

How Many Wives?

Tracing Descent of a Model for Polygyny through
Behavioural Ecology, Anthropology, Economics and Applied Science

- Monique Borgerhoff Mulder



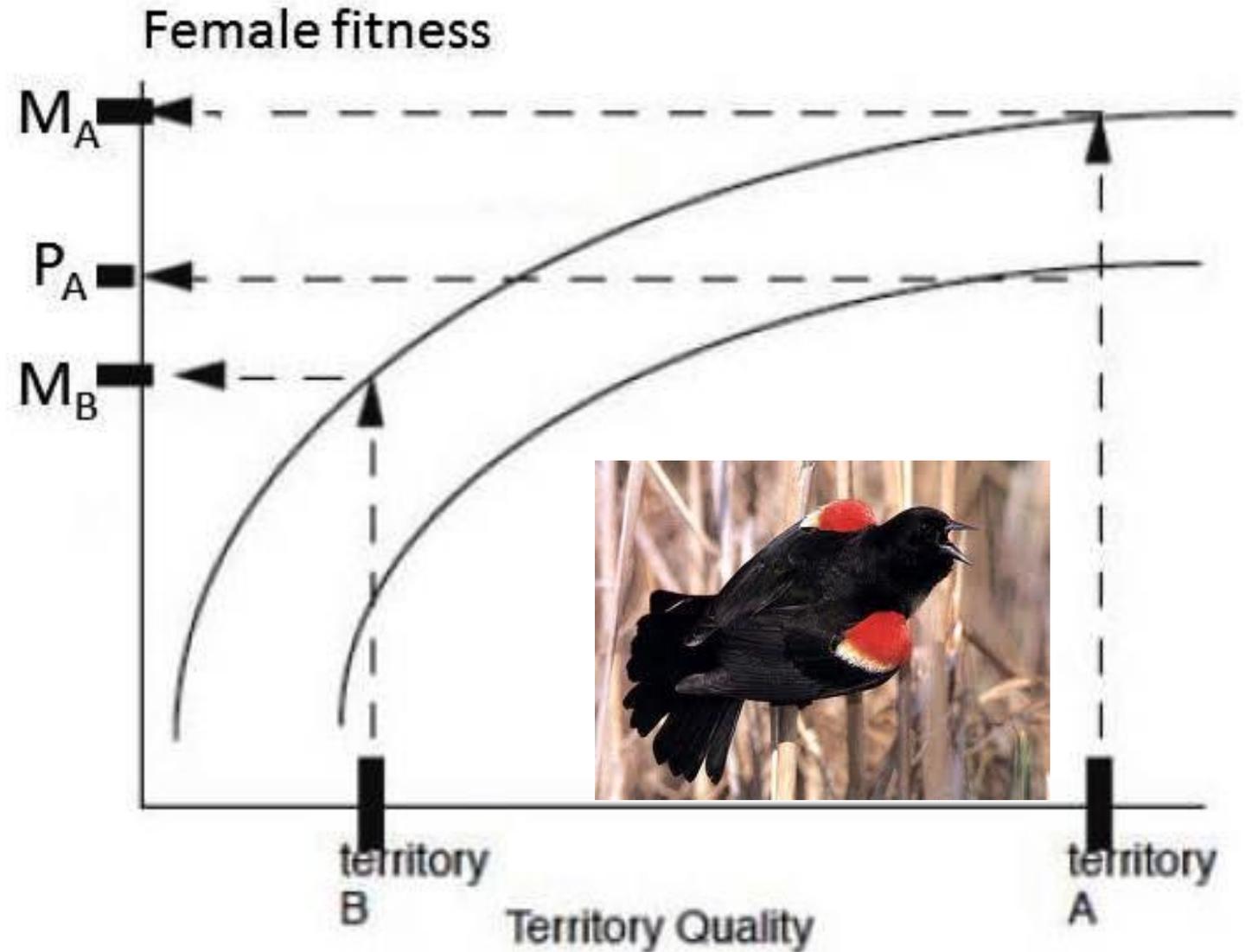
Predictions

- Male territory quality $c+$ number of mates and RS
- RS of P ♀ = M ♀
- More polygyny with greater resource inequality

Assumptions

- Female choice
- ♀ RS affected by male resources
- Resources equally divided among mates

Polygyny Threshold Model



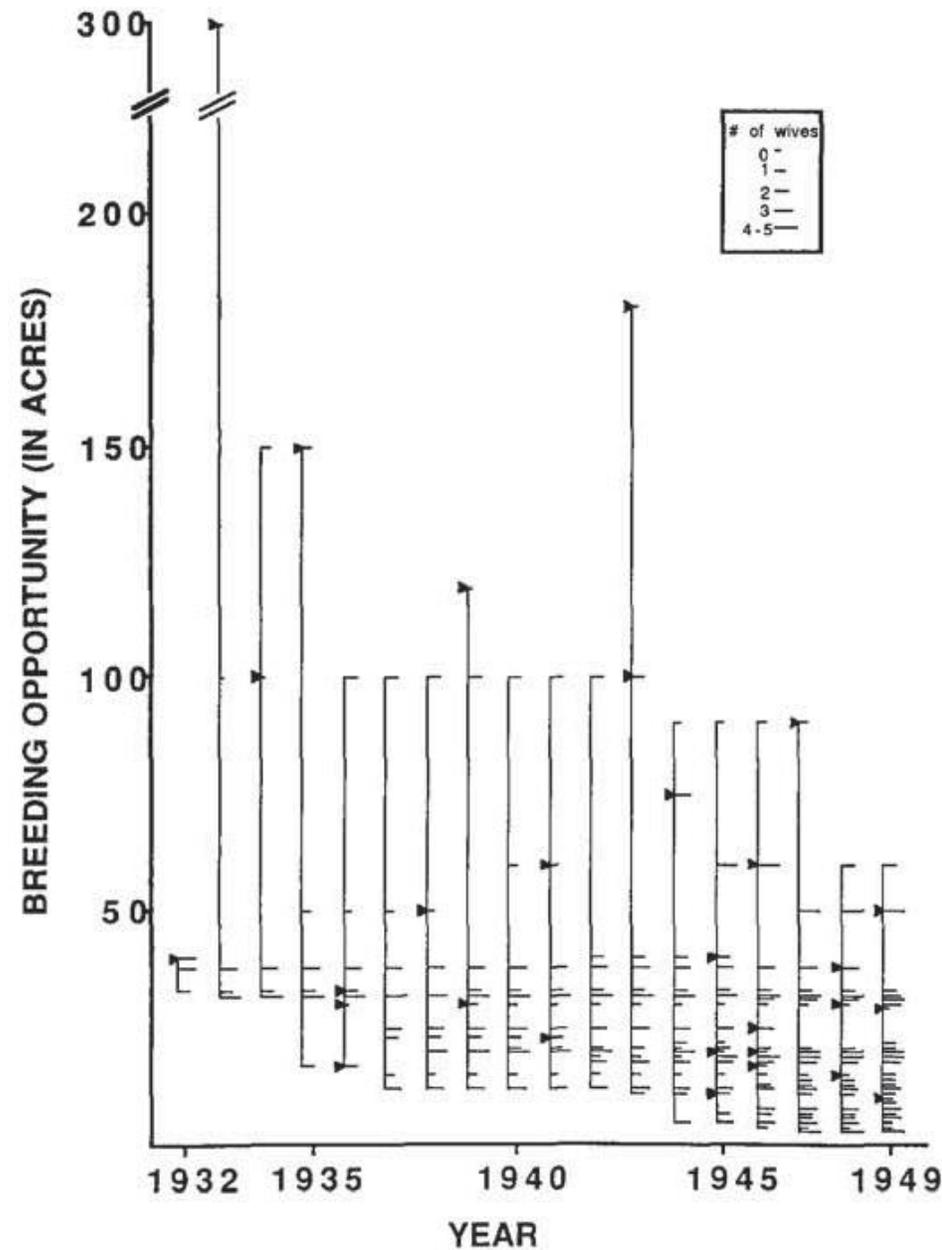
Kipsigis (agropastoralists, western Kenya, 1981-4)



Assumptions

- Men have 0-12 wives over lifetime
- Parents strongly guided by daughters' preferences
- Men's land and livestock critical to women's reproduction
- Resources equally divided among cowives

Female settlement pattern follow IDF



Borgerhoff Mulder 1990 *Behav. Ecol. Sociobiol.*

Kipsigis (agropastoralists, western Kenya, 1981-4)



Predictions

- Wealthier males more polygynous
- Fitness $P_{\text{♀}} = M_{\text{♀}}$
- More polygyny with greater wealth inequality



Yomut (Irons). Credit: Wikipedia



Mukogodo (Cronk). Credit: Laikipia Forum

Borgerhoff Mulder 1988. *Reproductive Success* (Ed. Vol Clutton Brock)

Kipsigis (agropastoralists, western Kenya, 1981-4)



- Predictions**
- Wealthier males more polygynous
 - Fitness $P_{\text{♀}} = M_{\text{♀}}$
 - **More polygyny with greater wealth inequality**



(3) Polygamy is as much appreciated by women as by men. When a man wishes to take a second wife he usually consults his first wife—he certainly does so if he is wise. She then frequently selects a wife from amongst her own friends. When such is the case harmony

Orchardson (1930) *The Kipsigis*

Greater wealth inequality ... more polygyny?

Polygyny c+ male resource holding potential



Male control over aquatic and terrestrial extraction sites associated with frequency of polygyny; WNAI N=118

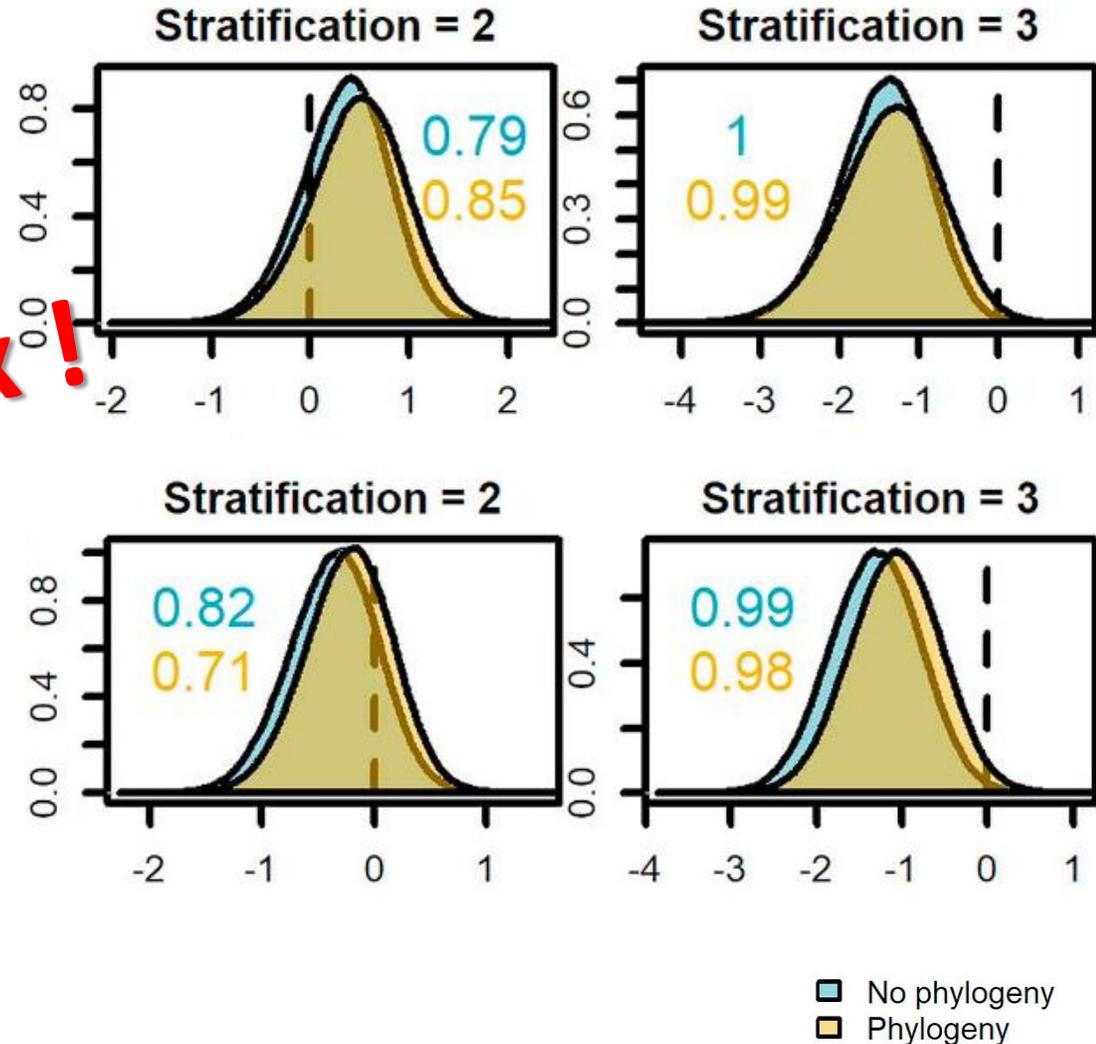
Sellen & Hruschka 2004 *Curr. Anth.*

Cultural rules allowing polygyny (V860, SCCS)

Percentage men married polygynously (V871 SCCS)

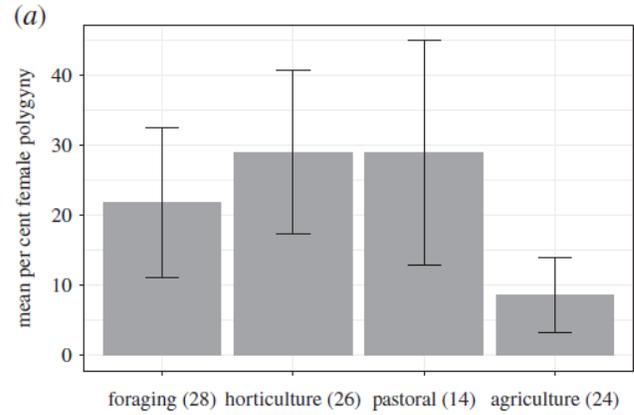
Polygyny Paradox!

Polygyny c+ inequality in male resources

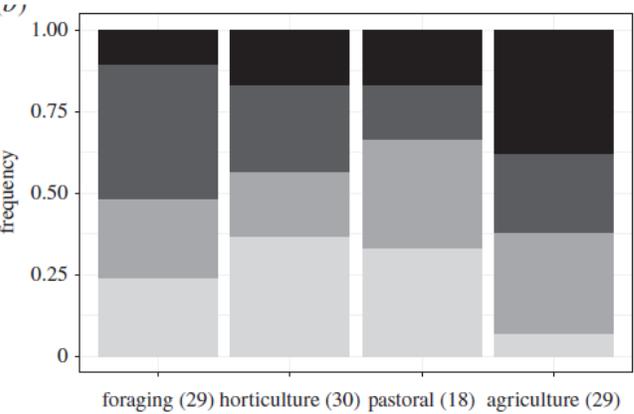


Standard CrossCultural Sample (N~184); Minocher et al 2019, *Evol. Hum. Behav.*

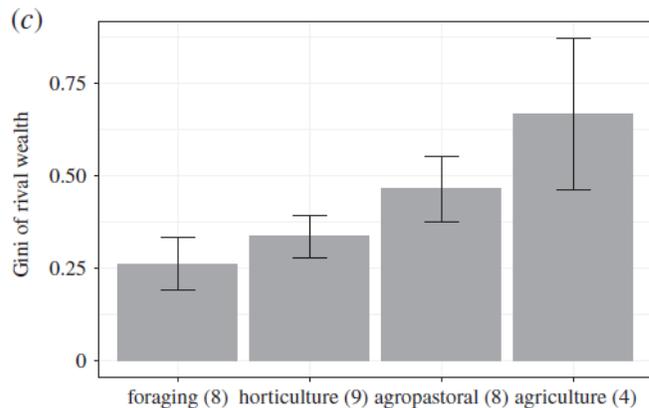
Solving the “Polygyny Paradox”



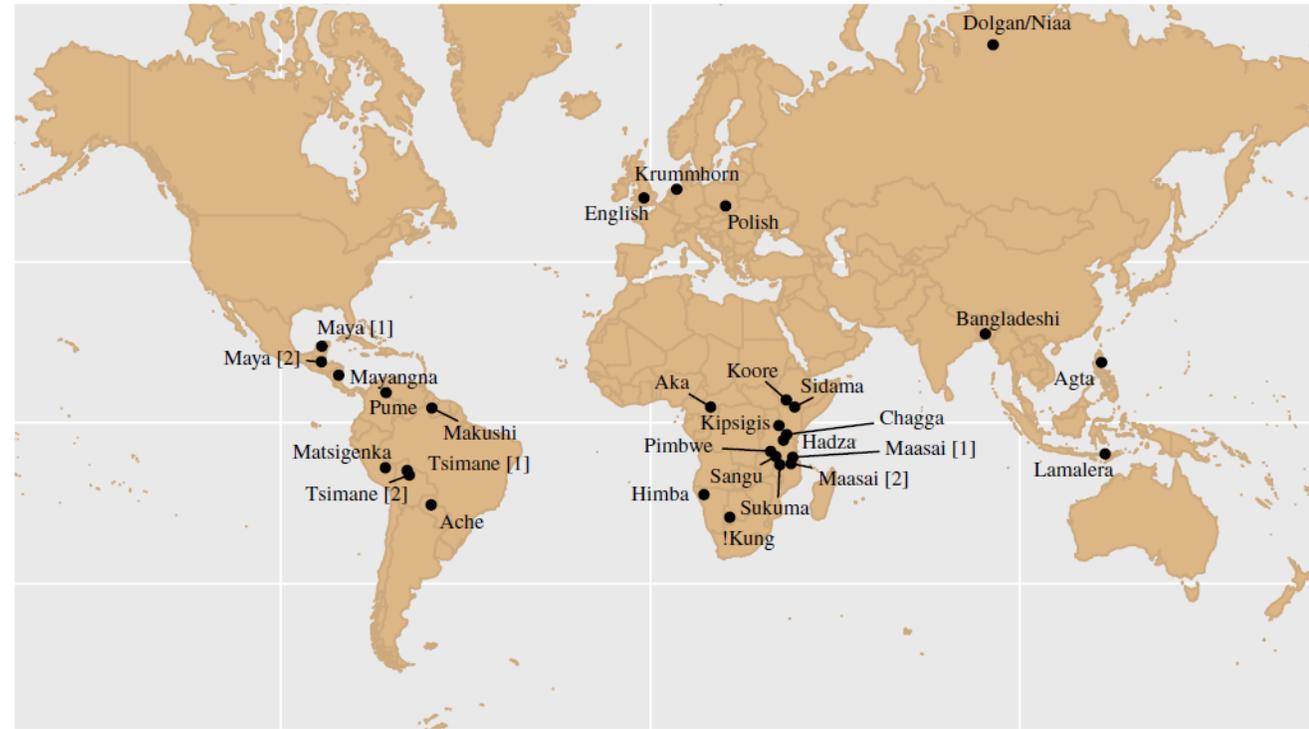
Societies in the Standard Cross Cultural Sample (N=186)



Legend for (b):
 ■ monogamy prescribed
 ■ monogamy preferred
 ■ limited polygyny
 ■ full polygyny



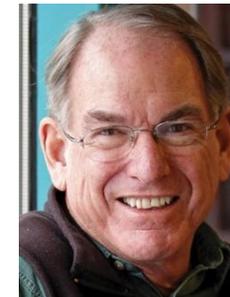
Borgerhoff Mulder et al 2009 *Science* (N=29)



Rebuilt the PTM as a mutual mate choice model to predict the conditions favouring monogamy, and then explored the parameters empirically

Oh et al (2018) *BioRxiv*

Ross et al (2018) *Roy. Soc. Interface.*



Mutual mate choice model

Man's fitness (w) a function of wives (n), two kinds of wealth (rival (m) and non-rival (g)) and the cost of acquiring a wife (c)

$$w = \underbrace{n^\delta}_{\text{effective number of wives}} \cdot \underbrace{g^\gamma \left(\frac{m - nc}{n} \right)^\mu}_{\text{average fitness per effective wife}}$$



Credit: Facebook

Rival wealth (m) and non-rival wealth (g) modelled as complements, e.g. skill*land

Weighting parameters:

μ = % increase in male fitness associated with a 1% increase in the male's rival wealth per wife (m)

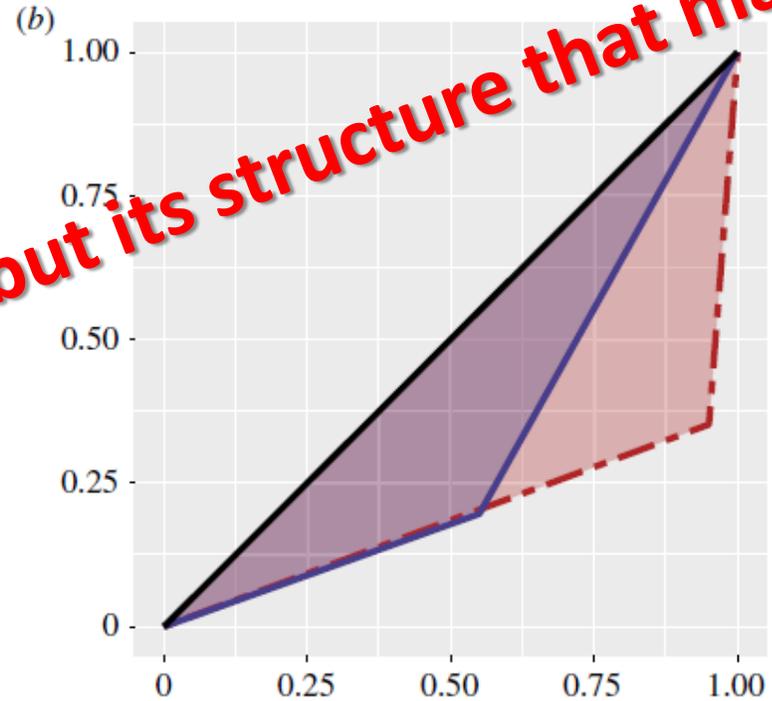
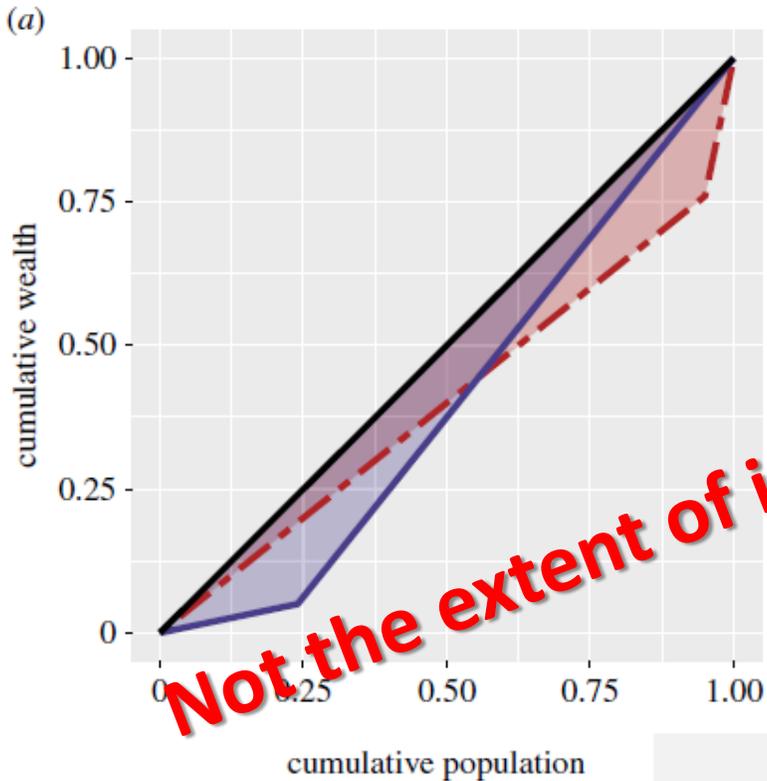
γ = % increase in male fitness associated with a 1% increase in the male's non-rival wealth (g)

δ = % increase in male fitness associated with 1% increase in number of wives, holding constant rival wealth per wife

Θ = fraction of rich males; females own no wealth

Model results: two conditions favouring monogamy even in highly unequal societies

- diminishing fitness returns to adding wives, arising from causes other than shared rival wealth (low δ)
- a very small class of exceptionally wealthy men (low Θ)



Not the extent of inequality (Gini) but its structure that matters!

Gini = .19
 Fraction of rich (Θ) = 0.05 (x); 0.76 (y)

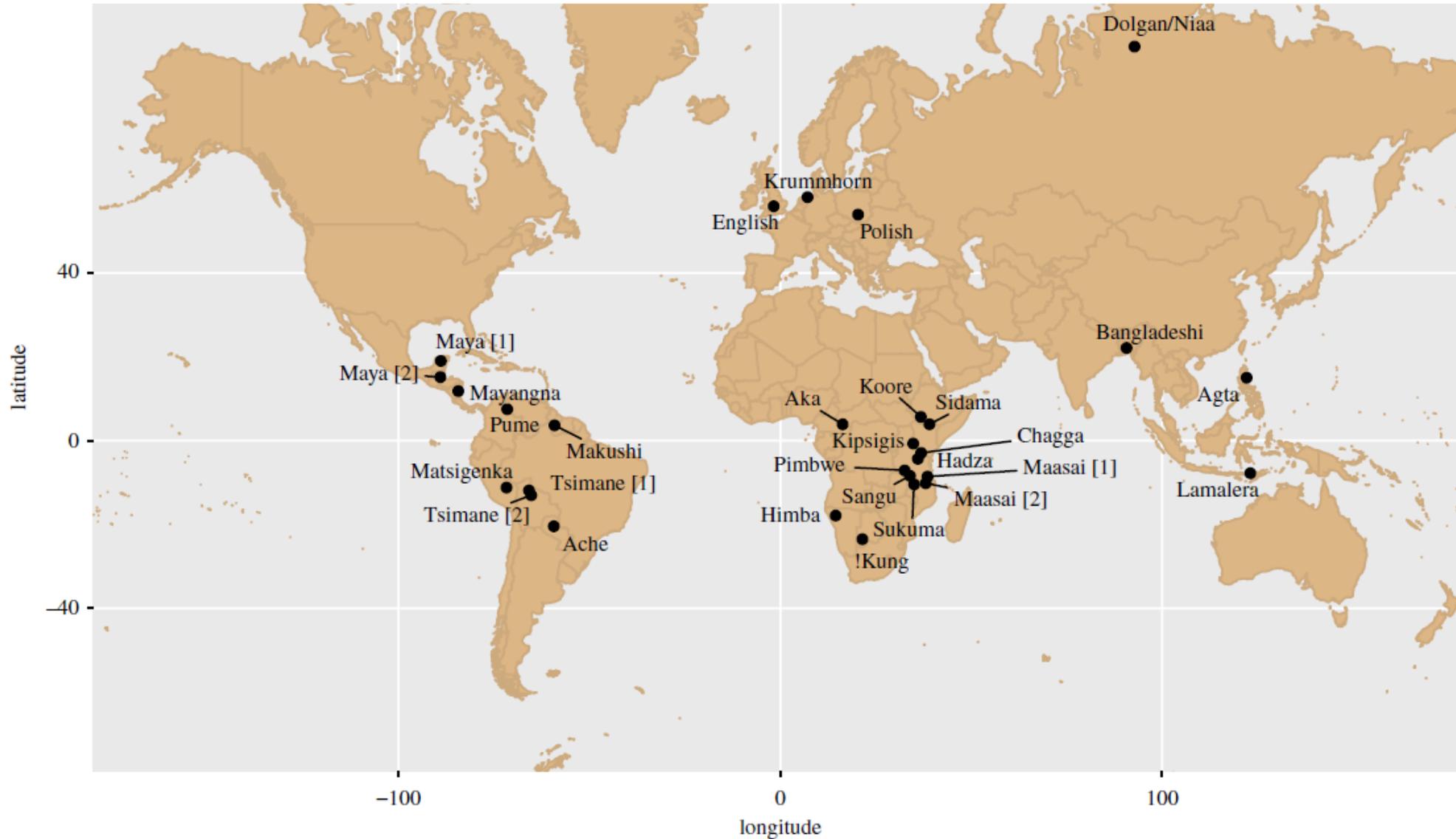
x (hypothetical AG popn)
 Gini = .6
 Fraction of rich (Θ) = 0.05 (x)

y (hypothetical HO, PA or HG popns)
 Gini = .35
 Fraction of rich (Θ) = 0.45 (y)

Under Y our model produces much higher levels of polygyny than under X, despite same Gini

Model predicts low levels of polygyny under X than Y

Building a cross-cultural data set (N=29) using Individual-level data



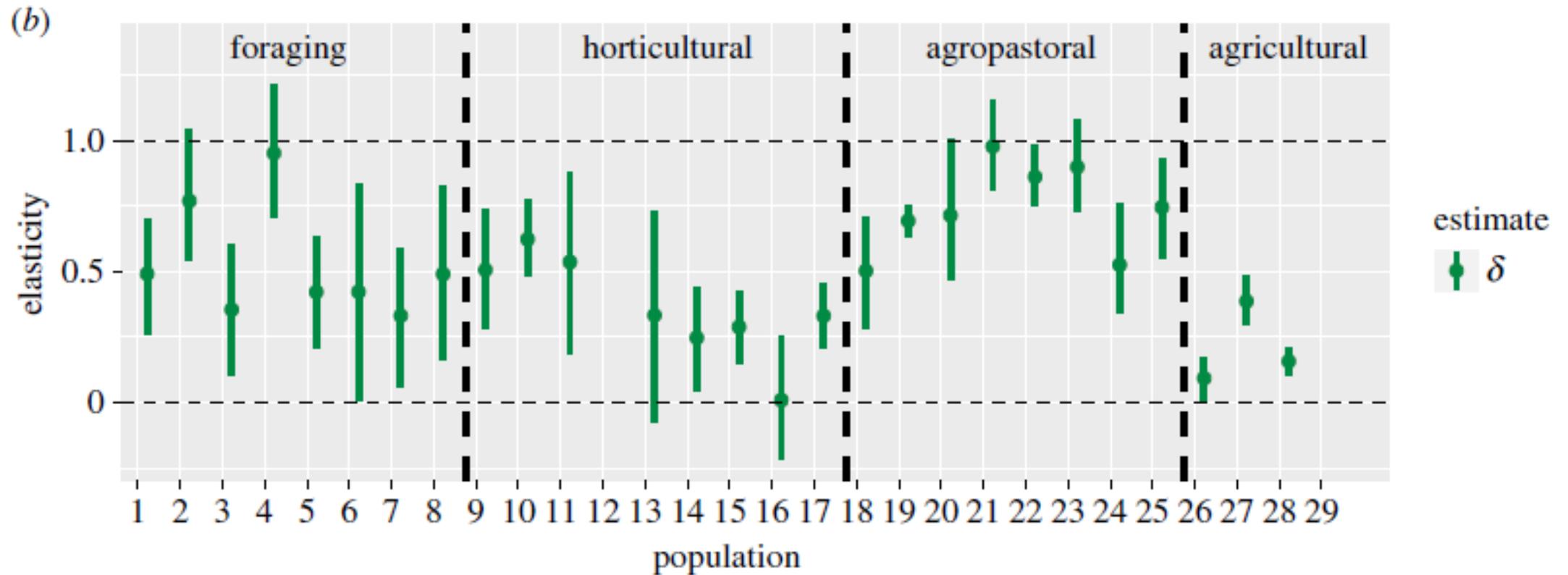
Male reproductive success: age adjusted

Polygyny: age adjusted measure of # wives married; (include sequential)

Wealth: locally relevant measures of rival wealth (livestock, land, money, household goods)

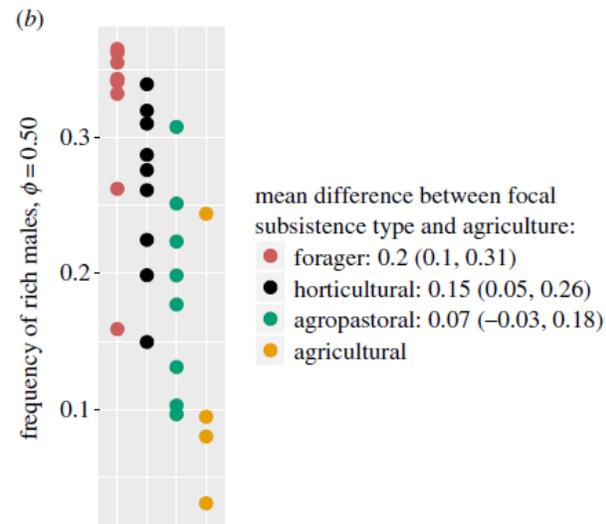
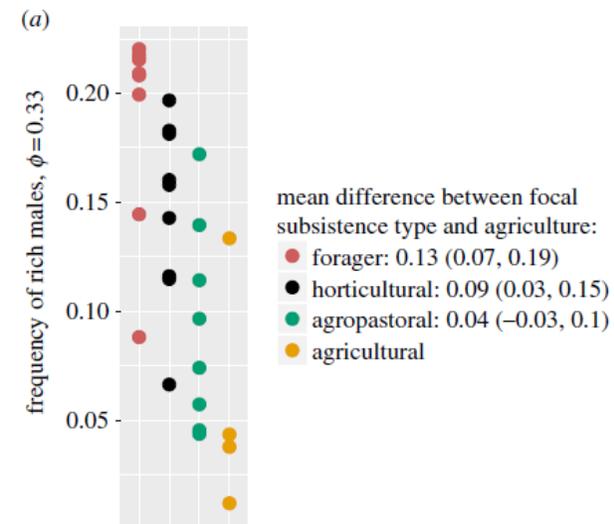
Empirical Results: Is there any evidence for the two necessary conditions?

- δ is less than 1 in most sampled populations (evidence of diminishing returns to adding wives for reasons other than sharing male rival wealth)
- θ is smaller in agricultural than other production systems



Empirical Results: Is there any evidence for the two necessary conditions?

- δ is less than 1 in most human populations (evidence of diminishing returns to adding wives for reasons other than sharing male rival wealth)
- Θ is smaller in agricultural than in other production systems (evidence of only very few men being able to meet the polygyny threshold)



Year	Site	$\theta, \phi = 0.33$	$\theta, \phi = 0.50$	$\theta, \phi = 0.66$
5100 BCE	Hamangia I and II	0.04	0.10	0.16
4800 BCE	Hamangia III	0.04	0.10	0.20
4550 BCE	Hamangia IV	0.05	0.10	0.18
4350 BCE	Varna I	0.07	0.13	0.23
4350 BCE	Varna II and III	0.02	0.05	0.09
321 BCE	Athens	0.02	0.05	0.16
116 BCE	Hermopolite	0.02	0.03	0.06
150	Roman Empire	0.03	0.13	0.37
1000	Byzantium	0.02	0.19	0.42
1258	Italy	0.05	0.09	0.17
1498	Italy	0.05	0.09	0.17
1511	Italy	0.07	0.12	0.20
1540	Quauhchichinollan	0.06	0.19	0.36
1540	Huitzillan	0.05	0.18	0.36

Identified (and confirmed empirically) two conditions:

- Highly skewed inequality
 - Rival qualities of males (beyond material wealth)
- } *jointly sufficient to generate a transition to more frequent monogamy in stratified populations*

Individual fitness optima

- Rational individual fitness calculations for men and women
- *Origins* of monogamy
- Norms might follow via imposition or imitation
(cf. Alexander 1979 *Darwinism & Human Affairs*; Henrich et al 2012)

Consistency with previous work

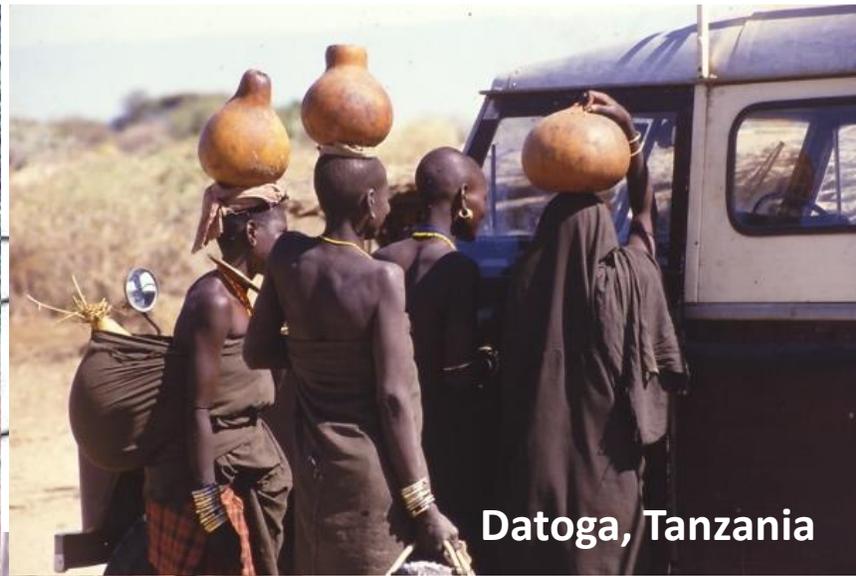
- Social unrest in class systems, and political pressure against rich
[Θ] (*Lagerlof 2010 J. Ec. Gr.; de la Croix and Mariani 2015 Rev. Econ. St.*)
- Tradeoffs and tensions between investing in wealth and/or wives
[δ] (*Tertilt 2006 J. Eur. Ec. Assoc, Alger 2021 JEBO*)

What is δ ?

- Paternal time investment in children and/or in wife
guarding (Hewlett 1992 *Intimate Fathers*; Betzig 1986 *Despotism*; Alger 2021 *JEBO*)
- Sexually transmitted disease
(Bauch and McElreath 2016, *Nat. Comms.*; Bove & Valleggia 2009 *Soc. Sci. Med.*)
- Cowife competition (Muhsam 1956. *Pop. Studies*)
- Measurement issues?



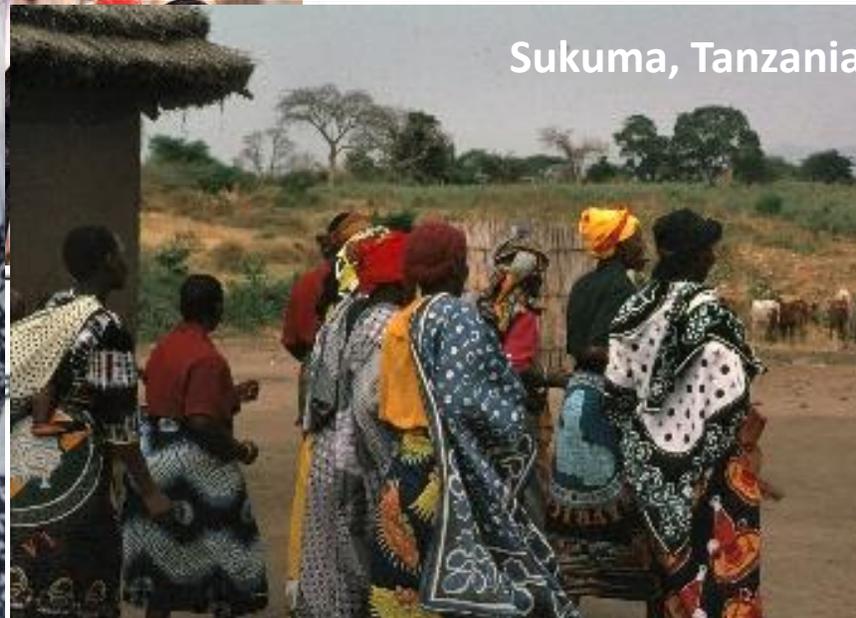
Kipsigis, Kenya



Datoga, Tanzania



Pemba, Zanzibar



Sukuma, Tanzania

**Co-wife
cooperation?**

Polygyny as a
“harmful cultural
practice”?

The role of norms
in structuring
marriage?

Mende and Temne men and women (n=523) in Sierra Leone

Interactions with partner across four economic games (sharing, costless sharing, envy and costless envy) characterized as:

- Egalitarian
- Resource maximizing
- Generous
- Selfish

Following Fehr et al (2008, *Nature*)

Not necessarily dysfunctional nor conflict ridden!

Behavioral Type Stranger vs. Husband vs. Cowives polygyny women

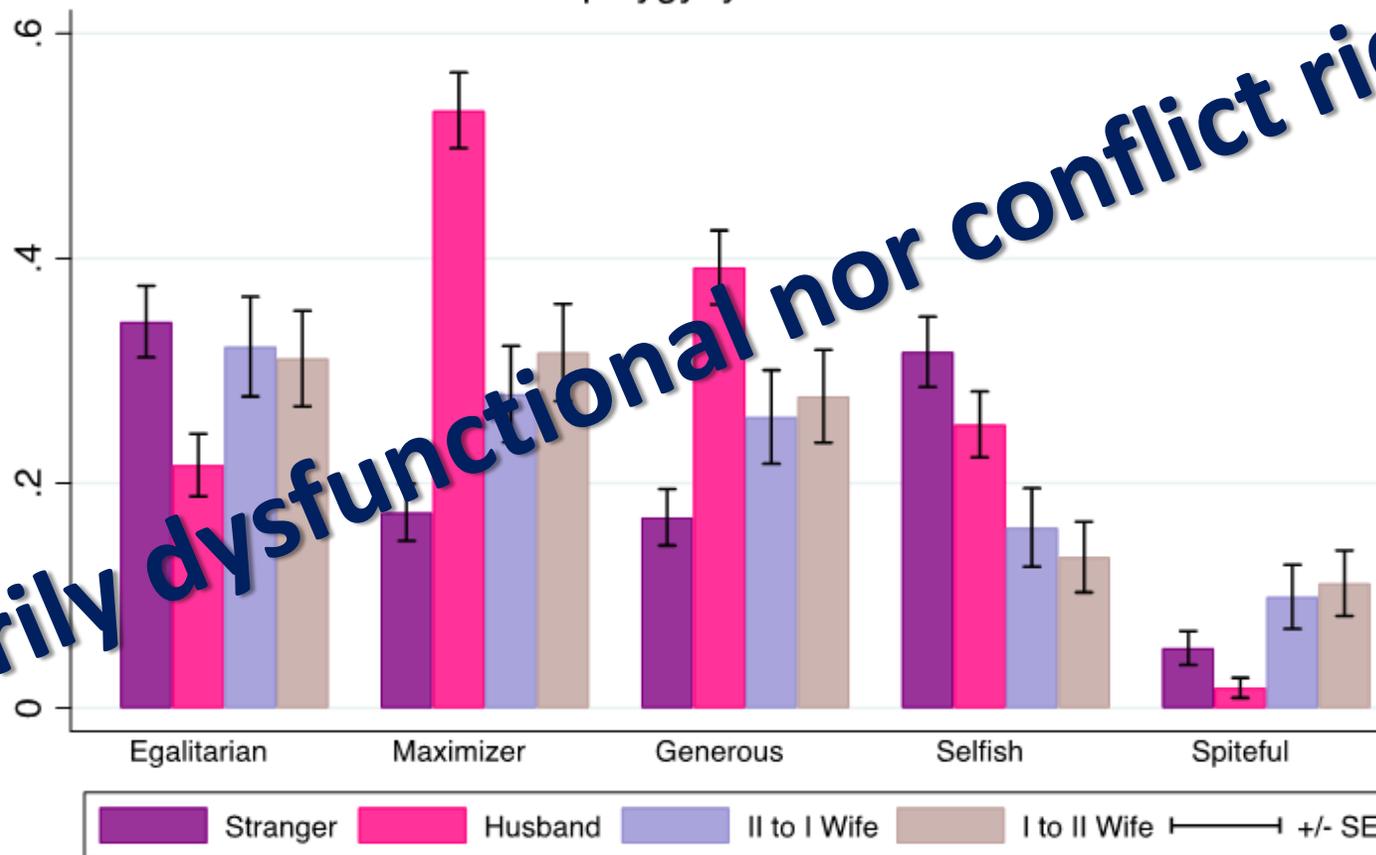


Table 4 Characterization of Different Behaviour Types on Basis of Cooperative Game Play

	Egalitarian		Maximizer		Generous		Selfish		Spiteful	
Share	(1,1)	(2,0)	(1,1)	(2,0)	(1,1)	(2,0)	(1,1)	(2,0)	(1,1)	(2,0)
Costless Share	(1,1)	(1,0)	(1,1)	(1,0)	(1,1)	(1,0)	(1,1)	(1,0)	(1,1)	(1,0)
Envy	(1,1)	(2,6)	(1,1)	(2,6)	(1,1)	(2,6)	(1,1)	(2,6)	(1,1)	(2,6)
Costless Envy	(1,1)	(1,2)	(1,1)	(1,2)	(1,1)	(1,2)	(1,1)	(1,2)	(1,1)	(1,2)

Alessandra Cassar, Cristina Moya and Bethany Gerdemann, in prep.



Selective evidence?

Bean and Minneau 1989 *Population Studies*; Borgerhoff Mulder 1992 *Hum. Nat.*, Bove & Vallenga 2009 *Soc. Sci. Med.*; Lawson & Gibson 2018 *Dem. Res.*

Dessy et al 2021 *World Bank Group*; Hidrobo et al 2021 *J. Dev. St.*

- Diverse polygynous institutions
- Ideological biases
- Methodological problems

Co-wife
cooperation?

**Polygyny as a
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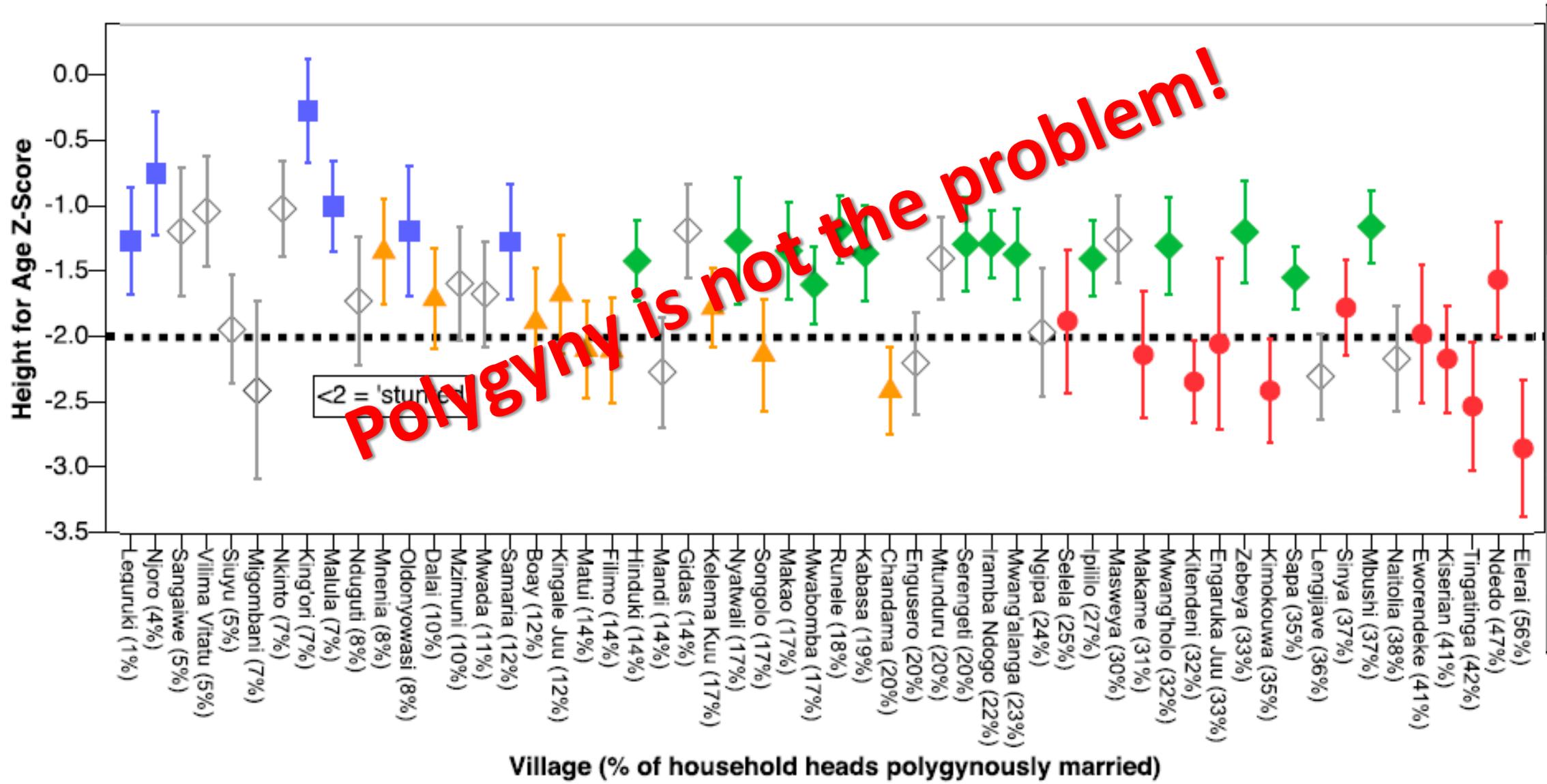


The link between polygamy and war

Plural marriage, bred of inequality, begets violence

Why nations that fail women fail

And why foreign policy should pay more heed to half of humanity



Cultural norms/institutions		With respect to “How Many Wives?”
... constrain individual fitness-optimizing behaviour by increasing costs of deviance from local norms, etc.	✓	Utah-Mormon war (1857-58)
... necessarily converge on individual fitness optima	X	Socially-Imposed monogamy (<i>Alexander 1979 Darwinism & Human Affairs</i>)
... originate from individual fitness optima but persist on account of costs of deviance, etc.	(✓)	Origins versus maintenance (<i>Ross et al 2018 RSiF; Ross et al 2016 Hum. Nat.</i>)
... far removed from individual fitness interests, and exist as a result of conquest, imposition or cultural lag	✓	e.g., colonial expansions; cultural memory as in phylogenetic signal to polygyny (<i>Minocher et al 2019 EHB</i>)
... when rendering a group more competitive, persist and spread as a result of cultural group selection	(✓)	Polygynous societies replaced by monogamous societies (<i>Alexander 1979; Henrich et al. 2012 PNAS; cf. White & Burton 1988 Am. Anth.</i>)

Lots more to do!

Co-wife cooperation?

Polygyny as a “harmful cultural practice”?

The role of norms in structuring marriage?

How do they intersect with individual fitness maximizing strategies?

Summary (or An Abstract Ignored)

- **Behavioural Ecologists** developed the PTM to study mating decisions in birds and mammals
- **Demographers/Public Health Scientists** focused primarily on the costs of polygyny to women
- **Anthropologists** paid greater attention to assumptions of PTM, and variability in polygynous systems (wealth types, extent of choice, opportunities for cooperation, and methodology)
- **Evolutionary Social Scientists** investigated the extent to which individual fitness maximization explained the distribution of polygyny
- **Economists** identified macro-level pathologies (and counterexamples)
- **Behavioural Economists** identified scope for efficiencies AND inefficiencies in polygynous households
- **Cultural Evolutionists** emphasize the importance of norms/institutions

Thanks to

- **So many households across Tanzania and Kenya where I have been so kindly welcomed with my endless questions**
- **So many great collaborators**
- **Generous funding organizations**
- **You the listeners**

