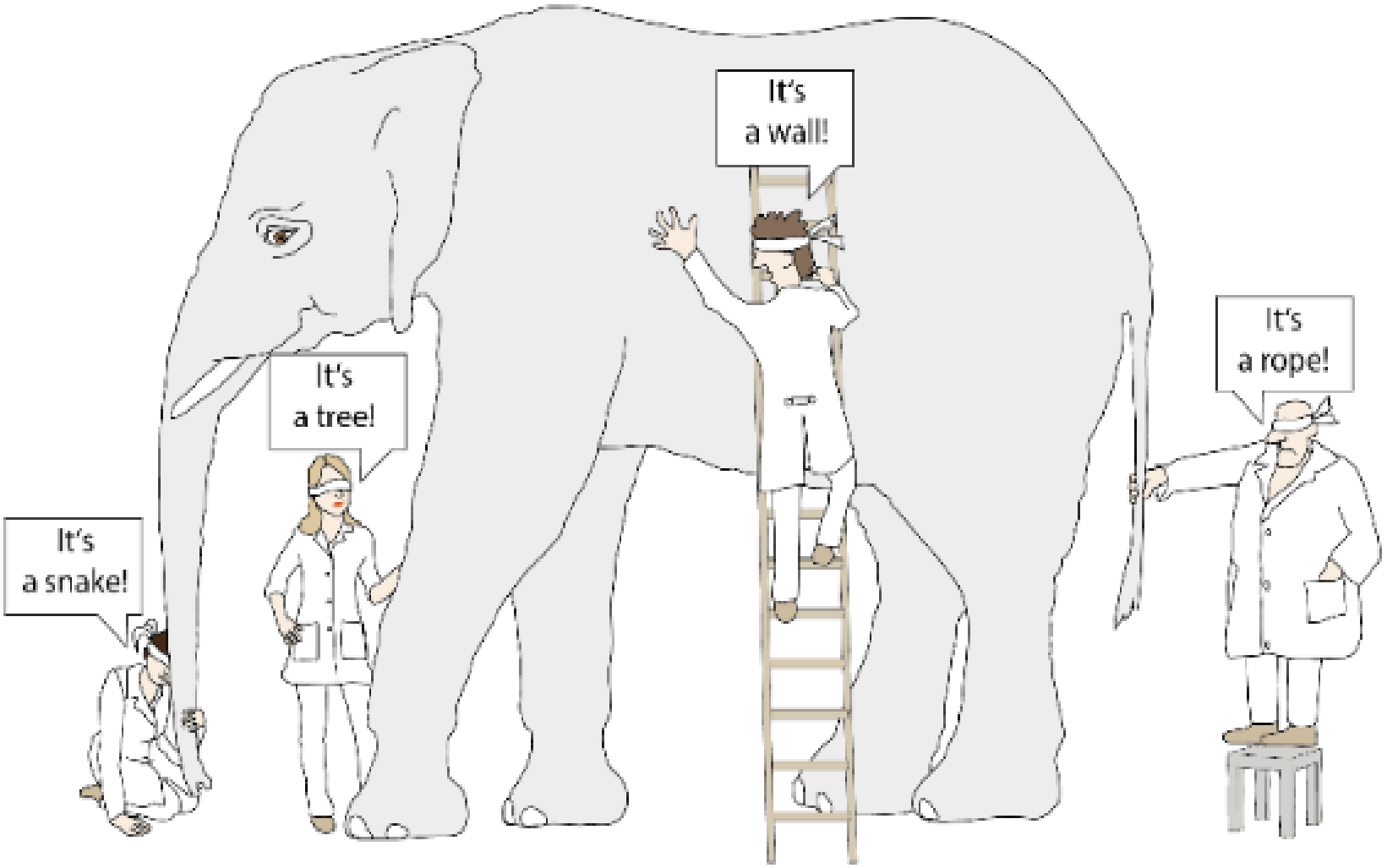
Kalahari Basin Prehistory: Genetic divergence

Mark Stoneking
on behalf of the KBA geneticists

Kalahari Basin Area

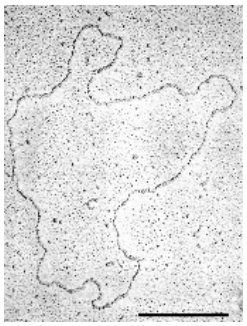
Endangered Language & Population History Research

The blind researchers and the elephant



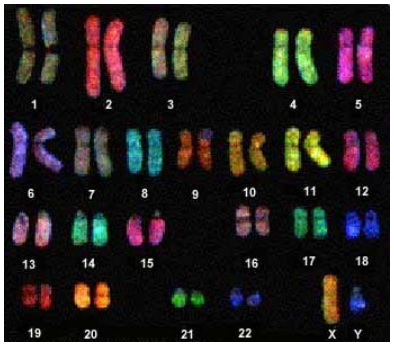
(with thanks to B. Pakendorf)

Outline

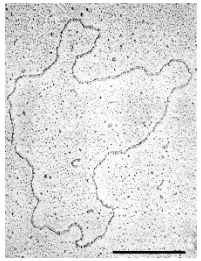


mtDNA: maternal history

Y chromosome: paternal history



Genome-wide data:
the other 99.5% of our ancestry

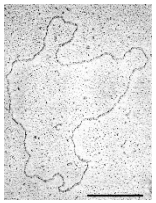


MtDNA

Unraveling the Complex Maternal History of Southern African Khoisan Populations

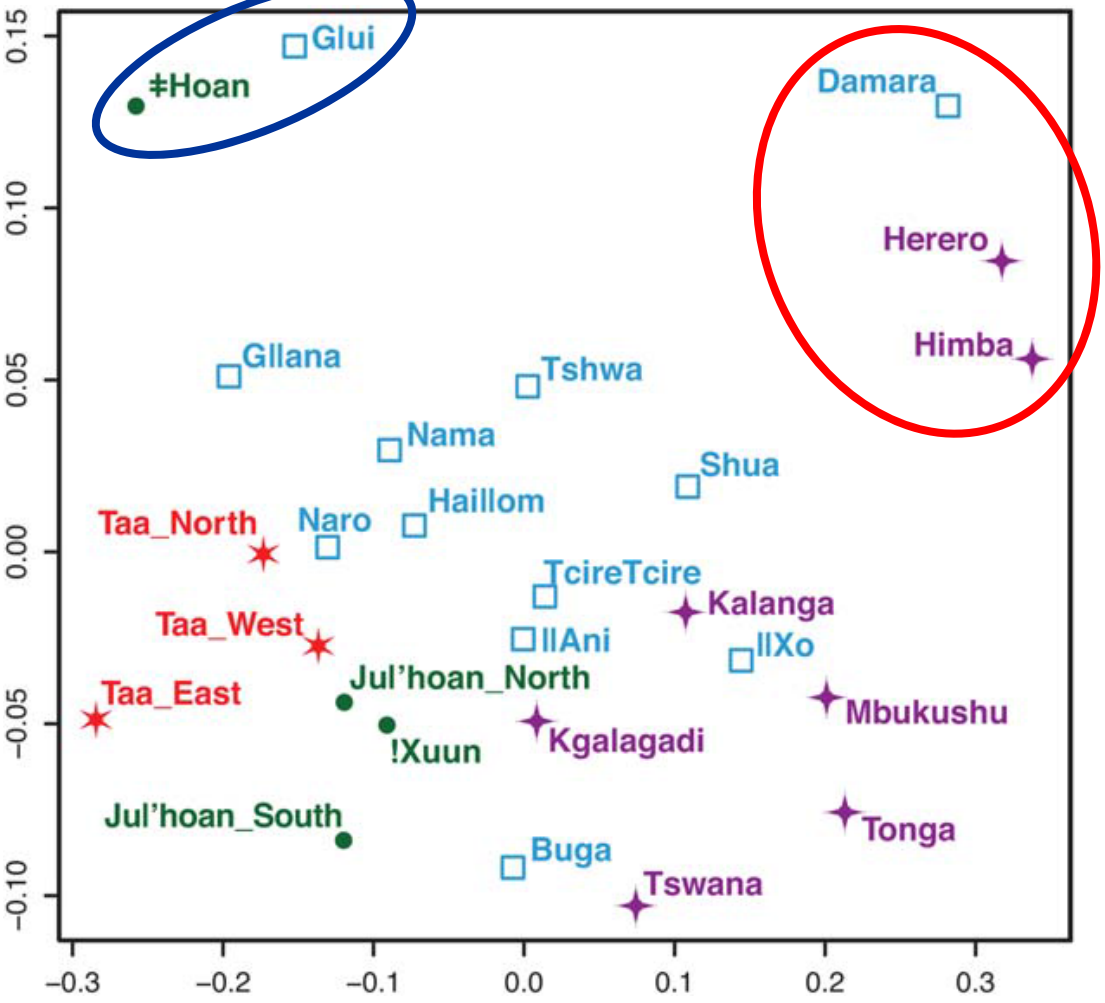
Chiara Barbieri,[1*] Tom Güldemann,[2,3] Christfried Naumann,[2,3] Linda Gerlach,[1] Falko Berthold,[1] Hirosi Nakagawa,[4] Sununguko W. Mpoloka,[5] Mark Stoneking,[6] and Brigitte Pakendorf[1*]

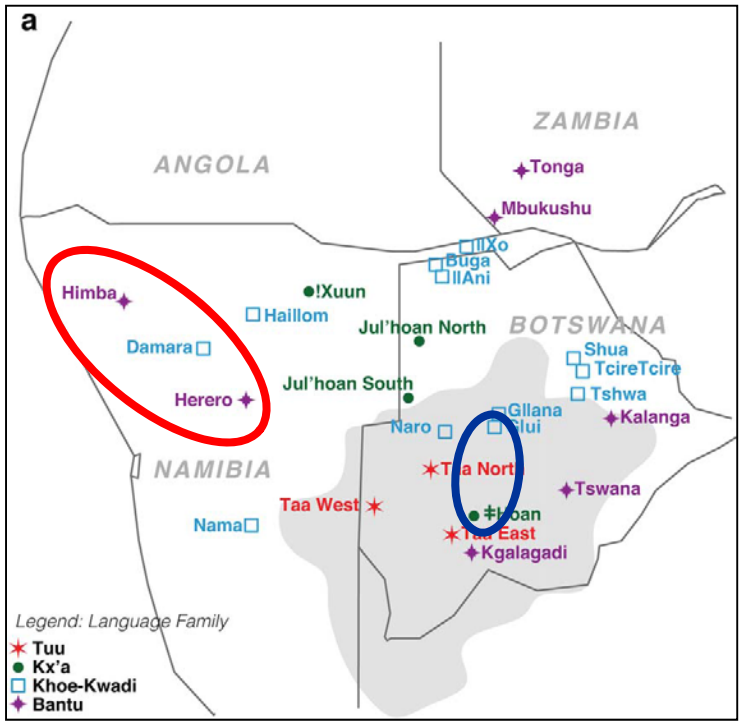
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY 153:435–448 (2014)

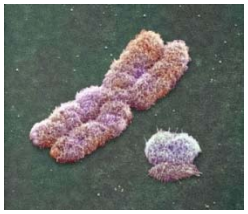


MtDNA

Multidimensional scaling (MDS) plot

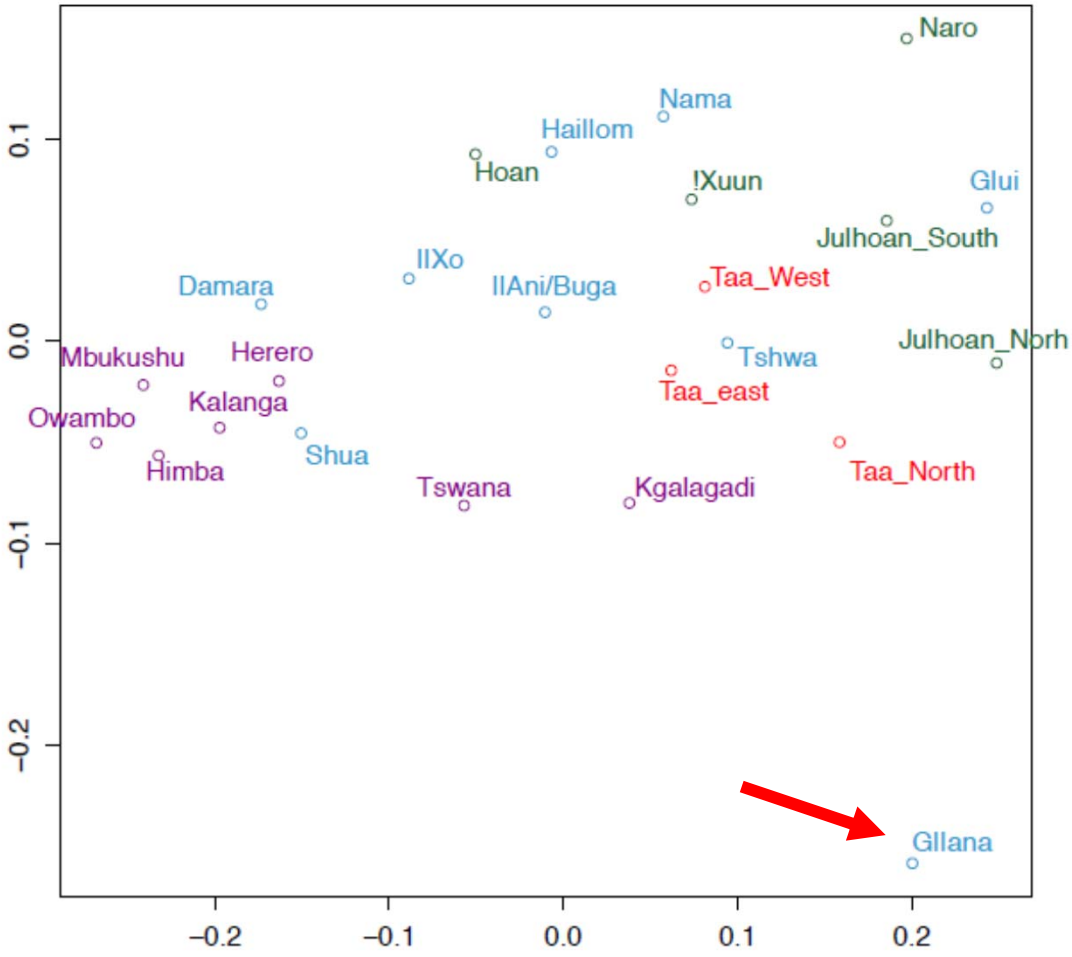


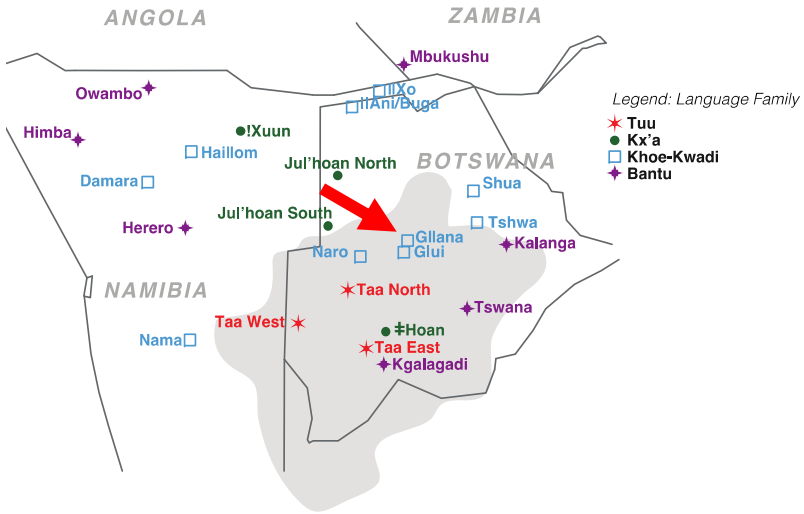




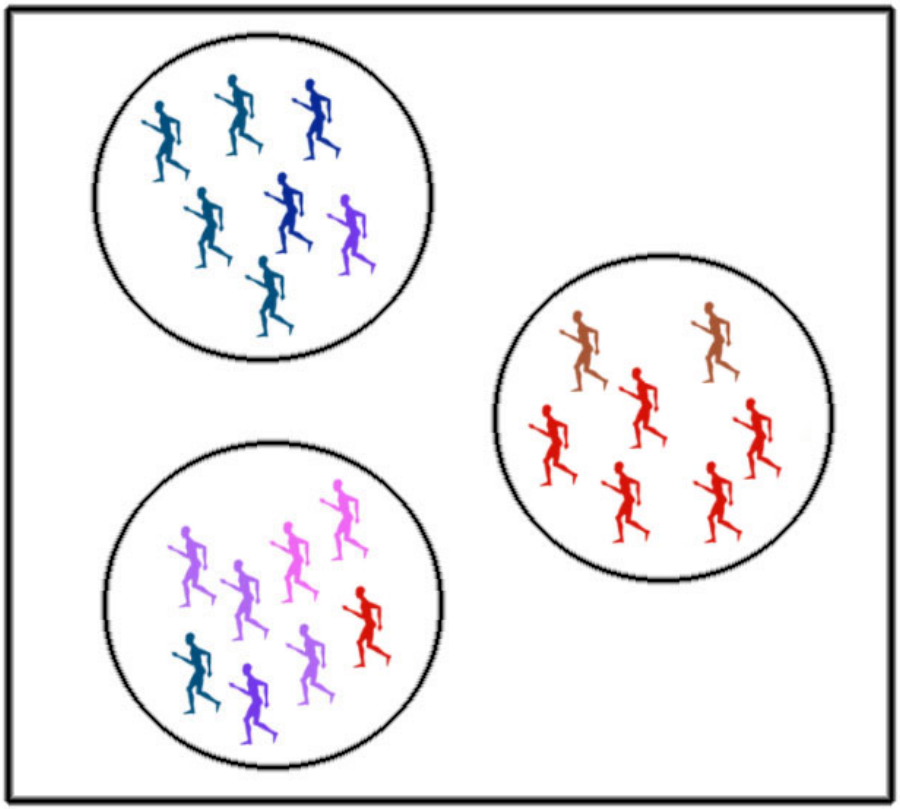
Y-chromosome

MDS plot

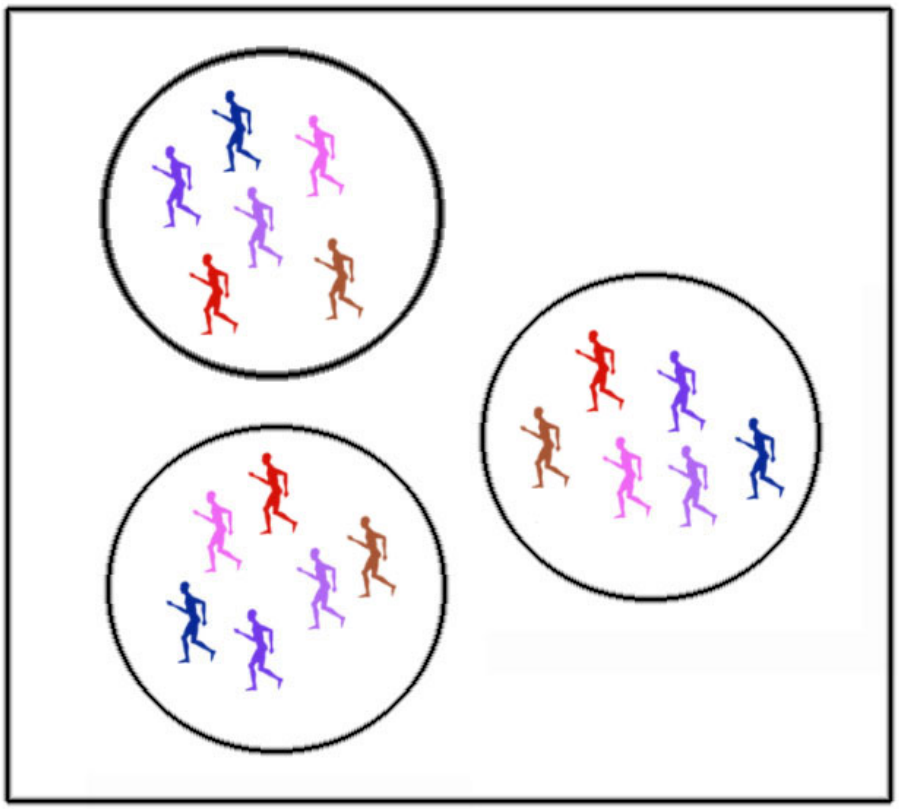




Analysis of Molecular Variance: AMOVA



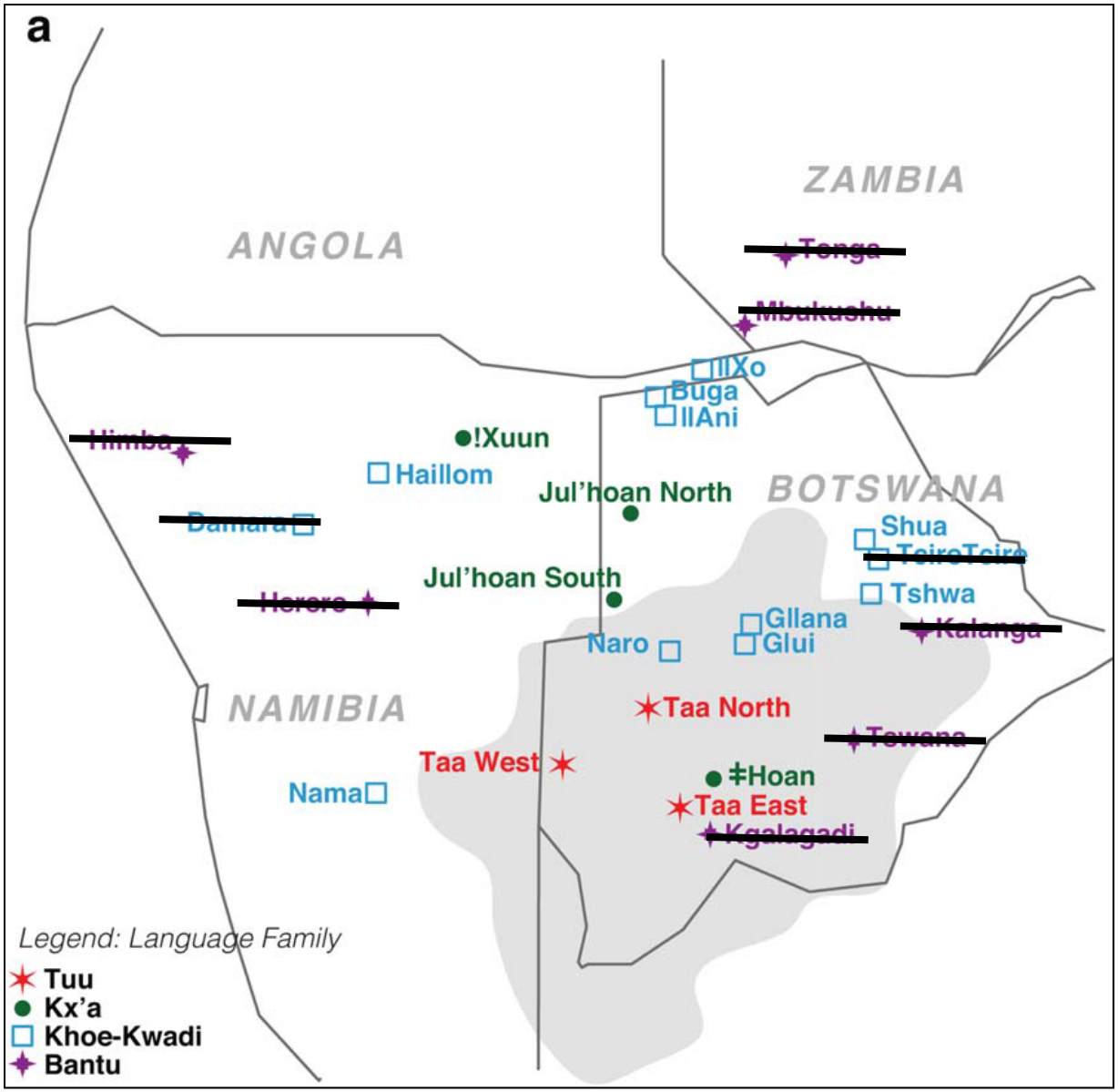
Larger genetic differences between groups



Smaller genetic differences between groups (and so more of the variance is within groups)

(with thanks to C. Barbieri)

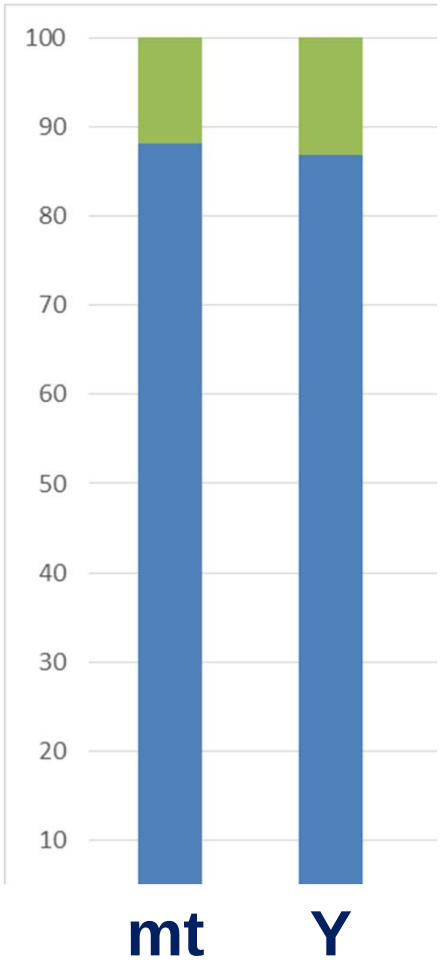
AMOVA – populations excluded



AMOVA – Khoisan groups

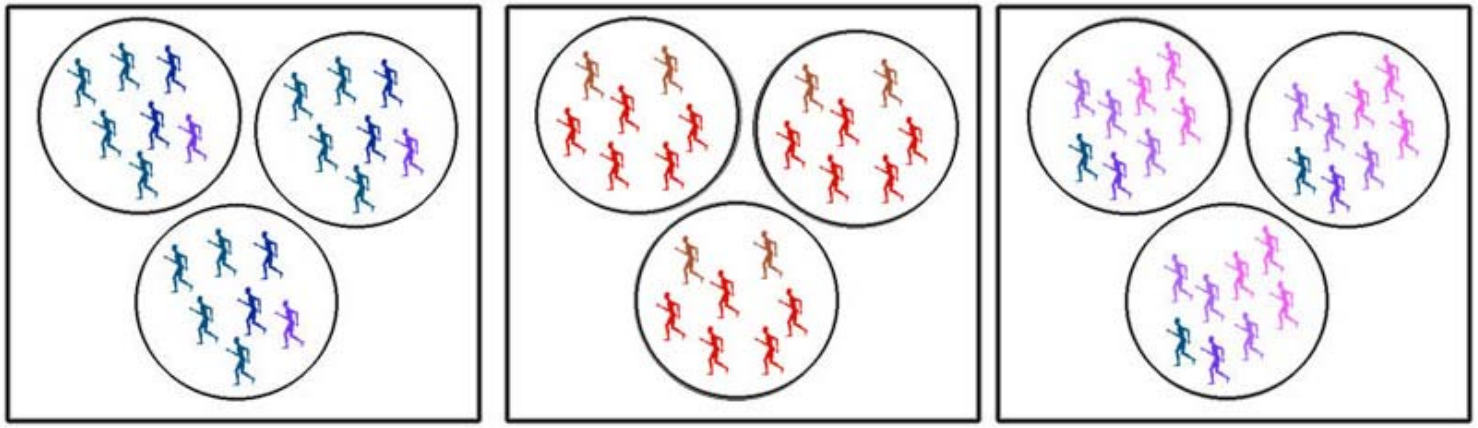
within groups

between groups



AMOVA to test groupings

1

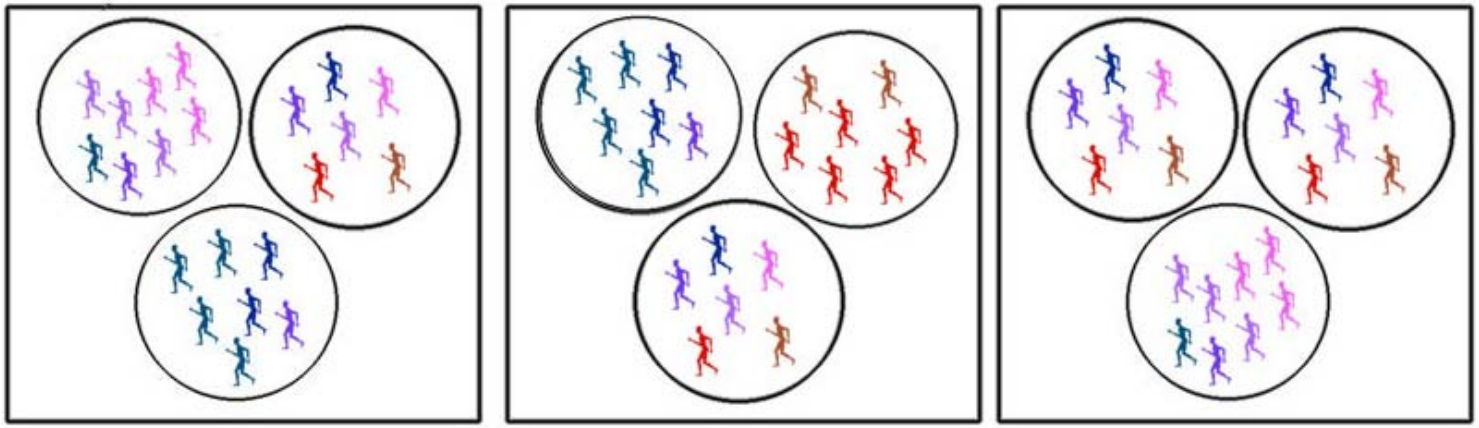


Larger genetic differences between groups
Smaller genetic differences among populations from the same group

Genetic differences are mostly between groups
=> groupings correspond to genetic structure

AMOVA to test groupings

2



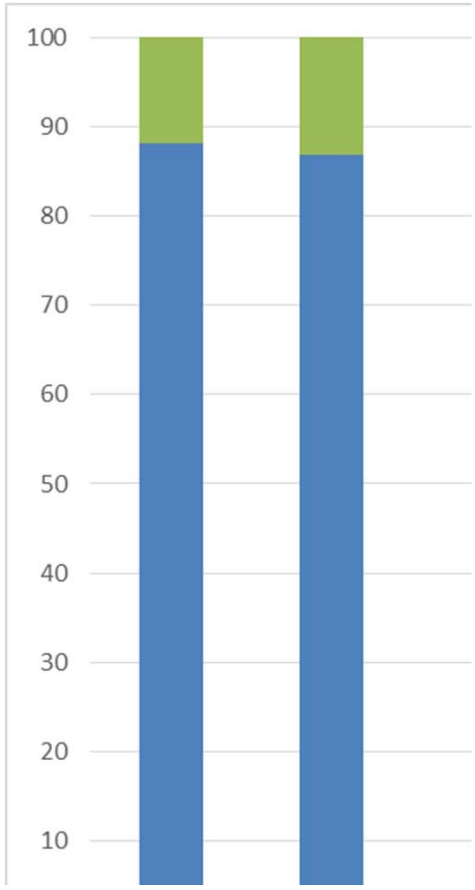
Larger genetic differences **among populations from the same group**

Smaller genetic differences **between groups**

Genetic differences are mostly **among populations from the same group**

=> groupings **DO NOT** correspond to genetic structure

AMOVA – Khoisan populations

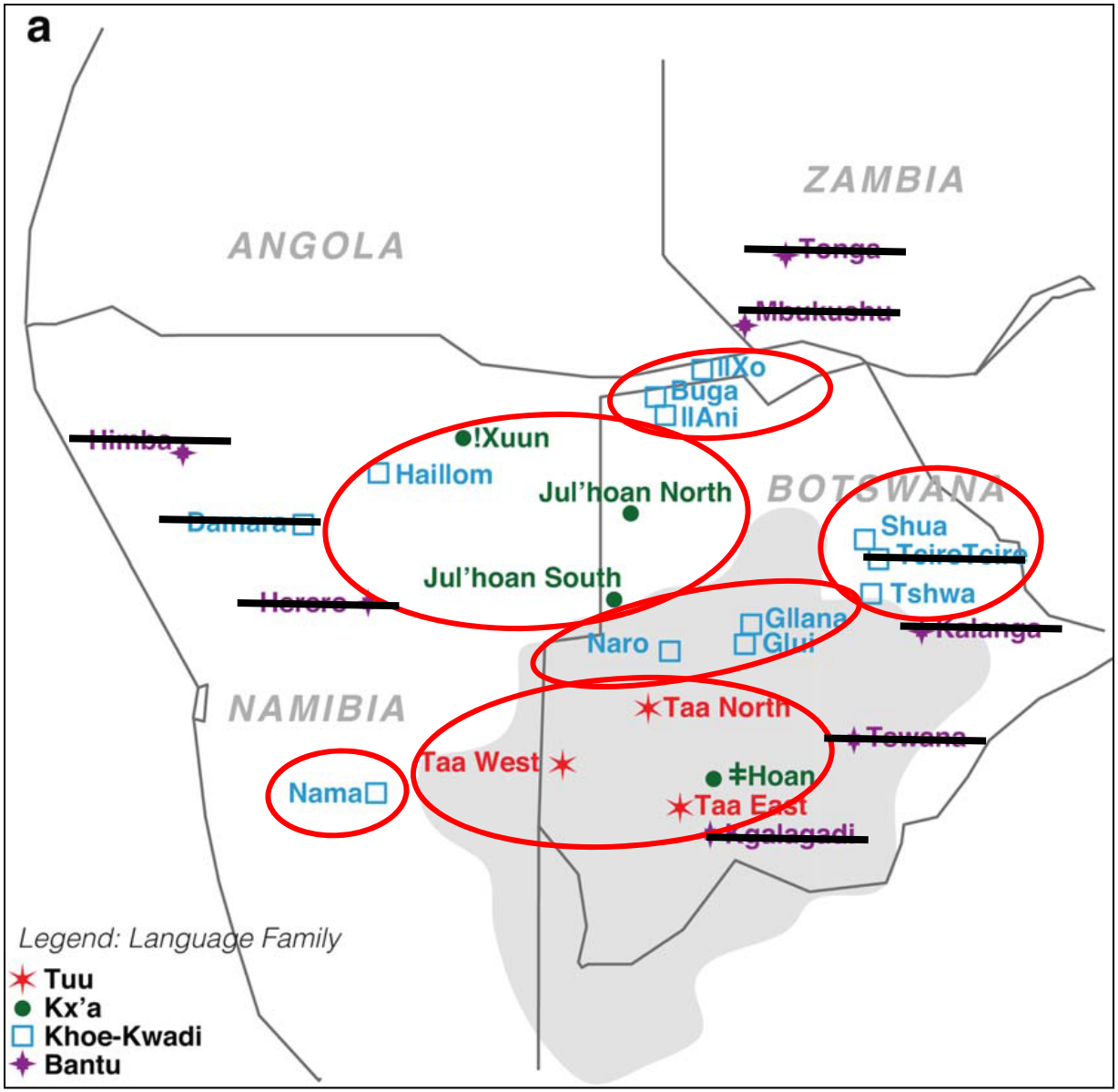


within groups

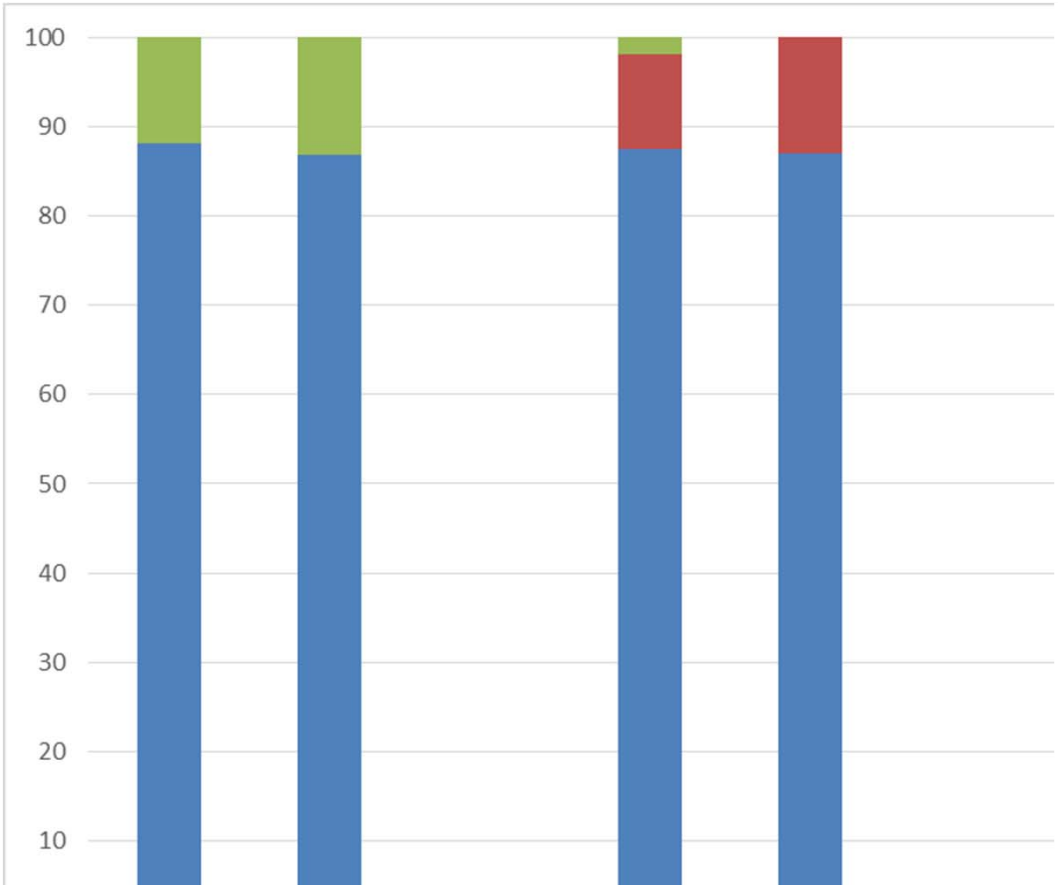
among populations within groups

between groups

Geographic clusters (Khoisan only!)



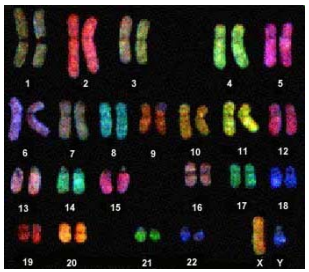
AMOVA – Khoisan groups



within groups

among populations within groups

between groups

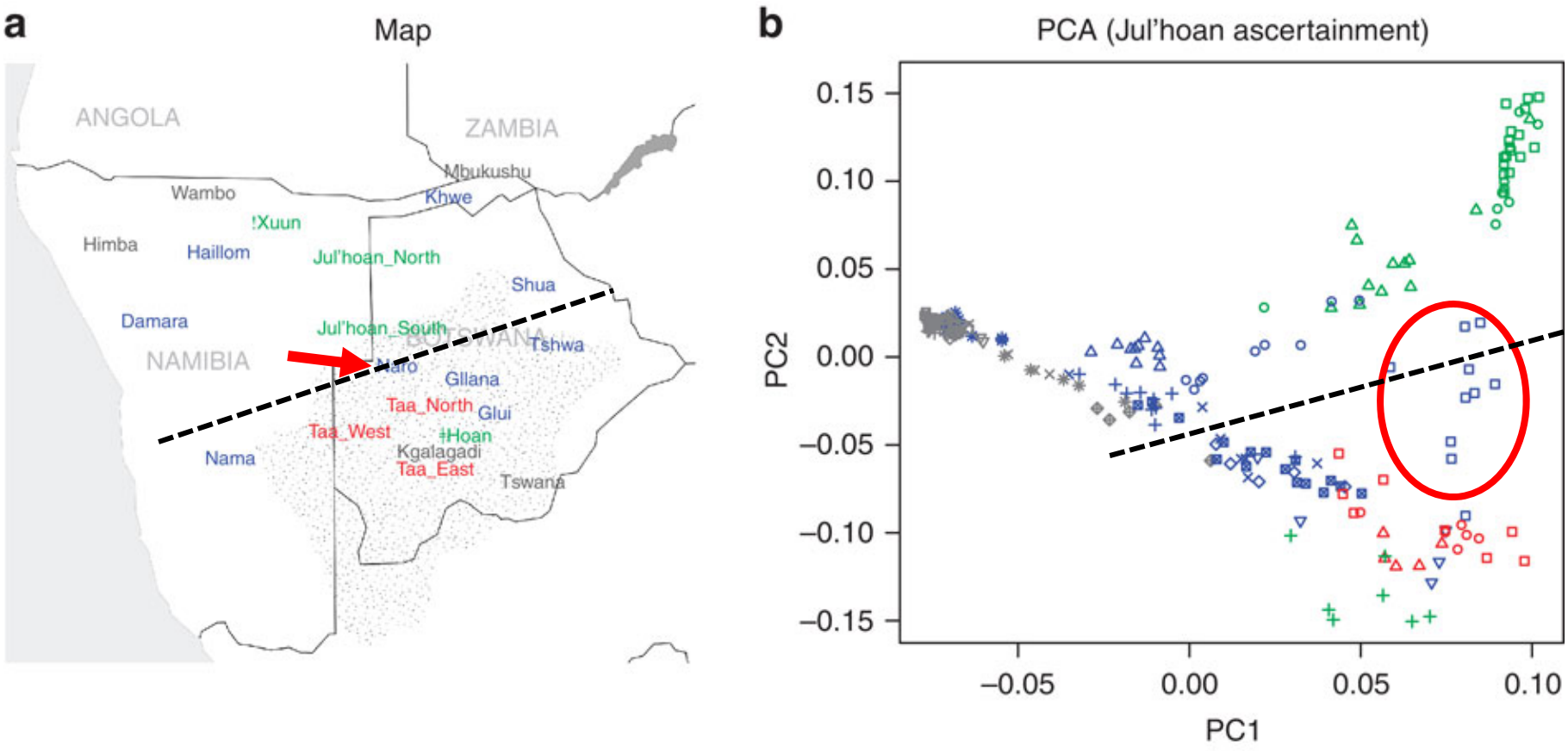


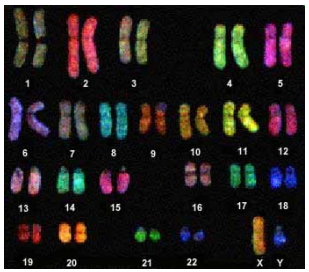
Genome-wide data

The genetic prehistory of southern Africa

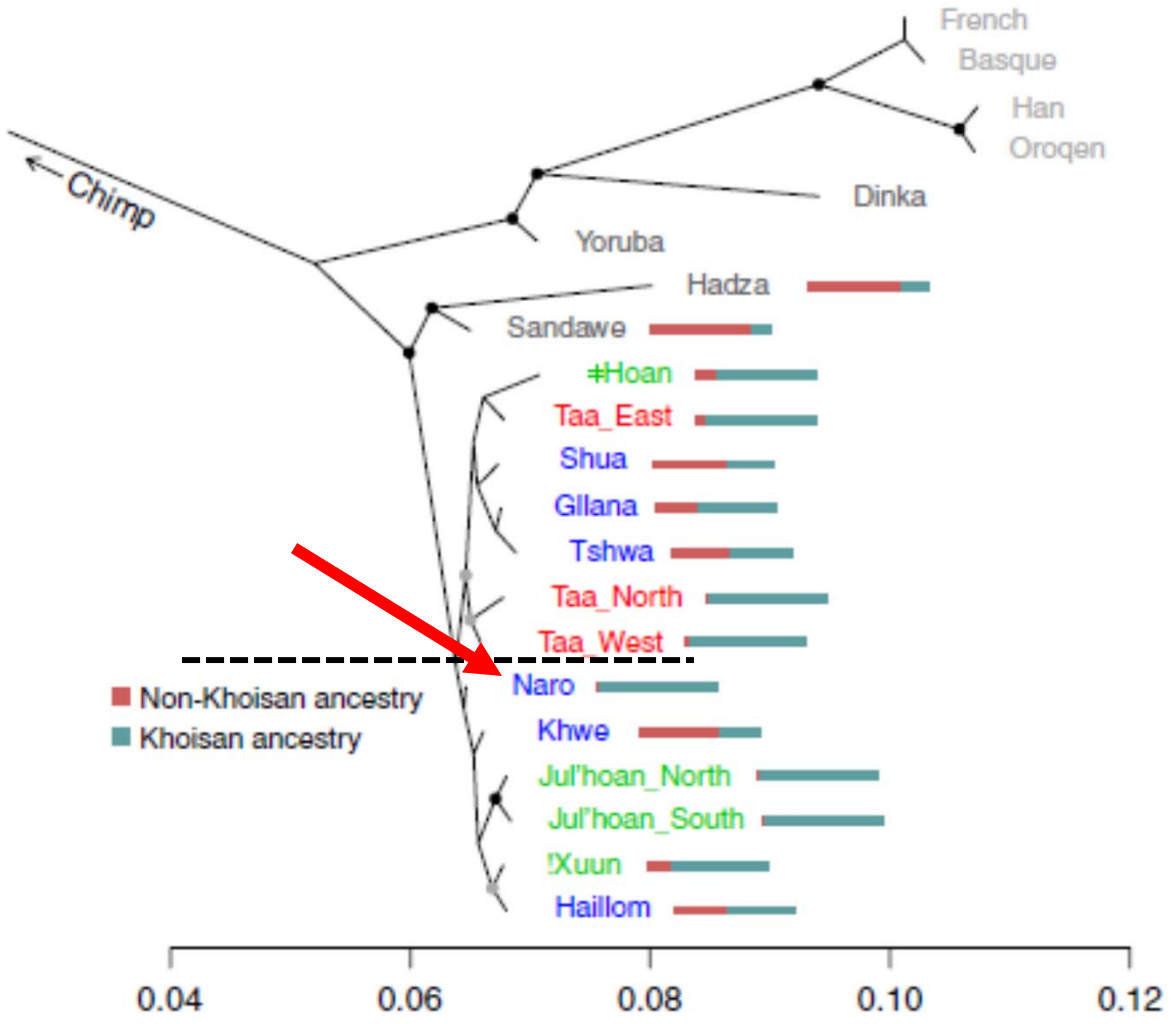
Joseph K. Pickrell[1], Nick Patterson[2], Chiara Barbieri[3,†], Falko Berthold[3,†], Linda Gerlach[3,†], Tom Güldemann[4,5], Blesswell Kure[6], Sununguko Wata Mpoloka[7], Hirosi Nakagawa[8], Christfried Naumann[4,5], Mark Lipson[9,10], Po-Ru Loh[9,10], Joseph Lachance[11,12], Joanna Mountain[13], Carlos D. Bustamante[14], Bonnie Berger[9,10], Sarah A. Tishkoff[11,12], Brenna M. Henn[14], Mark Stoneking[15], David Reich[1,2] & Brigitte Pakendorf[3,†]

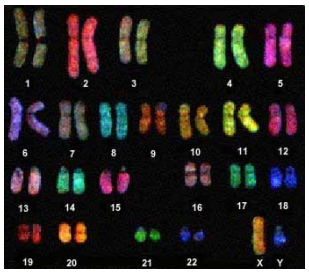
NATURE COMMUNICATIONS | 3:1143 | DOI: 10.1038/ncomms2140 | www.nature.com/naturecommunications


a
Map
ANGOLA
ZAMBIA
NAMIBIA
BOTSWANA
Wambo
Mbukushu
Khwe
!Xuun
Himba
Haillom
Jul'hoan_North
Shua
Damara
Jul'hoan_South
Tshwa
Naro
Gllana
Taa_North
Glui
Taa_West
ǂHoan
Kgalagadi
Nama
Taa_East
Tswana
b
PCA (Jul'hoan ascertainment)
PC2
PC1
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.05
0.00
0.05
0.10
Non-Khoisan
Himba
Wambo
Dinka
Yoruba
BantuSouthAfrica
BantuKenya
Mbukushu
Mandenka
Tswana
Kgalagadi
Khoe-Kwadi
Naro
Haillom
Khwe
Shua
Tshwa
Gllana
Glui
Nama
Damara
Kx'a
Jul'hoan_North
Jul'hoan_South
!Xuun
ǂHoan
Tuu
Taa_West
Taa_North
Taa_East

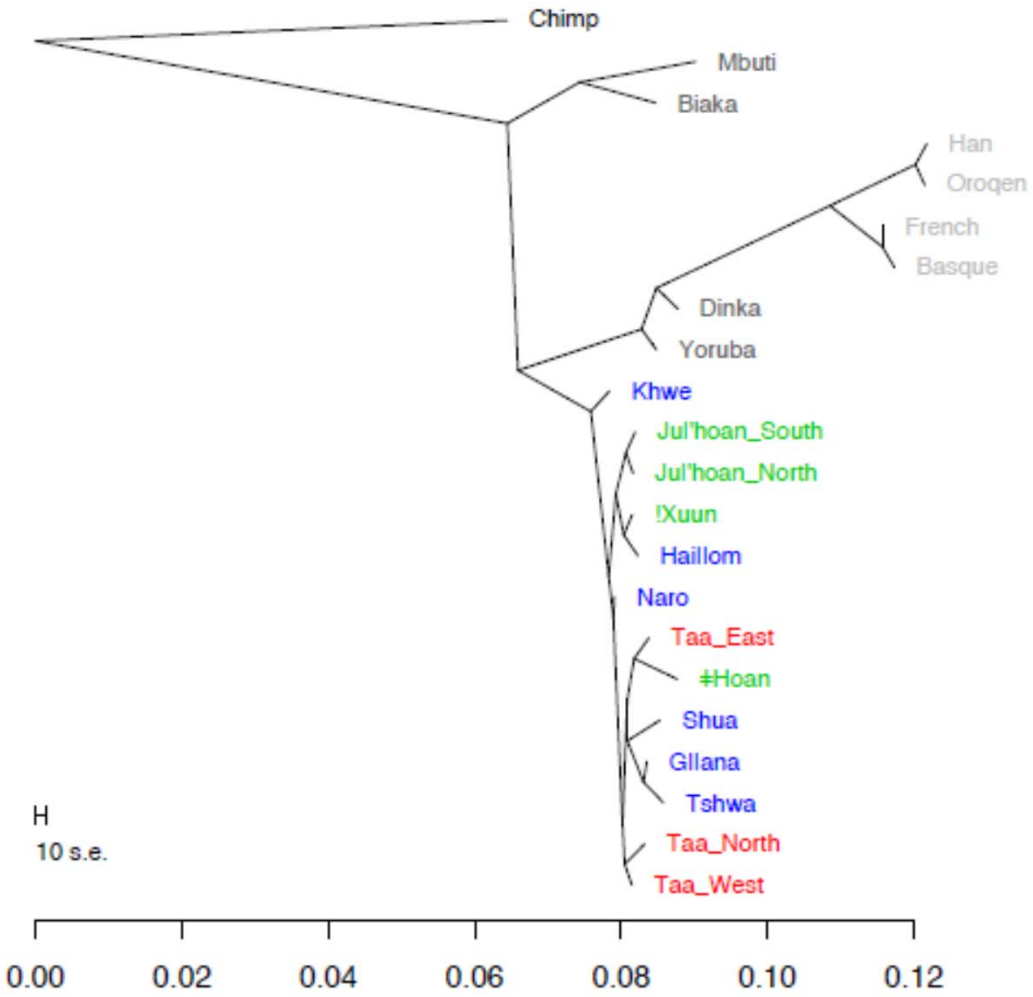


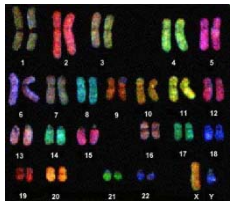
Tree based on "Khoisan" ancestry





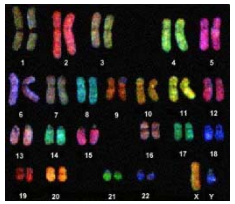
Tree based on “non-Bantu” ancestry





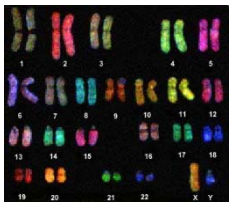
How old is this divergence?

- Developed an approach based on new mutations that occurred after the divergence of NW and SE Kalahari
- Result: divergence ~30,000 years ago
- many assumptions involved in the method that mean it is probably an upper bound
- however, a different method applied to a different dataset gives a similar date (~35,000 years ago; Schlebush et al. 2012)
- the existence of further substructure within mtDNA lineages suggests divergence could be even older

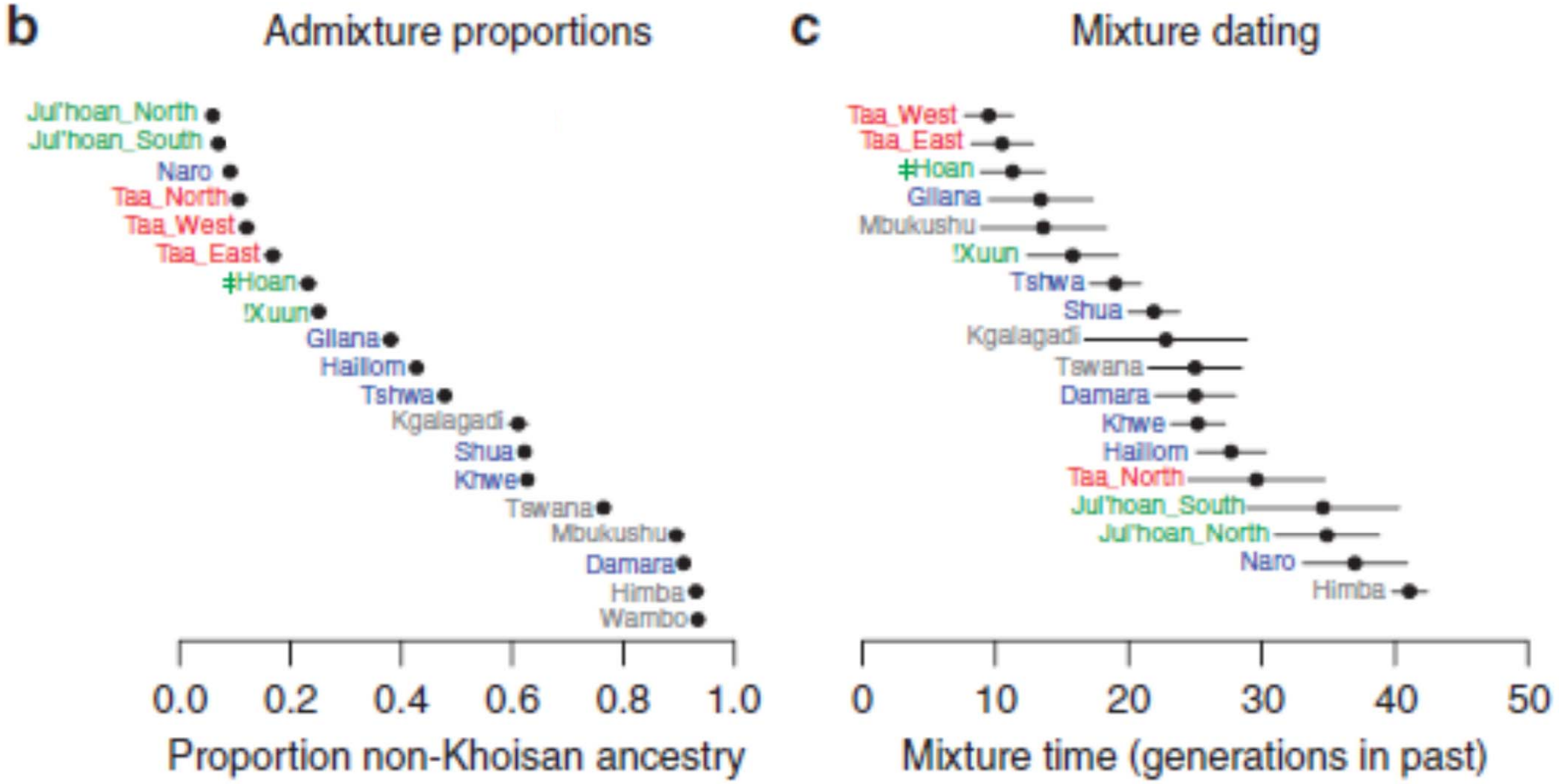


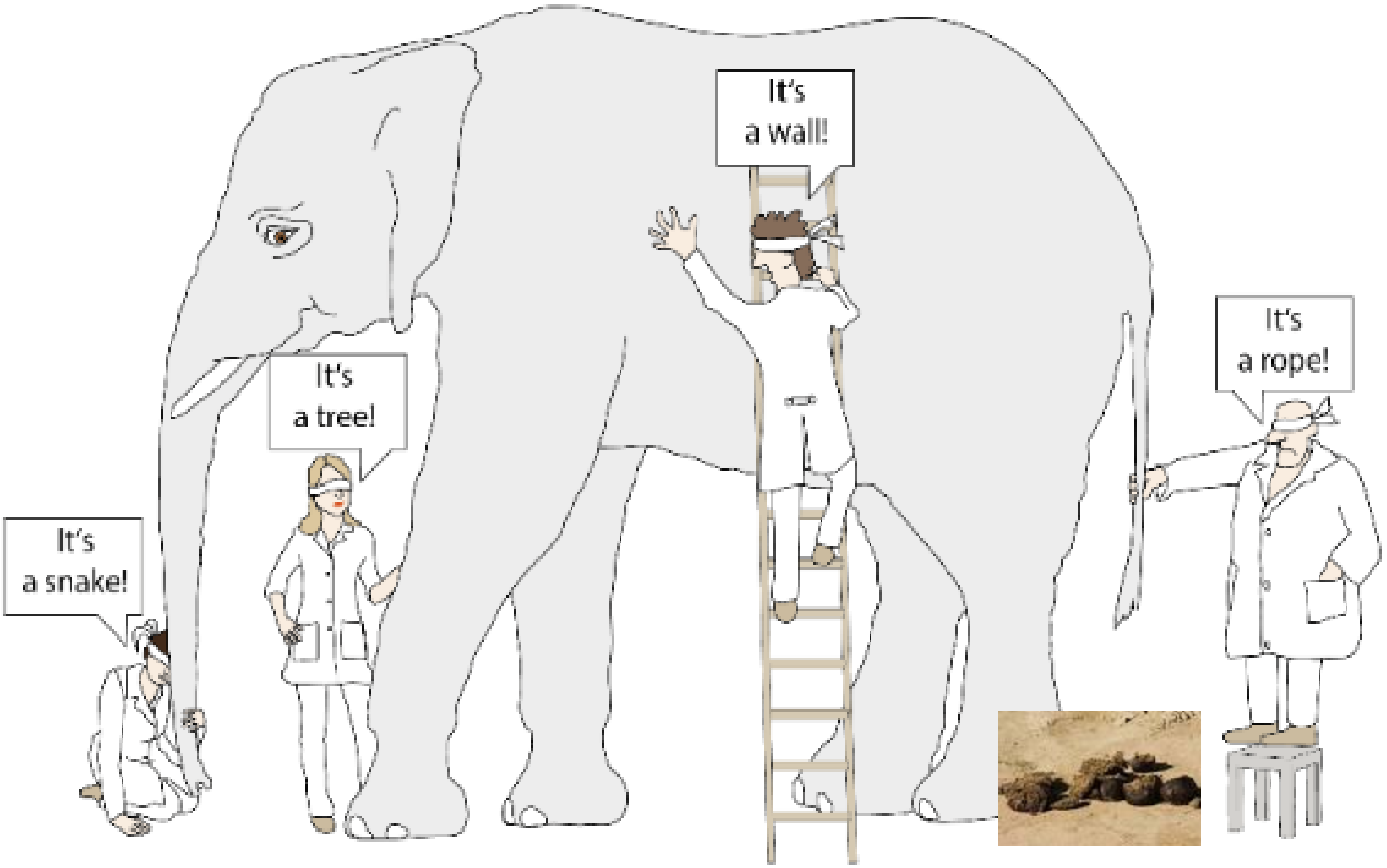
Was there contact after divergence?

- YES: identical mtDNA sequences shared between NW and SE Kalahari groups
- Modeling shows that such sharing reflects contact within the past 7,500 years ago (if it were any older, mtDNA sequences would no longer be identical)
- Overall, the results suggest deep divergence between NW and SE Kalahari groups (possibly due to the presence of Makgadikgadi Lake?) followed by more recent contact (possibly due to drying of the lake?)



And don’t forget: extensive contact with other groups!




It's a snake!
It's a tree!
It's a wall!
It's a rope!