?
2. Do some behaviours, as associated with certain proverb types show a higher frequency of occurrence in a paremiological minimum data set?

Chi-squared test for independence was used to test each of the nine behaviours across each country to identify any consistency in the behaviours.

The use of T-Test and ANOVA (analysis of variance) methods of analysis were rejected for use in this study as they require two or more means, respectively. In this case, the use of statistical means to calculate the variance between coders was not appropriate. So instead, all the results from each rater, for each proverb, were included. This resulted in the contingency table, that captured multiple behaviours for each proverb; multiple behaviours attributed to proverbs is highly probably because of the often mixed interpretations of proverb meaning and interpretation. This table was used to provide the raw data for a chi-squared analysis.

5.3 Stream three: nGram temporal analysis

Various studies have explored the idea that times of inter-group conflict and competition have promoted the development of prosocial tendencies (Bernhard, Fischbacher, & Fehr, 2006;, Richerson. P., et al, 2014; Turchin 2016). Looking at the origins of strong reciprocity, Kaplan et al, capture this in the following statement:

> "…group level characteristics that enhance group selection pressures—such as relatively small group size, limited migration, or frequent intergroup conflicts—coevolved with cooperative behaviors." (Kaplan, et al., 2005)

To explore the idea that proverbs may influence prosocial behaviour during times of conflict, data from the six PMs and the MKDB were used to populate Google nGrams to explore the temporal frequency of behaviour-modifying proverbs during World War Two and over time.

The data used for each of the streams was generated from the association of behaviour(s) with "proverbs with an evolutionary association" (PEAs). This approach allows the capture of 'data in the wild' as an alternative to game theory models normally used to identify behaviours.

Google nGrams, a publicly available search engine, to establish frequency during times of conflict. Google nGrams[13] is an analytical tool that uses deep mining algorithms. The algorithms use search words/phrases of up to five words to deep mine through a corpus of printed literature within a specified time; time periods can be chosen from any year between 1800-2022. Specifically, this project explored if there is a relationship between the influence of a given proverb to mapped behaviour/evolutionary mechanism in developing cooperative behaviour under given conditions, e.g., times of conflict.

A full list of proverbs was isolated, based on the nGram limitations, and used to provide a corpus of testable proverbs. These sets of proverbs were used as the search criteria to evaluate the relative frequency of each proverb, in the nGram corpus, over time.

Both search engines are used to explore if the behaviours identified in this study show any variation during times of conflict. For example, is there evidence for that specific behaviours are found at a higher frequency of use in proverbs over specific time periods, such as during wartime?

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[13] https://books.google.com/ngrams/info

Choice of proverbs for stream three

In terms of the application of the two data sources used in Stream three, the choice of the proverb was constrained by those proverbs that could be located using the nGram search. For the purposes of this analysis, the English language was used; however, in future analysis, other languages could also be used, including Spanish.

Analysis of the data focused on five core areas:

1. Frequency of behaviours across regions or countries (based on MKDB and PM data): Frequency was visualised using Bar charts.
2. Frequency of evolutionary mechanisms across regions (MKDB data). Frequency was visualised using Bar charts and a Radar chart.
3. Existence of any outliers in the data (MKDB and PM data) using a visual analysis.
4. Consistency in the behaviours across the six countries (PM data). Chi-squared test for independence
5. Temporal frequency of behaviours (MKDB and PM data). Performed using Google nGram analysis.

nGram accuracy and limitations

nGram is a Errors: Google's Books nGram has had several criticisms around accuracy:

- Semantic scanning errors such as ***s*** and ***f*** looking similar.
- The impact of research into linguistic evolution with the increasing inclusion of scientific and academic texts into the corpus, which may thereby impact the frequency of certain terms.
- Prolithic authors skewing the results. (Pechenick, 2015)

Five word limit: Google Books nGram mining is based on N=5. This requires truncation of a proverb of longer than five letters. This may return inaccuracies in the results. To avoid this, I will use proverbs that are either of five words or less or proverbs that still hold their meaning once truncated to five words.

Popularity: the general popularity of a proverb may make it difficult to do accurate comparisons against less popular proverbs. This is an important distinction, as popularity can come about for many reasons, including the use of proverbs in popular songs.

Book corpus bias: a 2015 study into socio-cultural and evolutionary linguistic inferences made using the Google Books corpus found that there was an unbiased sampling of publications. The book data used in nGram analysis was shown to be dominated by "scientific publications rather than popular works." This would have an impact of proverb frequency, as scientific publications are less likely than literature to use common language idiosyncrasies like idioms and proverbs. (Pechenick, et al., 2015)

Post-2000 reliability: the current nGram corpus covers the period between 1800-2022. An issue that may occur post 2020, is the inclusion of AI generated content, including books. The inclusion of content created using AI could potentially impact the frequency of proverb use, giving an artificial result of the importance of a particular proverb. AI-generated books are based on training models, like "Book3" that includes 191,000 human-authorised, pirated ebooks.[14] Post 2020 nGram results may be sullied by a rising number of AI-generated content, not just books, but articles and other content. As Google's nGram training corpora is obfuscated, researchers

[14] https://www.theatlantic.com/technology/archive/2023/08/books3-ai-meta-llama-pirated-books/675063/

cannot rely on the data for reliability or even accuracy. This specific potential dirtying of nGram data is one to be aware of.

nGram search analysis, time vs. frequency

Proverbs identified in streams one and two formed the basis of stream three analyses.

Stream three explores the potential historical events influence of proverbs on behaviour. Proverb frequency was used to establish if there are periods of increased use of specific proverbs over time; and if these time periods coincided with world events. This stream was used to explore some of the research that links conflict to the establishment of social norms (Richerson. P., et al, 2014); social norms being linked to language and culture, with work by Tomassello and Henrich & Boyd and on conformism and social learning being indicative of the association between certain group behaviours and mechanisms of social transmission – proxy for proverbs (Henrich & Boyd 1998; Tomasello, 2014).

The following proverbs were isolated for use in frequency analysis using Google nGram graphAPI. The choice was based on the criterion established for nGram accuracy, e.g., five word limit; also, that a chosen proverb was seen in at least two of the PMs, as a means to avoid outlier proverbs, after all "One swallow does not make a summer"; and, to cover the nine behaviours (A-I).

A: cheat deterrence

B: Honesty

C: Tit for tat (TFT)

D: Tit for two tats (TFTT)

E: Conformism

F: Reputation

G: Nepotism

H: Pay it forward

I: Altruistic punishment

Proverbs from the PM of the six countries

Proverb	**Behaviours**
One bad apple spoils the barrel (Korean, USA)	A,B,E,F
Walls have ears (Slovene, Czech, Spanish, USA, Korean)	A,E, I
Revenge is sweet (Slovene, Spanish, USA)	A,C, I
Once a thief (Slovene, Spanish, USA)	A,B,F
An eye for an eye… (Slovene, Czech, Spanish)	A,C,D, I
Truth will out (Somali, USA)	A,B
Honesty is the best policy (Somali, USA)	A,B,F
All that glitters is not gold (Slovene, Czech, USA)	A,B,F
Do unto others as you would do unto yourself (all expect Korea)	B,C,D,H
One swallow does not make a summer (Slovene, Czech, Spanish, USA)	A,C,D,E,H

Two heads are better than one (Slovene, USA)	C,F,H
Don’t bite the hand that feeds you (USA, Somalia, Spanish)	A,B,D, E, G
When in Rome… (Czech, Spanish, USA)	E
Birds of a feather… (All except Slovene)	C,D,E,G
Silence is golden ((Slovene, Czech, Spanish)	E
Modesty is a beautiful virtue (Slovene, Czech, Somalia)	E
It's good to have friends in high places (Spanish, Korean)	F, G
What’s goose for the gander… (Somali, Korean, USA)	B,C,E,G
The apple doesn't fall far from the tree (Slovene, Czech)	A,C,F,G
Like father, like son (mother, daughter) (Slovene, Czech, USA, Korean)	C,D,G
Blood is thicker than water (Slovene, USA, Korean)	C,D,G
All for one, and one for all (Slovene, Czech, USA, Somalia)	A,C,D,E,H
As you sow, shall you reap (Slovene, Spanish, Korean)	A,B,C,D,H
Friend in need (Czech, USA)	D,H

The list of proverbs was broken up into two sets to derive two lots of data for nGram analysis. By providing two datasets, it was hoped to help reduce any inaccuracies inherent in a single data set.

Proverb set one:

Proverb	Behaviour proverbs represents
Walls have ears	Cheat deterrence
Honesty is the best policy	Honesty
An eye for an eye…	TFT
Do unto others as you…	TFTT
When in Rome	Conformity
…friends in high places	Reputation
Like father, like son	Nepotism
…reap what you sow	Pay it Forward
Revenge is sweet.[15]	Altruistic punishment

Proverb set two:

Proverb	Behaviour proverbs represents
One bad apple spoils…	Cheat deterrence
Once a thief…	Honesty
One swallow does not make…	TFT
Don't bite the hand…	TFTT

[15] Note that Google nGram limits the number of characters; to incorporate proverbs that represented all nine behaviours I had to spilt the set up into two.

Silence is golden	Conformity
…friends in high places	Reputation
Blood is thicker than water	Nepotism
All for one and one…	Pay it Forward
End justifies the means.[16]	Altruistic punishment

Proverbs from the MKDB

A similar process to the one carried out to pick proverbs from the paremiological minimum of the six countries was carried out using the MKDB. This generated another set of proverbs from a different source.

Proverb	**Behaviour proverbs represents**
Once a thief always a thief,	Cheat deterrence
Honesty is the best policy	Honesty
No man is an island	TFT
Honey catches more flies than	TFTT
One for all and all for one	Conformity
Honour to whom honour is due	Reputation
Blood is thicker than water	Nepotism
As you sow you shall…	Pay it Forward
As you make your bed	Altruistic punishment

[16] Note that Google nGram limits the number of characters; to incorporate proverbs that represented all nine behaviours I had to spilt the set up into two.

5.4 Independent reviews

Independent coders were recruited to look at stream two's subset of the six countries' proverbs and to control subjectivity. The coders were knowledgeable on behaviour and so able to code each of the proverbs from the six countries by associating one or more behaviours with each. This coded set of behaviours generated the data needed to identify patterns across cultures that reflected social norms and behaviour.

Each reviewer went through the proverbs and associated one or more behaviours as they saw fit. The USA was chosen as the first sub-set of proverbs as these proverbs were likely more familiar to the two British coders recruited; this would allow the coders to understand the process. The coders then completed reviews of the PMs of the other five countries.

Coders were given an instruction document and a spreadsheet with the proverbs of interest to help in learning how the coding process worked. The proverb list was sanitised to remove the author's associated behaviours so as not to bias the opinion of the coders. (See Appendix 3 for coder instructions).

Once this process was complete, the spreadsheet showed each instance of an associated behaviour as a '1'. These listed behaviours were used for statistical analysis.

Proverb interpretation of meaning and inter-rater bias

Some proverbs proved challenging to interpret. An example of the varying interpretive views of a proverb provides a glimpse into how difficult it can be to have a coherent view of a proverb's meaning; for example, none of the three raters agreed on the underlying meaning of the proverb, "Two heads are better than one." The results below, show the behaviours attributed to this proverb from the three raters:

Rater 1: E

Rater 2: G

Rater 3: C, F, H

However, complete non-agreement between raters was rare, with only four instances in the Slovenia PM, two in the Czech Republic PM, and one in the USA PM. Raters found agreement on at least one behaviour across all the proverbs in Somalia, Spain and Korea.

5.5 Testing Inter-Rater Reliability (IRR)

An initial attempt used statistical methods to examine the inter-rater reliability (IRR) between the three raters. However, issues arose when attempting to analyse IRR: several tests have been developed to determine IRR; percentage agreement is the most basic but was not used in this assessment because it needs to account for chance agreement and can, therefore, overestimate the level of agreement. Also, multiple issues interpreting proverbs and behaviours could add to the coding. As mentioned, a proverb's meaning can be debatable, have mixed meanings, or at least open to interpretation. In addition, some proverbs may seem to mean one thing, but when the back story of a proverb is known, the true meaning becomes clear. For example, "*Beware of Greeks bearing gifts*" originates from the story about the Trojan Horse. The online Dictionary.com definition is:

"Do not trust enemies who bring you presents — they could very well be playing a trick." The saying is adapted from the words of Laocoon in the story of the Trojan Horse."

Without knowing the proverb's origin, it is easy to mistake the true meaning.

Interpretation issues and other interpretation variances, such as life experiences, age, and cultural views, could add bias and error to the interpretation. Therefore, statistical analysis of the coder reviews in this study is unlikely to offer confidence.

In addition, the nine behaviours used in the study add a degree of uncertainty to the coding method because of potential overlap and 'fuzziness' in interpretation. For example, cheat punishment and honesty could be part of the same fuzzy set describing general dishonest behaviour. Indeed, the coded proverbs from the PM for the USA include 13 of the 48 proverbs being coded for behaviours encouraging **both** cheat punishment and honesty.

This potential for the use of fuzzy set theory in interpretation means that codifying the proverbs using the behaviour definitions could be open to variance in interpretation.[17]

Because of this, calculating IRR is not as simple as defining the number of agreements or disagreements over the coding of proverbs and behaviours. The often mixed choices in behaviour encouraged/discouraged by proverbs adds a layer of complexity to determining the level of coder agreement.

Because of these issues, statistical methods such as Fleiss Kappa, traditionally used for IRR calculation, were assessed for application but rejected for the above reasons. Instead, using the Chi-square test of independence, the assigned behaviours across all three raters were used to determine the frequency of specified proverb types in the population.

[17] See section 9.1 on potential further work using fuzzy set theory

5.6 Criteria for exclusion of proverbs used in the study

The paremiological minimum (PM) lists of proverbs from the six countries involved in this study contained 150-303 proverbs per country. However, not all the proverbs could be assigned any of the cooperative behaviours identified in this study. For example, in the PM for the USA, the proverb "*easier said than done*" was excluded, as this proverb was not associated with any of the identified cooperative behaviours: As such, proverbs were excluded on the grounds they did not reflect the behaviours as outlined in this study. The result was a sub-set of proverbs for each country, with each aligning to one or more of the cooperative behaviours.

The criterion for excluding proverbs also used the Matti Kuusi database of the proverbs classification system to add weight to the decision to exclude: the Matti Kuusi DB is an established proverb corpus, classifying each proverb according to a classification typology.[18] Many of the MKDB proverb classes were unrelated to evolutionary tenets, for example the following class:

> Concepts of morality / PRIDE:HUMILITY, BOASTING : LOSS OF HONOR / F2a self-esteem, pursuit of honour -- loss of honour

Did not fit the remit of an evolutionary mechanism and associated behaviour(s). Therefore, any proverbs that could be found under this class were excluded. An example from the USA PM is:

"*Practice makes perfect*," which falls under the class:

Coping and learning/EXPERIENCE/PRACTICE/LEARNING/ M9a lessons learned from experience, life and travel

[18] For the full list of Matti Kuusi proverb typology classes, see: https://www.mattikuusiproverbtypology.fi/typology/

This classification model was used as a cross-reference against a random sample of ten excluded proverbs from each PM. For example, a proverb from the Spanish PM, "*many are called, but few are chosen,*" could (potentially) be interpreted as being associated with "reputation," however, the Matti Kuusi classification system defines this proverb within the class of "D1C" meaning:

The world and human life/PLURALITY OF THE WORLD AND HUMAN LIFE/D1c natural differences between phenomena / individuals

Therefore, this proverb and similar were deemed to be non-associative with behaviours directing group cooperation and, therefore, excluded from this study.

5.7 Issues with bias and errors

This study set out to move away from lab-based controlled experiments to test the evolution of group behaviours. Certain biases and errors were bound to slip into the study by using naturalistic data in the form of proverbs. The biases and errors recognised in this study as having a material impact on the results are shown below; attempts were made to ameliorate the inherent biases:

Bias type	**Amelioration of bias**
Selection bias: the proverbs representing the nine behaviours were chosen from the full proverbial minimum by myself. As such, there is a reasonable probability that some potential proverbs were missed from the sub-set list of PEAs (proverbs with an evolutionary association).	I attempted to reduce the impact of selection bias by cross-referencing the chosen and unchosen proverbs against the Matti Kuusi classification system. This is not without errors but offered 'another pair of eyes.' Some of the more complex concepts like "altruistic punishment" proved challenging to identify proverbs fitting the criteria for this behaviour.
Availability of sources: there were a limited number of proverbial minimum to choose from, thus limiting the available data.	The Matti Kuusi database offered a separate data source for analysis. However, the MKDB does not represent proverbs that are necessarily of a high-enough frequency in a culture as

	those listed in a proverbial minimum collection.
Knowledge and affinity bias: many proverbs are open to interpretation. There is a reasonable probability that raters would have different views on a proverb meaning that may be linked to affinity or knowledge of certain topic areas. This may be especially true with complex concepts like altruistic punishment.	Certain proverbs were difficult to interpret, especially if they were translated from a non-English language. As a rater I used a degree of interpretation and occasionally reverted to online proverb forums or the proverbial minimum papers, which offered interpretations of proverbs. The other two raters struggled with the interpretation of some proverbs and I shared some of the research via forums of their meaning. An example was “To eat the chicken and hold out a duck's drumstick.” This is a popular Korean proverb that is equivalent to the English language proverb, "honesty is the best policy." This was gleaned from the Korean paper on the paremiological minimum. Linked to affinity bias, knowledge about the back story of some proverbs may have resulted in the misunderstanding of a proverb.
Translation errors: translation of non-English proverbs to English sentences had	Non-English speaking country proverbs were translated into English. The translations used

potential for errors and bias to slip in during the translation, and subsequent interpretation of the translated text.	were either directly from a paper on the PM of one of the countries in the study or by using a digital translation tool. Both methods may have added in a degree of mistranslation. In addition, and related to affinity bias, even post-translation, the results could be difficult to interpret, this led to raters overlaying their own meaning onto the proverb. An example is the Slovenian proverb "*Vsi smo pod kožo krvavi*," which translates to the English "*We are all bloody under the skin."* This could be interpreted as the common English proverb of "*We all bleed the same colour*."

6 Results

6.1 Stream One: MKGB, proverb use across geographic regions

The behaviours and evolutionary mechanisms as associated for proverbs from each global area were analysed and graphs showing the relative frequency of each were generated. The Bar charts show some inconsistency in frequencies across the regions for many of the behaviours. The use of a Radar chart helps to focus on individual region results providing a view of behavioural signals in certain regions. For example, Islamic Cultures show a strong signal for conformism, cheat deterrence and honesty. South Saharan Africa shows strong signal for Pay it Forward, TFT, ad TFTT. Older Asiatic region show lower, but similar, skewing of cheat deterrence and conformism as the Islamic Cultures.

A: cheat deterrence

B: Honesty

C: Tit for tat (TFT)

D: Tit for two tats (TFTT)

E: Conformism

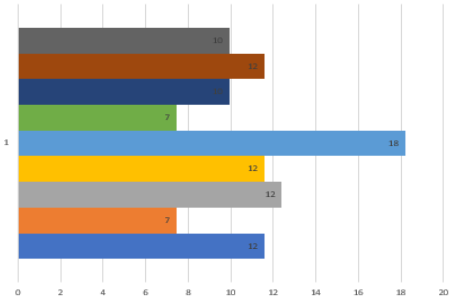
F: Reputation

G: Nepotism

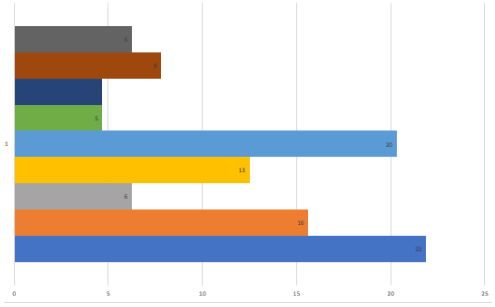
H: Pay it forward

I: Altruistic punishment

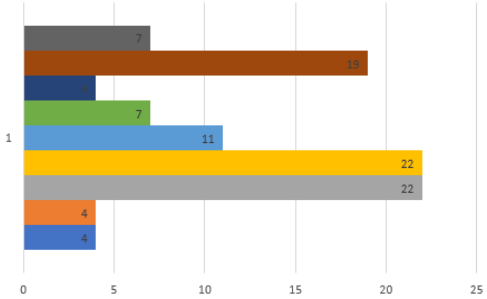
Global



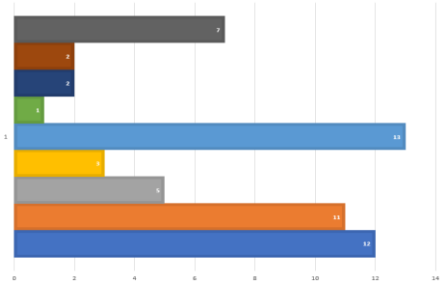
Older Asiatic



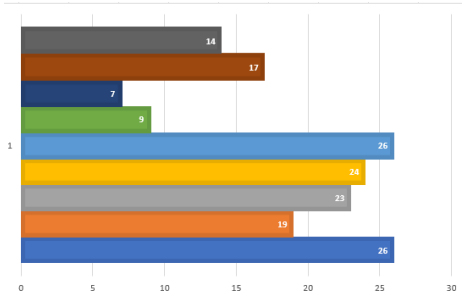
Sub-Saharan



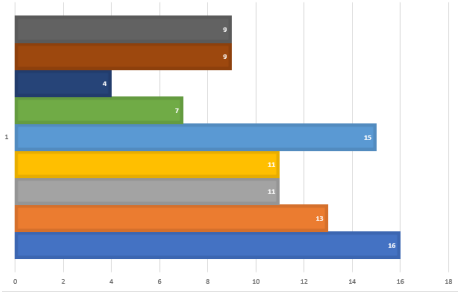
Islamic Cultures



Wider Europe



Finnish + Baltic Sea



Graph 1:Bar charts showing % frequency of each of the nine behaviours across the MKDB geographic regions.

Graph 2: Radar chart showing behaviours across the six regions

Chi-square test of independence

A contingency table capturing behaviour present was generated from the results of mapping MKDB proverbs to behaviours. The following results were obtained by running SPSS: *Analyze/Descriptive statistics/Crosstabs*:

- Run V1 vs. Yes
- Chi-square
- Observed counts
- Unstandardised residuals

The Chi-Square test of independence was performed using SPSS to assess the relationship between behaviours across the six regions.

The critical values of chi-square (right tail) table to reject or accept the null hypothesis:

The null hypothesis: the frequency of an evolutionary mechanism across the six regions does not change.

Alternate hypothesis: the frequency of an evolutionary mechanism changes across the six countries.

Behaviour A

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, degrees of freedom = 5 p = .242.

Behaviour B

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour C

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour D

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour E

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour F

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour G

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour H

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour I

The Chi-square test of independence showed that there was no significant relationship between region and behaviour. Therefore, the null hypothesis cannot be rejected, $X2 = 30.000$, $p = .224$.

6.2 Stream Two: Paremiological minimum proverbs across six countries

The data from the paremiological minimum of each country was captured in spreadsheet "Six countries PM data - full list." The captured results from the three raters were split across the table as:

1 – behaviour present

0 – behaviour absent

For each proverb from the sub-set of the PM that represents evolutionary mechanisms and behaviours.

Using these data, a chi-square test in Crosstabs of SPSS was carried out. This test was performed on each of the nine behaviours and compared across each of the six countries to identify the distribution of a single variable, i.e., a behaviour.

Statement: *Do proverbs display evidence of the nine behaviours across the six countries, and if so, do we see similar patterns of frequency across these countries?*

The null hypothesis: the frequency of a behaviour across the six countries does not change.

Alternate hypothesis: the frequency of a behaviour changes across the six countries.

Relative frequency of behaviours across each of the six countries

In addition, Bar charts and a radar chart were generated from the paremiological minimum of the six countries. This presents a visual, at-a-glance view of the variability of the nine behaviours in each country.

A: cheat deterrence

B: Honesty

C: Tit for tat (TFT)

D: Tit for two tats (TFTT)

E: Conformism

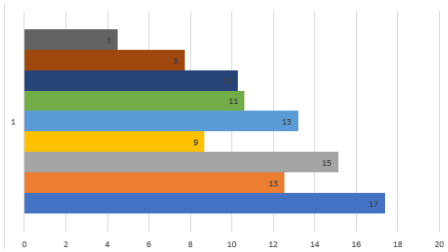
F: Reputation

G: Nepotism

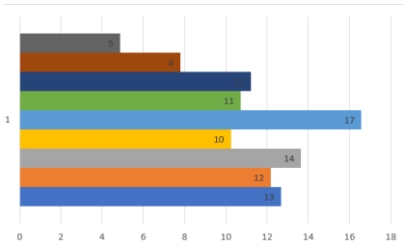
H: Pay it forward

I: Altruistic punishment

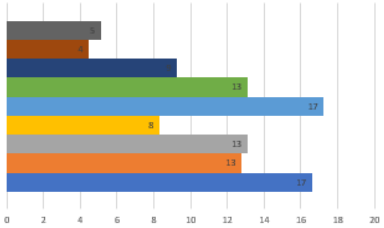
Slovenia



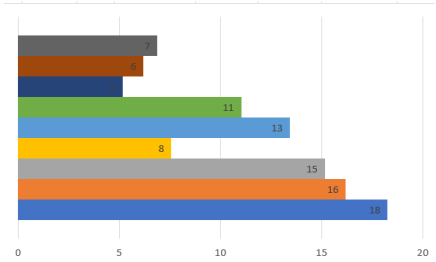
Czech Republic



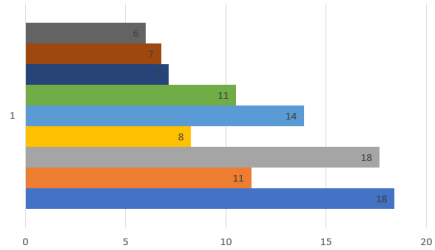
USA



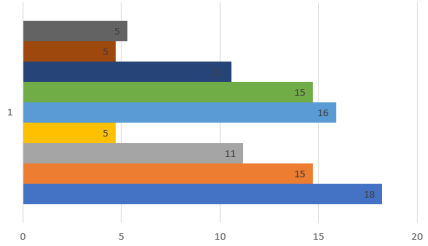
Somalia



Spain

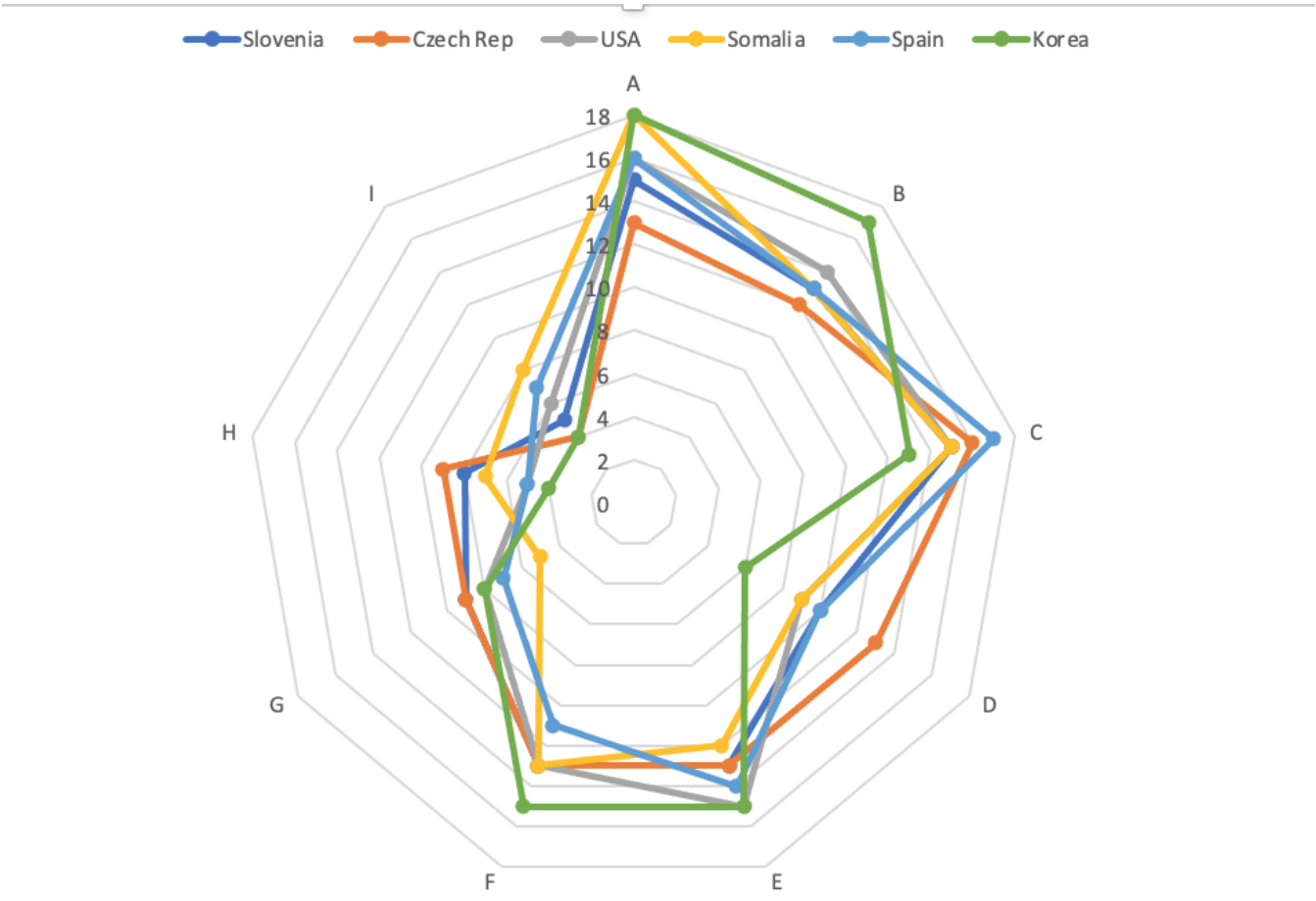


Korea



Graph 3: Bar charts showing relative frequency of proverbs related to the nine behaviours across six countries.

Radar chart showing behaviours across the six countries



Graph 4: Radar chart showing skewed frequency of the nine behaviours across the six countries

The radar chart shows a clear view of the skewing of behaviour frequencies towards higher frequency of behaviours in all countries for, cheat deterrence, honesty, TFT, Conformism, and reputation.

SPSS results: Chi-square test of independence

The following results were obtained by running SPSS: *Analyze/Descriptive statistics/Crosstabs*:

- Run V1 vs. Yes
- Chi-square
- Observed counts
- Unstandardised residuals

The Chi-Square test of independence was performed using SPSS to assess the relationship between behaviours across countries. The results were cross-referenced against a

Critical values of chi-square (right tail) table to reject or accept the null hypothesis:

The null hypothesis: the frequency of a behaviour across the six countries does not change.

Alternate hypothesis: the frequency of a behaviour changes across the six countries.

Behaviour A

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, degrees of freedom = 5 p = .242.

Behaviour B

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour C

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour D

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour E

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Behaviour F

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour G

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 18.000, p = .263.

Behaviour H

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, p = .224.

Behaviour I

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, p = .242.

Overall, all the nine behaviours show evidence of consistency of frequency of a given behaviour across the six countries.

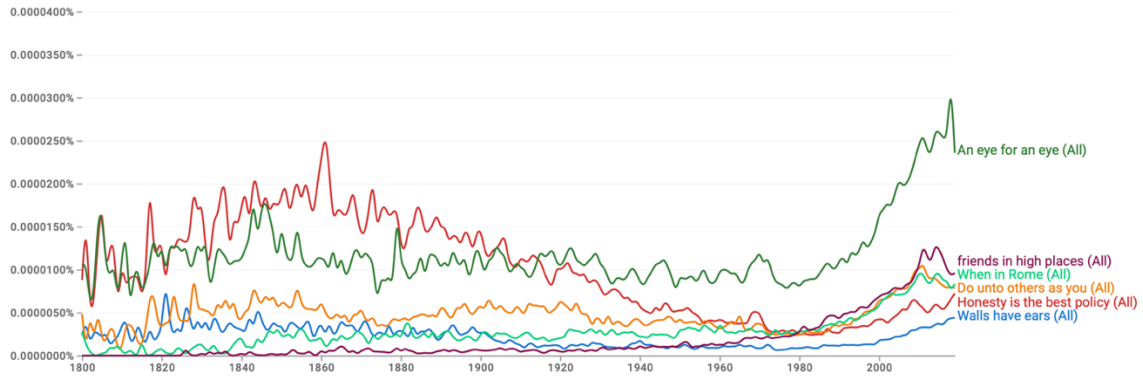
6.3 Stream Three: temporal evaluation of proverb frequency during World War Two

One interesting perspective is that proverb frequency waxes and wanes over time; proverbs come into existence and then increase and decrease in frequency over time. World and local events, such as war, economic uncertainty, and pandemics, may impact the frequency of proverb use, and this may be linked to the use of proverbs to encourage or discourage certain behaviours.

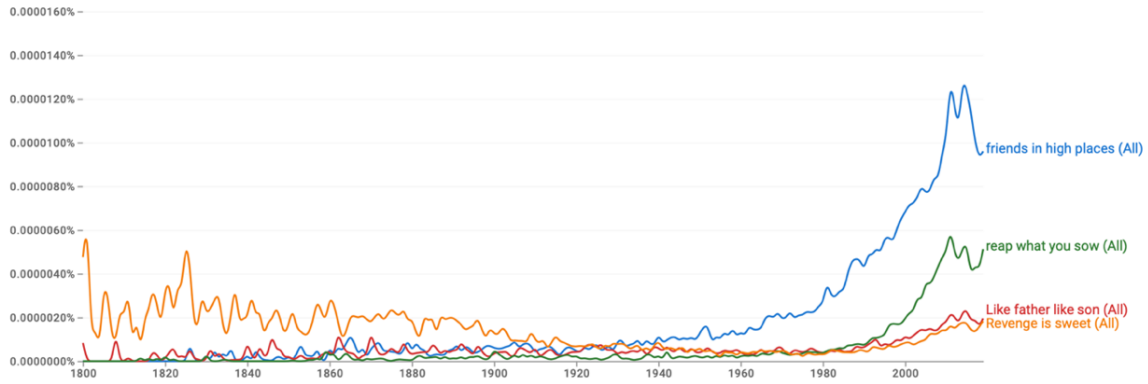
Note: "Friends in high places" is used as a baseline to connect the two graphs.[19]

[19] The meaning of "friends in high places…" is to refer to someone being given preferential treatment because they know someone who is influential or powerful.

Graphs using proverb set one (PM)[20]:



Click to see adjustable graph in Google nGram



Click to see adjustable graph in Google nGram

Graph 5: nGrams for PM proverbs set one showing frequency over time[21]

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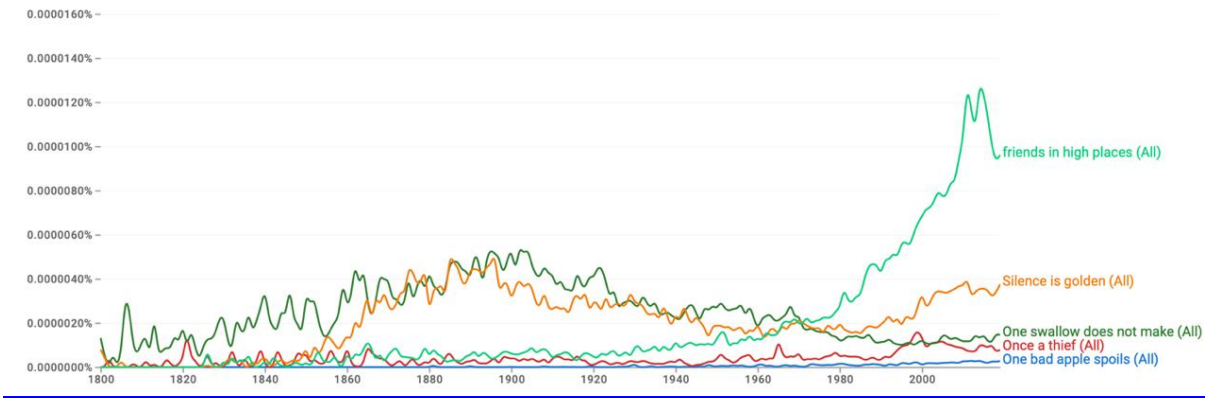
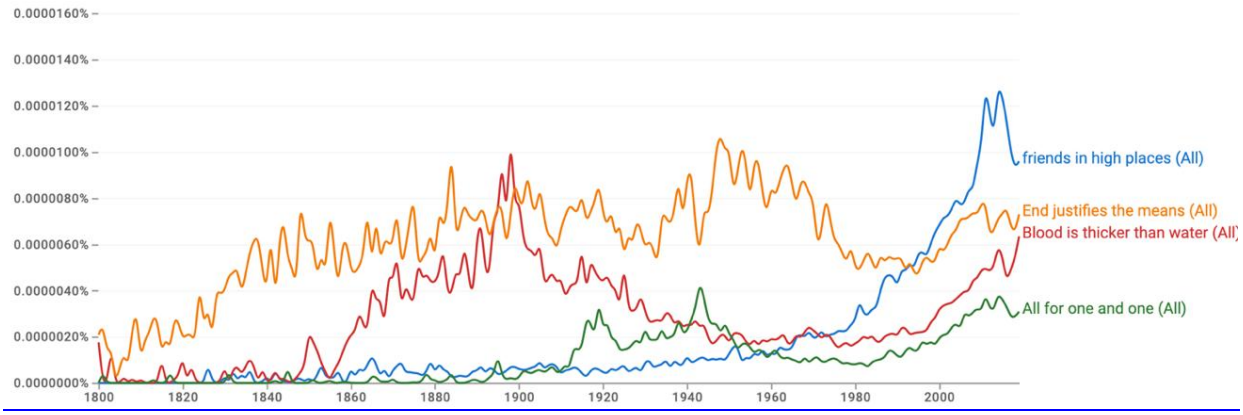
[20] "Friends in high places" is used as a baseline to connect the two graphs; Google nGram has a limit on the characters used in the search field.

[21] Note that nGram data after 2020 may be unreliable due to the input from non-human sources



[Click to see adjustable graph in Google nGram]



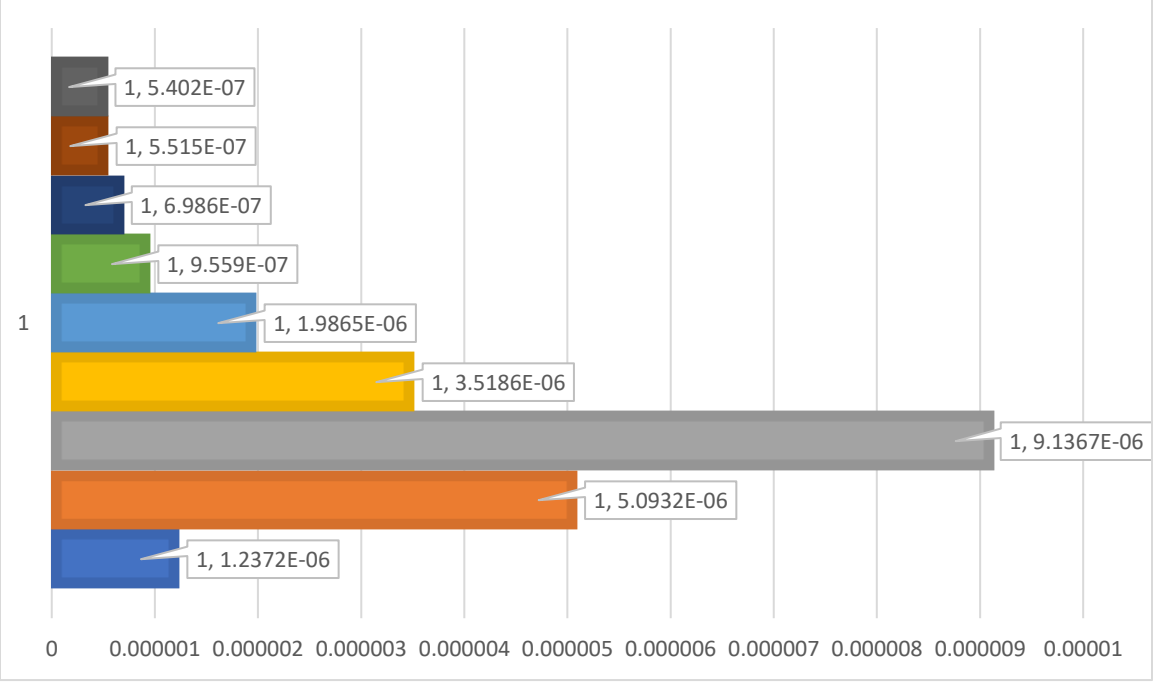
[Click to see adjustable graph in Google nGram]

Graph 6: nGrams for PM proverbs set two showing frequency over time

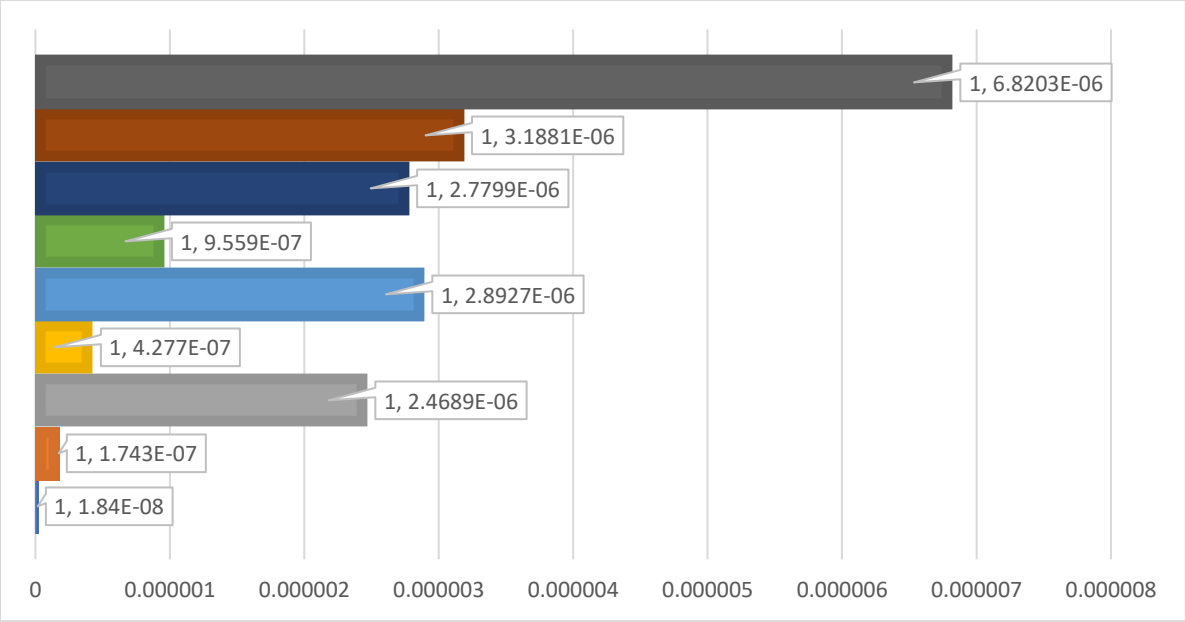
Bar charts showing relative frequency of behaviour

Using the nGram data, the relative frequencies of each type of proverb were generated; the frequencies for each proverb at the beginning of the years during WW2 (1941-1945) were used to generate a relative frequency Bar chart for each of the nine behaviours represented by the proverbs from sets one and two. The nGram frequency for each proverb was used to generate a Bar chart to show an at-a-glance view of the relative frequencies of the proverbs and associated behaviours at this time of extreme conflict around 1942/1943; two years were left between the mid-point of the war to take account of any lag in nGram data:

Set one



Set two



Graph 7: Relative frequencies of proverbs used during the height of WW2 – cumulative over the years 1941-1945

The two sets of proverbs show little if any consistency in frequencies for any of the nine behaviours. However, the signals for conformism, reputation, and TFT have strong signals in both sets of proverbs. Interestingly, set two shows a strong signal for nepotism, whereas set one has a weak signal for nepotism. This could potentially be explained by the choice of proverb to represent this behaviour:

Set one, nepotism: "Like father, like son."

Set two, nepotism: "Blood is thicker than water."

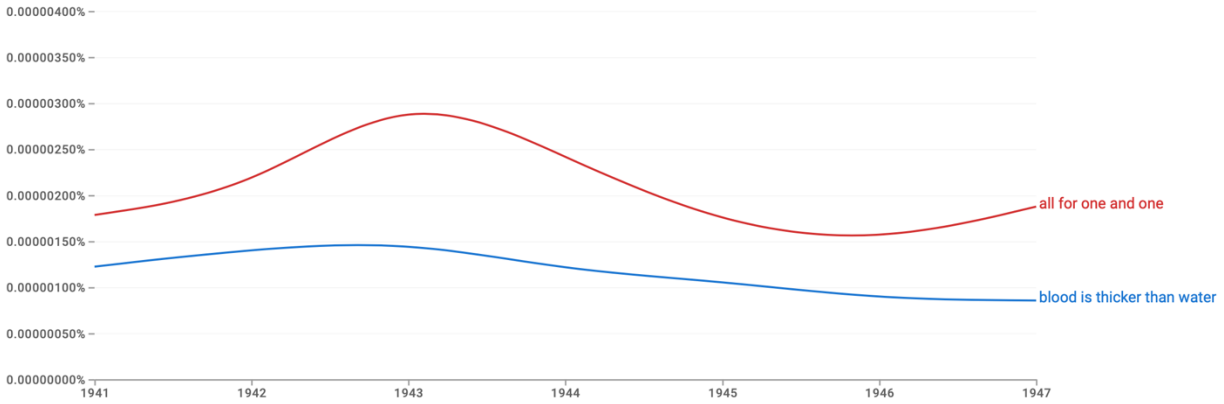
An nGram analysis of these two proverbs shows generally higher frequency across time for the proverb “Blood is thicker than water,” including during WW2. Interestingly, there was a sharp

peak around 1898 for the use of “Blood is thicker than water.” This coincides with the Spanish-American war. Other influential events in the 1890s that may impact proverb use around the time include The Wounded Knee Massacre of 1890. In the case of the former war, and the increased use of a proverb that represents nepotism, a general “brothers in arm” effect could be taking place and group nepotism in evidence. However, these events are conjectural and placed here for debate purposes. The coincidence of proverb frequency increase during times of war may be just that, coincidence. Further study that involved deeper mapping of historical events to proverb use would help elucidate this.

Analysis of proverbs using nGram

1800-2019

1941-1947



Click to see adjustable graph in Google

Graph 8: nGrams for PM proverbs set two showing frequency over time

The kin selection-favouring proverb, "Blood is thicker than water", is seen at generally higher frequency throughout the years of analysis, i.e., during WW2. However, a sudden increase in the use of the proverb "All for one and one for all", overtaking the use of "Blood is thicker,…"

occurs during WW2; a smaller spike is also noted during WW1.[22] These two spikes could be explained by the common strategy to encourage a sense of family amongst strangers during times of conflict and intra-group conflict. This type of behaviour, i.e., bonding with non-kin during times of conflict, is so well known it has its own saying, "We few, we happy few, we band of brothers." The phenomenon is also explored in the literature (Puurtinen & Mappes, 2008; Whitehouse et al., 2014).

During a time of extreme conflict, such as a war, humans must support each other within the allied groups, "

All for one and one for all" to ensure competitive advantage over non-allied groups. During WW2, for example, a meeting between Prime Minister Winston S. Churchill, President Franklin Delano Roosevelt, and General George C. Marshall in June of 1942, where the USA agreed to supply British armed forces with Sherman tanks and guns, Churchill, used the proverb "A friend in need is a friend indeed" (Mieder, 2005). Proverb use during wartime would require methods that encourage group cooperation to bond people within the group, regardless of genetic kinship. Evolutionary mechanisms including generalised reciprocity, direct and indirect reciprocity, and cultural group selection are all evident in the proverb "one for all and all for one." Group nepotism is a theory that could potentially explain why a proverb, such as "one for all...," that

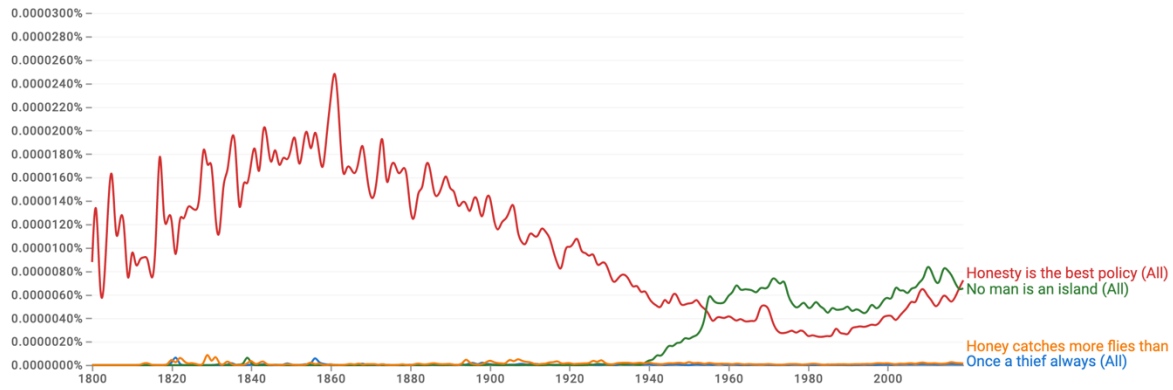
[22] Notably, there is a smaller spike around 1845, where "all for one and one for all" overtake the use of "blood is thicker than water." This date coincides with the publication of the book, "The Three Musketeers," which famously uses the line "all for one and one for all." The book was published as a serialisation between March and July 1844.

encourages an extended non-kin group to bond together, sees a sudden peak during a time of extreme inter-group conflict (Jones, 2000). A further study to elucidate and tease out group nepotism from kin-selection could be performed using a richer proverb data set.

As an interesting aside, The Journal of the King's Lancashire Military Convalescent Hospital, from 1918, lists a set of proverbs that have been bastardised to suit the context of WW1. For example, “Hun-esty is the worst policy” is clearly a play on the cheat deterrence and honesty proverb, “Honesty is the best policy.” See Appendix 4 for the full list of bastardised proverbs.

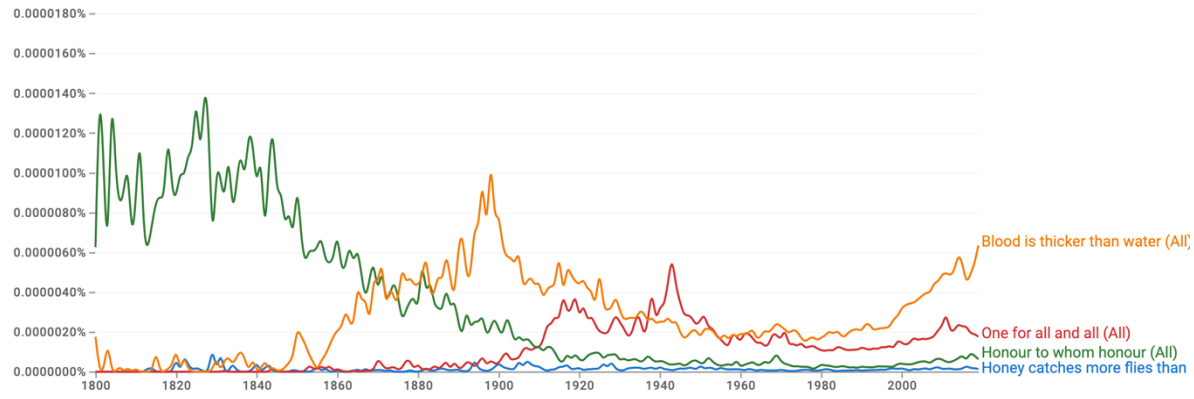
nGram analysis of proverbs from the MKDB

The same process as above was repeated using sample proverbs from the MKDB:

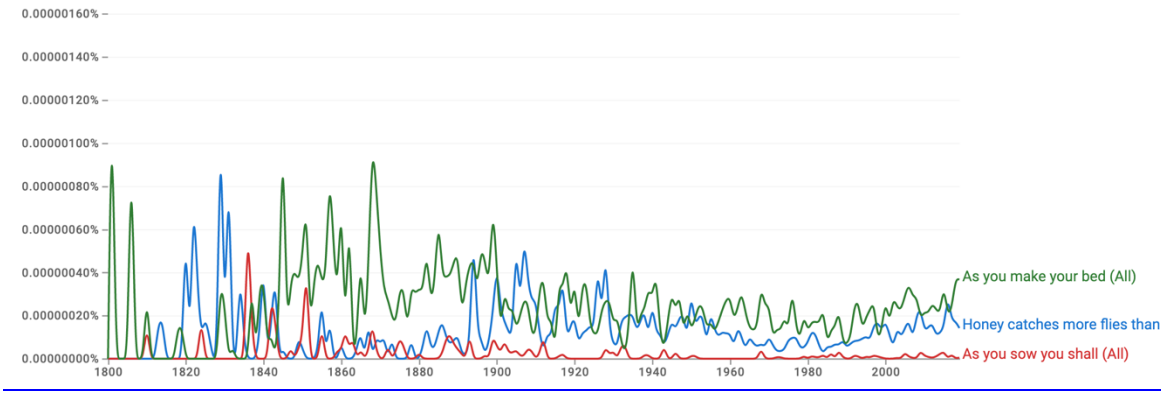


Click to see adjustable graph in Google nGram

(“honey catches more flies” is used as a baseline to connect the two graphs.)



Click to see adjustable graph in Google nGram



Click to see adjustable graph in Google nGram

Graph 9 nGrams of DKDB proverbs across time

Relative frequencies of MKDB proverbs captured for the years 1941-1945:

A: cheat deterrence

B: Honesty

C: Tit for tat (TFT)

D: Tit for two tats (TFTT)

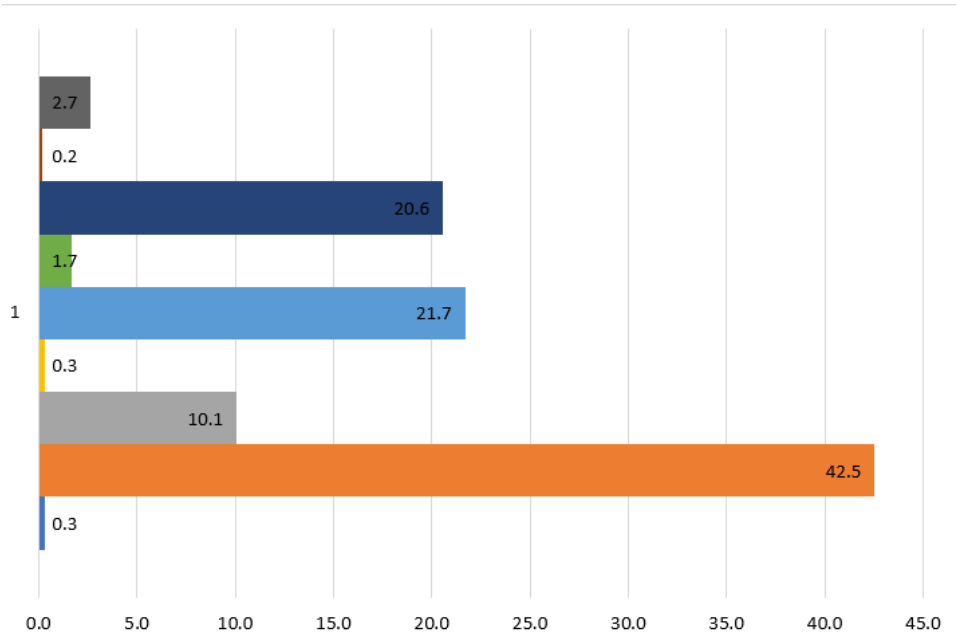
E: Conformism

F: Reputation

G: Nepotism

H: Pay it forward

I: Altruistic punishment



Graph 10: Relative frequencies of proverbs used as a total during the years 1941-1945

Honesty, conformism, and nepotism shows strong signals in the proverb data.

7 General Discussion

The Cultural Evolution Society defines culture as:

> "…as any information that is passed from one individual to another via *social learning*, rather than genetically. Social learning (aka cultural transmission) can take the form of observation and imitation, spoken or written language, or teaching."[23]

Proverbs are part of the folklore of human culture (Arewa & Dundes, 1964). People use proverbs to admonish, encourage, and direct behaviour, encouraging social norms, like being honest or waiting patiently. To date, the oldest proverb found is 3,800 years old, scribed onto a tablet from the Assyrian empire (Unseth, 2018). Proverbs are also persistent and can be found across most cultures in the world. Today, proverbs cross any cultural divide, even being used to make points on social media platforms like Instagram. For example, the popular African culture magazine "African Vibes" offers a daily proverb on Instagram under its "Wise Words" section.[24]

The use of proverbs by modern-day politicians is evidence of the widespread power attributed to these pithy statements. (Basau, 2021) Obama's speech "A New Beginning"[25] uses the proverb:

> "Do unto others as we would have them do unto us."

[23] https://culturalevolutionsociety.org/about-cultural-evolution/what-is-cultural-evolution/

[24] https://www.instagram.com/africanvibes/

[25] https://obamawhitehouse.archives.gov/issues/foreign-policy/presidents-speech-cairo-a-new-beginning

Notably, Obama was given a round of applause when he said this – perhaps showing that the proverb chimed with the audience.

However, proverbs prove a challenging way to collect real-world data. Dependency on identifying popular proverbs and their frequency of use, interpretation issues, and association with the nine behaviours added complexities to the analysis, particularly within the confines of a Masters by Research study.

This study was ambitious. Instead of taking well-worn paths that utilise controlled experiments based on game theory models, the study attempted to use 'data in the wild,' aka, proverbs. This study looked at evolutionary mechanisms and behaviours on a global level in stream one and across six countries in stream two. A third stream attempted to build a picture of possible temporal effects on proverbs during a conflict, such as WW2, to offer insight into proverb use during conflict conditions.

Three conditions helped to counterbalance the potential for bias and misinterpretation in proverb choice: Firstly, proverbs are widely used across cultures, as evidenced by the existence of the Paremiological Minimum, with many of the same proverbs (or variants) appearing in the PMs of the six countries. Secondly, the subset of proverbs from each PM was cross-checked against the Matti Kuusi database classification system – this reduced, but did not eliminate, bias. Thirdly, the proverb subsets were interpreted by two additional reviewers who were knowledgeable about behaviours. Nevertheless, certain influential and counterproductive factors must be considered as the results of this study are analysed.

Each stream came with its own challenges: Stream one used proverb data that represented broad global regions, but there was no frequency data for the proverbs; Stream two proverb data was based on frequency, but was limited to six countries. Stream three had many technical/nGram related limitations. All proverbs were open to interpretation by the three reviewers (myself included). In addition, adding Cultural Group Selection and associating conformism and altruistic punishment with this category, may have added further bias and inaccuracy in associating proverbs with behaviour(S). Consequently, the results may show general inaccuracies that are compounded by these variables. However, the results may offer some degree of insight into the relative frequency of behaviours across cultures as reflected by proverb-based social learning.

A general issue that affected the entire study was the lack of coherence across the broader research community on the underlying drivers of CGS. Smith has produced a table that highlights the areas of "disagreement or ambiguity surrounding cultural group selection (CGS) as an explanation for human cooperation." These include the foundational issue that there may be several versions of CGS to deal with, each having its own unique set of variables, e.g. differing foundational evolutionary mechanisms. A lack of coherence with regards evolutionary mechanisms adds complexity and uncertainty compounding this is lack of empirical evidence that mechanisms such as social learning strategies like conformism or norm psychology are used to create cooperation in groups. (Smith, 2020)

However, Smith highlights the importance of recognising the "distinction between cultural variation acting on cultural fitness vs cultural variation acting on biological fitness." In the case of proverbs, these pithy statements that contain group norms and general expectations of good

behaviour that benefit all levels of a group, should, if followed, help improve overall group fitness. But whether this extend to biological fitness or not, is still open to debate and dependent on conditions.

Also worth noting is that the project is built upon a foundation layer that maps behaviours to evolutionary mechanisms. This was done as a means to focus in on recognized behaviours based on research. As debates continue on the driving behaviours behind these mechanisms, the mapping made need to be updated.

It is worth noting that restrictions of time and resources in this study have meant cruder data evaluation. Indeed, the Green Beard effect or network reciprocity effects were absent from the analysis; these areas could have offered further insights into the impact of proverbs on behaviour within non-kin groups by exploring group dynamics.

7.1 Stream one discussion

Could comparable frequencies be identified using the Matti Kuusi database to explore behaviours that drive evolutionary mechanisms?

Stream one focused on the five evolutionary mechanisms associated with the nine proximate behaviours. Visualisation of the results was obtained by using a graphical analysis of frequencies of the proverbs associated with the five evolutionary mechanisms across the six geographic regions.

The Matti Kuusi database (MKDB) provided a rich source of proverb data, but one that did not specifically record the common use of a proverb in a population. There needs to be more evidence for the popularity of a proverb in the wild to make observations more precise. The MKDB does, however, place proverbs into geographic regions, so this could offer a high-level

view of worldwide proverb use and so provide a general framework for the association of evolutionary mechanisms and behaviours. A Radar chart view of the MKDB results provided a visual method to view the frequency of evolutionary mechanisms and behaviours across the six geographic regions.

Another view was provided by Bar charts generated using proverb data based on the frequencies of the proverbs associated with the five evolutionary mechanisms and the associated proximate behaviours; each region shows similar frequencies, but perhaps most interesting is that these frequencies are higher for some proverbs than others. Of the five evolutionary mechanisms, kin selection related proverbs had the lowest frequency in each region; this is interesting considering the strength of research around kin selection and Hamilton's rule as a force for cooperative behaviour in groups. Conversely, the other four evolutionary mechanisms used as a basis for this study had associated proverbs found at higher frequencies than kin selection-related proverbs (3-9%): Indirect reciprocity proverbs had frequencies of 15-21%; Generalised reciprocity proverbs occurred at 19-26%; CGS-related proverbs were found at frequencies of 21-29%; Direct reciprocity proverbs occurred at between 24-33%.

A potential reason for lower levels of nepotism and related Kin Selection behaviour noted in proverbs across the regions would be interesting to explore further. It may be that proverbs may be less important in encouraging or discouraging behaviour amongst related individuals; other forms of social transmission and norm behaviour may be at play, making proverbs less effective or unnecessary to enforce kin-selective behaviours. For example, proverbs may be more effective "at a distance" as proverbs are transmitted by both written and spoken methods – a proverb can be spoken to a large audience by an influential person or transmitted using written texts. Kin may

use proverbs. However, proverbs that instil nepotism may be at a lower frequency in the population with more direct methods promoting kin selection.

Nepotism in groups, however, may be more complicated. For example, in the Brothers Karamazov Game, whereby the relation of two brothers to a third, compounds the Hamilton coefficient from 0.5 to 0.7. Kin selection in groups is complicated by emotional bonds, trust, and indirect fitness costs and benefits. (Allen-Arave, et al., 2008)

Smith (2020) notes that biological and cultural adaptations are hard to separate when it comes to looking at mechanisms behind group cooperation. The two are often intrinsically connected in the case of several behaviors, namely reputation, reciprocity, kinship, and punishment – cultural adaptations enhancing biological fitness. He points out that "nepotism, reputation building, and other mechanisms of cooperation supported by reciprocity and inclusive fitness exist," but the degree of their impact on large-scale cooperation is not yet established.

An area that may be worth exploring is kin selection within large groups, where relatedness is not obvious and where biological ideas of kin are confused by non-kin relationships (an unrelated best friend is a daughter's aunty). This may mean that kin selection and the associated proximate mechanism, nepotism, could be expressed as "group nepotism". One of the areas that this study should have explored in more depth if time permitted, was this notion of group nepotism. The concept of group nepotism was proposed in 2000 by Jones who suggested that in groups of kin helping other related kin the "effective coefficient of relatedness can be greater than if each acts individually." The paper also points out that in larger groups it can be difficult to determine kinship; multi-level selection may develop a form of "proxy-kin" with nepotism working at the group rather than at an individual level. By adding group nepotism as an

additional behaviour, (Mateo, J., 2002) it may be possible to look more closely at proverbs that encompass nepotism at the group level or socially imposed nepotism and group solidarity, "all for one and one for all" (Jones, 2000).

Proverbs that displayed signals of direct reciprocity were closely equivalent across all the regions. CGS, as associated with conformism and altruistic punishment, showed similar frequencies in all regions except for Islamic cultures, where the frequency was higher: so there may be cultural differences in Islamic cultures concerning the interpretation of proverbs and conformist behaviour. However, stream two's paremiological minimum data sets contained no Islamic proverbs, so this cannot be cross-referenced. Further studies would benefit from finding or establishing proverb data from an Islamic country to cross-check the frequency of conformism and Pay It Forward behaviours .

Common frequencies across all regions of direct reciprocity indicate cooperative behaviours such as cheat deterrence, TFT, and TFTT. Similarly, the radar chart of behaviours for MKDB proverbs found that cheat deterrence was at a high signal for all regions except for Islamic cultures. However, the latter had a high signal for TFT and TFTT. Conformism was another behaviour at a high signal for all regions except Islamic cultures. Islamic cultures were an outlier with Pay it Forward – an behaviour associated with indirect and generalised reciprocity, at a higher signal than the other regions. This result could be an indicator of cultural differences in the use of proverbs with Islamic cultures preferring religious proverbs. Further studies would benefit from adding in data from a Paremiological Minimum of an Islamic culture.

7.2 Steam two discussion

Did the data show similar frequencies of cross-cultural behaviours?

Unlike the MKDB, stream two was based on data from the Paremiological Minimum, i.e., the most popular proverbs in the country of interest. The Chi-square results presented one of three outcomes: p=.242, .224, .263. The Chi-square tests of independence could not reject the null hypothesis that the frequency of a given behaviour is associated with a specific country. In other words, the consistency of the behaviours seen across the six countries is independent of the country. This is backed up by visualising the frequency of behaviours in the proverb data for each country using graphical methods. Cheat deterrence, honesty, TFT, conformism, and reputation are the highest frequency levels of the nine behaviours across all countries. Altruistic punishment was found at the lowest frequency levels, all raters choosing fewer numbers of proverbs to represent this behaviour. However, this may be an artefact of altruistic punishment being a confusing term for raters; the complex nature of acurate proverb interpretation made it difficult for raters to tease out meaning that relates to a behaviour that encourages altruistic punishment in large-scale non-kin groups. Future studies could focus on differences between proverbs that reflect honesty, cheat deterrence, and altruistic punishment with fuzzy set values assigned to the tripartite of behaviours.[26]

Notably, honesty was at a lower level than cheat deterrence across the six countries; this was expected, as research has shown that honesty is an evolutionary factor in smaller group sizes (Kumar et al., 2021).

Outliers

[26] See section 9.1 on further studies

In general, the Bar charts show consistency in frequency in six of the nine behaviours across the six countries, with three outliers identified in the following behaviours:

Cheat deterrence (A), the Czech Republic shows a lower frequency of proverbs associated with this behaviour.

Tit for Two Tats (D), Korea, shows a lower frequency of proverbs associated with this behaviour.

Nepotism (G), Somalia and Spain show a lower frequency of proverbs associated with this behaviour.

As to why these outliers existed, several reasons can be offered:

- All the countries identified as outliers required proverbs to be translated. Translation errors could be responsible for some or all the discrepancies.
- Cultural differences in social norms could impact the meaning of a proverb and lead to general errors in the interpretation of meaning by the three British raters in this study.
- Social norms differ across countries; while norms, such as conformism, may be a universal concept, they differ across cultures, "One man's meat is another man's poison." Norm psychology predicts differences in cultural evolutions of norms.

A study involving 33 nations, highlighted cultural differences in “tight” (strong norms with a low tolerance of deviant behaviour) and “loose” (weak social norms with a high tolerance of deviant behaviour) (Gelfand, et al., 2011). Norms can also change within groups as circumstances change, such as when conflicts arise (Bar-On and Lamm, 2023). Further to this, evidence involving the strength of social norms can be related to differences in norm violation across cultures. For example, one study found that individuals in tight cultures adhered to social norms and were more sensitive to others' violations than those in loose cultures (Mu et al., 2015). In these cases, errors in interpretation during paremiological minimum compilation would then be compounded during PM usage in this study.

Low-frequency behaviours

The visualisation of the data also shows that certain behaviours have consistently lower frequencies than others. For example, behaviours **Pay It Forward** (H) and **altruistic punishment** (I) were identified in fewer than 5-8% (median = 6.5%) and 3-7% (median = 5%) (respectively) of proverbs across the six countries using the PM data. These results may be skewed by the behaviour definition, proving complicated to define when matching to a proverb. This is evidenced by the fact that any proverb assigned as altruistic punishment was also assigned to cheat deterrence and honesty; when does altruistic punishment become cheat deterrence and vice versa? Yet again, the complex nature of proverb interpretation and the chance for misinterpretation made definitive behaviour allocation to a proverb, challenging. If there was any confusion or obfuscation of the meaning of a proverb, this interpretation and matching became even more complex and open to compound errors.

The MKDB analysis that looked at evolutionary mechanisms shows a low frequency of Kin Selection across all the regions. Interestingly, the frequency result for nepotism (behaviour associated with Kin Selection) in the PM data frequency is low, but not the lowest, across the PM of the six countries; values range from 5% to 11% with a median of 9.5%.

Returning to the earlier comment about low values of Kin Selection and the associated behaviour of nepotism, this could be because kin-biased behaviours tend to act at an individual level rather than a group level. If proverbs are a mechanism used to instil social norms, the transfer of acceptable behaviour via this mode of delivery would be expected to be optimised for broader groups, with proverbs being distributed by word of mouth and/or written texts. Kin-selected

behaviour does not need enforcement using large network transfer delivery models. Group nepotism, for example, may be better encouraged by using proverbs that define more general nepotistic acts that relate to the broader group, i.e., instead of "Like father, like son", a proverb "one for all and all for one" could be interpreted as group nepotism.

High-frequency behaviours

The top three most popular behavioural themes of proverbs were, in order of frequency:

1. **Cheat Deterrence** (A) (13-19%)
2. **Conformism** (14-17%)
3. **Tit for Tat** (11-18%)

Cheat deterrence

Deterring cheats is of fundamental importance in any group. Game theory models have long explored the dynamics of cheating vs norm behaviour at a species level. However, a study into cheat deterrence among the Shiwiar of Ecuadorian Amazonia used the Wason selection task to identify violations of group norms across cultures. The study compared the results of the Shiwiar villagers with Harvard undergraduates to look at cross-cultural variation; the results show that cheat detection was "developmentally buffered against cultural variation." (Sugiyama, Tooby & Cosmides 2002).

The Sugiyama et al. paper found that social exchange was an important aspect of defining and enforcing the "social contract" that formed the social norms of a group, with cheats violating that contract. The paper also discusses the idea of "social contract algorithms" that define the conditions for "adaptively engaging in social exchange behaviour," including the ability to detect cheats.

In this study, proverbs were associated with the precursor to cheat detection, cheat deterrence. As

proverbs are a vehicle for social learning, a proverb is used to chastise an individual for potential cheating behaviour, act as a deterrent, and pressurise individuals into following social norms and the social contract. Proverbs, as such, may be part of the framework of the developmental architecture of our species (Tooby & Cosmides, 2015).

Conformism

These result for conformism is not surprising. Studies have found that conformist behaviour strongly influences group dynamics; a seminal work by Asch in 1955 discussed how the opinions held by authorities or large groups appeared to shift the views of subjects towards the view of this authority (Asch, 1955). Since then, many studies have explored the urge to conform (Henrich & Boyd, 1998). The 1998 paper from Heinrich and Boyd focuses on how beliefs and values are transmitted within groups using social learning. Their study has an intra-group focus, offering the Amish as an example of conformism within a group setting, the lifestyle and appearance of the Amish identifying them as a coherent group. Conformist behaviour establishes group ties within specific groups, like school children and soldiers who wear uniforms to conform to and identify with a group. Conformism across the six countries concurs with studies into behaviours in groups that identify conformism as necessary in the evolution of large-scale groups (Boyd & Richerson).

While looking at relative frequencies across countries for nine behaviours, this study does not differentiate the type of conformist behaviour nor the expected expression of conformism, just that the proverbs can be associated with an expectation of conformist values.

Tit for Tat

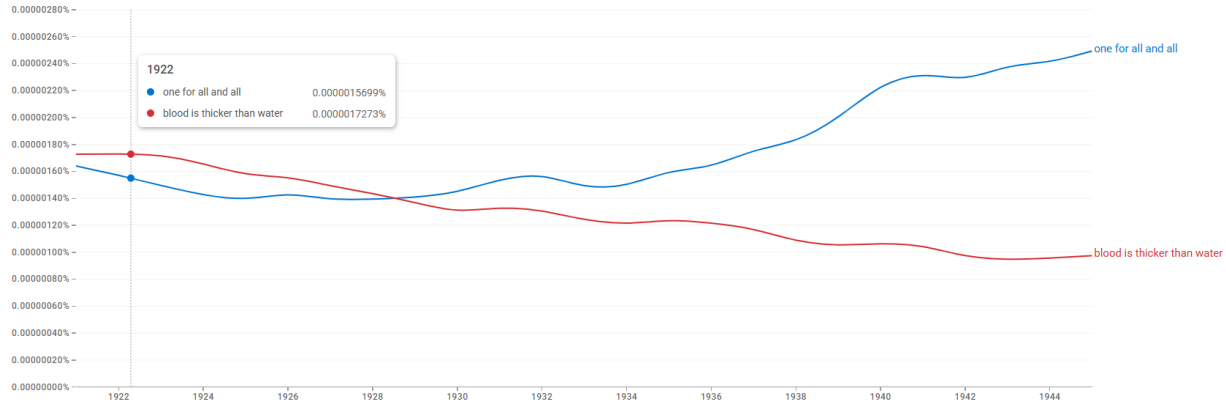
Tit for Tat (TFT) is an established behaviour that creates evolutionary stable strategies that allow groups to form and flourish (Axelrod, 1980). Unsurprisingly, TFT is observed in high

frequencies across proverbs of all the countries in this study. In concurrence with this finding is a meta-analysis study involving 6000 participants across 13 countries that explored cross-cultural differences in Prisoners Dilemma games. The study used the repeated prisoner's dilemma. The results showed "no significant difference in cooperative behaviour between individualistic and collectivistic countries when cultural norms are measured at the country level" (Rezaei, 2015).

7.3 Stream three discussion

Was there any evidence for behaviours at a higher frequency of use during a conflict?

Stream three took a different track from the previous two streams. The data was explored using temporal analysis via Google nGrams. As discussed in the methodology, this method has inherent bias, errors, and user interface constraints. However, the results did provide some insights, with spikes in popularity of a proverb representing nepotism (see graph 8) showing a higher frequency until a sudden spike in the frequency of a reciprocity proverb overtaking this as world economic events nose-dive and conflict escalates in the 1930s.



Graph 11: Google nGram of two proverbs over time

The question arises: Is this evidence that people must pull together as a broader group, acting cooperatively, and displaying reciprocal behaviours, because of the threat of war?

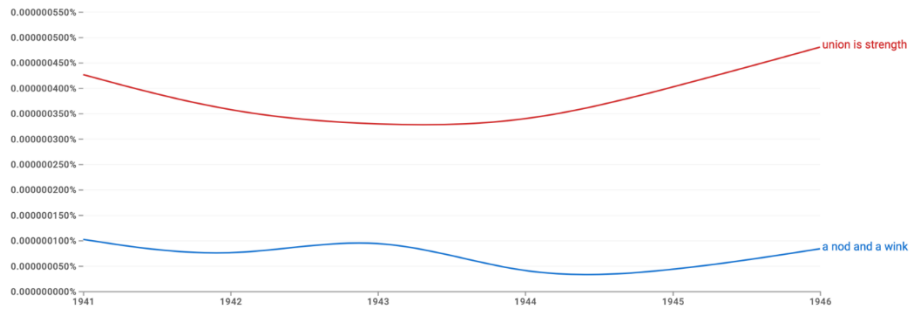
Stream three focused on 1941-1945, i.e., World War Two, to see if certain behaviours promoting group norms were at higher frequencies. The results show little correlation between proverbs representing the same behaviour. Unfortunately, the general analysis of the nine behaviours in stream three did not produce compelling results, as the two proverb streams delivered varying results regarding the frequency of proverb use/types of behaviour. The use of two sets of proverbs to cross-reference the results only highlighted the stark differences; the Bar charts of

proverb sets one and two show no visual correlation between the nine behaviours. However, there is evidence that proverbs representing the behaviours were used during WW2 at reasonable frequencies.

The use of Google nGrams has several challenges already discussed in the section "Notes on nGram accuracy." Stream three of the study has many inherent issues in analysing the proverb data. One of the most obvious is that the proverbs used to identify frequency during the war years were taken from the current paremiological minimum of the six countries, not proverbs associated explicitly with the years of interest. An ameliorating factor is that many proverbs used, while current, are also established proverbs used for decades, if not centuries. For example, a proverb in the USA PM, "virtue is its own reward," is attributed to Socrates.

As a comparison, an nGram analysis of a famous but evolutionary-neutral proverb used during the 1940s, "a nod and a wink," was performed against the proverb "Union is strength," found in the more recent PM of Slovenia and Spain.

Union is strength was chosen to represent conformity, i.e., sticking together and acting as one. The result below shows that the latter is found at a much higher frequency than a popular but evolutionary-neutral proverb.



Graph 12: nGram showing the frequency of two proverbs during WW2

Historical event impact on proverb frequency

Social events can impact proverb use, in turn, affecting a temporal exploration. Earlier in the study, an analysis of “One for all and all for one,” found a spike at the time that the book “The Three Musketeers” famed for using the proverb, was published. Another example is the proverb "one bad apple,” the nGram for this proverb seeing a sudden increase in use after The Osmonds' hit of the same name, was released in 1970. Thus, the use of "one bad apple" in a historical analysis that overlapped the early 1970s would provide an inaccurate reflection of the popularity of this proverb as an indicator of the encouragement of cheat deterrence.

7.4 General observations

The focus of this study was to explore the role that proverbs play in encouraging or discouraging behaviours, and if the frequency of those proverbs is similar across cultures? Naturalistic data in human society are often used to explore and evidence human behaviours. A 2021 paper offers examples of natural data pools used to test evolutionary hypotheses. These examples come from the archaeological record, contemporary hunter-gatherer observations, systematic observations of individuals in public places, and other sources (Fitzgerald & Thompson, 2021). One of the examples is the social learning of children in modern-day hunter-gatherer tribes, citing that children learn from kin and non-kin in the tribe. The paper points out the shortcomings and issues with using real-world data; the same bias and confounding factors mentioned in the study, such as variable control, were found in this study. For example, the fact that the behaviours show similar frequency levels across countries does not exclude population-level differences in how those behaviours are exhibited.

By looking at the evidence collated from proverb data, the study hoped to explore if humans use proverbs across cultures to encourage or discourage certain types of behaviour that reflect the social norms of groups (Phillips, et al., 2011). The three streams generated some answers in

finding commonality in proverbs representing behaviours, particularly conformism, TFT, and cheat deterrence; however, the array of biases and errors must be considered.

Using naturalistic data, in this case proverbs, was challenging, and biases were a central component of this challenge: interpretation bias was possibly the most confounding element in the study. However, allowing the three raters to associate more than one behaviour with a proverb helped to reduce this bias by facilitating flexibility in interpretation; after all, behaviours comprise a Venn of behavioural elements, an example being altruistic punishment and cheat deterrence, which resulted in some overlap when choosing behaviours to match proverbs; although found at a lower frequency than cheat deterrence, proverbs associated with altruistic punishment always overlapped with those associated with cheat deterrence. Then again, allowing the association of multiple behaviours added further complexity when it came to analysis – which is the dominant behaviour?

The qualitative and complex nature of naturalistic signals was a challenge in this study. To ameliorate this, three raters analysed and qualified proverb-behaviour associations. Other methods include cross-referencing the Matti Kuusi database classification system with the paremiological minimum of the six countries. Creating data from the proverbs that reflected behaviours has broad potential in studying human cooperation. This natural laboratory can offer us a temporal and current view of how human beings use linguistic vehicles to encourage or discourage behaviours that work at the group level. However, methods to reduce interpretation bias are essential.

8.Further discussion

The behaviours we use to interact with each other have an evolutionary origin, including within non-kin groups (Boyd & Richerson, 1988; Fehr & Fischbacher, 2004; Nowak, 2006; Silk & House, 2016). A group of altruistic, peaceful, and productive individuals is more likely to increase the chance of reproduction of the individuals within the group (Trivers, 1971; Denton, 2022). However, proverbs used to encourage expected behaviours may be obfuscated by the interplay between universal and culturally specific, non-mutually exclusive behavioural patterns (Smith et al., 2006). This study has found evidence in proverb data that points to universal behavioural patterns; the paremiological minimum of the six countries shows the commonality of behaviours that belie the cultural conditions of the region. As mapped to proverb type frequency, certain behaviours are more common than others and persist across countries: for example, all six countries show a lower frequency of nepotism, pay it forward, and altruistic punishment than other behaviours; all six countries show higher frequencies of cheat deterrence, TFT, and conformism. However, these behaviours, whilst universal, may reflect different social norms at the cultural level. For example, the proverb "Walls have ears" is found in five of the six countries and "All for one, and one for all" is found in four of the six countries, demonstrating universality of this proverb. However, the specific social norms driving the behaviours reflected in the proverbs may vary at the country level.

Group size plays a part in the effectiveness of social norms; optimising conditions to allow a group to thrive becomes increasingly difficult as group size increases (Boyd & Richerson, 1988.) Social cues, such as proverbs, provide a mechanism to enforce such behaviours by encouraging social norms without resorting to force or violence. For example, proverbs may be a handy way to provide punishment without metering out dangerous actions that would impact group

membership. Boyd and Richerson call some forms of enforcement of punishment of noncooperators "retribution". For example, they list acts such as noncooperators targeted by negative gossip. The paper suggests that an evolutionary stable strategy for the evolution of group cooperation can come about from "moralistic strategies" (Boyd & Richerson, 1992); proverbs may be one form of "moralistic strategy."

As easy-to-remember snippets of knowledge and advice, proverbs can be easily communicated around a group; a 2020 study into intergenerational proverb transmission found that proverbs used oral and digital means to pass on proverbial wisdom – the choice of which medium was age-dependent (Amojo, 2020). Whatever method is used to transmit a proverb, the persistence and popularity of proverbs across cultures is a testament to the success of this little packet of wisdom.

The behaviour-modifying potential of proverbs is more complex than this study could deal with. Blurring the boundaries of proverb–behaviour mapping is that behaviours are more of a continuum than distinct entities; honesty and cheat deterrence could be seen as two sides of the same coin. Conformist behaviour, for example, may differ in essence between groups but still be about conforming to a social norm: Brexiters and Remainers are distinct groups with different ideologies, but both use proverbs and idioms to encourage conformance with a specific political view.

This project explored using proverbs to encourage and enforce certain behavioural norms. At a high level, the proverbs demonstrate signals for all nine behaviours, as mapped to the five evolutionary mechanisms. However, a detailed exploration of behaviour signals and proverbs would elicit more precise data.

8.1 Overlapping and inter-connected nature of behaviour

This study used categorical variables to make the research tractable. However, there are limitations to this approach. Categorical values, such as behaviour, can be challenging to interpret. When analysing the proverbs for behaviour best fit, assigning a yes or no to the presence of a behaviour may compound inaccuracies and generate errors in the results by adding in assumptive bias; the frequencies are linked per behaviour to each proverb. However, at least some of the nine behaviours are not distinct, thus compounding the complex nature of the data used to generate results. For example, honesty and cheat deterrence may overlap – an honest behaviour signal may also have a degree of cheat deterrence signalling. Also, behaviours may be cumulative or connected. For example, conformism and cheat deterrence, as well as honesty and cheat deterrence, can be considered linked; both act symbiotically to adjust and encourage certain behaviours that help to evolve cooperative groups, making that group more successful by encouraging (enforcing) social norms. In other words, norms are not separate entities but interactive or at least on a spectrum.

Alexrod defines a norm as:

> “A norm exists in a given social setting to the extent that individuals usually act in a certain way and are often punished when seen not to be acting in this way.” (Axelrod, 1986)

Proverbs may be open to interpretation for a reason – they are required to act as a tool of encouragement, or even a control method, across large, often complex groups of kin and non-kin; proverbs may need to be multi-faceted, aka "fuzzy-by-nature," to be an effective communication tool.

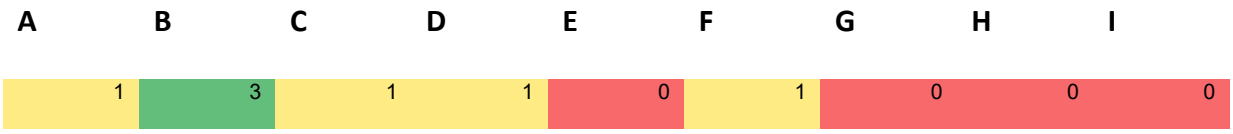
Further studies using proverbial data need to capture the interpretation overlap and inter-connected nature of proverb meaning. However, an attempt was made to minimise this effect by allowing the three raters to choose more than one behaviour when assessing each proverb for behaviour fit. For example, the Slovenian proverb "The clock ticks, he says nothing" saw raters assign A, B, C, D, and G (cheat deterrence, honesty, Tit for Tat, Tit for Two Tats, and nepotism.) These results were then used as data to feed a Chi-square analysis and to generate Bar charts based on the overall frequency of behaviours. The Chi-square results cannot confirm without doubt that the nine behaviours are at a similar frequency across each country, but the null hypothesis was not rejected. However, each of the nine behaviours can be seen in the data at varying frequencies. The Bar charts give an at-a-glance view of the relative frequencies of the nine behaviours on a per-country behaviour. The data shows that certain behaviours have stronger signals than others.

9.Suggestions for further work

9.1 Fuzzy hypothesis testing

The study of group behaviour is one of system analysis. Behaviours are not distinct entities; one behaviour may be intrinsically linked to another. Behaviours like altruistic punishment, cheat deterrence, honesty, and TFT may require similar proverb mechanisms to encourage or discourage behaviour. For example, the proverb, "An eye for an eye, a tooth for a tooth", was associated with all these behaviours by the three raters. Conventional statistical models may need to be more flexible to take account of the multi-variate, 'fuzzy' nature of proverbs and behaviour.

For future research, it is recommended that proverbs are classified into fuzzy sets that reflect the degree of membership of a set; for example, the proverb: "Trust but verify" had the following behaviours assigned to it by the three raters:



Each behaviour A to I would be assigned a fuzzy set with a value of 0 to 1; this would generate fuzzy sets representing each behaviour.

The results would then allow each proverb to be assigned a fuzzy value using the rater results. In the above example, the fuzzy value for Trust but verify would be assigned as the following:

A	B	C	D	E	F	G	H	I
0.33	1	0.33	0.33	0	0.33	0	0	0

So “Trust but verify” would be a member of five fuzzy sets representing behaviours A, B, C, D, F, i.e.,

degree_of_membership(Y)= max(degree_of_membership(A), degree_of_membership(B))

The membership value would be a weighting to all more appropriate and accurate maths to be performed (Chukhrova & Johannssen, 2021).

Alternatively, reviewers could assign a value (0-1.0, in increments of 0.1) to weight a proverb against a given behaviour. This would be repeated for each potential behaviour across all the proverbs. This would provide a statistical weighting for analysis by ANOVA to explore the variation of behaviours across the six countries: the results 'defuzzified' to test the hypothesis.

The use of Fuzzy Intersection or Fuzzy Union could also be used to explore the overlap of behaviours, with proverbs providing data to show that certain behaviours are often found together when proverbs are interpreted.

9.2 Further work taking proverb choice and project remit into account

The proverbs used as data in this study map to one or more of the nine behaviours associated with group cooperative mechanisms. However, it is worth noting that further work on proverbs could encompass areas such as:

- Coercion and dominance, e.g., ‘Might is right.’
- Hierarchy as a means of control, e.g., ‘Never argue against one who is greater than you.’
- The power of conciliation and compromise, e.g., ‘Gentleness achieves more than violence.’
- Rewarding good behaviour, e.g., ‘He that labours and thrives spins gold.’

However, these areas are outside the remit of this project.

9.3 Further nGrams analysis

Further work on nGram analysis could be undertaken. For example, comparing the cumulative frequency of proverbs for the nine behaviours during the period of the WW2 versus a temporal window of the same length in one or more others period, for example WW1 and a simlr time period that includes the financial crash of 2007/2008. A deeper dive into the nGram data could be achieved by using a R function, Python script, etc. These are freely available on Github.[27]

10.Conclusion

It is established that proverbs are intrinsic to human mental architecture, as evidenced by their cross-cultural and historical persistence. As a form of social learning, proverbs teach us what is right and wrong, what social norms are important to conform to, and how to act in certain situations, "When in Rome, do as the Romans do," "Revenge is sweet." The proverb is a pithy package of wit and wisdom, but it often has undertones of control and conformism that run deeply across the six countries explored in this study. The results of this study offer evidence of similar frequencies in the nine behaviours across the six countries of interest. Cheat deterrence, honesty, conformism, and Tit for Tat have strong signals, implying that the cohesion required in large non-kin groups, must begin with adherence to social norms, with punishment for non-

[27] Examples of freely available R functions in Github repos: GitHub - blairfix/read_ngram: An R function for reading data from the Google 2020 ngram corpus; GitHub - seancarmody/ngramr: R package to query the Google Ngram Viewer

conformists as a tacit outcome. However, mapping this to the fluid world of evolutionary mechanisms like CGS is challenging.

The relative frequencies of behaviours provide a window into the importance of these behaviours within a given group, in this case, a specific country. However, they also offer insights into the equivalent importance placed on behaviours across cultures.

Sustaining social norms is costly; it takes effort to keep people in line, and cheaters will surface under certain conditions, such as poor resource availability or a lack of policing. Proverbs and similar linguistic tools, such as idioms, can reinforce acceptable behaviours without resorting to physical controls such as violence. As such, proverbs may be an important tool in the development of group cooperation for the simple fact that they help avoid social norm controls that require physical violence or social exclusion; like a peahen flaring her tail as a warning response to an intruder, a proverb can act as a non-physical method to control behaviour. The success of proverbs is evident in their popularity and persistence in society over long periods. This success is not just because they are pithy statements, but because they manage and encourage social norms and expected behaviours in society. Knowing how and when to wield a proverb may well contribute towards social stability and group cooperation.

Appendix 1: Project assumptions:

The following assumptions are used in this study:

1. Proverbs provide a mechanism that demonstrates how to cooperate without requiring a structured population.
2. For proverbs to successfully propagate across a non-regular network, the rule identified in the 2006 paper by Ohtsuki, et. Al., follows:

   Co-operators have a fixation probability greater than **1/N**

   Defectors have a fixation probability of less than **1/N**

   if:

   b/c>k

   (Ohtsuki, Hauert, Lieberman, et al. 2006)

   For any given population size, the above condition favours co-operators.

Appendix 2: Coder review documentation

It was decided that independent raters were needed to reduce the bias from a single person performing a review of the proverbs. It was hoped that having more than one pair of eyes, and using individuals that had a knowledge of evolutionary psychology/anthropology would help to alleviate inaccuracies in proverb interpretation. The use of a weighting system (see also sections 5.4 and 5.5) was used to also reduce inaccuracies in interpretation.

The independent expert raters were given the following documentation to advise them on the task:

Instructions for review of proverbs

1. Use the companion spreadsheet, entitled 'Proverbs across cultures – for review.' This spreadsheet contains a sub-set of proverbs taken from the paremiological minimum of six countries. [28][29]
2. These proverbs were chosen as representative of one or more of the nine behaviours that form the basis of this project (see next section for a definition of each of the nine behaviours).
3. Raters should review the proverbs listed in the spreadsheet as the basis for analysis. However, please feel free to refer to the referenced PM for each country.
4. **Using the code shown next to each PM**, choose any behaviours that the proverb seems to reflect. There may be more than one behaviour associated with a proverb.

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[28] Certain proverbs are more popular than others. Studies that explore the relative popularity of proverbs in a culture look to define an empirical list of most frequently used proverbs. The result is known as the **paremiological minimum** (PM) of a given country or region; this provides a list of the most popular proverbs in a society, often showing frequency of use; a PM can also give an insight into why certain proverbs are popular.

[29] The first pass review will look at proverbs from a single country to establish the level of correlation.

5. Once the established behaviours are associated with each proverb, choose a single 'primary' behaviour from your list, i.e., a behaviour most likely to be encouraged using this proverb.

NOTE: the spreadsheet also shows a random sample of excluded proverbs.[30] These proverbs are for reference only. The Matti Kuusi database of proverbs classification system was used to justify the exclusion of some proverbs. Exclusion was based on low fit to the nine behaviours used in this study.

Example of proverbs for review: USA

		Code
USA	**Behaviour**	A: cheat deterrence
One bad apple spoils the barrel		B: honesty
What a tangled web we weave when first we practise to deceive		C: Tit for tat (TFT)
Once a thief always a thief		D: Tit for two tats (TFTT)
There's no honor amongst thieves		E: conformism
Beware of Greeks bearing gifts		F: reputation
All that glitters is not gold.		G: nepotism
Truth lies at the bottom of a well		H: pay it forward
Honesty is the best policy		I: altruistic punishment
Mind your own business		
Virtue is its own reward		
Confession is good for the soul		
The truth will out		

[30] See also document 'Criteria for exclusion of proverbs.'

Revenge is sweet

Do unto others as you would have them do unto you

Attack is the best defense

One swallow does not make a summer

Forgive and forget

Don't bite the hand that feeds you

Let bygones be bygones

Two heads are better than one

Give a man enough rope and he'll hang himself

Hear no evil, see no evil, speak no evil

Think before you speak

United we stand divided we fall

There's safety in numbers

Were all in the same boat

When in Rome do as the Romans do

Curiosity killed the cat

Don't rock the boat

Look before you leap

Early to bed and early to rise...

Keep your nose to the grindstone

Fools rush in where angels fear to tread

Discretion is the better part of valor

Don't upset the apple cart

Birds of a feather flock together

What's good for the goose is sauce for the gander

The more the merrier

Many hands make light work

A man is judged by the company he keeps

Blood is thicker than water

Charity begins at home

There's no place like home

Like father, like son

One good turn deserves another

A friend in need is a friend indeed

Walls have ears

It takes two to tango

Appendix 3: Further notes for consideration

Notes on Spatial reciprocity

The ‘spatial structure’ of a network is influential in the evolution of cooperative behaviour. Research into spatial reciprocity, based on evolutionary game dynamic analysis, has found that “strong social ties might hinder, while asymmetric spatial structures for interaction and trait dispersal could promote cooperation” (Su, et.al., 2019). Spatial topology is another consideration that can give insight into how co-operators can reach a dominant position within a given network (Wang, 2013).

The social graph involved in the propagation of proverbs is outside of the remit of this study. However, this would be an interesting research vehicle and one that could be an extension of the project.

Notes on ‘group-think’

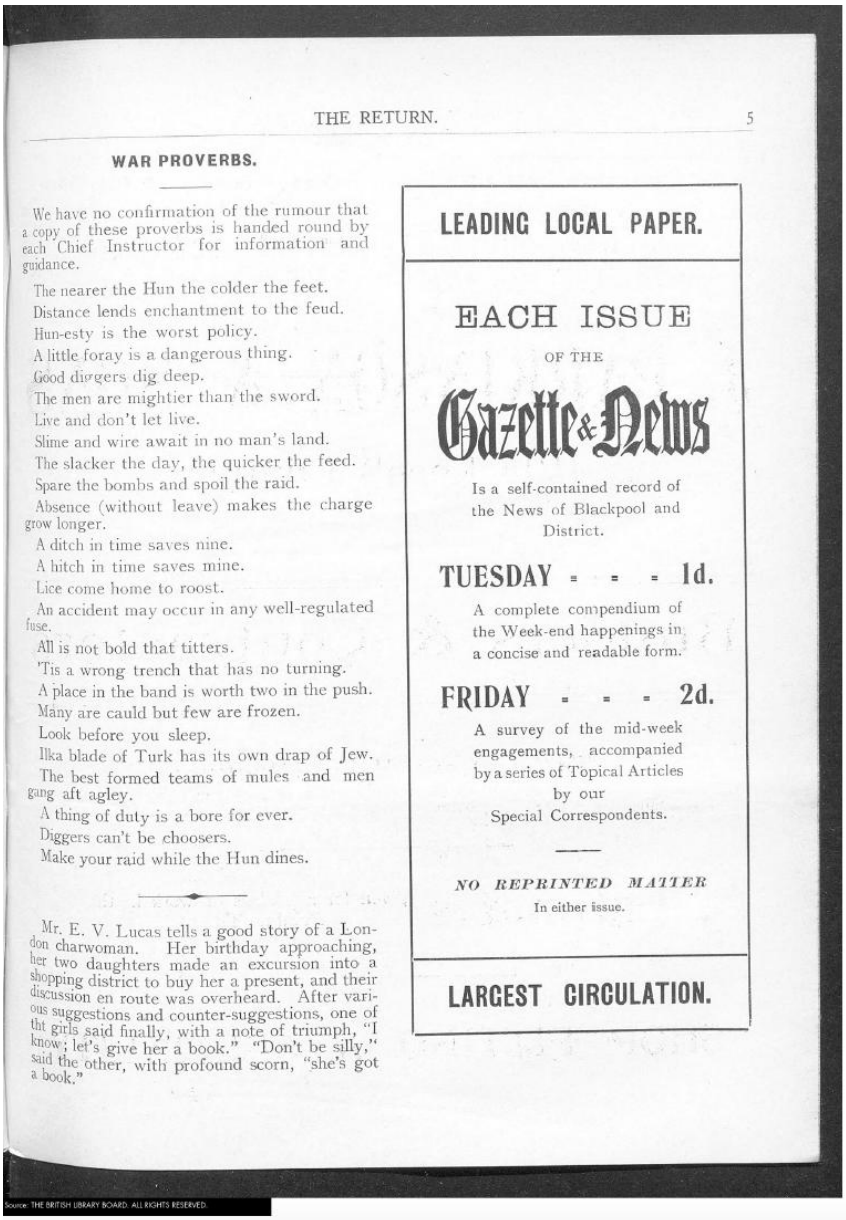
Social norms are an important aspect of ‘group-think’, i.e., the ability of a group of individuals to conform to certain good behaviours that benefit the group. In the paper “Two Key Steps in the Evolution of Human Cooperation: The Interdependence Hypothesis”, Tomasello, et.al., talk about group-mindedness and collective intentionality in the evolution of cooperation. (Tomasello, 2012); the paper describes how “permanent group-minded practises” are an inherent part of cultural groups.

Social identity and signalling

Social identity in human cultural evolution is another aspect of reputation building. A study (Smaldino, 2019) explored the use of social identity signals on group cooperation. Smaldino

points out that “people care a lot about social identity, and place high value on clearly identifying to others who they are and to which groups they belong.” These signals take numerous forms such as “overt declarations, clothing, and vocabulary.”

Appendix 4: WW1 bastardised proverbs



WAR PROVERBS.

We have no confirmation of the rumour that a copy of these proverbs is handed round by each Chief Instructor for information and guidance.

The nearer the Hun the colder the feet.
Distance lends enchantment to the feud.
Hun-esty is the worst policy.
A little foray is a dangerous thing.
Good diggers dig deep.
The men are mightier than the sword.
Live and don't let live.
Slime and wire await in no man's land.
The slacker the day, the quicker the feed.
Spare the bombs and spoil the raid.
Absence (without leave) makes the charge grow longer.
A ditch in time saves nine.
A hitch in time saves mine.
Lice come home to roost.
An accident may occur in any well-regulated fuse.
All is not bold that titters.
'Tis a wrong trench that has no turning.
A place in the band is worth two in the push.
Many are cauld but few are frozen.
Look before you sleep.
Ilka blade of Turk has its own drap of Jew.
The best formed teams of mules and men gang aft agley.
A thing of duty is a bore for ever.
Diggers can't be choosers.
Make your raid while the Hun dines.

Mr. E. V. Lucas tells a good story of a London charwoman. Her birthday approaching, her two daughters made an excursion into a shopping district to buy her a present, and their discussion en route was overheard. After various suggestions and counter-suggestions, one of the girls said finally, with a note of triumph, "I know; let's give her a book." "Don't be silly," said the other, with profound scorn, "she's got a book."

WAR PROVERBS. The Return: The Journal of the King's Lancashire Military Convalescent Hospital; Oct 11, 1918; 5, 135; Trench Journals and Unit Magazines of the First World War pg. 5

Appendix 5: Results based on evolutionary mechanisms

Analysis of the underlying evolutionary group mechanisms behind behaviours was performed as an adjunct study with the following results:

Evolutionary mechanisms: relative frequency across regions

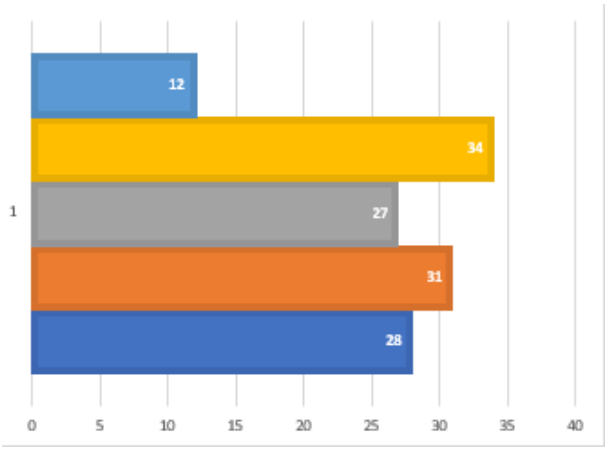
CGS: Cultural Group Selection

DR: Direct reciprocity

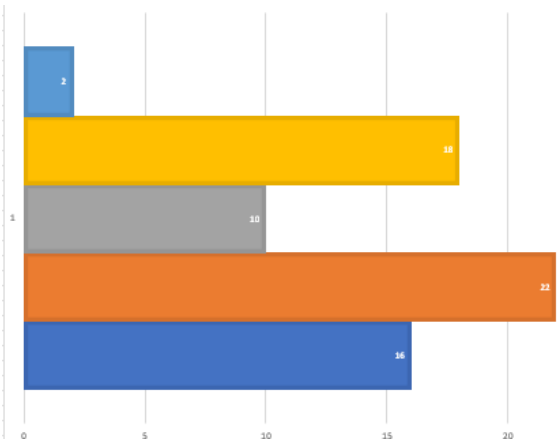
IR: Indirect reciprocity

GR: Generalised reciprocity

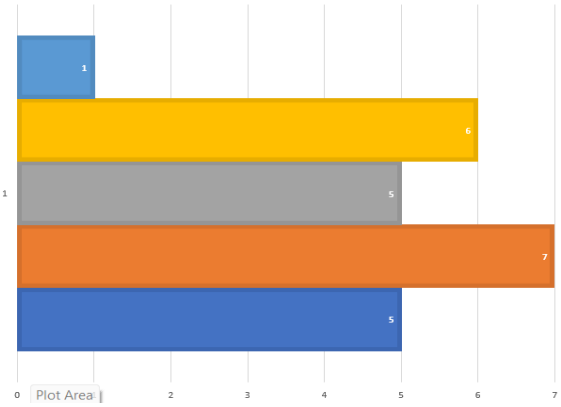
KS: Kin Selection



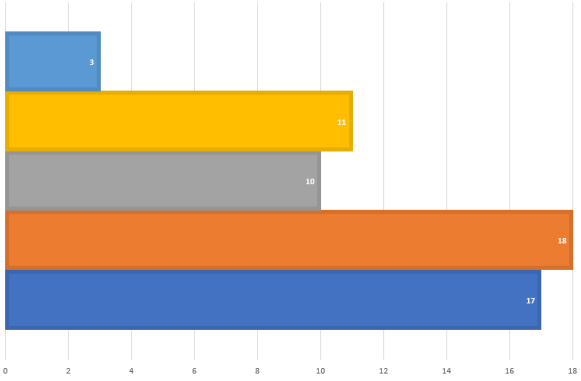
Global



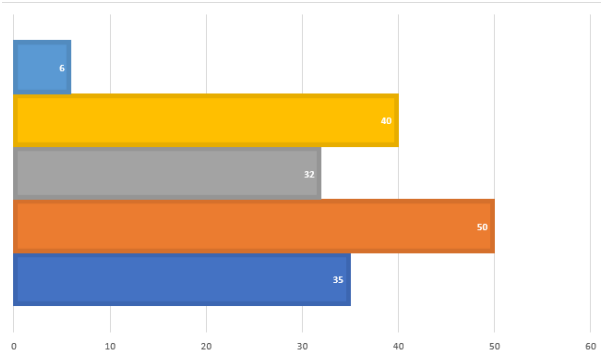
Older Asiatic



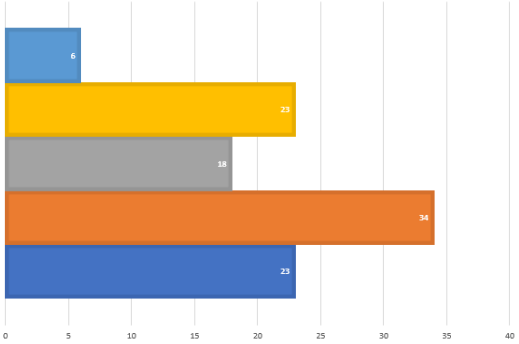
Sub Saharan Africa



Islamic Cultures



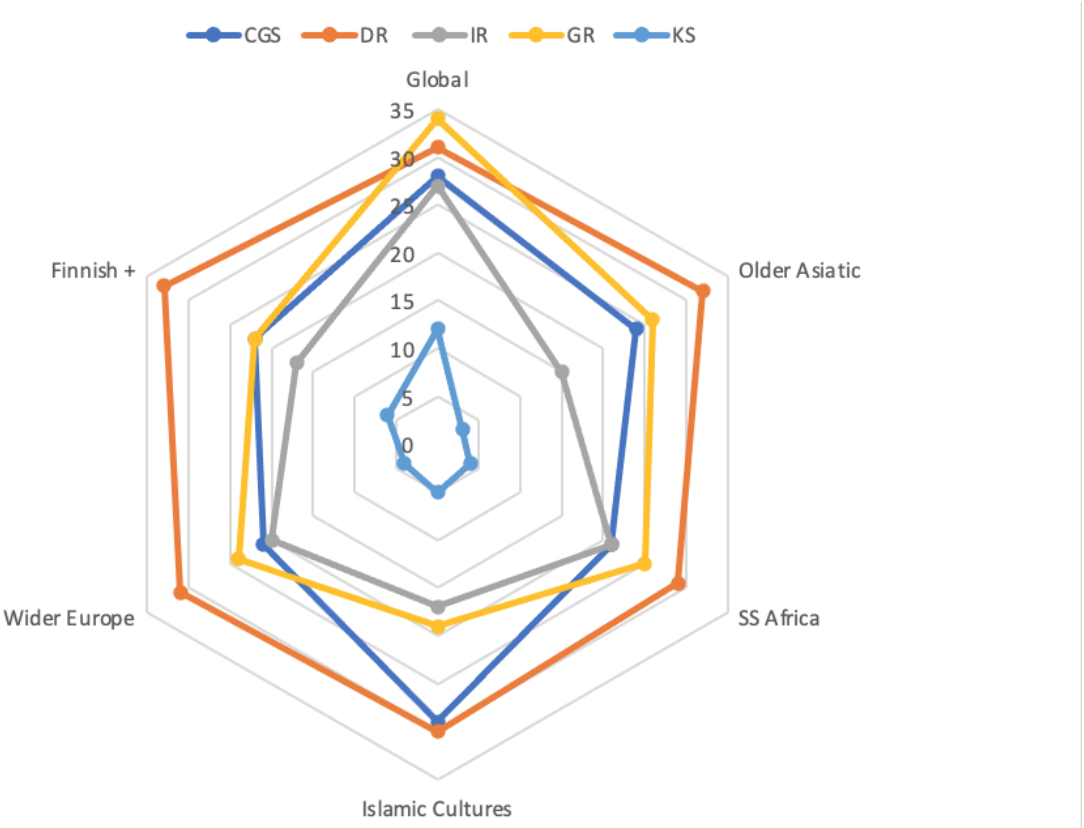
Wider Europe



Finnish+

Graph 12 Bar charts showing % frequency of each of the five evolutionary mechanisms across the geographic regions covered by the MKDB.

Matti Kuusi's database places proverbs into the general class of 'global' if they are found in multiple geographies; therefore, having global as a separate variable skewed the results when comparing across the other more localised geographic regions: A radar chart shows the skewing of evolutionary mechanisms on a per region basis to help view global within the context of the other regions:



Graph 13: Radar chart showing evolutionary mechanisms across the six regions

Cultural Group Selection and Direct Reciprocity show the strongest signals in the proverb data. Kin Selection shows the lowest signal. These results are in line with the evidence for evolutionary mechanisms at work in larger groups. The results show consistency across the

cultural divide. An SPSS Chi-square test of independence test was performed on each of the five evolutionary mechanisms to test the null hypothesis.

Evolutionary Mechanism: Direct Reciprocity (DR)

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, degrees of freedom = 6 p = .224.

Evolutionary Mechanism: Indirect Reciprocity (IR)

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, degrees of freedom = 6 p = .242.

Evolutionary Mechanism: Generalised Reciprocity (GR)

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, degrees of freedom = 6 p = .224.

Evolutionary Mechanism: Kin Selection (KS)

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 24.000, degrees of freedom = 6 p = .242.

Evolutionary Mechanism: Cultural Group Selection (CGS)

The Chi-square test of independence showed that there was no significant relationship between country and behaviour. Therefore, the null hypothesis cannot be rejected, X2 = 30.000, degrees of freedom = 6 p = .224.

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