**The Coevolution of Religious and Political Authority in Austronesian Societies**

Oliver Sheehan1\*, Quentin D. Atkinson1, Russell D. Gray1,2, Joseph Bulbulia3,4, & Joseph Watts2,5,6

1School of Psychology, University of Auckland, Auckland, New Zealand.

2Department of Linguistic and Cultural Evolution, Max Planck Institute for the Science of Human History, Jena, Germany.

3School of Humanities, University of Auckland, Auckland, New Zealand.

4School of Psychology, Victoria University of Wellington, Wellington, New Zealand.

5Religion Programme, University of Otago, Dunedin, New Zealand.

6Centre for Research on Evolution, Belief, and Behaviour, University of Otago, Dunedin, New Zealand.

\*Correspondence to: [oliver.sheehan@auckland.ac.nz](mailto:oliver.sheehan@auckland.ac.nz)

# **Abstract**

*Authority, an institutionalized form of social power, played an essential role in the evolution of large-scale societies during the Holocene. Religious authority and political authority both have deep histories in human societies, but the nature of their relationship is contested. We purpose-built an ethnographic dataset of 97 Austronesian societies and used phylogenetic methods to address two longstanding questions about the evolution of religious and political authority: firstly how and to what extent these two institutions have co-evolved, and secondly the order in which more differentiated and less differentiated systems of religious and political authority have tended to evolve. We found very strong evidence for interdependence between religious and political authority**, as well as evidence against a progression from more differentiated to less differentiated systems. Our results provide insight into how political and religious authority have worked synergistically to drive the evolution of large-scale societies.*

The scale and complexity of human societies increased vastly during the Holocene1,2. Authority, a form of social power that is vested in a culturally recognised ‘role’ or ‘office’ and is exercised over a specific group of people3, was one of the key innovations that enabled this transition. In small groups where a large proportion of members can interact directly, group decisions can be made on an informal and non-authoritarian basis. However, perhaps because of cognitive constraints, groups of more than a few thousand people generally require systems of command and control in order to make and implement group decisions2,4.

A few small-scale societies reportedly lack authority altogether5. Most societies, however, including many that are usually considered ‘egalitarian’, recognise authority at some level, minimally that of a ‘household head’ over other household members1,5. In more hierarchical societies authority may be exercised over a sub-local group such as a clan or village ward, a local community such as a village or district, or a supralocal grouping such as a chiefdom or state, with higher levels of authority usually overlying rather than replacing lower levels2,4. In addition to varying in its scope, authority varies in its types. Ethnographers frequently distinguish between political (also ‘secular’, ‘temporal’, or ‘civil’) authority and religious (‘ritual’, ‘sacred’, ‘spiritual’ etc.) authority6. For some ethnographers, this distinction turns on the ‘means’ by which authority operates, with political authority being based on physical force and religious authority relying on supernatural sanctions or supernatural legitimacy7,8. Others make this distinction with reference to the ‘ends’ to which authority is directed. Firth6 describes politics as ‘focused on relations of men with other men’, in contrast to religion which ‘is more oriented to relations of men with gods or other spiritually conceived forces’, while Garland9 defines religious authority as ‘the right … to act authoritatively both in the name of, and in matters of, religion’. Here we focus on the second conception, operationalising religious authority as a right to manage interactions between living human beings and supernatural agents or powers, and political authority as a right to manage interactions between living human beings.

Scholars generally agree that religion and politics, and by extension religious and political authority, are and have been related in societies past and present6. However, they vary in the emphasis that they place on this relationship, and on their views of its direction. The relationship between religion and politics is generally acknowledged in theories of religious evolution (see e.g. 10,11), but religion is sometimes ignored altogether in theories of political evolution (see e.g. 12). Authors who explicitly acknowledge the relationship between religious and political evolution often see politics as having causal precedence. Religion, according to this view, responds to political changes but has little power to cause them, though it may serve to ‘underpin’ or ‘legitimise’ political arrangements that already exist1,10,13. However, others have argued that it is religion that has driven the evolution of political systems rather than the other way around14-16. A third view is that while religion and politics have co-evolved, neither has consistently had causal precedence, one version of this argument being that ‘sacred’ and ‘secular’ matters are so closely interwoven in premodern societies that they cannot be separated even analytically17.

In many societies religious and political authority are vested in the same office(s), as in a polity headed by a ‘priest-king’ or ‘priest-chief’. In others they are differentiated to a greater or lesser degree6,18. Whether the relationship between religious and political authority has evolved to become more or less differentiated, and how the two institutions have co-evolved, are separate but closely related questions. One of the most obvious ways in which one form of authority could have given rise to the other would be for an office or role that was originally solely religious to acquire political functions, or vice versa19. Another possibility is that the earliest forms of authority were both political and religious, and that distinct religious and political offices were a later development. It has long been noted that the earliest known kings wielded religious as well as political authority20-22, and some have argued that this was true of earlier forms of authority also15,23. However, others have noted that fairly small-scale societies often draw some kind of distinction between religious and political authority6,13,18, suggesting the possibility that the earliest forms of religious and political authority were distinct and that combined systems developed only subsequently. Arguments for this progression are occasionally found in the literature – the ‘divine kingship’ of Hawaii, for example, has been explained as the outcome of a process whereby political leaders gained progressively more religious authority24.

Hence there at least two longstanding questions about the evolution of religious and political authority: firstly, how and to what extent they have co-evolved, and secondly the order in which more differentiated and less differentiated systems have evolved. Archaeological and historical evidence from around the world hints at answers to both of these questions. It has been noted that in most early city-states, the earliest monumental structures appear to have served religious rather than secular purposes16,22,25, suggesting that religious authority may have come first. The extent to which the earliest forms of authority were differentiated is more difficult to infer from the archaeological record, but the earliest written records clearly indicate that in at least one area of primary state formation, Mesopotamia, religious and political authority were initially combined and later became partly distinct25. Presently, the incompleteness and ambiguity of both the historical and archaeological records leave these questions unresolved.

Cultural phylogenetic methods allow the evolutionary histories of cultural traits to be reconstructed from ethnographic data - a process that has been labelled ‘virtual archaeology’26. These methods provide a useful complement to the archaeological and historical records in reconstructing patterns of cultural change over evolutionary time. Cultural phylogenetic methods typically model cultural ancestry using language ‘trees’ or phylogenies. Since there is no widely recognised phylogeny of the world’s languages, cultural phylogenetic studies usually focus on cultural variation within a single recognised language family. The Austronesian language family of Southeast Asia and the Pacific has proven particularly well-suited to a cultural phylogenetic approach. It is the second-largest language family in the world whose existence is uncontroversial27, and is famously diverse. As well as having a great variety of social and political structures28, the Austronesian-speaking world was until recently home to a large number of indigenous religions that were similarly diverse and are relatively well-documented29. Systems of religious and political authority within these societies varied in their scale as well as their level of differentiation30,31. Because of these advantages, there have already been a number of cultural phylogenetic studies of Austronesian-speaking societies e.g. 32-34, including two that have examined the co-evolution of socio-political phenomena and elements of religious belief and ritual35,36.

Here we present a cultural phylogenetic study of the evolution of religious and political authority in the Austronesian-speaking world. Based on ethnographic descriptions, we coded 97 Austronesian-speaking societies on the presence of systems of religious and political authority and the scale of the social groups that these systems incorporated. In societies that had both religious and political authority, we also coded the extent to which the two were differentiated. We mapped these traits onto trees representing relationships between the languages spoken in these societies, and reconstructed the evolutionary histories of the traits under different models in order to answer two sets of questions about how they have evolved. Firstly, we evaluated the extent to which religious and political authority have co-evolved, as well as investigating the nature of their coevolutionary relationship. Secondly, we tested the sequence in which more differentiated and less differentiated systems of religious and political authority have evolved.

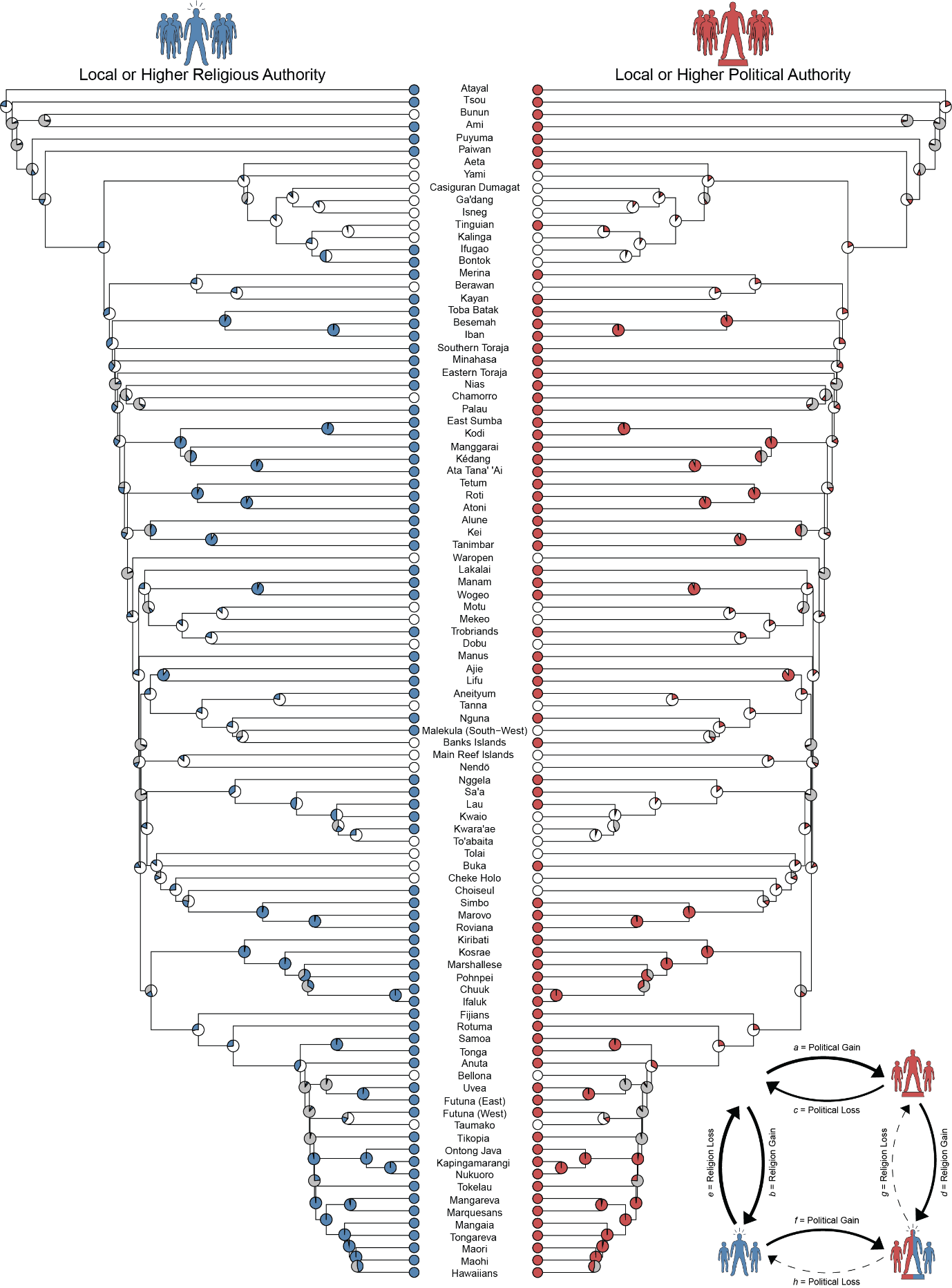
# **Results**

## *Coevolution*

Our first series of phylogenetic analyses focused on the coevolution of religious and political authority. We preliminarily coded both religious and political authority as ordinal variables with four possible states: ‘absent’ (not present above the household level), ‘sublocal’ (incorporating a group larger than the household but smaller than the local community), ‘local’ (incorporating the local community), and ‘supralocal’ (incorporating more than one local community). To make these variables amenable to our planned coevolutionary analyses, we converted them into three pairs of binary variables. One of the variables in each pair represented religious authority at a particular level, and the other represented political authority at the same level. The first pair of variables represented the presence or absence of these forms of authority at the sublocal level or higher, the second their presence or absence at the local level or higher, and the third their presence or absence at the supralocal level (see Table 1). Each pair of variables was the focus of one of our coevolutionary analyses. Hence each analysis modelled the coevolution of religious authority at a particular level with political authority at the same level.

|  |  |  |
| --- | --- | --- |
| Binary variable | Absent | Present |
| Authority | 0 | 1,2,3 |
| Authority at the local level or higher | 0,1 | 2,3 |
| Supralocal authority | 0,1,2 | 3 |

*Table 1.* Binarisation of Ordinal Variables with States 0, 1, 2, and 3.

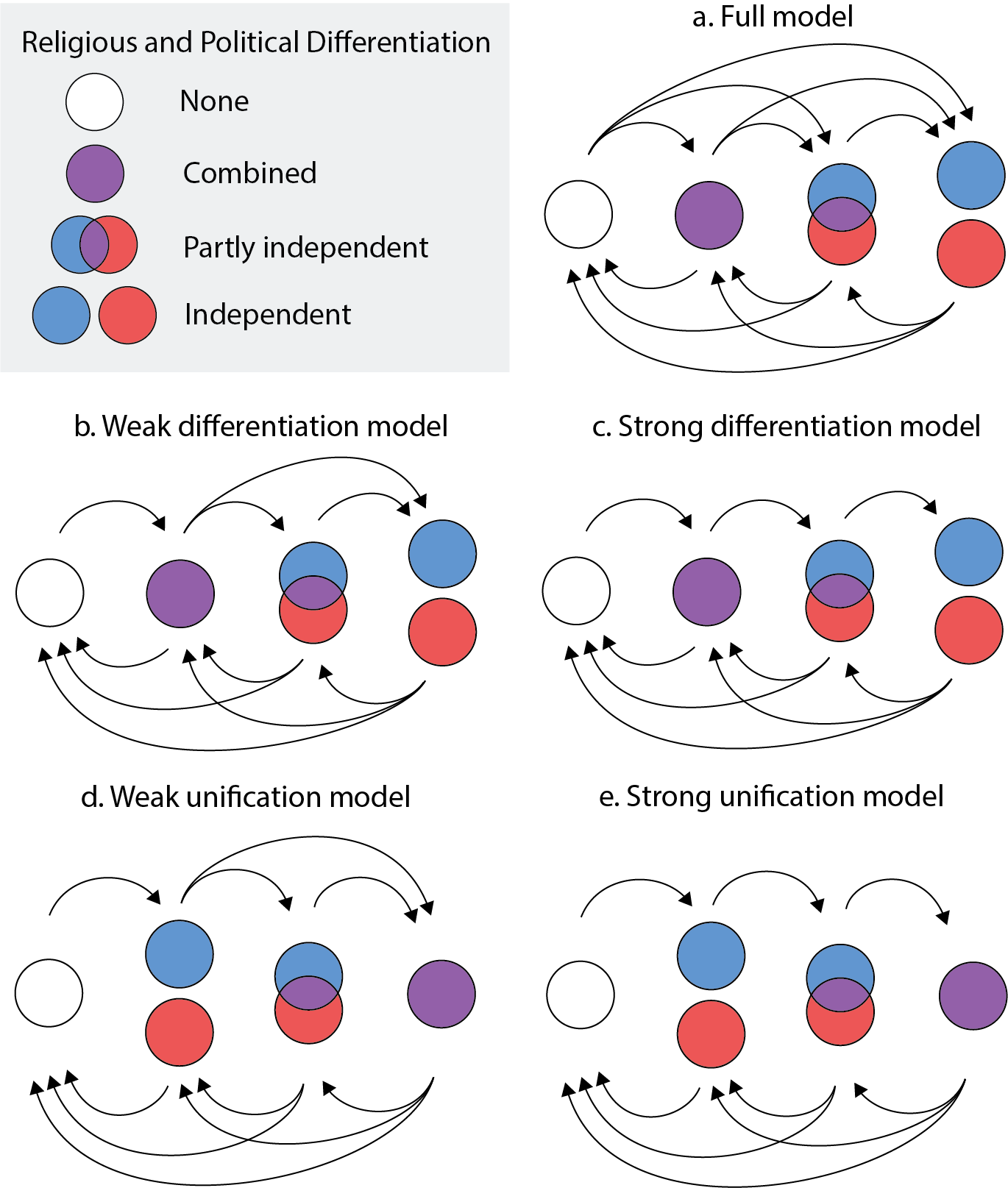
Our analyses of coevolution tested dependent models of trait evolution (in which rates of loss or gain in one trait can depend upon the presence or absence of the other trait) against independent models (in which rates of loss or gain in one trait are not affected by the presence or absence of the other trait)37. Support for dependent over independent models of trait evolution were evaluated using Bayes Factors. Our analyses strongly supported coevolution between religious and political authority at all levels, but the evidence was stronger at higher than at lower levels. For religious and political authority at the sublocal level or higher, coevolution was favoured with a Log Bayes Factor (Log BF) of 21.4. The corresponding Log BF for religious and political authority at the local level or higher was 27.5 (see Figure 1), while the coevolution of supralocal religious and political authority was favoured with a Log BF of 61.5 (see Supplementary Tables 2 and 3). All of these Log BFs represent ‘very strong support’ for co-evolution38.

*Figure 1. Coevolution of religious and political authority at the local level or higher.* Ancestral state reconstructions of religious and political authority at the local level or higher are plotted on a maximum clade credibility tree. Pie charts at the internal nodes of the tree represent the proportion of models in which the trait was inferred to be present at that node, with grey representing the proportion of trees in the sample from which that particular node was absent. In the transition matrix at the bottom right, thickness of the arrows is proportional to rates of change from one state to another. For the coevolution of sublocal and supralocal religious and political authority, see Supplementary Figures 1 and 2.

To gain further insight into how religious and political authority have coevolved, we performed further analyses in which particular pairs of rates were constrained to make loss or gain of one type of authority equally likely in the presence or absence of the other type of authority. These analyses produced strong evidence that religious and political authority sustain each other (make each other less likely to be lost), and weaker but still substantial evidence that they promote each other (make each other more likely to be gained). Dependent models in which rates of loss of one type of authority were constrained to be equal in the presence or absence of the other type of authority (see Supplementary Tables 4 and 5) performed substantially worse than the unconstrained dependent model (BFs of 2.1 to 9.7 in favour of the unconstrained dependent model, considered ‘positive’ to ‘strong’ evidence). In contrast, none of the dependent models in which rates of gain of one type of authority were constrained to be equal in the presence or absence of the other type (see Supplementary Tables 6 and 7) performed substantially worse than the unconstrained dependent model (Log BFs of from 1.6 in favour of the constrained model to 1.3 in favour of the unconstrained, considered ‘not worth more than a bare mention’). However, all of the constrained dependent models substantially outperformed the independent model (Log BFs of 12.5 to 61.5, ‘very strong evidence’). Together, these results indicate that while religious and political authority are tightly coupled, neither holds causal precedence over the other, and that the two types of authority both sustain and promote each other.

## *Sequential evolution*

In our second series of phylogenetic analyses, we tested the sequence in which less differentiated and more differentiated systems of authority evolved. We coded the ‘structure’ of religious and political authority as an ordinal variable with four possible states: ‘none’ (one or both forms of authority lacking, hence no structure), ‘combined’ (vested in the same office or offices), ‘partly independent’ (e.g. vested in distinct offices that are part of the same hierarchy), and ‘independent’ (vested in distinct offices that are not part of the same hierarchy). We tested four sequential models of trait evolution against a ‘full model’ which allowed any transition between any level of differentiation (see Figure 2). Two of the sequential models required more differentiated authority structures to evolve from less differentiated ones. These ‘differentiation’ models consisted of a ‘strong’ and a ‘weak’ version. In the strong version, ‘independent’ could only evolve from ‘partly independent’, and ‘partly independent’ could only evolve from ‘combined’, whereas the weak version also allowed a direct transition from ‘combined’ to ‘independent’. The other two sequential models required less differentiated authority structures to evolve from more differentiated ones. These ‘unification’ models also consisted of a strong version (which required ‘combined’ to evolve from ‘partly independent’, and ‘partly independent’ to evolve from ‘independent’) and a weak version (which also allowed a direct transition from ‘independent’ to ‘combined’). As in the first set of analyses, we evaluated models based on Bayes Factors.



*Figure 2. Five models of the evolution of religious and political authority.* In the full model (a), any transition between any two states is allowed. In the weak differentiation model (b), independent systems of authority must evolve from either combined or partly independent systems, and partly independent systems must evolve from combined systems. In the strong differentiation model (c), independent systems of authority must evolve from partly independent systems of authority, which in turn must evolve from combined systems of authority. In the weak unification model (d), combined systems of authority must evolve from either independent or partly independent systems of authority, and partly independent systems of authority must evolve from independent systems of authority. In the strong unification model (e), combined systems of authority must evolve from partly independent systems of authority, which in turn must evolve from independent systems of authority.

The results of these analyses were inconsistent with either of the unification models, and did not provide clear evidence either for or against the differentiation models (see Supplementary Table 8). The full (unconstrained) model did not perform substantially better or worse than either the strong or weak versions of the differentiation model (Log BFs of 0.24 and 0.52 respectively in favour of the full model, ‘not worth more than a bare mention’). However, the full model substantially outperformed both the strong and weak versions of the unification model (Log BFs of 6.44, ‘strong evidence’ and 3.14, ‘positive evidence’), and both versions of the differentiation model substantially outperformed both versions of the unification model (Log BFs between 2.62, ‘positive evidence’ and 6.20 ‘strong evidence’). Overall, these results do not favour a stepwise process of unification and are consistent with a stepwise process of differentiation, although alternative models cannot be ruled out.

# **Discussion**

We found very strong evidence for coevolution between religious and political authority in the Austronesian-speaking world. This relationship was reciprocal rather than directional, with neither of the two institutions being the ‘prime mover’. Religious and political authority both sustained and promoted each other, but the evidence that they sustained each other was particularly strong. Evidence for coevolution became stronger when political and/or religious authority were present at higher levels. We found no clear evidence for or against a progression from less differentiated to more differentiated systems of authority, but our results were inconsistent with a progression from more differentiated to less differentiated systems.

The interdependence between religious and political authority that we observed accords with ethnographic descriptions of the two institutions being closely intertwined. In many Austronesian societies supreme religious and political authority were vested in the same office, the ‘divine kingship’ of Hawaii being perhaps the most famous example39. In other cases, the two institutions were vested in different offices that were part of the same hierarchy. Arrangements varied: supreme political authority might be subordinate to supreme religious authority, as in Tonga40, a relationship that was reversed in Roviana41. Even in societies where religious and political leaders enjoyed *de jure* independence and were sometimes opposed, they usually headed the same social group and often worked together closely. In Tahiti, for example, high priests are reported to have ‘exercised immense influence’ in secular affairs, ‘depending more or less on the character of the king’42. While it was clearly possible for one type of authority to exist without the other, since some societies in the sample had only one type, it seems that when both were present, interdependence was all but inevitable. These results are inconsistent with utilitarian theories of political evolution in which religion is irrelevant or limited to a supporting role, but nor do they indicate that religion necessarily plays the leading role.

There are several plausible mechanisms by which religious and political authority might have sustained and empowered each other during the long expanse of Austronesian cultural evolution. Ethnographic sources often explicitly describe religious authority as supporting political authority by increasing its legitimacy and reinforcing it with supernatural sanctions. In Chuuk, for example, the *itang* (‘political priests’) ‘legitimized chiefship through divine sanction and the spirit power (*manaman*) that went with it’, according to one source43. Political authority could have in turn strengthened religious authority by increasing its prestige and resource base, and perhaps also by helping to suppress challenges to its monopoly13. There are also logical reasons why societies with one type of authority might have been be more likely to gain the other. A society that lacks any kind of authority can gain a specific type of authority only through the creation of new roles or offices, but a society that already has one type of authority also has the option of vesting a new type of authority in an existing office. Existing types of authority might also have served as models for new types, which would have made it still more likely that a society with one type of authority would gain another. The fact that religious and political authority sustained each other may reflect an association between having both types of authority and having a greater number and variety of authoritative roles and offices in general, increasing the redundancy in the system and decreasing the likelihood that any specific type of authority would be lost completely.

The interdependence between religious and political authority observed in the present study is in keeping with the results of two previous studies that examined the coevolution of religious beliefs and practices with other socio-political traits and found causal relationships in both directions35,36. Although the results of the present study do not support a directional relationship, they do not rule it out entirely. The coding of religious and political authority as ordinal variables with four states obscured some of the variation and made religious and political authority appear to correspond somewhat more closely than they did in actuality. For example, the Toba Batak were coded as having both supralocal religious and religious and political authority. However, although both religious and political authority existed on a supralocal level among the Toba Batak, the scope of religious authority was much greater. Some powerful chiefs governed groups of villages with combined populations of up to a thousand, but tens or perhaps even hundreds of thousands acknowledged the religious authority of the Si Singamangaraja44,45. Had a finer-grained coding system been feasible, it is possible that some directionality would have been observed.

Evidence for coevolution was very strong at all levels of political and religious authority, but was stronger at higher than at lower levels: stronger for local than for sublocal, and strongest for supralocal. This pattern may reflect a coevolutionary relationship between authority and group size. As social groups become larger, systems of authority become increasingly necessary in order to make and implement group decisions4. This rule should apply regardless of whether the decisions in question are political or religious. If both religious and political authority co-evolve with group size, their coevolutionary relationship with each other might well be expected to become stronger as groups become larger.

While we were unable to clarify whether or not there was a progression from less differentiated to more differentiated systems of religious and political authority, our results were inconsistent with a progression in the opposite direction. Lack of clearer support for the differentiation models over the full model may partly reflect sample characteristics. The fact that all or almost all early states had combined structures of political and religious authority22 suggests that if there is a sustained trend towards differentiation, this trend emerges only in societies that have already reached the state level. Pre-colonial Austronesian societies varied greatly in their complexity, but there were few state-level societies46, and fewer still among those who retained their indigenous religions until the modern era. On the other hand, there may simply be no such trend to observe. It may be noted that the relationship between religion and politics has varied considerably even among industrial states, including those that consider themselves secular47.

In summary, the present study found strong evidence for a reciprocal coevolutionary relationship between religious and political authority. The evidence for this interdependence became stronger as the scale of religious and political authority increased. We uncovered strong evidence that religious and political authority both sustain and promote each other, but the evidence that they sustained each other was particularly striking. We found no clear evidence for or against a progression from less differentiated to more differentiated systems of authority, but clear evidence against a progression from more differentiated to less differentiated systems. While many authors have argued that religious and political authority have co-evolved, the present study provides quantitative evidence of the closeness of this relationship as well as specific insights into how these two institutions have worked synergistically to drive the evolution of large-scale societies.

# **Methods**

## *Phylogenies*

Cultural ancestry was modelled using a sample of 1,000 trees from the posterior distribution of a previously published Bayesian reconstruction of the Austronesian language family33. The sample of 400 languages used in the original analysis was pruned to include only the 97 languages that corresponded to societies for which the relevant variables could be coded. Societies that corresponded to more than one of the languages in the tree were assigned the language that had the largest number of speakers according to Ethnologue48. Pruning of phylogenies was conducted using the packages ‘ape’49 and ‘geiger’50 in the programming language ‘R’51. The pruned set of phylogenies is available via the Open Science Framework (OSF, <https://osf.io/cm53v/>).

## *Coding of Variables*

Ninety-seven Austronesian-speaking societies were coded with respect to three variables: religious authority, political authority, and the structure of religious and political authority. All three variables were originally coded in ordinal form with four states, but the first two were subsequently binarised to make them suitable for the intended coevolutionary analyses37.

Authority was defined as a form of social power vested in a specific social role or office and exercised over a specific group of people3. Religious authority was defined as a right to manage interactions between living human beings and supernatural agents or powers6,9, whereas political authority was defined as a right to manage interactions between living human beings6. The variables ‘religious authority’ and ‘political authority’ each had the same four states. Societies in which the relevant form of authority did not exist, or encompassed a group no larger than the household, were coded ‘0’. Societies in which the relevant form of authority existed above the household level were coded ‘1’ if the group they incorporated was ‘sublocal’ (smaller than the local community), ‘2’ if the group was ‘local’ (coextensive with the local community) and/or consisted of multiple sublocal groups, and ‘3’ if the group was ‘supralocal’ (consisting of more than one local community). The local community was defined as ‘the maximal group of persons who normally reside together in face-to-face association’52. These two ordinal variables were binarised using the same three cutoff points (1, 2, and 3). The first cutoff represented the presence or absence of the relevant type of authority above the household level, the second the presence or absence of that form of authority at the local level or higher, and the third the presence or absence of supralocal religious or political authority (see Table 1).

The variable ‘structure of religious and political authority’ represented the extent to which religious and political authority were differentiated. Societies were coded (0) if either religious or political authority, or both, were lacking. If supreme religious and political authority were combined (vested in the same office or offices), the society was coded (1). Societies in which supreme religious and political authority were partly independent were coded ‘2’. This was a residual category that included societies in which the two forms of authority were incompletely partitioned between different offices (e.g., supreme political authority being vested in one office, and supreme religious authority shared between this office and another) as well as those in which they were vested in different offices that were part of the same hierarchy (e.g., a high priest being the subject of a secular high chief, or vice versa). Finally, societies in which supreme religious and political authority were independent (vested in different offices that were not part of the same hierarchy) were coded (3).

Austronesian societies have undergone dramatic changes in their religious and political organisation through contact with non-Austronesian societies, particularly over the past few centuries. Almost all Austronesian societies underwent some form of colonisation that resulted in permanent change to their political systems. Moreover, almost all Austronesian-speakers now affiliate with either Christianity or Islam, either instead of or alongside their traditional religious beliefs and practices53. Since the cultural phylogenetic methods used in the present study assume predominantly vertical (within-lineage) cultural transmission54, they cannot justifiably be applied to ethnographic data from Austronesian societies today. For this reason, societies were coded as they were immediately prior to colonisation and / or large-scale conversion to a world religion (whichever occurred earlier). Coding was based on a range of ethnographic sources, and each coding decision was justified with citations. Data and citations are provided in Supplementary Table 1, as well as on the Austronesian Religion Database ‘Pulotu’29.

## *Phylogenetic Analyses*

Phylogenetic analyses were conducted using the software package BayesTraits (Version 3.0)55. Two components of this package were used: ‘Discrete’ to investigate the coevolution of religious and political authority, and ‘Multistate’ to test the sequence in which the structure of religious and political authority evolved. ‘Discrete’ tests dependent and independent models of the evolution of pairs of binary traits. In dependent models, rates of loss and / or gain of one trait can be affected by the presence or absence of the other trait, whereas in independent models the rates of loss or gain in each trait are not affected by the presence or absence of the other trait. ‘Multistate’ tests models of the evolution of a single trait that adopts two or more discrete states. Both Discrete and Multistate can be run using a Maximum Likelihood (ML) or Markov Chain Monte Carlo (MCMC) approach. The analyses reported in the present study used an MCMC approach, but the choice of priors was guided by preliminary analyses involving an ML approach. Data and command files for all phylogenetic analyses are provided on the OSF (<https://osf.io/cm53v/>).

*Maximum Likelihood Estimations.* One hundred optimisation attempts were made for each tree in the sample.

*MCMCs.* The Discrete and Multistate MCMCs were run using the same settings. Each involved 100,000,000 iterations of the chain, with the first 10,000,000 removed as burn-in. Based on the results of the MLEs, a reverse-jump hyperprior with an exponential distribution that can range between 0 and 10 was chosen for all analyses. A stepping-stone sampler with 100 stones was run for 100,000 iterations to estimate the log marginal likelihoods for the models in the posterior distribution of each analysis. All analyses were independently replicated three times, and each replication converged on highly similar rate and log marginal likelihood values (see Supplementary Tables 2-8.).

Initially, three pairs of Discrete MCMCs were run, each of which tested dependent and independent models of the evolution of one of the binarised religious authority variables and the corresponding political authority variable. The first pair of Discrete MCMCs involved authority at any level, the second involved authority at the local level or higher, and the third specifically supralocal authority (see Table 1). To further investigate how religious and political authority have co-evolved, a series of constrained follow-up analyses were performed and compared to the independent and the unconstrained dependent analyses. For each level of authority, the same four series of constraints were placed on the models in the dependent analyses. The first series of constraints tested whether religious authority promoted the emergence of political authority (made it more likely to be gained) by constraining the analyses to include only models in which societies with and without religious authority gained political authority at the same rate (rate q12 was restricted to be equal to rate q34). The second series of constraints tested whether political authority promoted the emergence of religious authority by constraining the analyses to include only models in which societies with and without political authority gained religious authority at the same rate (rate q13 was restricted to be equal to rate q24). The third series of constraints tested whether religious authority helped to sustain political authority (made it less likely to be lost) by constraining the analyses to include only models in which societies with and without religious authority lost political authority at the same rate (rate q21 was restricted to be equal to rate q43). The fourth series of constraints tested whether political authority sustained religious authority by constraining the analyses to include only models in which societies with and without political authority lost religious authority at the same rate (rate q31 was restricted to be equal to rate q42).

In the Multistate analyses, five models were tested (see Figure 2). In the ‘full model’, any transition between any two states was allowed. This allowed the analyses to select from all possible model structures. In the ‘strong differentiation model’, rates of transition from 0 to 2 (q02), 0 to 3 (q03) and 1 to 3 (q13) were set to zero. This constrained the analyses to include only models in which more differentiated authority structures evolved from less differentiated ones (1 → 2 → 3). In the ‘strong unification model’, rates of transition from 0 to 1 (q01), 0 to 2 (q02), and 3 to 1 (q31) were set to zero. This constrained the analyses to include only models in which less differentiated authority structures evolved from more differentiated ones (3 → 2 → 1). Since 2 (‘partly independent’) is a more heterogeneous category than 0, 1, and 3, less stringent (‘weak’) versions of the differentiation and unification models were also tested. In the ‘weak differentiation model’, only rates q02 and q03 were restricted to zero (i.e. transitions from 1 → 3 were also allowed). In the ‘weak unification model’, only q01 and q02 were restricted to zero (i.e. transitions from 3 → 1 were also allowed).

*Model comparison.* Support for the posterior distribution of analyses with different model structures was evaluated using Log Bayes Factors (Log BFs) calculated from the log marginal likelihoods obtained for each posterior distribution of models. Log BFs were interpreted following a scheme in which 0-2 is ‘not worth more than a bare mention’, 2-6 is ‘positive evidence’, 6-10 is ‘strong evidence’, and 10 or higher is ‘very strong evidence’38.

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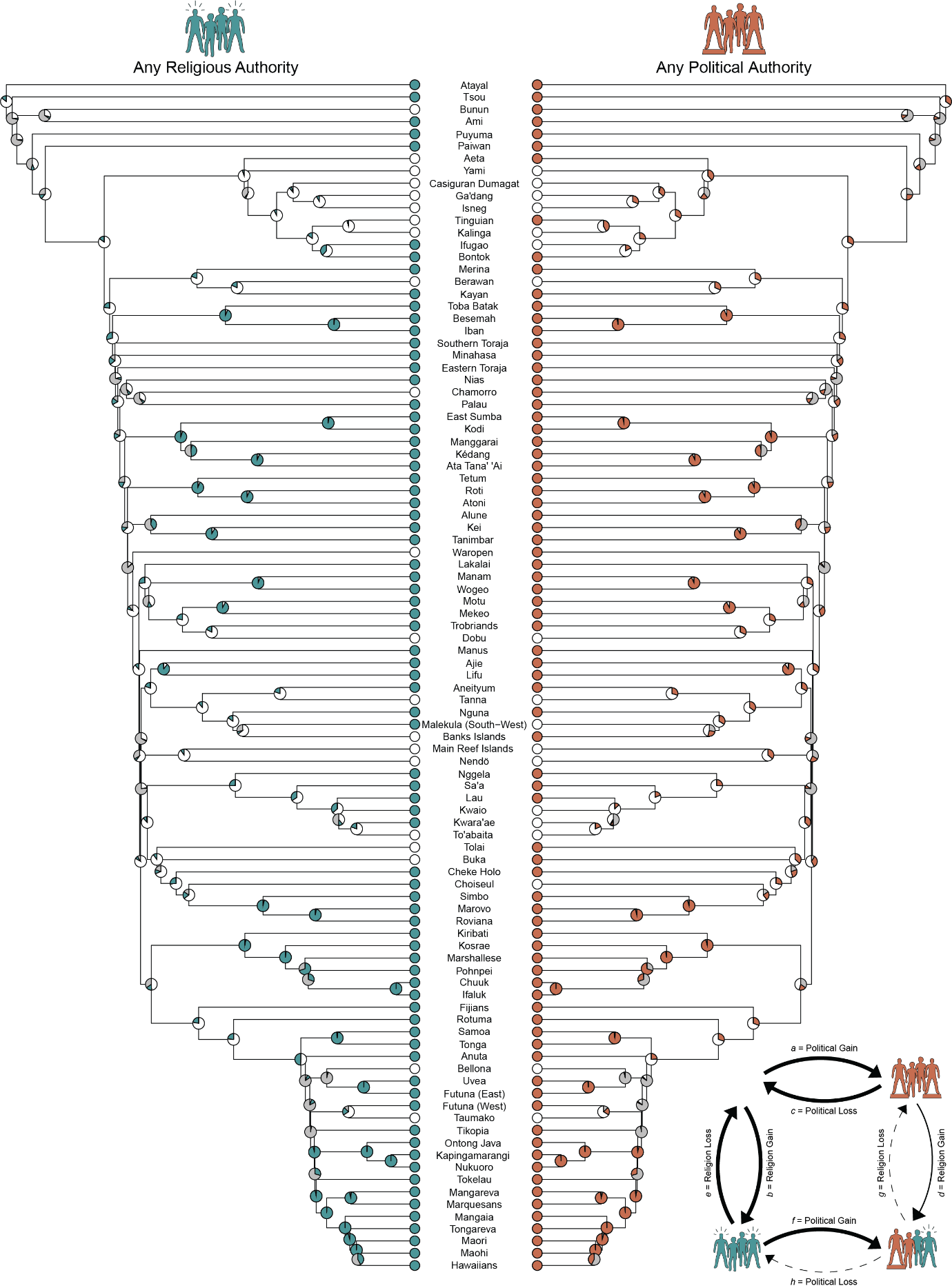
# **Author Contributions**

O.S. designed and wrote up the project with input from Q.D.A., R.D.G. J.B. & J.W. O.S. coded the data. Both O.S. and J.W. performed the statistical analyses.

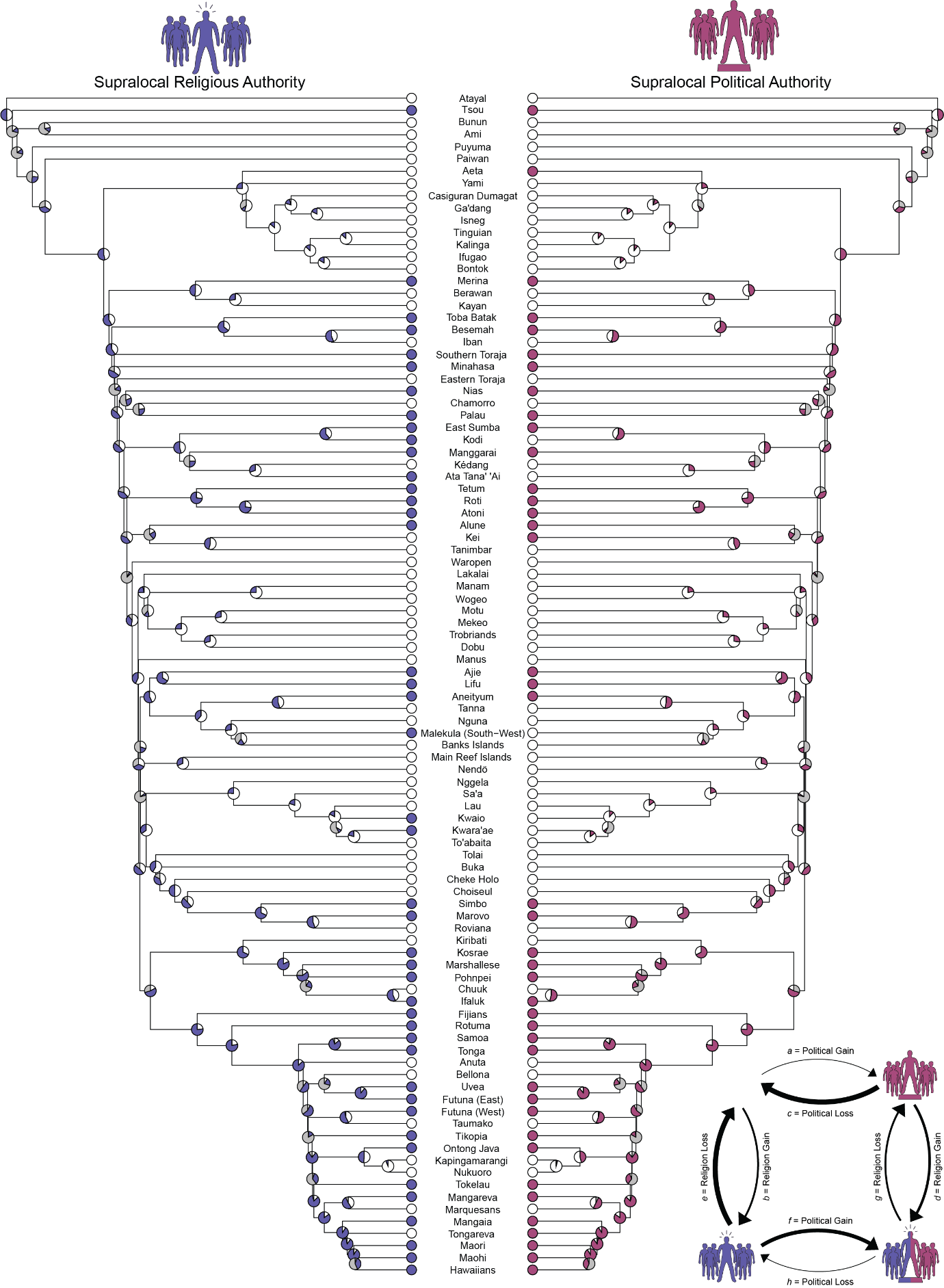
# **Competing Interests**

The authors declare no competing interests.

**Supplementary Figures**



*Supplementary Figure 1. Coevolution of religious and political authority at the sublocal level or higher.* Ancestral state reconstructions of religious and political authority at the sublocal level or higher are plotted on a maximum clade credibility tree. Pie charts at the internal nodes of the tree represent the proportion of models in which the trait was inferred to be present at that node, with grey representing the proportion of trees in the sample from which that particular node was absent. In the transition matrix at the bottom right, thickness of the arrows is proportional to rates of change from one state to another.



*Supplementary Figure 2. Coevolution of religious and political authority at the supralocal level or higher.* Ancestral state reconstructions of religious and political authority at the supralocal level or higher are plotted on a maximum clade credibility tree. Pie charts at the internal nodes of the tree represent the proportion of models in which the trait was inferred to be present at that node, with grey representing the proportion of trees in the sample from which that particular node was absent. In the transition matrix at the bottom right, thickness of the arrows is proportional to rates of change from one state to another.

**Supplementary Tables**

## **Supplementary Table 1: Coding Decisions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Society** | **ABVD (Austronesian Basic Vocabulary Database) Code** | **Religious Authority** | **Political Authority** | **Structure of Religious and Political Authority** | **Source (s)** |
| Aeta | 444 | 0 | 3 | 0 | Brosius1; Lebar2; Reed3 |
| Ajie | 1188 | 3 | 3 | 1 | Clifford4; Leenhardt5 |
| Alune | 80 | 3 | 3 | 2 | Boulan-Smit6 |
| Ami | 350 | 2 | 2 | 2 | Lebar2; Mabuchi7 |
| Aneityum | 149 | 3 | 3 | 1 | Spriggs8 |
| Anuta | 253 | 2 | 2 | 1 | Feinberg9,10 |
| Ata Tana' 'Ai | 124 | 3 | 2 | 2 | Lewis11,12 |
| Atayal | 255 | 2 | 2 | 1 | Lebar2; Mabuchi7 |
| Atoni | 42 | 3 | 3 | 1 | Schulte Nordholt13 |
| Banks Islands | 376 | 0 | 2 | 0 | Codrington14,15 |
| Bellona | 206 | 0 | 0 | 0 | Monberg16 |
| Berawan | 45 | 0 | 0 | 0 | Huntington & Metcalf17 |
| Besemah | 107 | 3 | 3 | 1 | Collins18 |
| Bontok | 36 | 2 | 1 | 2 | Jenks19 |
| Buka | 187 | 0 | 2 | 0 | Blackwood20; Ogan21 |
| Bunun | 202 | 0 | 2 | 0 | Huang22 |
| Casiguran Dumagat | 417 | 0 | 0 | 0 | Headland23,24 |
| Chamorro | 18 | 0 | 2 | 0 | Cordy25; Thompson26 |
| Cheke Holo | 209 | 1 | 1 | 1 | White27 |
| Choiseul | 44 | 2 | 0 | 0 | Scheffler28 |
| Chuuk | 349 | 2 | 2 | 3 | Dobbin & Hezel29; Goodenough30 |
| Dobu | 218 | 0 | 0 | 0 | Fortune31 |
| East Sumba | 32 | 3 | 3 | 2 | Forth32 |
| Eastern Toraja | 208 | 2 | 2 | 1 | Adriani & Kruyt33; Downs34 |
| Fijians | 11 | 3 | 3 | 2 | Thomson35 |
| Florida | 102 | 2 | 2 | 1 | Codrington15 |
| Futuna (East) | 210 | 3 | 3 | 1 | Burrows36  Kirch37 |
| Futuna (West) | 156 | 3 | 3 | 3 | Capell38 |
| Hawaiians | 52 | 3 | 3 | 1 | Kirch39; Valeri40 |
| Iban | 28 | 2 | 2 | 3 | Freeman41; Jensen42; Pringle43 |
| Ifaluk | 347 | 3 | 3 | 3 | Burrows & Spiro44 |
| Ifugao | 419 | 2 | 0 | 0 | Barton45; Conklin46; Lebar2 |
| Isneg | 424 | 0 | 0 | 0 | Keesing47; Vanoverbergh48,49 |
| Kalinga | 429 | 0 | 0 | 0 | Barton50; Dozier51 |
| Kapingamarangi | 217 | 2 | 2 | 3 | Emory52 |
| Kayan | 237 | 2 | 2 | 1 | Rousseau53,54 |
| Kédang | 236 | 2 | 2 | 2 | Barnes55 |
| Kei | 59 | 2 | 3 | 2 | Hooe56 |
| Kiribati | 346 | 2 | 2 | 2 | Grimble & Maude57; Macdonald58 |
| Kodi | 318 | 3 | 2 | 2 | Hoskins59 |
| Kosrae | 65 | 3 | 3 | 1 | Athens60; Dobbin & Hezel29 |
| Kwaio | 66 | 3 | 0 | 0 | Keesing61,62 |
| Kwara'ae | 213 | 3 | 0 | 0 | Burt63 |
| Lakalai | 281 | 2 | 2 | 3 | Chowning64;  Chowning & Goodenough65 |
| Lau | 68 | 2 | 2 | 2 | Ivens66 |
| Lifu | 196 | 3 | 3 | 2 | Leenhardt5; Ray67 |
| Main Reef Islands | 501 | 0 | 0 | 0 | Davenport68 |
| Malekula (South-West) | 453 | 3 | 0 | 0 | Deacon & Wedgwood69 |
| Manam | 168 | 2 | 2 | 1 | Lutkehaus70,71 |
| Mangaia | 58 | 3 | 3 | 3 | Buck72 |
| Mangareva | 239 | 3 | 3 | 3 | Buck73 |
| Manggarai | 84 | 3 | 3 | 2 | Erb74 |
| Manus | 71 | 2 | 2 | 2 | Gustafsson75, Schwartz76 |
| Maohi | 173 | 3 | 3 | 3 | Oliver77 |
| Maori | 85 | 3 | 3 | 3 | Bowden78 |
| Marovo | 87 | 3 | 3 | 2 | Hviding79 |
| Marquesans | 38 | 2 | 2 | 3 | Thomas80,81 |
| Marshallese | 344 | 3 | 3 | 2 | Carucci82; Dobbin & Hezel29 |
| Mekeo | 89 | 1 | 1 | 2 | Hau’ofa83 |
| Merina | 92 | 3 | 3 | 1 | Campbell84; Larson85; Sibree86 |
| Minahasa | 137 | 3 | 3 | 3 | Schouten87 |
| Motu | 26 | 1 | 1 | 1 | Groves88,89 |
| Nendö | 502 | 0 | 0 | 0 | Davenport90 |
| Nguna | 103 | 2 | 2 | 2 | Facey91 |
| Nias (South) | 104 | 3 | 3 | 2 | Hummel & Telaumbanua92; Viaro & Ziegler93 |
| Nukuoro | 238 | 2 | 2 | 2 | Carroll94; Eilers95 |
| Ontong Java | 418 | 3 | 3 | 3 | Hogbin96 |
| Pagan Gaddang | 177 | 0 | 0 | 0 | Lebar2; Wallace97 |
| Paiwan | 109 | 2 | 2 | 1 | Matsuzawa98 |
| Palau | 179 | 3 | 3 | 3 | Dobbin & Hezel29; Parmentier99 |
| Pohnpei | 271 | 3 | 3 | 2 | Dobbin & Hezel29; Hanlon100 |
| Puyuma | 264 | 2 | 2 | 1 | Lebar2 |
| Roti | 116 | 3 | 3 | 3 | Fox101,102 |
| Rotuma | 117 | 3 | 3 | 2 | Howard103 |
| Roviana | 221 | 2 | 2 | 2 | Aswani104; Nagaoka105 |
| Sa'a | 118 | 2 | 2 | 2 | Ivens106 |
| Samoa | 473 | 3 | 3 | 1 | Meleisea107 |
| Simbo | 226 | 3 | 3 | 2 | Dureau108; Scheffler109 |
| Southern Toraja | 447 | 3 | 3 | 1 | Nooy-Palm110 |
| Tanimbar | 78 | 2 | 2 | 2 | Koentjaraningrat111 |
| Tanna | 162 | 0 | 0 | 0 | Lindstrom112,113 |
| Taumako | 375 | 0 | 0 | 0 | Davenport114 |
| Tetum | 134 | 3 | 3 | 2 | Hicks115 |
| Tikopia | 155 | 3 | 3 | 1 | Firth116 |
| Tinguian | 426 | 0 | 2 | 0 | Cole & Gale117 |
| To'abaita | 223 | 0 | 0 | 0 | Hogbin118 |
| Toba Batak | 188 | 3 | 3 | 2 | Sibeth119; Vergouwen120 |
| Tokelau | 245 | 3 | 3 | 1 | Huntsman & Hooper121; MacGregor122 |
| Tolai | 382 | 0 | 1 | 0 | Epstein123,124; Simet125 |
| Tonga | 136 | 3 | 3 | 2 | Cummins126 |
| Tongareva | 235 | 2 | 3 | 2 | Campbell127; Roscoe128 |
| Trobriands | 159 | 2 | 2 | 1 | Malinowski129,130; Powell131; Weiner132 |
| Tsou (Northern) | 138 | 3 | 3 | 1 | Lebar2 |
| Uvea | 258 | 3 | 3 | 2 | Burrows133 |
| Waropen | 142 | 0 | 1 | 0 | Held134 |
| Wogeo | 146 | 2 | 2 | 1 | Hogbin135,136 |
| Yami | 254 | 0 | 0 | 0 | Lebar2; Yu137 |

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## **Supplementary Table 2: Summary of Discrete Analyses (Dependent Unconstrained)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Sublocal or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -85.67 | 1.34 | 1.32 | 1.35 | 0.30 | 1.34 | 1.26 | 0.003 | 0.002 |
| **2** | -85.61 | 1.32 | 1.30 | 1.32 | 0.31 | 1.32 | 1.25 | 0.004 | 0.002 |
| **3** | -85.58 | 1.32 | 1.31 | 1.33 | 0.30 | 1.32 | 1.24 | 0.003 | 0.002 |
| **Mean** | -85.62 | 1.32 | 1.31 | 1.33 | 0.30 | 1.33 | 1.25 | 0.003 | 0.002 |
| **Religious and Political Authority (Local or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -89.30 | 0.85 | 0.84 | 0.92 | 0.55 | 0.94 | 0.69 | 0.002 | 0.003 |
| **2** | -89.27 | 0.84 | 0.83 | 0.92 | 0.55 | 0.93 | 0.69 | 0.001 | 0.002 |
| **3** | -89.22 | 0.85 | 0.83 | 0.93 | 0.57 | 0.94 | 0.68 | 0.002 | 0.002 |
| **Mean** | -89.26 | 0.85 | 0.84 | 0.92 | 0.56 | 0.94 | 0.69 | 0.002 | 0.002 |
| **Religious and Political Authority (Supralocal)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -103.01 | 0.22 | 0.72 | 5.14 | 5.35 | 6.64 | 3.30 | 0.70 | 0.27 |
| **2** | -103.08 | 0.22 | 0.76 | 5.21 | 5.61 | 6.88 | 3.39 | 0.74 | 0.28 |
| **3** | -103.13 | 0.22 | 0.73 | 5.08 | 5.36 | 6.67 | 3.26 | 0.71 | 0.27 |
| **Mean** | -103.07 | 0.22 | 0.74 | 5.14 | 5.44 | 6.73 | 3.32 | 0.72 | 0.27 |

## **Supplementary Table 3: Summary of Discrete Analyses (Independent)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Sublocal or Higher)** | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | |
| **α1** | **β1** | **α2** | **β2** |
| **1** | -96.30 | 0.09 | 0.09 | 0.09 | 0.09 |
| **2** | -96.33 | 0.09 | 0.09 | 0.010 | 0.09 |
| **3** | -96.38 | 0.09 | 0.09 | 0.10 | 0.09 |
| **Mean** | -96.34 | 0.09 | 0.09 | 0.10 | 0.09 |
| **Religious and Political Authority (Local or Higher)** | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | |
| **α1** | **β1** | **α2** | **β2** |
| **1** | -103.02 | 0.11 | 0.11 | 0.11 | 0.11 |
| **2** | -102.97 | 0.11 | 0.11 | 0.11 | 0.11 |
| **3** | -103.002 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Mean** | -103.00 | 0.11 | 0.11 | 0.11 | 0.11 |
| **Religious and Political Authority (Supralocal)** | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | |
| **α1** | **β1** | **α2** | **β2** |
| **1** | -133.80 | 2.24 | 2.25 | 2.23 | 2.24 |
| **2** | -133.82 | 2.34 | 2.35 | 2.32 | 2.33 |
| **3** | -133.87 | 2.32 | 2.32 | 2.30 | 2.31 |
| **Mean** | -133.83 | 2.30 | 2.31 | 2.29 | 2.29 |

## **Supplementary Table 4: Summary of Discrete Analyses (Dependent, Loss of Political Authority Constrained to be Equal With or Without Religious Authority)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Sublocal or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -89.98 | 0.73 | 0.34 | 0.53 | 0.74 | 1.06 | 4.59 | 0.03 | 0.53 |
| **2** | -90.34 | 0.75 | 0.33 | 0.53 | 0.73 | 1.07 | 4.67 | 0.03 | 0.53 |
| **3** | -89.92 | 0.75 | 0.35 | 0.53 | 0.77 | 1.06 | 4.67 | 0.03 | 0.53 |
| **Mean** | -90.08 | 0.74 | 0.34 | 0.53 | 0.75 | 1.06 | 4.64 | 0.03 | 0.53 |
| **Religious and Political Authority (Local or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -92.94 | 0.24 | 0.30 | 0.17 | 0.46 | 1.51 | 0.99 | 0.01 | 0.17 |
| **2** | -92.92 | 0.25 | 0.29 | 0.17 | 0.48 | 1.51 | 0.95 | 0.01 | 0.17 |
| **3** | -92.95 | 0.24 | 0.29 | 0.17 | 0.46 | 1.52 | 0.95 | 0.01 | 0.17 |
| **Mean** | -92.93 | 0.24 | 0.29 | 0.17 | 0.47 | 1.51 | 0.97 | 0.01 | 0.17 |
| **Religious and Political Authority (Supralocal)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -104.30 | 0.47 | 0.52 | 0.82 | 9.76 | 9.36 | 2.92 | 0.53 | 0.82 |
| **2** | -104.23 | 0.46 | 0.57 | 0.81 | 9.58 | 9.49 | 2.99 | 0.53 | 0.81 |
| **3** | -104.64 | 0.46 | 0.55 | 0.79 | 9.59 | 9.54 | 2.87 | 0.51 | 0.79 |
| **Mean** | -104.39 | 0.46 | 0.55 | 0.81 | 9.64 | 9.46 | 2.93 | 0.52 | 0.81 |

## **Supplementary Table 5: Summary of Discrete Analyses (Dependent, Loss of Religious Authority Constrained to be Equal With or Without Political Authority)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Sublocal or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -89.89 | 0.89 | 0.78 | 1.29 | 3.05 | 0.43 | 1.31 | 0.43 | 0.04 |
| **2** | -89.71 | 0.88 | 0.80 | 1.29 | 2.99 | 0.43 | 1.35 | 0.43 | 0.04 |
| **3** | -90.01 | 0.93 | 0.80 | 1.35 | 2.95 | 0.43 | 1.32 | 0.43 | 0.04 |
| **Mean** | -89.87 | 0.90 | 0.80 | 1.31 | 3.00 | 0.43 | 1.33 | 0.43 | 0.04 |
| **Religious and Political Authority (Local or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -94.08 | 0.32 | 0.49 | 1.29 | 3.72 | 0.44 | 0.89 | 0.44 | 0.01 |
| **2** | -94.17 | 0.34 | 0.49 | 1.31 | 3.70 | 0.43 | 0.92 | 0.43 | 0.01 |
| **3** | -94.06 | 0.35 | 0.50 | 1.32 | 3.79 | 0.44 | 0.90 | 0.44 | 0.01 |
| **Mean** | -94.11 | 0.34 | 0.49 | 1.31 | 3.74 | 0.44 | 0.90 | 0.44 | 0.01 |
| **Religious and Political Authority (Supralocal)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -104.15 | 0.22 | 0.54 | 8.59 | 1.90 | 0.72 | 8.22 | 0.72 | 0.41 |
| **2** | -104.15 | 0.22 | 0.54 | 8.60 | 1.43 | 0.68 | 7.87 | 0.68 | 0.37 |
| **3** | -104.05 | 0.23 | 0.53 | 8.66 | 1.88 | 0.72 | 8.13 | 0.72 | 0.40 |
| **Mean** | -104.12 | 0.23 | 0.54 | 8.61 | 1.74 | 0.71 | 8.07 | 0.71 | 0.39 |

## **Supplementary Table 6: Summary of Discrete Analyses (Dependent, Gain of Political Authority Constrained to be Equal With or Without Religious Authority)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Any Level)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -84.82 | 1.30 | 1.28 | 1.30 | 0.24 | 1.29 | 1.30 | 0.002 | 0.003 |
| **2** | -84.93 | 1.31 | 1.29 | 1.32 | 0.23 | 1.31 | 1.31 | 0.001 | 0.003 |
| **3** | -84.74 | 1.29 | 1.28 | 1.30 | 0.24 | 1.29 | 1.29 | 0.001 | 0.002 |
| **Mean** | -84.83 | 1.30 | 1.28 | 1.31 | 0.24 | 1.30 | 1.30 | 0.001 | 0.003 |
| **Religious and Political Authority (Local or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -88.52 | 0.76 | 0.76 | 0.86 | 0.42 | 0.87 | 0.76 | 0.001 | 0.002 |
| **2** | -88.62 | 0.77 | 0.77 | 0.87 | 0.41 | 0.88 | 0.77 | 0.001 | 0.001 |
| **3** | -88.57 | 0.77 | 0.77 | 0.85 | 0.41 | 0.86 | 0.77 | 0.001 | 0.001 |
| **Mean** | -88.57 | 0.77 | 0.77 | 0.86 | 0.41 | 0.87 | 0.77 | 0.001 | 0.001 |
| **Religious and Political Authority (Supralocal)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -103.88 | 0.50 | 0.31 | 6.37 | 4.26 | 6.10 | 0.50 | 0.25 | 0.35 |
| **2** | -103.66 | 0.50 | 0.31 | 6.50 | 4.14 | 5.94 | 0.50 | 0.25 | 0.35 |
| **3** | -103.66 | 0.49 | 0.32 | 6.43 | 4.11 | 5.83 | 0.49 | 0.25 | 0.34 |
| **Mean** | -103.74 | 0.50 | 0.31 | 6.43 | 4.17 | 5.96 | 0.50 | 0.25 | 0.35 |

## **Supplementary Table 7: Summary of Discrete Analyses (Dependent, Gain of Religious Authority Constrained to be Equal With or Without Political Authority)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Religious and Political Authority (Sublocal or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -85.77 | 0.75 | 0.73 | 0.76 | 0.73 | 0.77 | 0.59 | 0.01 | 0.002 |
| **2** | -85.76 | 0.75 | 0.72 | 0.75 | 0.72 | 0.76 | 0.58 | 0.004 | 0.002 |
| **3** | -85.63 | 0.74 | 0.72 | 0.75 | 0.72 | 0.76 | 0.59 | 0.01 | 0.002 |
| **Mean** | -85.72 | 0.75 | 0.72 | 0.75 | 0.72 | 0.76 | 0.59 | 0.01 | 0.002 |
| **Religious and Political Authority (Local or Higher)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -88.72 | 0.74 | 0.73 | 0.83 | 0.73 | 0.84 | 0.49 | 0.001 | 0.001 |
| **2** | -88.65 | 0.74 | 0.73 | 0.84 | 0.73 | 0.85 | 0.49 | 0.001 | 0.002 |
| **3** | -88.78 | 0.75 | 0.74 | 0.85 | 0.74 | 0.86 | 0.48 | 0.001 | 0.002 |
| **Mean** | -88.72 | 0.74 | 0.74 | 0.84 | 0.74 | 0.85 | 0.49 | 0.001 | 0.002 |
| **Religious and Political Authority (Supralocal)** | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | |
| **q12** | **q13** | **q21** | **q24** | **q31** | **q34** | **q42** | **q43** |
| **1** | -103.04 | 0.15 | 0.52 | 6.33 | 0.52 | 4.24 | 4.15 | 0.48 | 0.15 |
| **2** | -103.01 | 0.16 | 0.53 | 6.39 | 0.53 | 4.23 | 4.18 | 0.49 | 0.15 |
| **3** | -103.13 | 0.15 | 0.53 | 6.36 | 0.53 | 4.15 | 4.21 | 0.49 | 0.15 |
| **Mean** | -103.06 | 0.15 | 0.53 | 6.36 | 0.53 | 4.21 | 4.18 | 0.49 | 0.15 |

## **Supplementary Table S8: Summary of Multistate Analyses**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Full Model** | | | | | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | | | | | |
| **q01** | **q02** | **q03** | **q10** | **q12** | **q13** | **q20** | **q21** | **q23** | **q30** | **q31** | **q32** |
| **1** | -129.86 | 0.51 | 1.05 | 0.30 | 0.57 | 1.21 | 0.89 | 0.83 | 1.28 | 0.93 | 0.56 | 1.26 | 1.23 |
| **2** | -129.86 | 0.51 | 1.04 | 0.30 | 0.56 | 1.18 | 0.87 | 0.81 | 1.25 | 0.92 | 0.55 | 1.25 | 1.23 |
| **3** | -129.82 | 0.51 | 1.05 | 0.30 | 0.56 | 1.17 | 0.86 | 0.81 | 1.24 | 0.93 | 0.57 | 1.25 | 1.24 |
| **Mean** | -129.85 | 0.51 | 1.04 | 0.30 | 0.57 | 1.19 | 0.87 | 0.82 | 1.26 | 0.92 | 0.56 | 1.25 | 1.23 |
| **Differentiation Model (Strong Version) (q02 q03 q13=0)** | | | | | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | | | | | |
| **q01** | **q02** | **q03** | **q10** | **q12** | **q13** | **q20** | **q21** | **q23** | **q30** | **q31** | **q32** |
| **1** | -129.95 | 1.87 | 0 | 0 | 1.82 | 1.93 | 0 | 0.06 | 1.79 | 1.89 | 0.32 | 1.42 | 1.69 |
| **2** | -129.99 | 1.87 | 0 | 0 | 1.82 | 1.93 | 0 | 0.06 | 1.80 | 1.90 | 0.32 | 1.42 | 1.71 |
| **3** | -129.97 | 1.86 | 0 | 0 | 1.82 | 1.95 | 0 | 0.06 | 1.82 | 1.91 | 0.31 | 1.42 | 1.70 |
| **Mean** | -129.97 | 1.87 | 0 | 0 | 1.82 | 1.93 | 0 | 0.06 | 1.80 | 1.90 | 0.32 | 1.42 | 1.70 |
| **Differentiation Model (Weak Version)** **(q02 q03=0)** | | | | | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | | | | | |
| **q01** | **q02** | **q03** | **q10** | **q12** | **q13** | **q20** | **q21** | **q23** | **q30** | **q31** | **q32** |
| **1** | -130.13 | 1.72 | 0 | 0 | 1.35 | 1.76 | 1.08 | 0.20 | 1.61 | 1.17 | 0.45 | 1.43 | 1.53 |
| **2** | -130.08 | 1.72 | 0 | 0 | 1.33 | 1.73 | 1.11 | 0.22 | 1.58 | 1.16 | 0.47 | 1.44 | 1.52 |
| **3** | -130.12 | 1.72 | 0 | 0 | 1.34 | 1.76 | 1.10 | 0.21 | 1.62 | 1.17 | 0.47 | 1.44 | 1.52 |
| **Mean** | -130.11 | 1.72 | 0 | 0 | 1.34 | 1.75 | 1.09 | 0.21 | 1.61 | 1.17 | 0.46 | 1.44 | 1.53 |
| **Unification Model (Strong Version)** **(q01 q02 q31=0)** | | | | | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | | | | | |
| **q01** | **q02** | **q03** | **q10** | **q12** | **q13** | **q20** | **q21** | **q23** | **q30** | **q31** | **q32** |
| **1** | -133.06 | 0 | 0 | 3.96 | 0.05 | 4.52 | 0.48 | 0.03 | 4.62 | 4.44 | 3.98 | 0 | 4.66 |
| **2** | -133.06 | 0 | 0 | 3.97 | 0.05 | 4.57 | 0.49 | 0.04 | 4.67 | 4.48 | 3.98 | 0 | 4.72 |
| **3** | -133.08 | 0 | 0 | 3.99 | 0.04 | 4.55 | 0.50 | 0.04 | 4.66 | 4.47 | 4.00 | 0 | 4.70 |
| **Mean** | -133.07 | 0 | 0 | 3.97 | 0.05 | 4.55 | 0.49 | 0.04 | 4.65 | 4.46 | 3.99 | 0 | 4.70 |
| **Unification Model (Weak Version)** **(q01 q02=0)** | | | | | | | | | | | | | |
| **Run** | **Log Marginal Likelihood** | **Transition Rates** | | | | | | | | | | | |
| **q01** | **q02** | **q03** | **q10** | **q12** | **q13** | **q20** | **q21** | **q23** | **q30** | **q31** | **q32** |
| **1** | -131.42 | 0 | 0 | 1.98 | 0.65 | 1.84 | 1.25 | 0.32 | 1.89 | 1.44 | 1.05 | 1.83 | 2.00 |
| **2** | -131.39 | 0 | 0 | 1.97 | 0.64 | 1.85 | 1.26 | 0.33 | 1.89 | 1.43 | 1.04 | 1.83 | 2.00 |
| **3** | -131.45 | 0 | 0 | 1.94 | 0.63 | 1.83 | 1.25 | 0.34 | 1.89 | 1.40 | 1.01 | 1.80 | 1.97 |
| **Mean** | -131.42 | 0 | 0 | 1.96 | 0.64 | 1.84 | 1.25 | 0.33 | 1.89 | 1.42 | 1.04 | 1.82 | 1.99 |