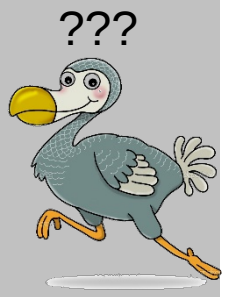
Diversidade da Vida - 2023

Universidade de São Paulo

FFCLRP, Departamento de Biologia, Ribeirão Preto, SP

Evolução Cultural

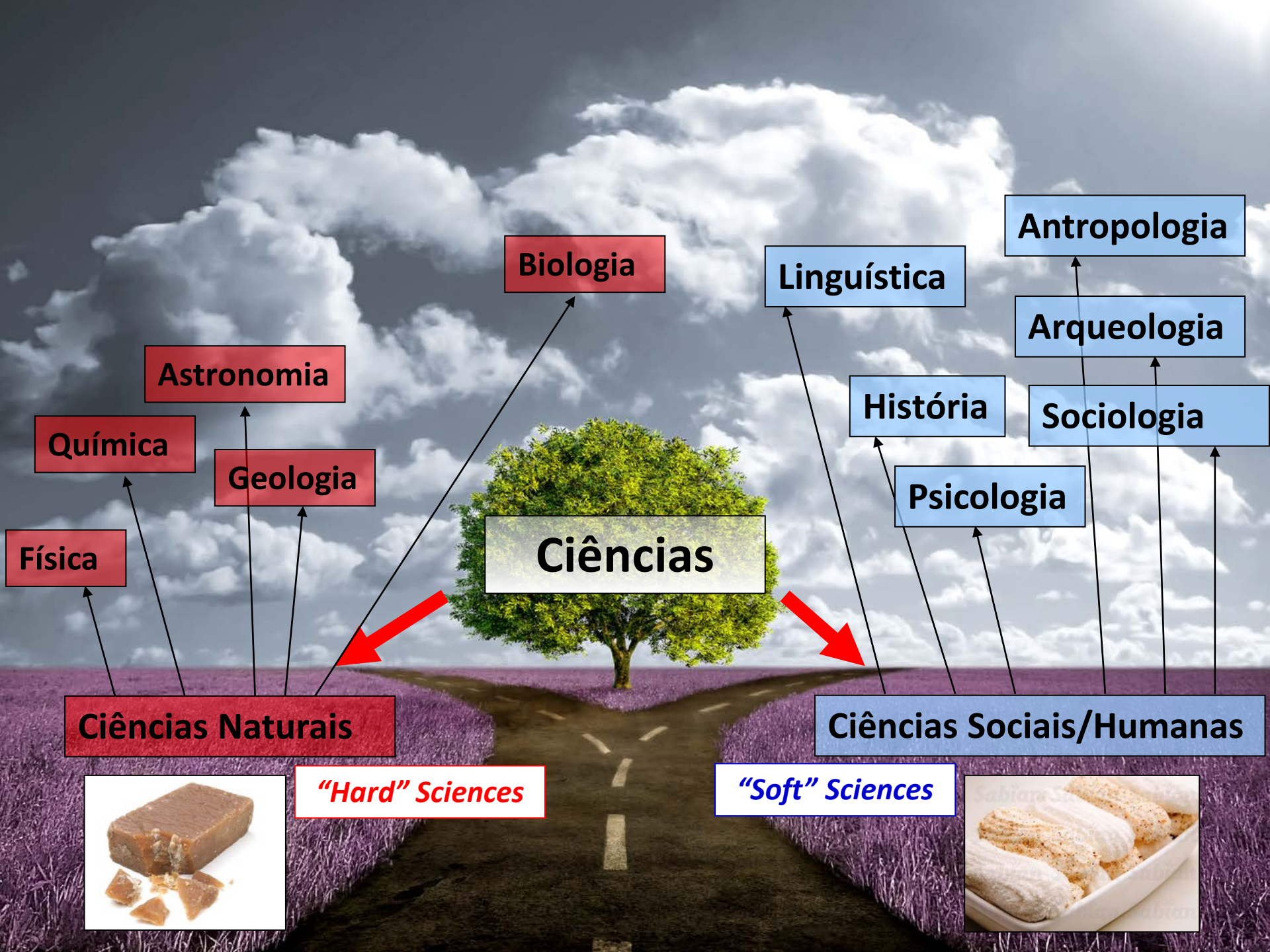


OBJETIVOS

- Examinar a natureza das características biológicas e culturais e indagar se as supostas diferenças sustentam tal separação epistemológica.

- Refletir sobre a necessidade de uma “linguagem comum” para possibilitar o diálogo dentro da ciência => o valor das definições precisas de conceitos para permitir o debate.

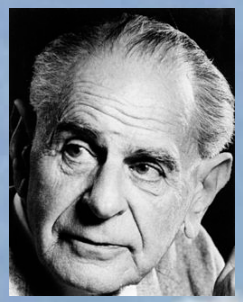
- Investigar a possibilidade de aproximação entre áreas do conhecimento atualmente distanciadas, como a Biologia e as Humanidades, utilizando, como estudo de caso, a cultura e a teoria evolutiva.


Antropologia
Biologia
Linguística
Arqueologia
Astronomia
História
Sociologia
Química
Geologia
Psicologia
Física
Ciências
Ciências Naturais
Ciências Sociais/Humanas
"Hard" Sciences
"Soft" Sciences

Hard sciences: **construção do pensamento a partir do raciocínio hipotético-dedutivo; formulação teóricas de ampla aplicação (leis); teorias matematicamente axiomatizadas; proposições atendem ao critério de demarcação de Popper (falsificacionismo)**

Soft sciences: **construção do pensamento a partir da indução; não existem formulações teóricas de ordem geral; teorias descritas em linguagem natural (tautologias são comuns); proposições geralmente não atendem ao critério de demarcação de Popper (falsificacionismo)**

Física



Karl R. Popper (1902-1994)

Biologia

Escala de dureza de Mohs

O que é cultura?

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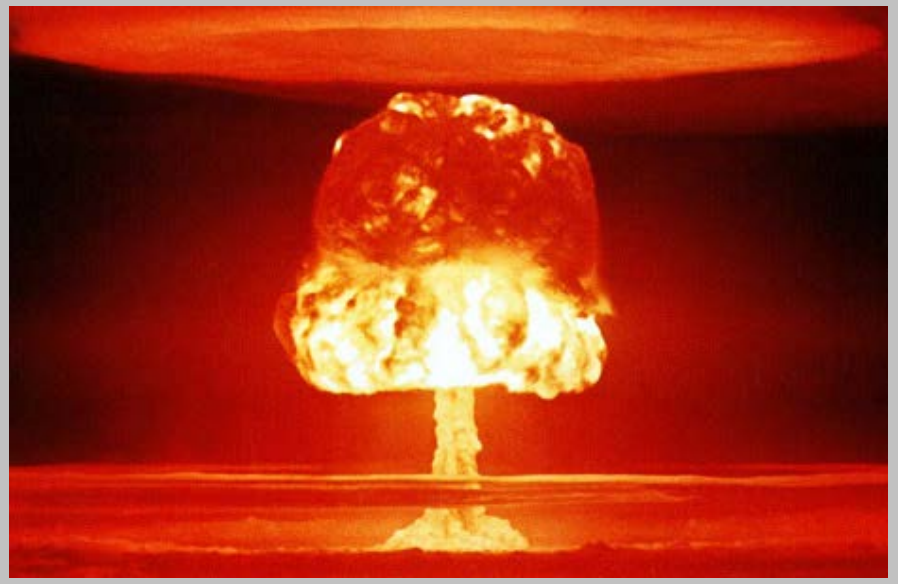


O que é cultura?

Cultura (etimologia) - meados do século XV => "cultivo da terra, ato de preparar a terra para as colheitas", do latim *cultura* - “um cultivo, agricultura", figurativamente "cuidado, cultura, uma honra", do particípio passado do radical *colere* ("para cuidar, guardar; cultivar, cultivar“).

- O sentido figurado de cultura como "*cultivo através da educação, aperfeiçoamento sistemático e refinamento da mente*" é atestado por volta de 1500;

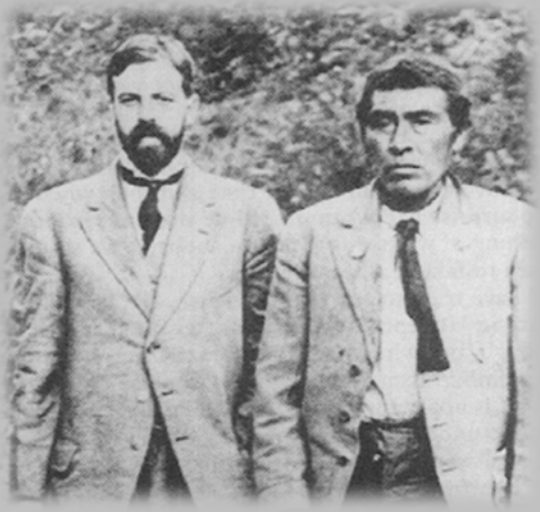
1910 - *antropologia cultural*;
1912 - *difusão cultural*;
1935 - *diversidade cultural*;
1937- *imperialismo cultural*;
1932 - *pluralismo cultural*.

O que é cultura?

Edward Burnett Tylor
(antropólogo, Londres, 1832-1917)

E. B. Tylor (1871), *Primitive Culture, Vol. 1*: **"...todo aquele complexo que inclui conhecimentos, crenças, arte, moral, leis, costumes e quaisquer outras capacidades e hábitos adquiridos pelo *homem* como membro da sociedade".**

O que é cultura?

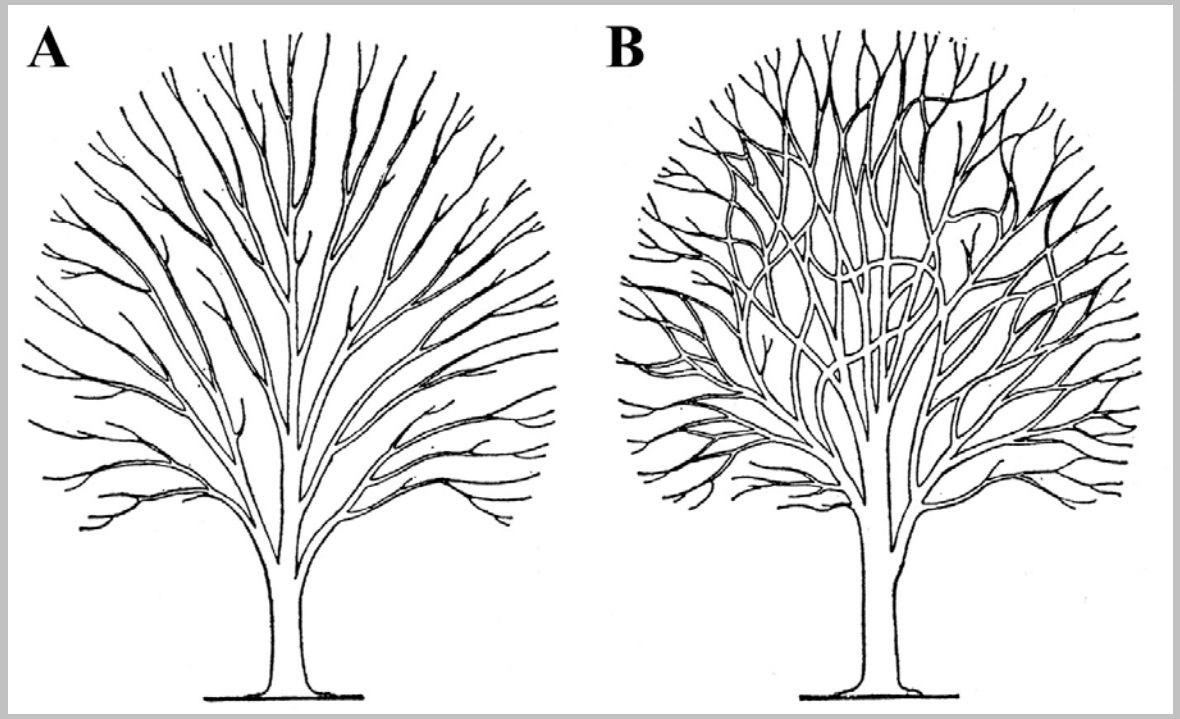


Kroeber (dir.) com **Ishi** (*ca*. 1861-1916), considerado o último membro da tribo dos Yahi, da Califórnia, em 1911

Alfred Louis Kroeber (antropólogo, linguista, arqueólogo da University of California, Berkeley, Hoboken, EUA, 1876-1960)

A. L. Kroeber (1948), *Anthropology*: **"... podemos nos aproximar do [conceito do] que é cultura dizendo que é o que a espécie humana possui e que outras espécies sociais carecem."**

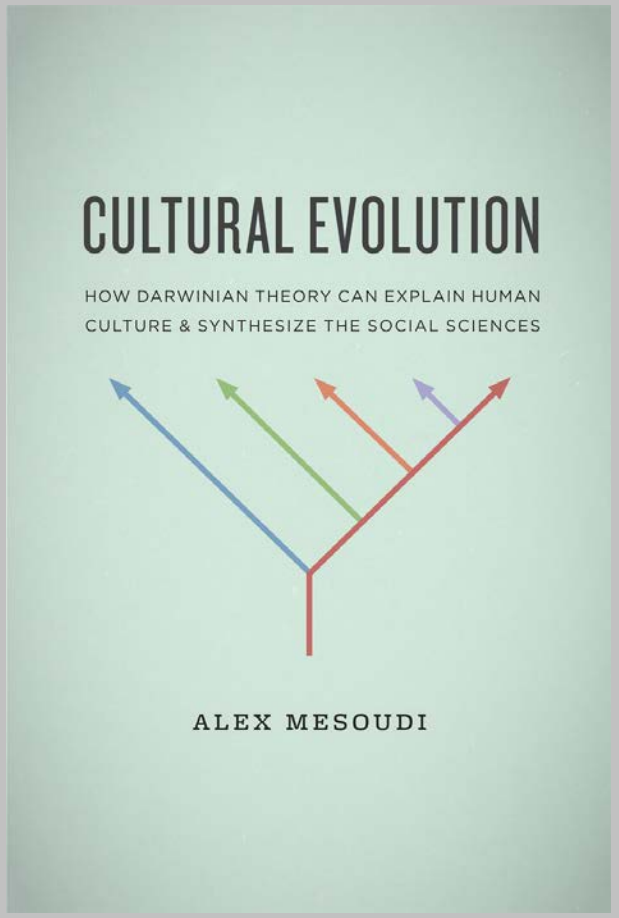
O que é cultura?



A) Evolução biológica; B) Evolução cultural, segundo *Kroeber* (1948)

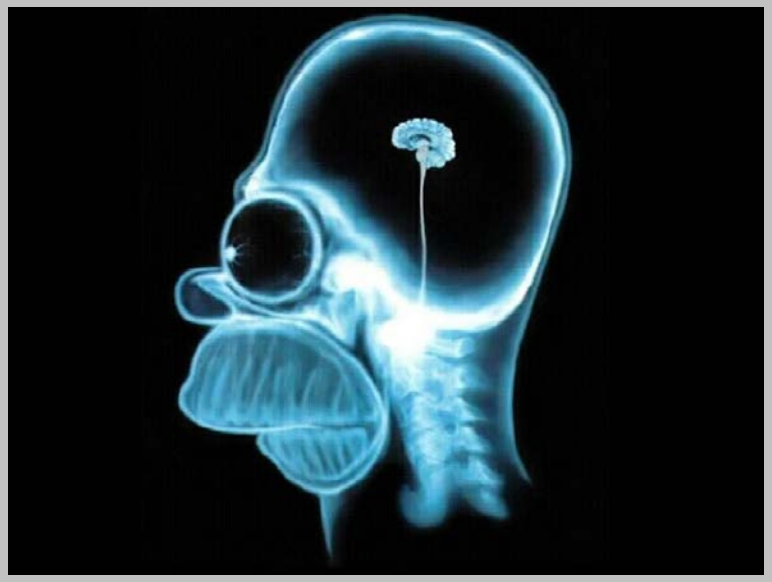
O que é cultura?

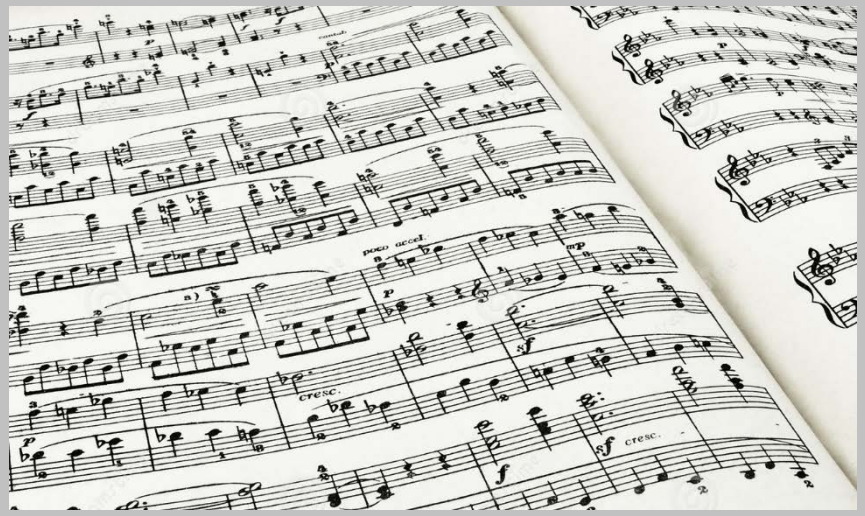
Alex Mesoudi (psicólogo, University of Exeter - Cornwall *campus*, UK)



A. Mesoudi (2011: pp. 2-3), *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences [= Evolução cultural: como a teoria darwiniana pode explicar a cultura humana e sintetizar as ciências sociais]*: **"...cultura é informação que é adquirida de outros indivíduos por meio de mecanismos de transmissão social, tal como a imitação, o aprendizado ou a linguagem"**.

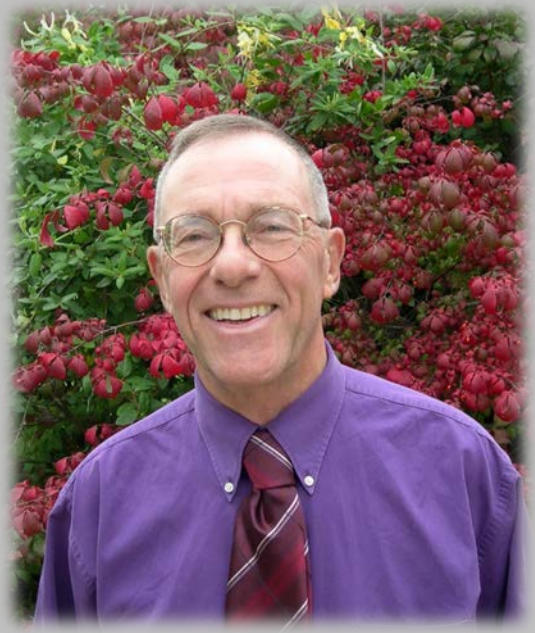
Biologia e Cultura – Formas de arquivamento da informação

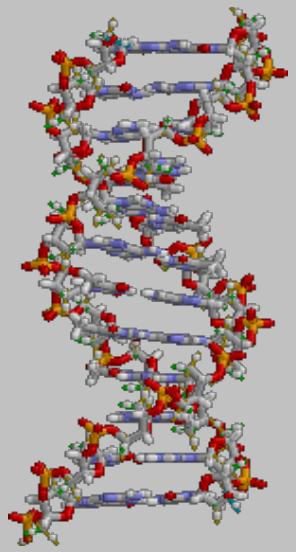




O que é evolução?

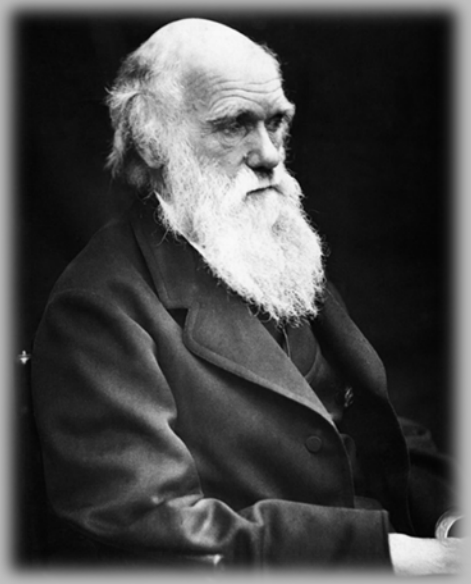
Douglas J. Futuyma (1986), *Evolutionary Biology*: “No sentido mais amplo, a evolução é apenas mudar e, por isso, é onipresente; galáxias, linguagens e sistemas políticos, todos evoluem. Já evolução biológica... **é a mudança nas propriedades das populações de organismos que transcendem o tempo de vida de um único indivíduo**. A ontogenia de um indivíduo não é considerada evolução; os organismos individuais não evoluem. Alterações nas populações que são consideradas evolutivas são aquelas **que são herdadas por meio do material genético, a partir de uma geração para a seguinte**.”



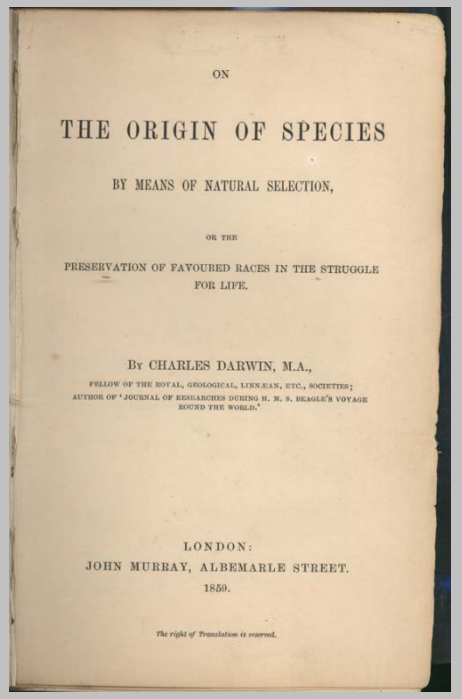


Hall, B. K. & Hallgrímsson, B., eds. (2008). *Strickberger's Evolution* (4th ed.): “A evolução é **a mudança das características hereditárias de populações biológicas ao longo de gerações sucessivas**.”

Teorias Culturais na Biologia



Charles R. Darwin (1809-1882)



ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNEAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

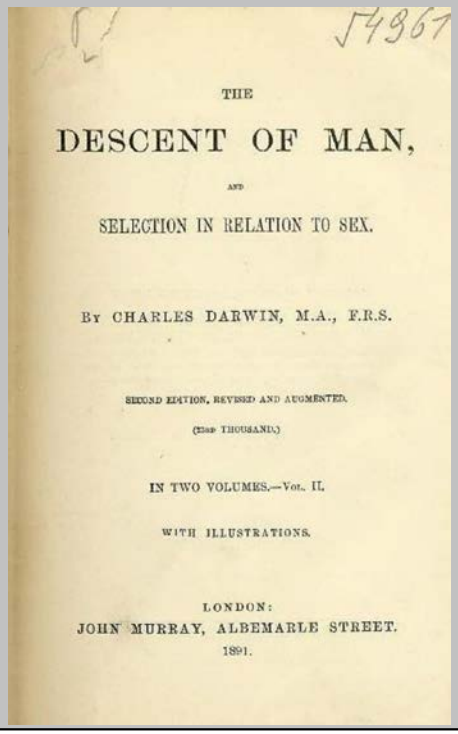
LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

The right of Translation is reserved.

Origem das Espécies (1859, cap. 13): "Pode valer a pena ilustrar esta visão da classificação, tomando o exemplo das línguas. Se possuíssemos um pedigree (filogenia) perfeito da humanidade, um arranjo genealógico das raças do homem, teríamos a melhor classificação das várias línguas hoje faladas em todo o mundo; e se todas as línguas extintas e todos os dialetos intermediários que mudam lentamente fossem incluídos, esse arranjo seria, eu acho, um único possível. No entanto, pode ser que uma linguagem muito antiga tenha alterado pouco e tenha dado origem a poucas línguas novas, enquanto que outras (devido à disseminação e posterior isolamento) se alteraram muito e deram origem a muitas novas línguas e dialetos. Os vários graus de diferença entre as línguas do mesmo estoque (ancestral) devem ser expressas por grupos subordinados a grupos; mas o arranjo apropriado, ou mesmo possível, ainda seria o genealógico; e isso seria totalmente natural, pois conectaria todas as línguas, extintas e modernas, pelas afinidades mais próximas, o que revelaria a filiação e a origem de cada língua".

Teorias Culturais na Biologia

Charles R. Darwin **(1809-1882)**



THE

DESCENT OF MAN,

AND

SELECTION IN RELATION TO SEX.

By CHARLES DARWIN, M.A., F.R.S.

SECOND EDITION, REVISED AND AUGMENTED.

(21st THOUSAND.)

IN TWO VOLUMES.—Vol. II.

WITH ILLUSTRATIONS.

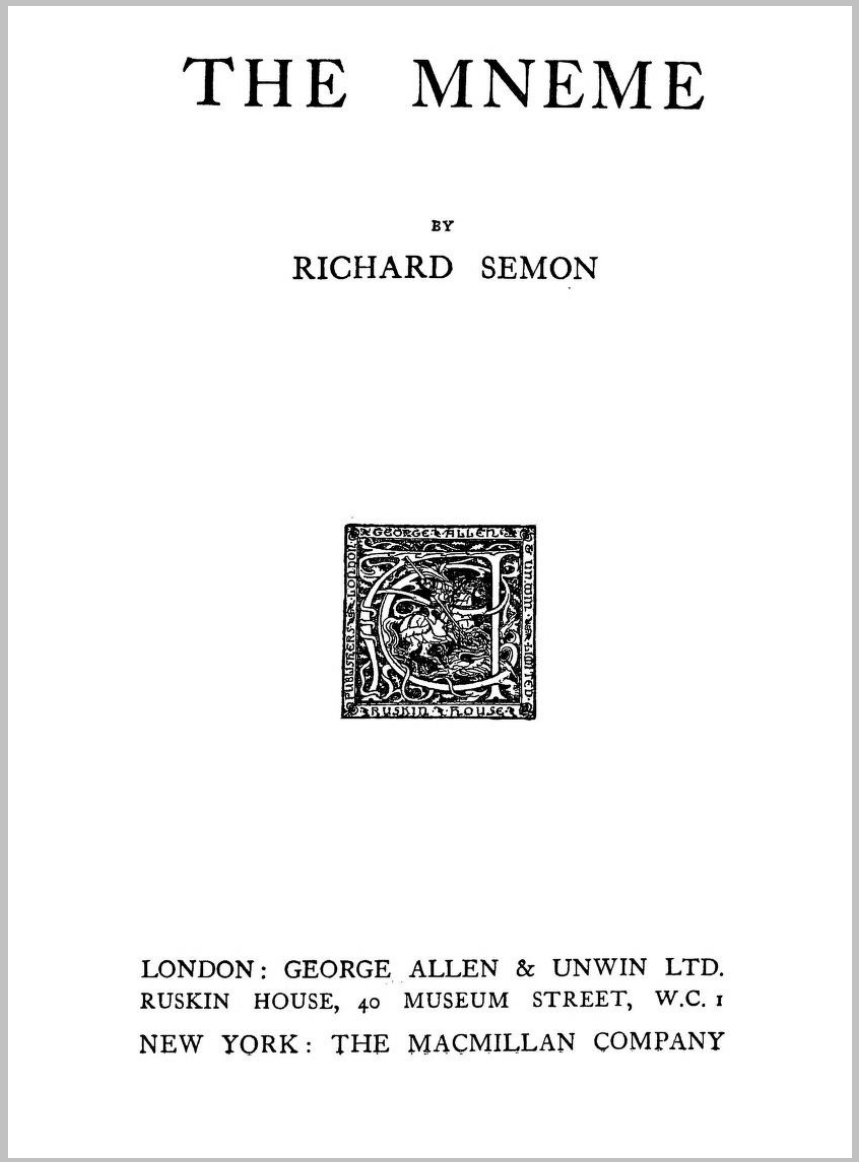
LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1891.

A Origem do Homem e a Seleção em Relação ao Sexo (1871: p. 86): "A formação de diferentes línguas e de distintas espécies, e as provas que ambas se desenvolveram por meio de um processo gradual, são curiosamente as mesmas. (...) Encontramos em diferentes linguagens ***homologias*** marcantes, que são devidas ao compartilhamento de descendência, e ***analogias***, que são devidas a um processo de formação semelhante. (...) A sobrevivência ou preservação de certas palavras favoritas, na luta pela existência, é a ***seleção natural***".

Teorias Culturais na Biologia

Richard Semon (1859-1918), Universidade de Jena

Mneme - memória de uma experiência de fora para dentro => resultando no "***engrama***" ou "***traço mnêmico***", que seria revivido quando um elemento semelhante a um componente do complexo original de estímulos fosse encontrado



THE MNEME

BY

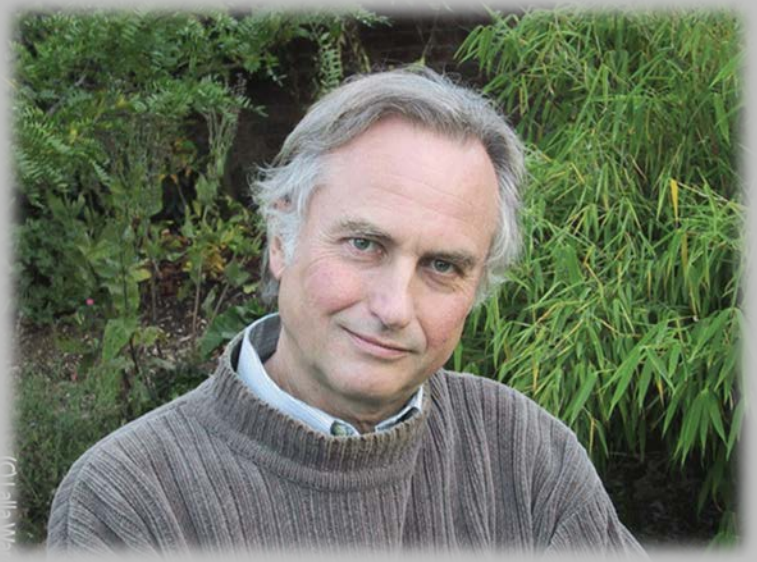
RICHARD SEMON

LONDON: GEORGE ALLEN & UNWIN LTD.
RUSKIN HOUSE, 40 MUSEUM STREET, W.C. 1
NEW YORK: THE MACMILLAN COMPANY

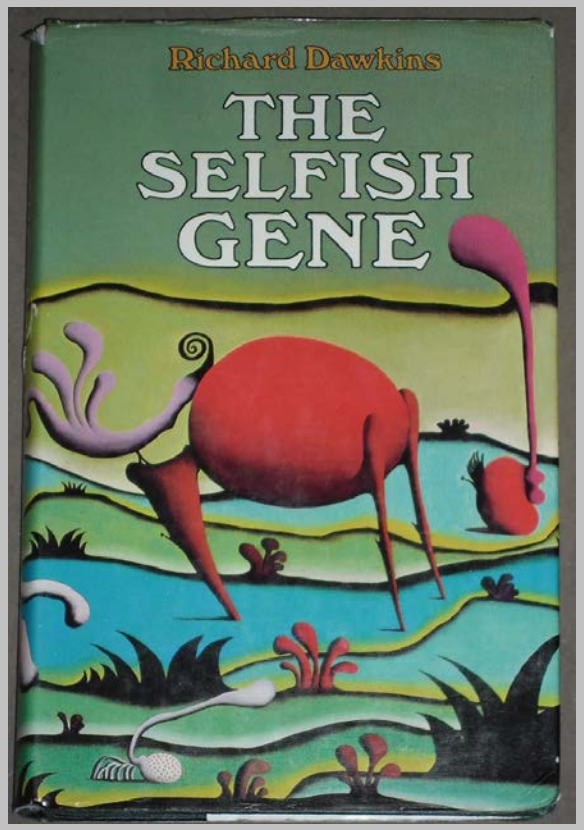
Semon, R. 1904. **Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens**. Leipzig, Verlag Wilhelm Engelmann. 391p.

Semon, R. 1921. **The Mneme**. London, George Allen & Unwin. 320p.

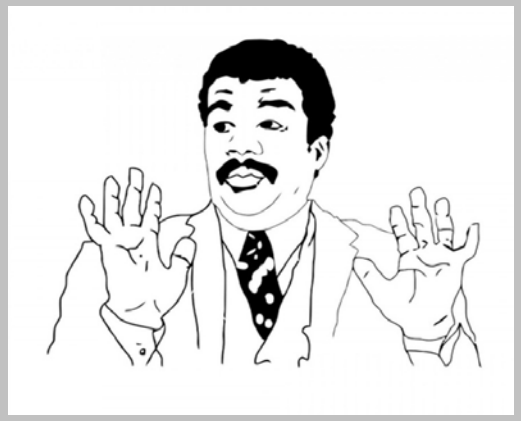
Teorias Culturais na Biologia

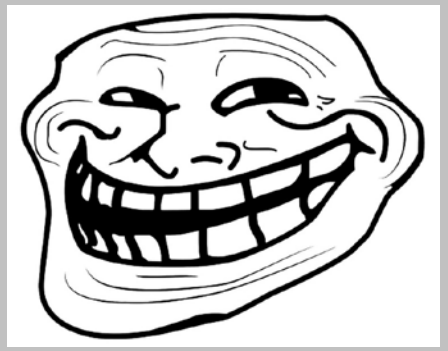


Richard Dawkins (1941-)



O Gene Egoísta (1976)





Meme - o equivalente cultural do gene, a unidade básica da memória ou do conhecimento, que o ser humano transfere conscientemente para os seus descendentes.

Quem tem cultura?

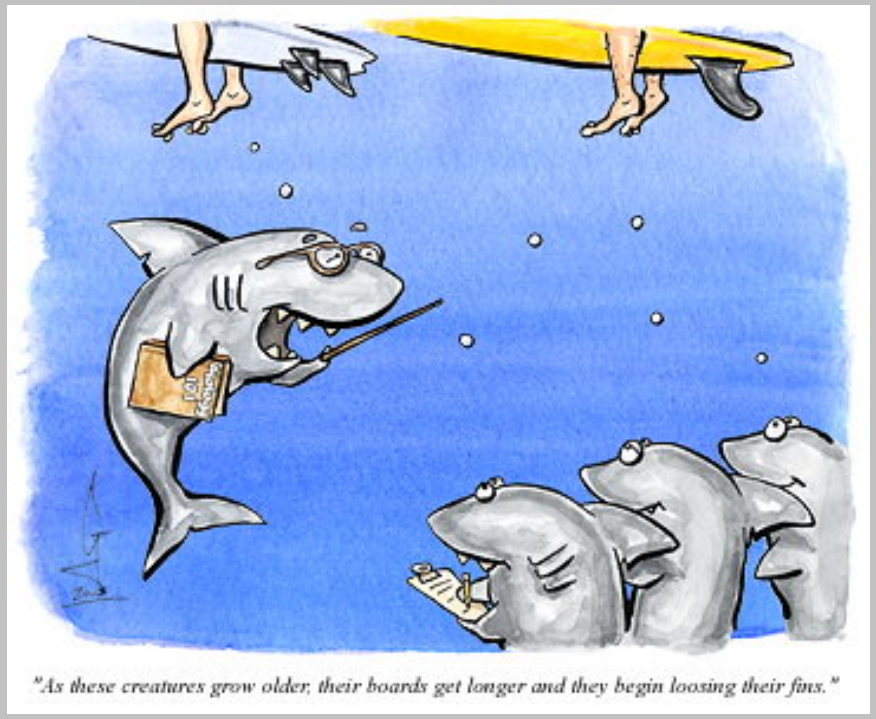
Aprendizado em animais não-humanos

Journal of Animal Ecology 2004
73, 190–196

Movements, habitat use and feeding success of cultural clans of South Pacific sperm whales

HAL WHITEHEAD and LUKE RENDELL
Department of Biology, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada

Aprendizado em animais não-humanos



"As these creatures grow older, their boards get longer and they begin loosing their fins."

Guttridge *et al*. (2013)

Anim Cogn (2013) 16:55–64
DOI 10.1007/s10071-012-0550-6

ORIGINAL PAPER

Social learning in juvenile lemon sharks, *Negaprion brevirostris*

Tristan L. Guttridge · Sander van Dijk · Eize J. Stamhuis · Jens Krause · Samuel H. Gruber · Culum Brown

Received: 8 November 2011 / Revised: 14 June 2012 / Accepted: 7 August 2012 / Published online: 30 August 2012

Abstract Social learning is taxonomically widespread and can provide distinct behavioural advantages, such as in finding food or avoiding predators more efficiently. Although extensively studied in bony fishes, no such empirical evidence exists for cartilaginous fishes. Our aim in this study was to experimentally investigate the social learning capabilities of juvenile lemon sharks, *Negaprion brevirostris*. We designed a novel food task, where sharks were required to enter a start zone and subsequently make physical contact with a target in order to receive a food reward. Naive sharks were then able to interact with and observe (a) pre-trained sharks, that is, 'demonstrators', or (b) sharks with no previous experience, that is, 'sham demonstrators'. On completion, observer sharks were then isolated and tested individually in a similar task. During the exposure phase observers paired with 'demonstrator' sharks performed a greater number of task-related behaviours and made significantly more transitions from the start zone to the target, than observers paired with 'sham demonstrators'. When tested in isolation, observers previously paired with 'demonstrator' sharks completed a greater number of trials and made contact with the target significantly more often than observers previously paired with 'sham demonstrators'. Such experience also tended to result in faster overall task performance. These results indicate that juvenile lemon sharks, like numerous other animals, are capable of using socially derived information to learn about novel features in their environment. The results likely have important implications for behavioural processes, ecotourism and fisheries.

Keywords Local and stimulus enhancement · Group living · Social facilitation · Social information use · Elasmobranchs

Electronic supplementary material The online version of this article (doi:10.1007/s10071-012-0550-6) contains supplementary material, which is available to authorized users.

T. L. Guttridge (✉)
Institute for Integrative and Comparative Biology, University of Leeds, L.C. Miall Building, Leeds LS2 9JT, UK
e-mail: tristanguttridge@gmail.com

T. L. Guttridge · C. Brown
Department of Biological Sciences, Macquarie University, Innovation Drive, Sydney, NSW, Australia

S. van Dijk · E. J. Stamhuis
Ocean Ecosystems, University of Groningen, Kerklaan 30, P.O.Box 14, Groningen, The Netherlands

J. Krause
Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, 12587 Berlin, Germany

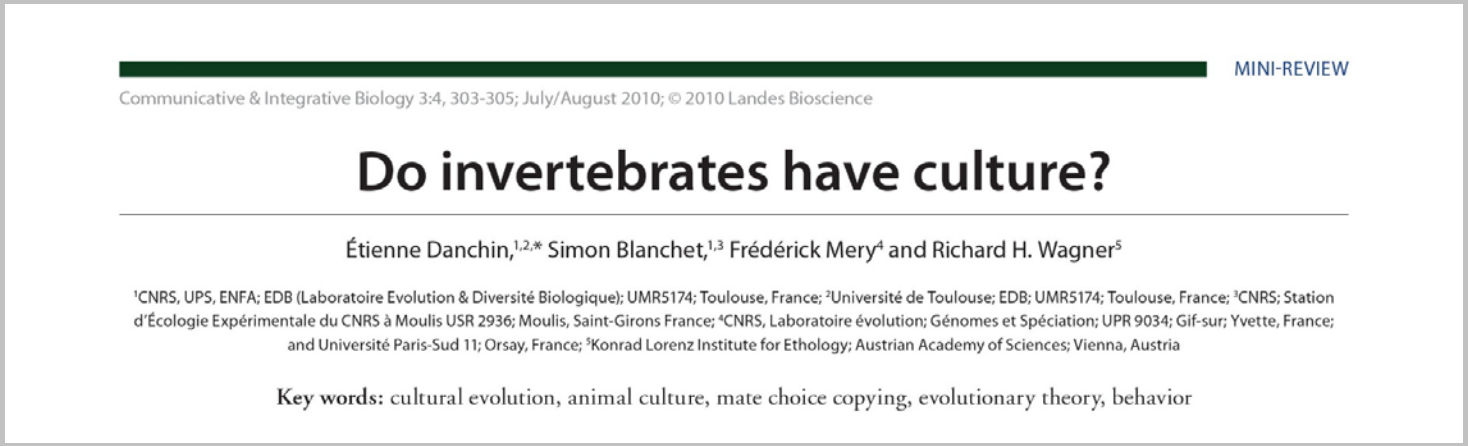
S. H. Gruber
Bimini Biological Field Station, 15 Elizabeth Drive, South Bimini, Bahamas

S. H. Gruber
Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, USA

Introduction

Group living among wild animals is a widespread phenomenon and can provide distinct behavioural advantages such as enhanced foraging, reduced predation risk and social learning (Krause and Ruxton 2002). In the context of animal research, social learning can be defined as any process through which one individual (the demonstrator)

Aprendizado em animais não-humanos



MINI-REVIEW

Communicative & Integrative Biology 3:4, 303-305; July/August 2010; © 2010 Landes Bioscience

Do invertebrates have culture?

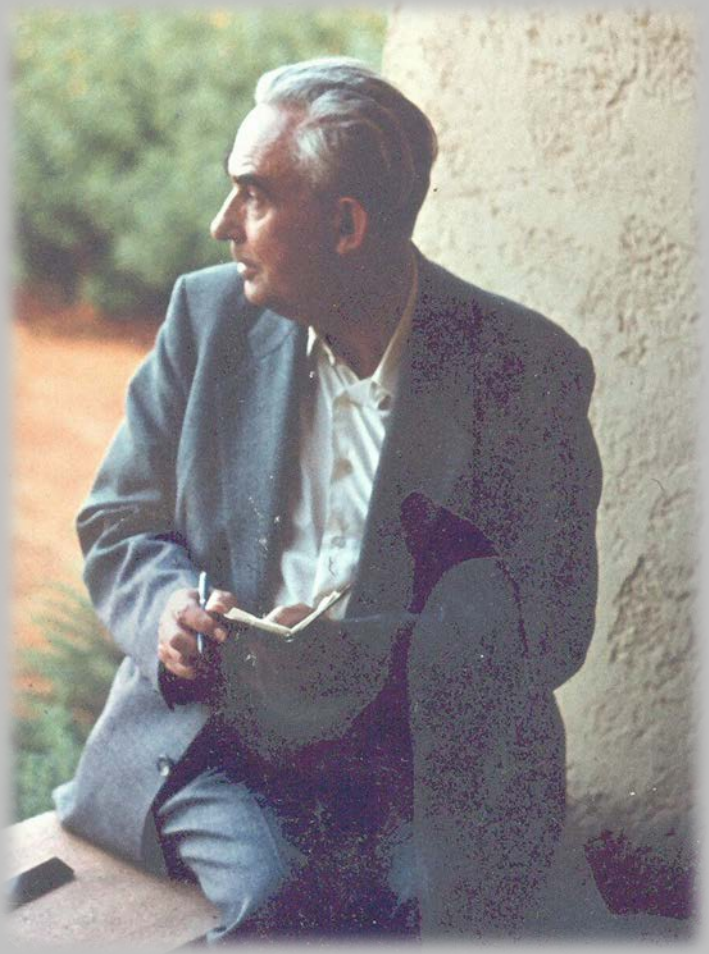
Étienne Danchin,[1,2,*] Simon Blanchet,[1,3] Frédérick Mery[4] and Richard H. Wagner[5]

[1]CNRS, UPS, ENFA; EDB (Laboratoire Evolution & Diversité Biologique); UMR5174; Toulouse, France; [2]Université de Toulouse; EDB; UMR5174; Toulouse, France; [3]CNRS; Station d'Écologie Expérimentale du CNRS à Moulis USR 2936; Moulis, Saint-Girons France; [4]CNRS, Laboratoire évolution; Génomes et Spéciation; UPR 9034; Gif-sur; Yvette, France; and Université Paris-Sud 11; Orsay, France; [5]Konrad Lorenz Institute for Ethology; Austrian Academy of Sciences; Vienna, Austria

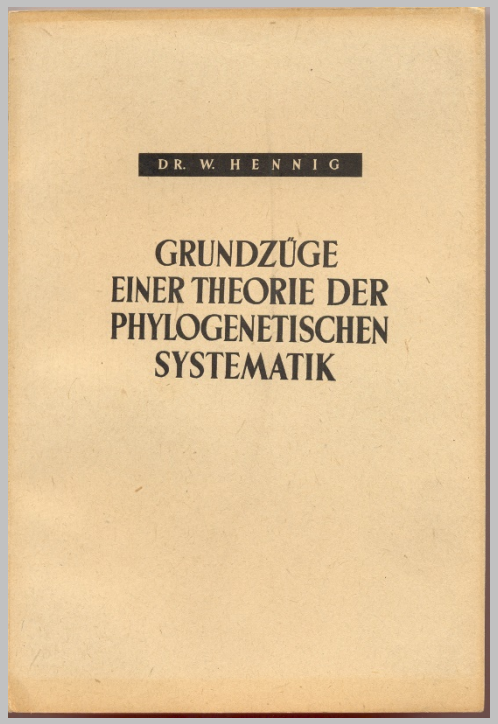
Key words: cultural evolution, animal culture, mate choice copying, evolutionary theory, behavior

Etologia (Biologia) - área da zoologia responsável pelo estudo do comportamento animal, inclusive daqueles atributos (caracteres) aprendidos.

***Sistemática Filogenética* – sistema geral de organização de informação biológica**



Willi Hennig (1913-1976)



***Teoria geral da Sistemática Filogenética* (1950)**

Sistemática Filogenética e Comportamento

Deborah McLennan
University of Toronto, Dept. Ecology & Evolutionary Biology

Evolution, 45(8), 1991, pp. 1773–1789

INTEGRATING PHYLOGENY AND EXPERIMENTAL ETHOLOGY: FROM PATTERN TO PROCESS

DEBORAH A. MCLENNAN
Department of Zoology, University of Toronto, Toronto M5S 1A1, CANADA

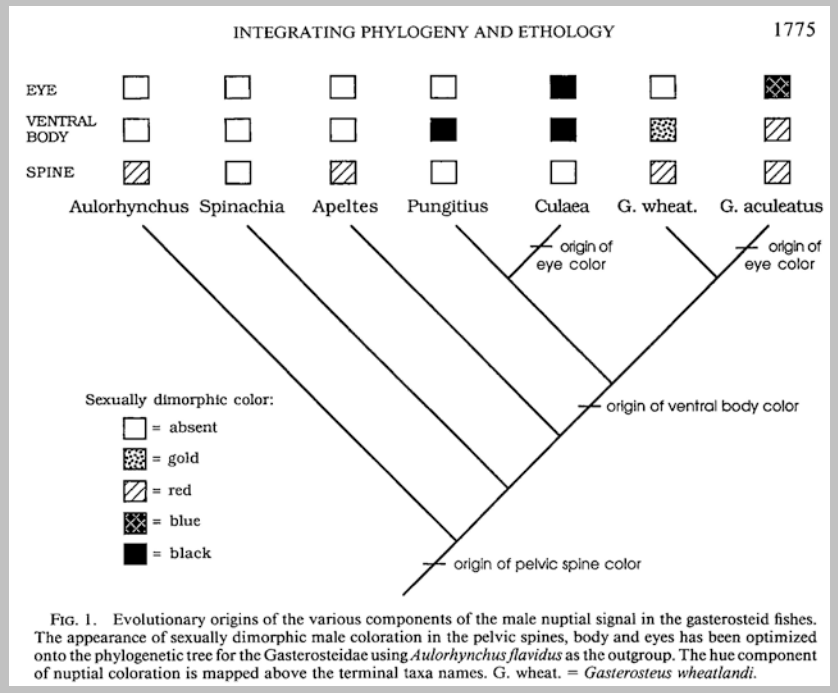
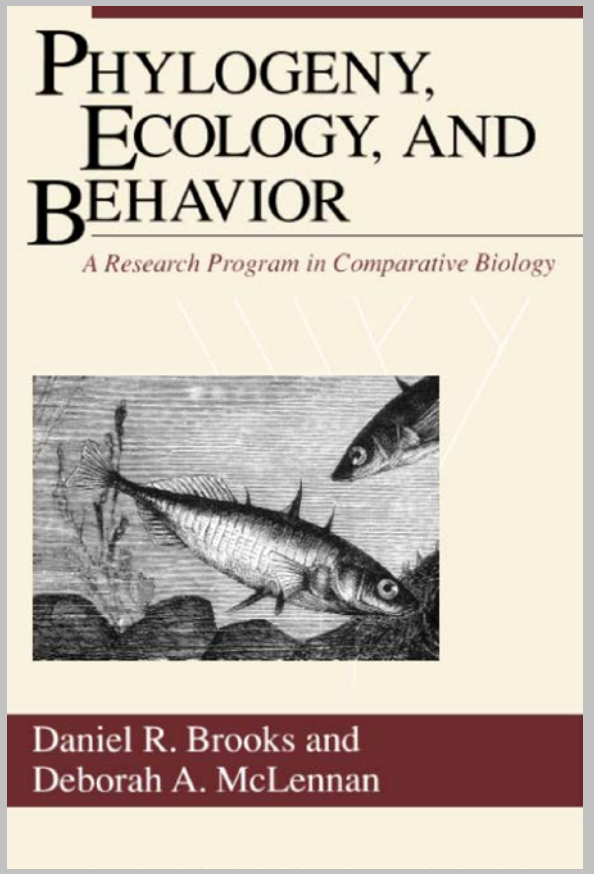
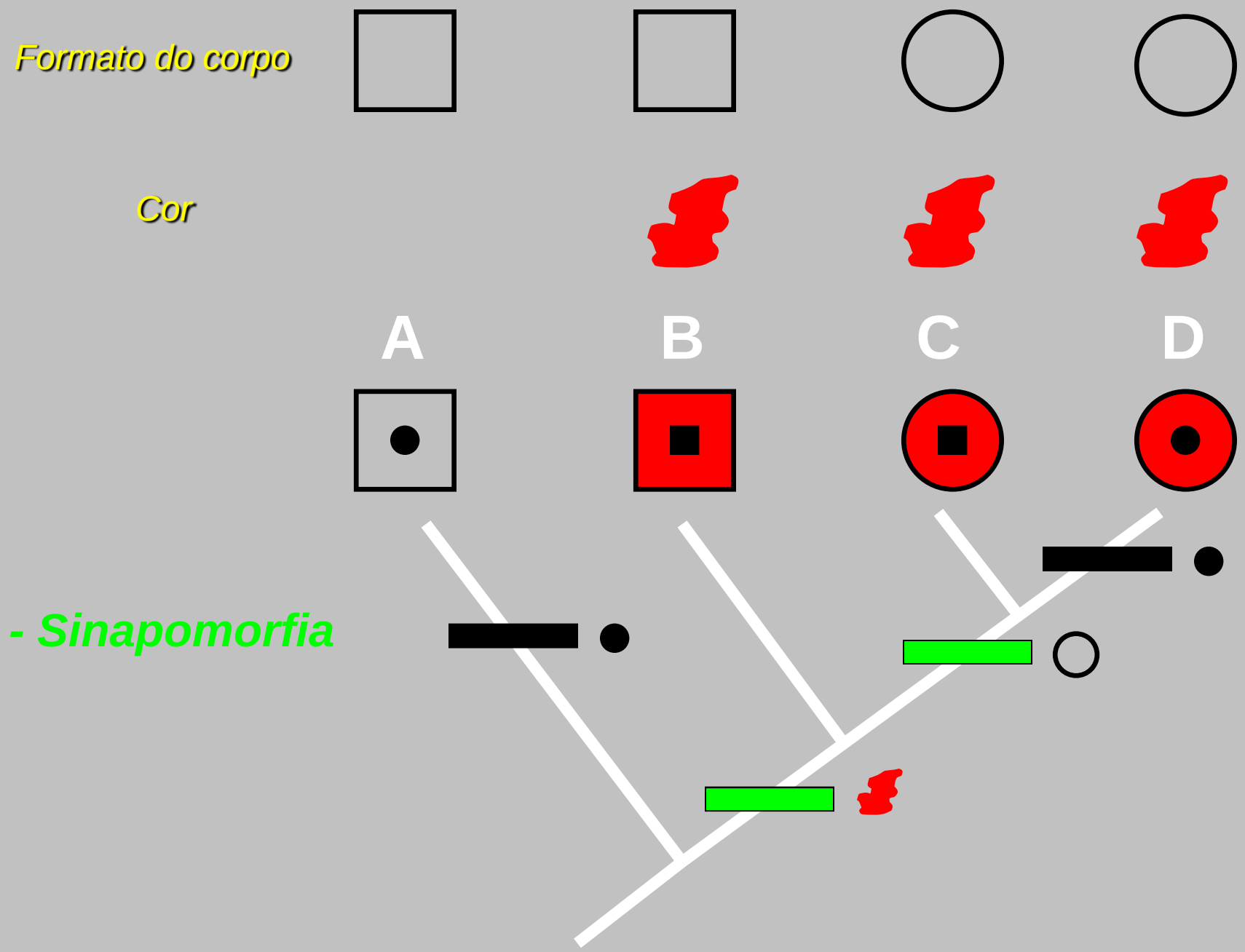


FIG. 1. Evolutionary origins of the various components of the male nuptial signal in the gasterosteid fishes. The appearance of sexually dimorphic male coloration in the pelvic spines, body and eyes has been optimized onto the phylogenetic tree for the Gasterosteidae using *Aulorhynchus flavidus* as the outgroup. The hue component of nuptial coloration is mapped above the terminal taxa names. G. wheat. = *Gasterosteus wheatlandi*.




Formato do corpo
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A
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C
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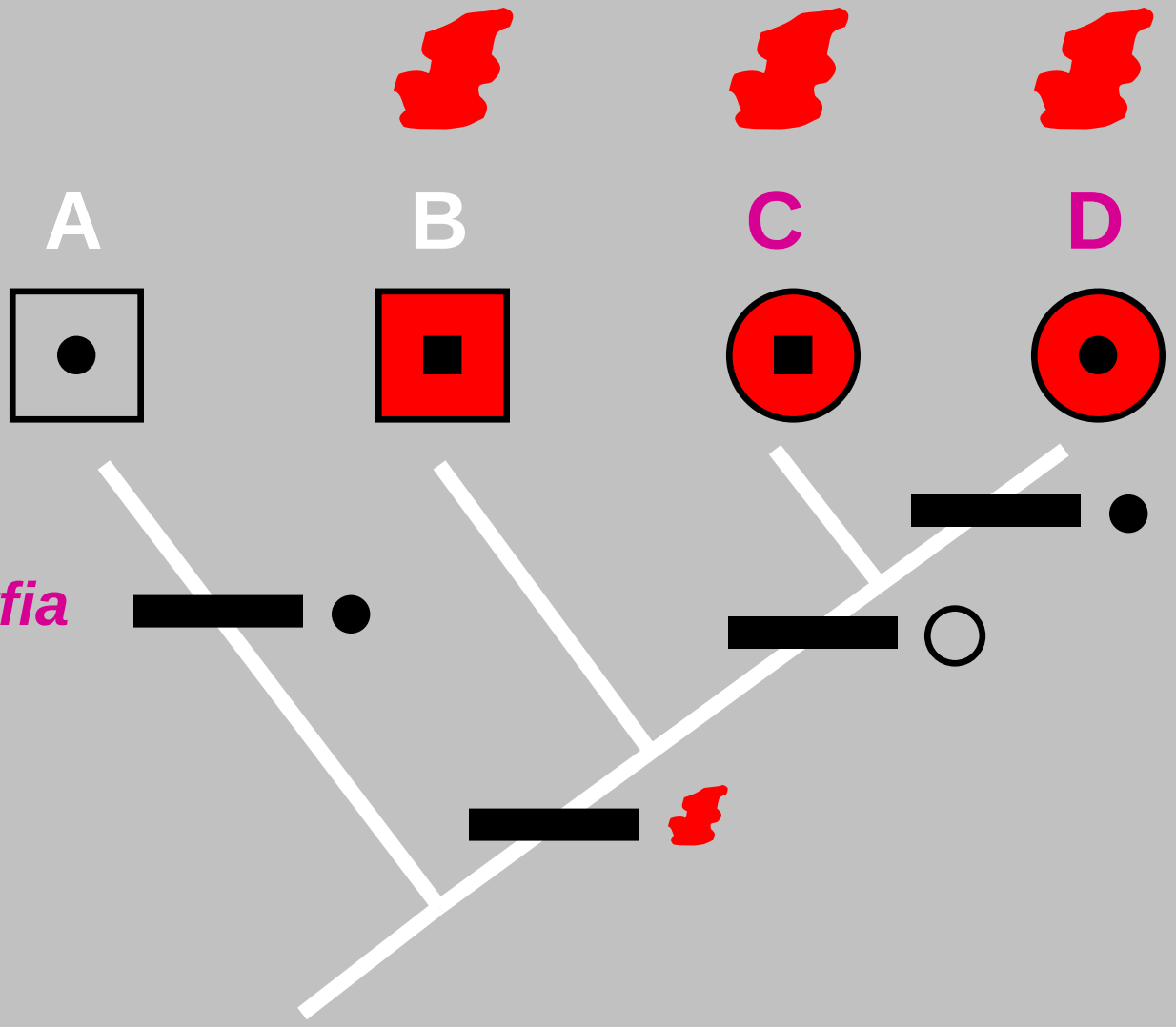
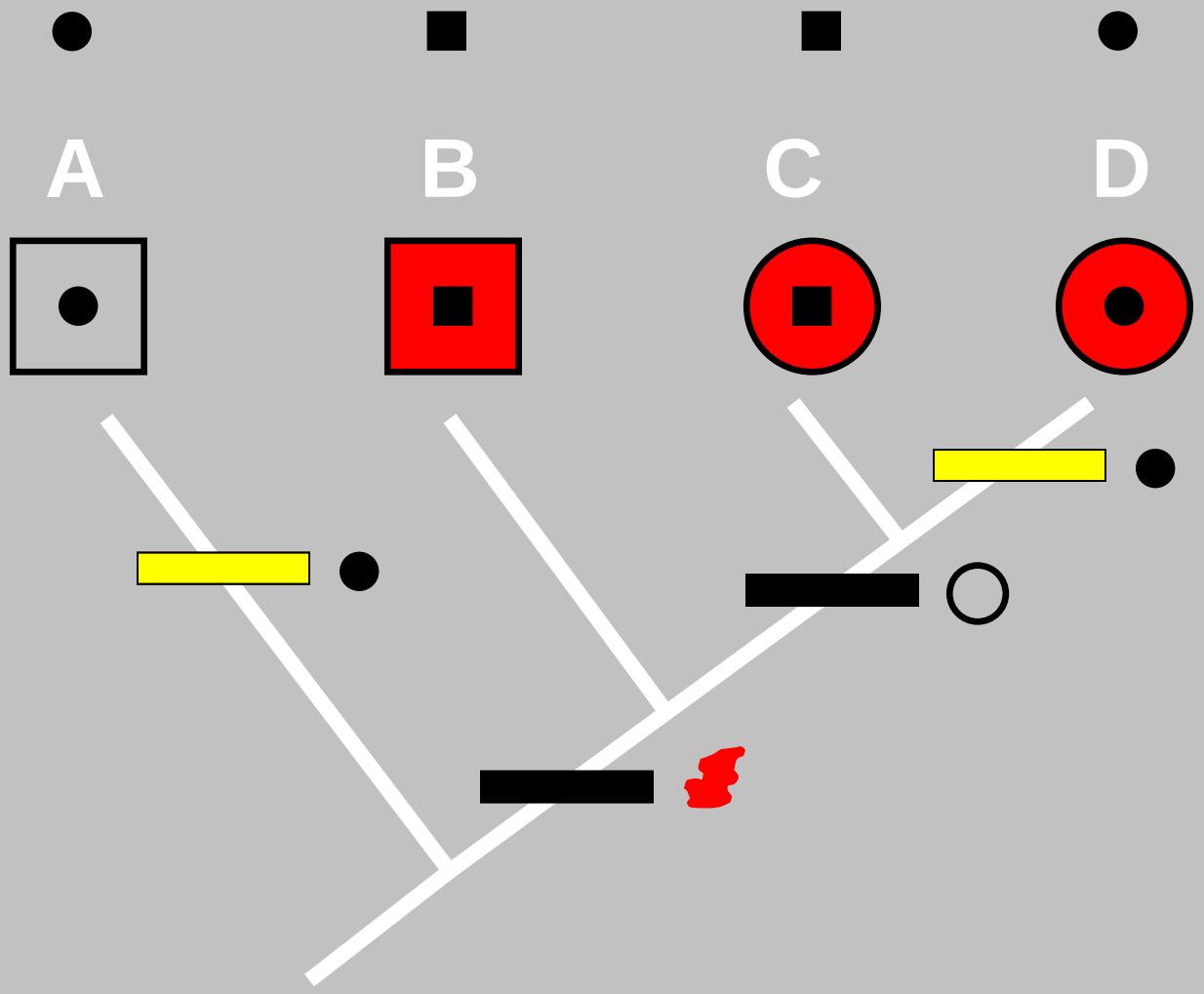
- Sinapomorfia

Cor



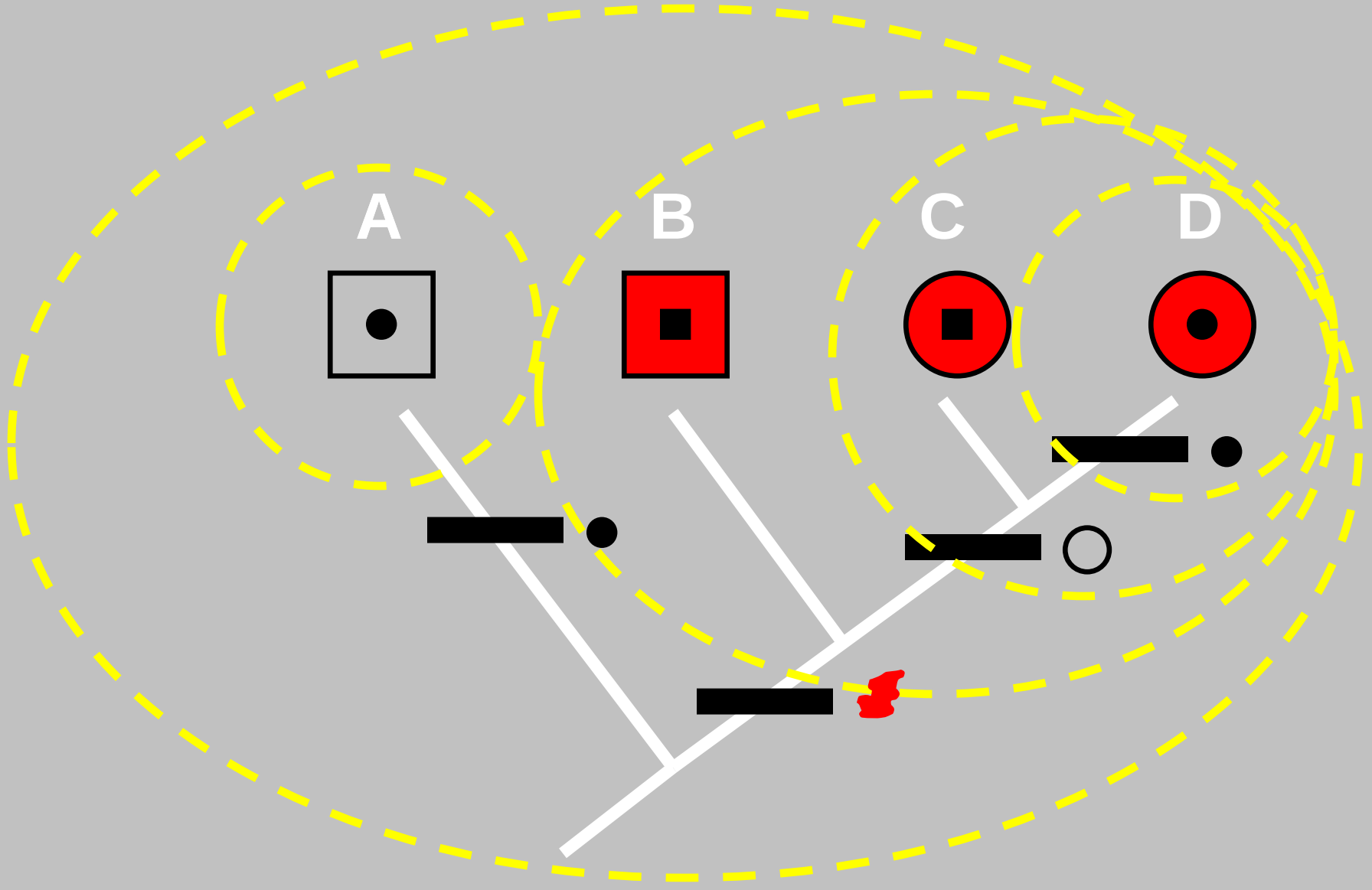
- Simplesiomorfia

Formato do apêndice central

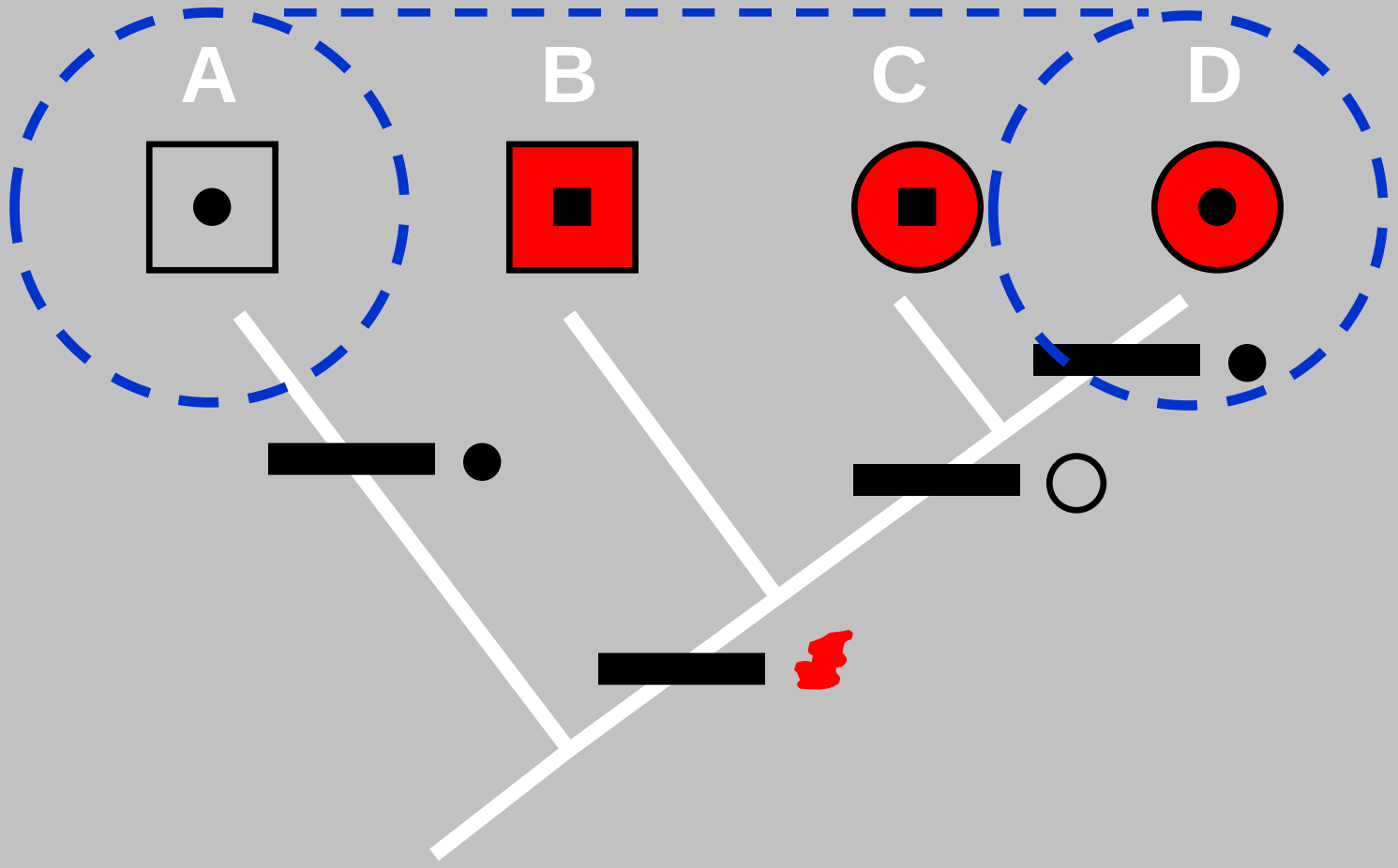


- Homoplasia

- Grupos monofiléticos



- Grupos não-monofiléticos



As reconstruções filogenéticas são feitas necessariamente por meio de características anatômicas “estáveis”, geneticamente herdadas?

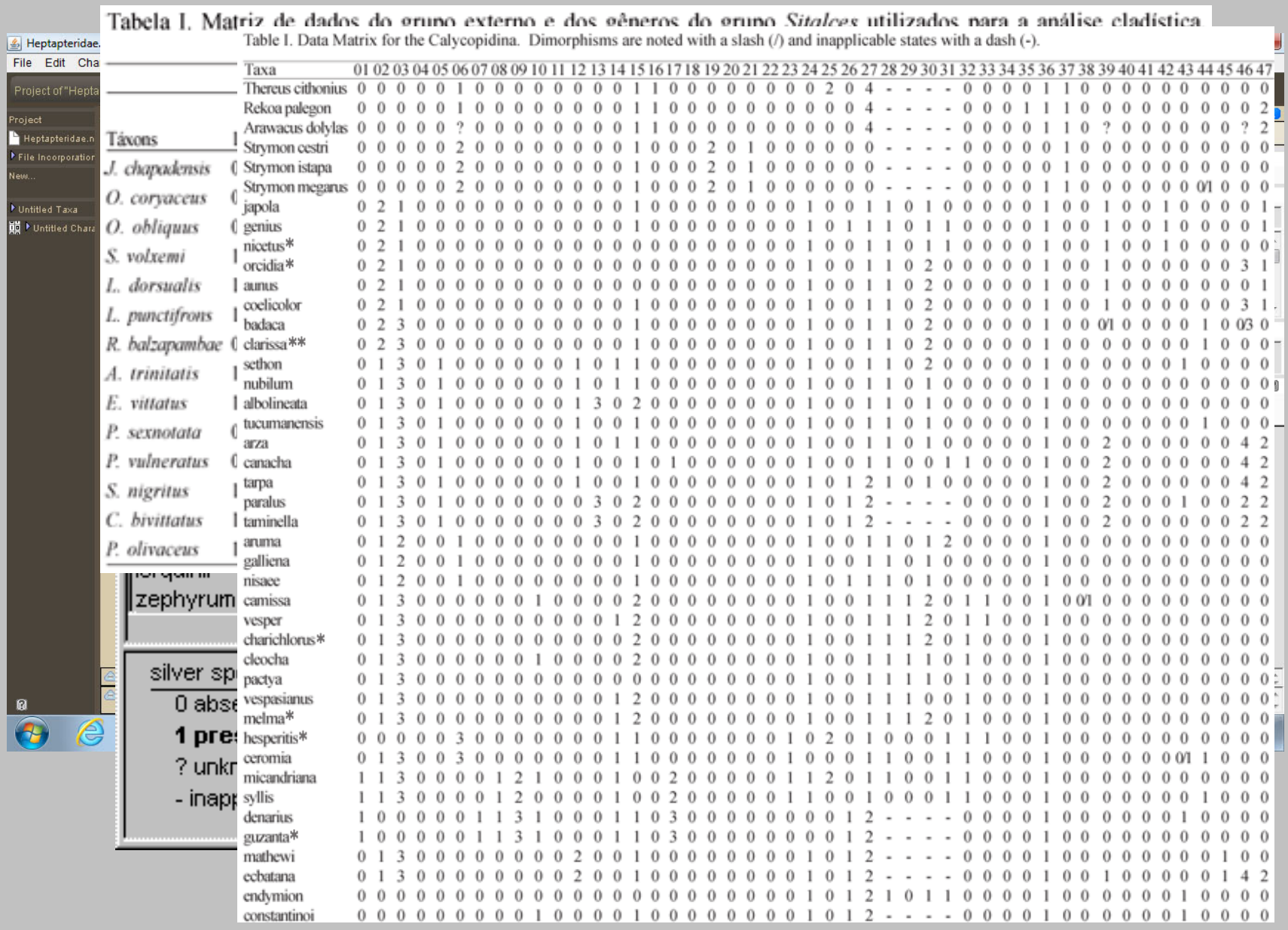


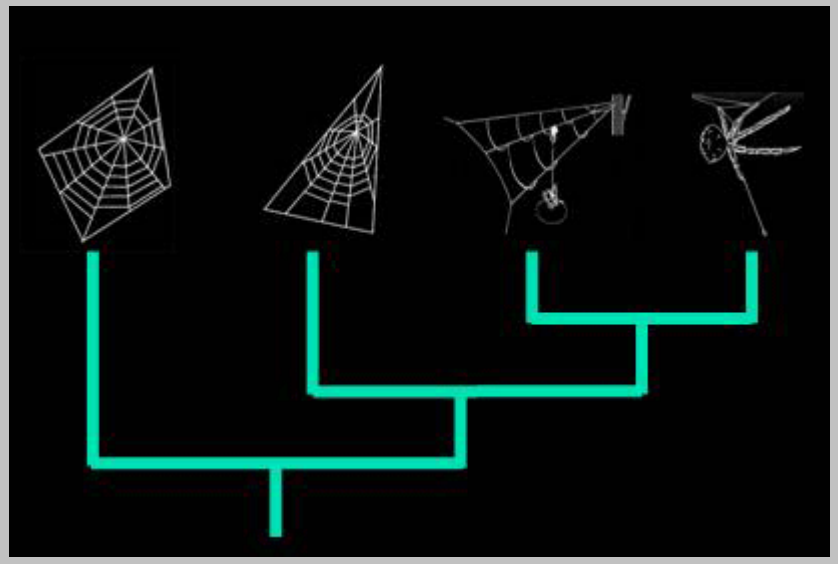
Tabela I. Matriz de dados do grupo externo e dos gêneros do grupo *Sitalces* utilizados para a análise cladística

Table I. Data Matrix for the Calycopidina. Dimorphisms are noted with a slash (/) and inapplicable states with a dash (-).

Taxa	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Thereus cithonius	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	4	-	-	-	-	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Rekoa palegon	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	4	-	-	-	-	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	2
Arawacus dolylas	0	0	0	0	0	?	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	4	-	-	-	-	0	0	0	0	1	1	0	?	0	0	0	0	0	0	?	2
Strymon cestri	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	-	-	-	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Strymon istapa	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	-	-	-	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Strymon megarus	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	-	-	-	-	0	0	0	0	1	1	0	0	0	0	0	0	0/1	0	0	0
japola	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1
genius	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1
nicetus*	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0
orcidia*	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3	1
aunus	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
coelicolor	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3	1
badaca	0	2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	0/1	0	0	0	0	1	0	0/3	0
clarissa**	0	2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
sethon	0	1	3	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
nubilum	0	1	3	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
albolineata	0	1	3	0	1	0	0	0	0	0	0	1	3	0	2	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
tucumanensis	0	1	3	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
arza	0	1	3	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	2	0	0	0	0	0	4	2
canacha	0	1	3	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	0	0	1	0	0	2	0	0	0	0	0	4	2
tarpa	0	1	3	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	1	0	1	0	0	0	0	0	1	0	0	2	0	0	0	0	0	4	2
paralus	0	1	3	0	1	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	1	0	1	2	-	-	-	-	0	0	0	0	1	0	0	2	0	0	0	1	0	0	2	2
taminella	0	1	3	0	1	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	1	0	1	2	-	-	-	-	0	0	0	0	1	0	0	2	0	0	0	0	0	0	2	2
aruma	0	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
galliena	0	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
nisaee	0	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
camissa	0	1	3	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	1	0	0	1	0	0/1	0	0	0	0	0	0	0	0	0
vesper	0	1	3	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
charichlorus*	0	1	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
cleocha	0	1	3	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
pactya	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
vespasianus	0	1	3	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
melma*	0	1	3	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
hesperitis*	0	0	0	0	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	2	0	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
ceromia	0	1	3	0	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0/1	1	0	0
micandriana	1	1	3	0	0	0	0	1	2	1	0	0	0	1	0	0	2	0	0	0	0	0	0	1	1	2	0	1	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
syllis	1	1	3	0	0	0	0	1	2	0	0	0	0	1	0	0	2	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
denarius	1	0	0	0	0	0	1	1	3	1	0	0	0	1	1	0	3	0	0	0	0	0	0	0	0	1	2	-	-	-	-	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
guzanta*	1	0	0	0	0	0	1	1	3	1	0	0	0	1	1	0	3	0	0	0	0	0	0	0	0	1	2	-	-	-	-	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
mathewi	0	1	3	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	-	-	-	-	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
ecbatana	0	1	3	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	-	-	-	-	0	0	0	0	1	0	0	1	0	0	0	0	0	1	4	2
endymion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
constantinoi	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	-	-	-	-	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0

As reconstruções filogenéticas são feitas necessariamente por meio de características anatômicas “estáveis”, geneticamente herdadas?

Caracteres comportamentais, herdados ou aprendidos, podem ser utilizados para construir filogenias?



Caracteres comportamentais podem ser herdados?

nature communications

Article

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Call combinations and compositional processing in wild chimpanzees

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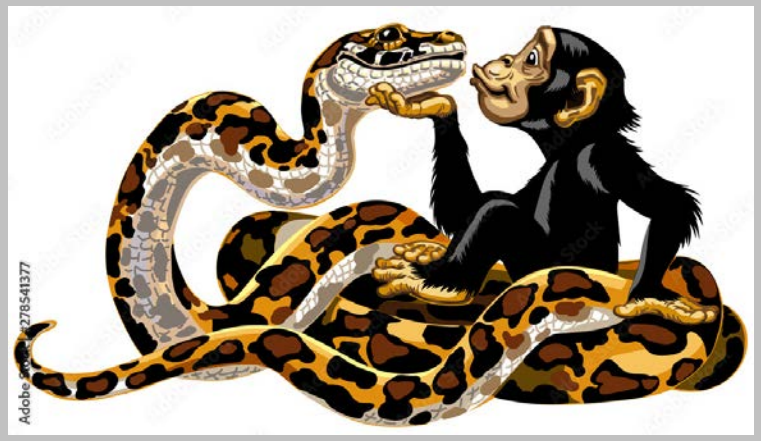
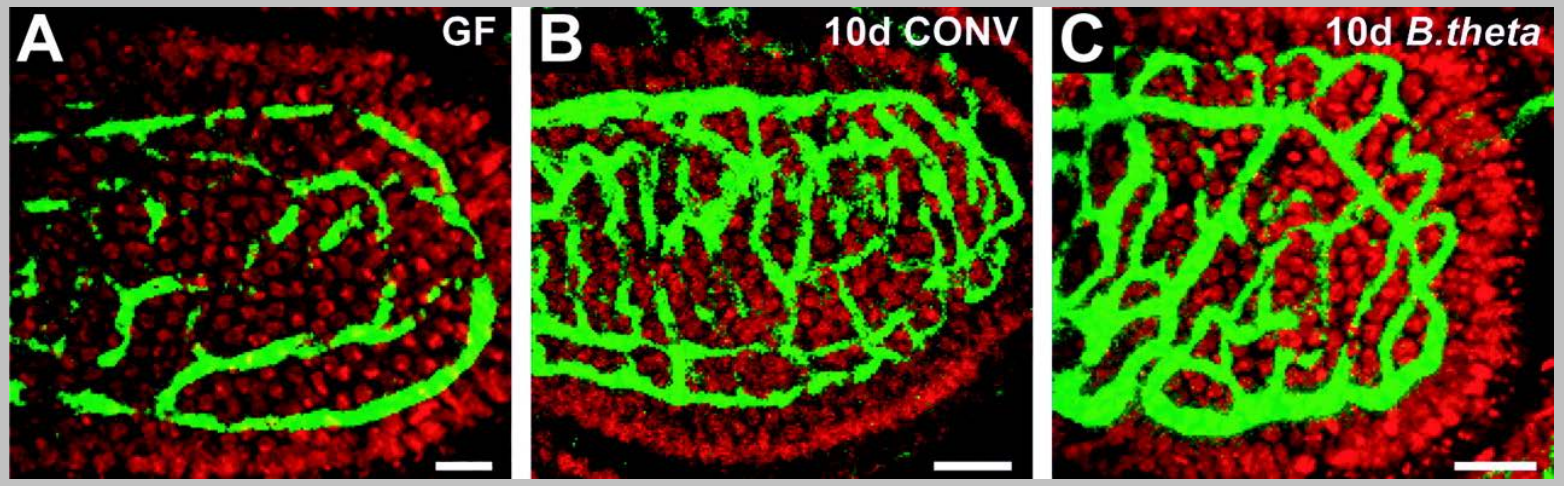
Check for updates

Maël Leroux[1,2,3], Anne M. Schel[4], Claudia Wilke[1,2,3], Bosco Chandia[2], Klaus Zuberbühler[2,3,5,6], Katie E. Slocombe[7] & Simon W. Townsend[1,3,8]

Through syntax, i.e., the combination of words into larger phrases, language can express a limitless number of messages. Data in great apes, our closest-living relatives, are central to the reconstruction of syntax's phylogenetic origins, yet are currently lacking. Here, we provide evidence for syntactic-like structuring in chimpanzee communication. Chimpanzees produce "*alarm-huus*" when surprised and "*waa-barks*" when potentially recruiting conspecifics during aggression or hunting. Anecdotal data suggested chimpanzees combine these calls specifically when encountering snakes. Using snake presentations, we confirm call combinations are produced when individuals encounter snakes and find that more individuals join the caller after hearing the combination. To test the meaning-bearing nature of the call combination, we use playbacks of artificially-constructed call combinations and both independent calls. Chimpanzees react most strongly to call combinations, showing longer looking responses, compared with both independent calls. We propose the "*alarm-huu + waa-bark*" represents a compositional syntactic-like structure, where the meaning of the call combination is derived from the meaning of its parts. Our work suggests that compositional structures may not have evolved de novo in the human lineage, but that the cognitive building-blocks facilitating syntax may have been present in our last common ancestor with chimpanzees.



E qual a natureza dos caracteres anatômicos? Todos têm base totalmente genética? *E se nem tudo for genética?* =>*Plasticidade fenotípica*



Angiogênese induzida em pequenos vilos intestinais de ratos adultos. A–C: imagens confocais da rede de capilares no terço superior das pequenas vilosidades intestinais (capilares – verde; núcleos - vermelho).
(A) com alimentação normal; (B) após colonização com microbiota colhida de “doador”; (C) após colonização com *Bacterioides thetaiotaomicron* (*B. theta*) apenas. Escalas - 25 μm.

Stappenbeck T S et al. PNAS 2002;99:15451-15455

E qual a natureza dos caracteres anatômicos? Todos têm base totalmente genética? *E se nem tudo for genética?* =>*Plasticidade fenotípica*

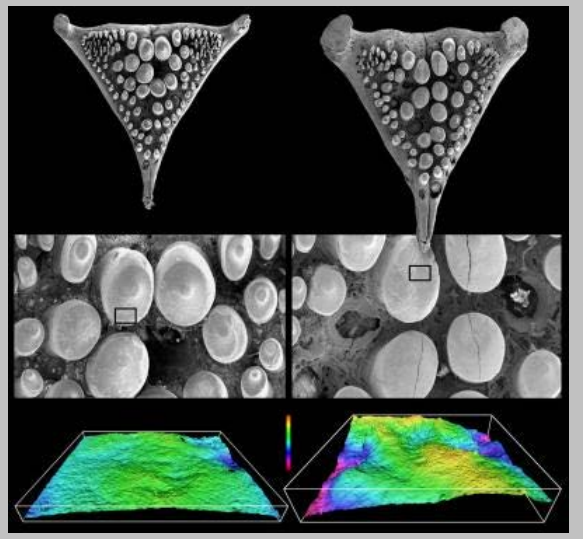
MOLECULAR ECOLOGY

Molecular Ecology (2014) **23**, 4511–4526 doi: 10.1111/mec.12851

Regulatory gene networks that shape the development of adaptive phenotypic plasticity in a cichlid fish

RALF F. SCHNEIDER,*† YUANHAO LI,* AXEL MEYER*† and HELEN M. GUNTER*‡[1]

**Lehrstuhl für Zoologie und Evolutionsbiologie, Department of Biology, University of Konstanz, Universitätstrasse 10, 78457 Konstanz, Germany, †International Max Planck Research School for Organismal Biology, University of Konstanz, Universitätsstr 10, 78457 Konstanz, Germany, ‡Zukunftskolleg, University of Konstanz, Universitätsstr 10, 78457 Konstanz, Germany*



***Astatoreochromis alluaudi* (Cichildae)**

Fonte: http://www.african-cichlid.com/Alluaudi.htm

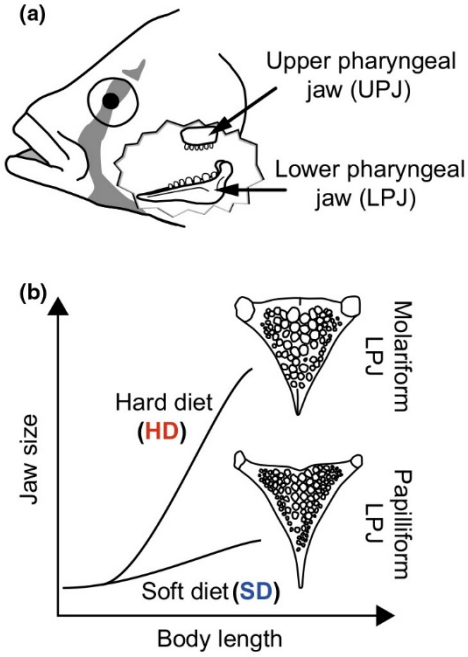


Fig. 1 Cichlid fishes possess a mechanically robust pharyngeal jaw apparatus. (a) The PJA is comprised of a pair of upper pharyngeal jaws (UPJ) that articulate directly with the neurocranium and the lower pharyngeal jaw (LPJ), which is formed by the suturing of the 5th ceratobranchial arches. (b) For the cichlid *Astatoreochromis alluaudi*, the mechanical properties of the diet influence LPJ development, whereby individuals fed a soft diet develop a smaller, more slender papilliform LPJ, the baseline condition, while individuals fed a hard diet develop a larger, more robust molariform LPJ that withstands increased biting forces. Image modified from Hoogerhoud (1984).

Caracteres comportamentais podem ser uma base genética?

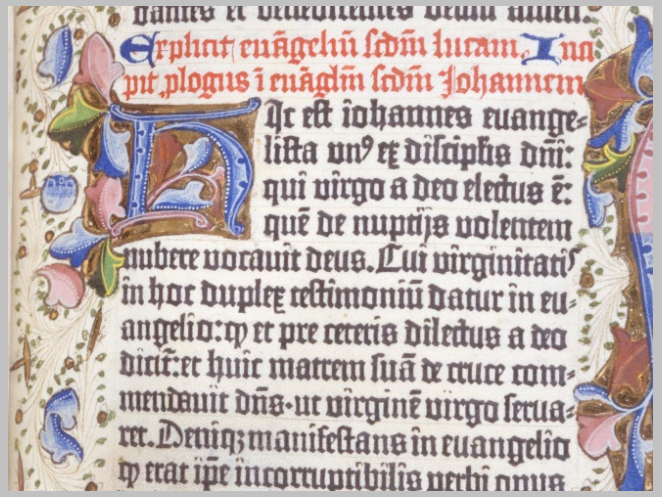
Teoria estrutural - *Burrhus Frederic Skinner* (1904, Susquehanna Depot - 1990, Cambridge), Harvard University

Teoria gerativa - *Avram Noam Chomsky* (1928, East Oak Lane, Filadélfia -)

Assimilação da evolução biológica pelas Humanidades – Linguística

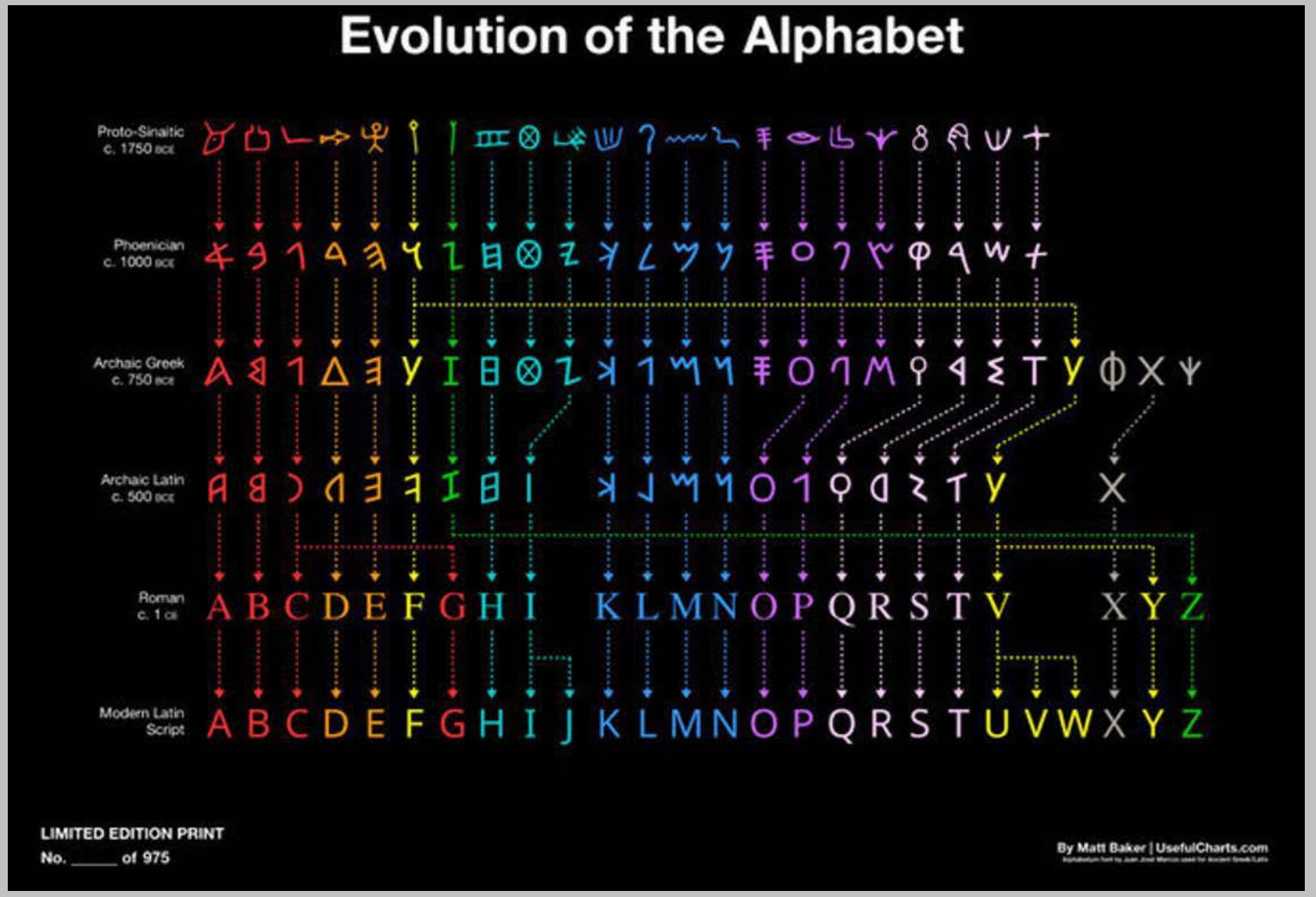
A Torre de Babel, por *Pieter Bruegel*, o Velho (Vienna, 1563)

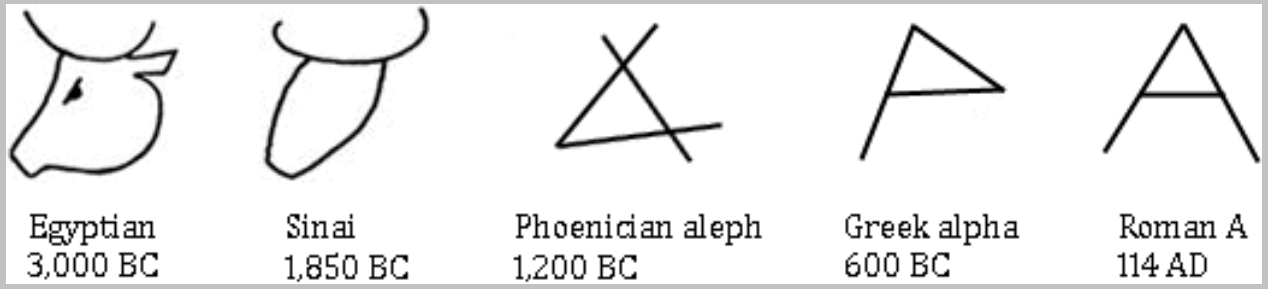
Assimilação da evolução biológica pelas Humanidades – Linguística



ა	ბ	გ	დ	ე	ვ	ზ	თ	ი	კ	ლ
a	b	g	d	e	v	z	t	i	k’	l
[a]	[b]	[g]	[d]	[e]	[v]	[z]	[tʰ]	[i]	[k’]	[l]
მ	ნ	ო	პ	ჟ	რ	ს	ტ	უ	ფ	ქ
m	n	o	p’	zh	r	s	t’	u	p	k
[m]	[n]	[ɔ]	[p’]	[ʒ]	[r]	[s]	[tʼ]	[u]	[pʰ]	[kʰ]
ღ	ყ	შ	ჩ	ც	ძ	წ	ჭ	ხ	ჯ	ჰ
gh	q’	sh	ch	ts	dz	ts’	ch’	kh	j	h
[ɣ]	[qʼ]	[ʃ]	[t͡ʃʰ]	[t͡sʰ]	[d͡z]	[t͡sʼ]	[t͡ʃʼ]	[x]	[ʤ]	[h]

Evolução cultural – Linguística





Evolução cultural – Linguística

August Schleicher (1821-1868)

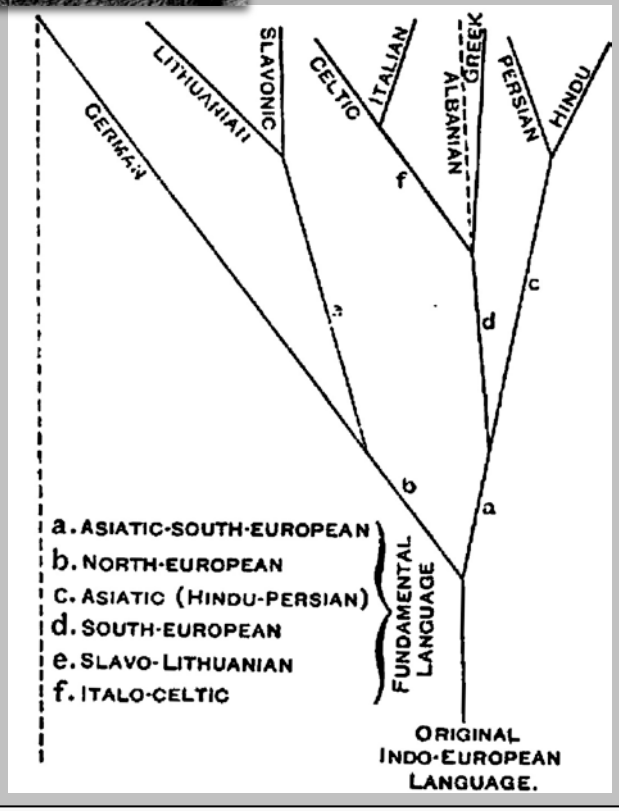
Sinapomorfias

Palavra em português	*Cognatos (idioma)*
alto	alt (catalão); alto (espanhol); alto (italiano); haut (francês); înalt (romeno)
ar	aire (catalão); aire (espanhol); air (francês); air (inglês); aria (italiano); aer (romeno)
cair	caure (catalão); caer (espanhol); cadere (italiano); cădea (romeno)
clima	Klima (alemão); clima (catalão); clima (espanhol); climat (francês); climate (inglês); clima (italiano); climă (romeno)
combate	combat (catalão); combate (espanhol); combat (francês); combat (inglês); combattimento (italiano); combatere (romeno)
nome	Name (alemão); nom (catalão); nombre (espanhol); nom (francês); name (inglês); nome (italiano); nume (romeno)
superior	superior (catalão); superior (espanhol); supérieur (francês); superior (inglês); superiore (italiano); superior (romeno)
trabalho	treball (catalão); trabajo (espanhol); travail (francês); travaliu (romeno)
verdade	veritat (catalão); verdad (espanhol); vérité (francês); verità (italiano); verity (inglês); adevăr (romeno)
Setembro	September (alemão), setembre (catalão); September (inglês); septiembre (espanhol); Septembre (francês); settembre (italiano)

Homoplasias

Falsos cognatos entre a *língua portuguesa* e a *língua inglesa*:

Palavra em inglês	*Falso cognato em português*	*Significado real*
anthem	antena	hino
ingenious	ingênuo	engenhoso
pregnant	impregnada	grávida; prenha
spectacles	espetáculos	óculos

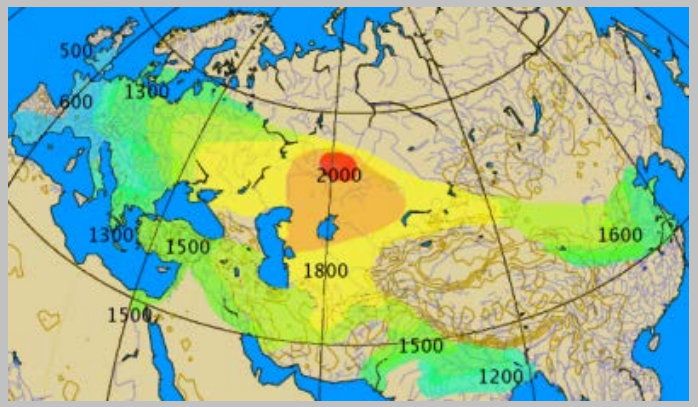


Árvore genealógica (*Stammbaum*), expressando as relações de proximidade lingüísticas de Schleicher (1853).

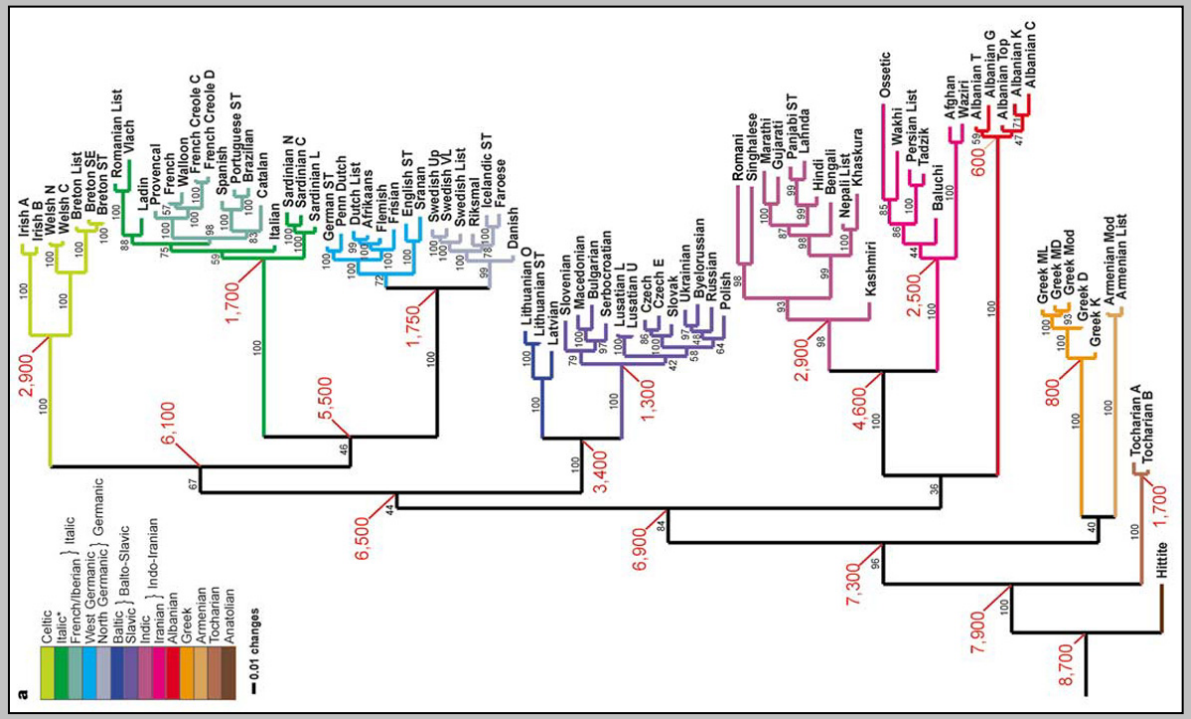
Assimilação da evolução biológica pelas Humanidades – Linguística

Russell D. Gray
University of Auckland

Quentin Atkinson
University of Auckland



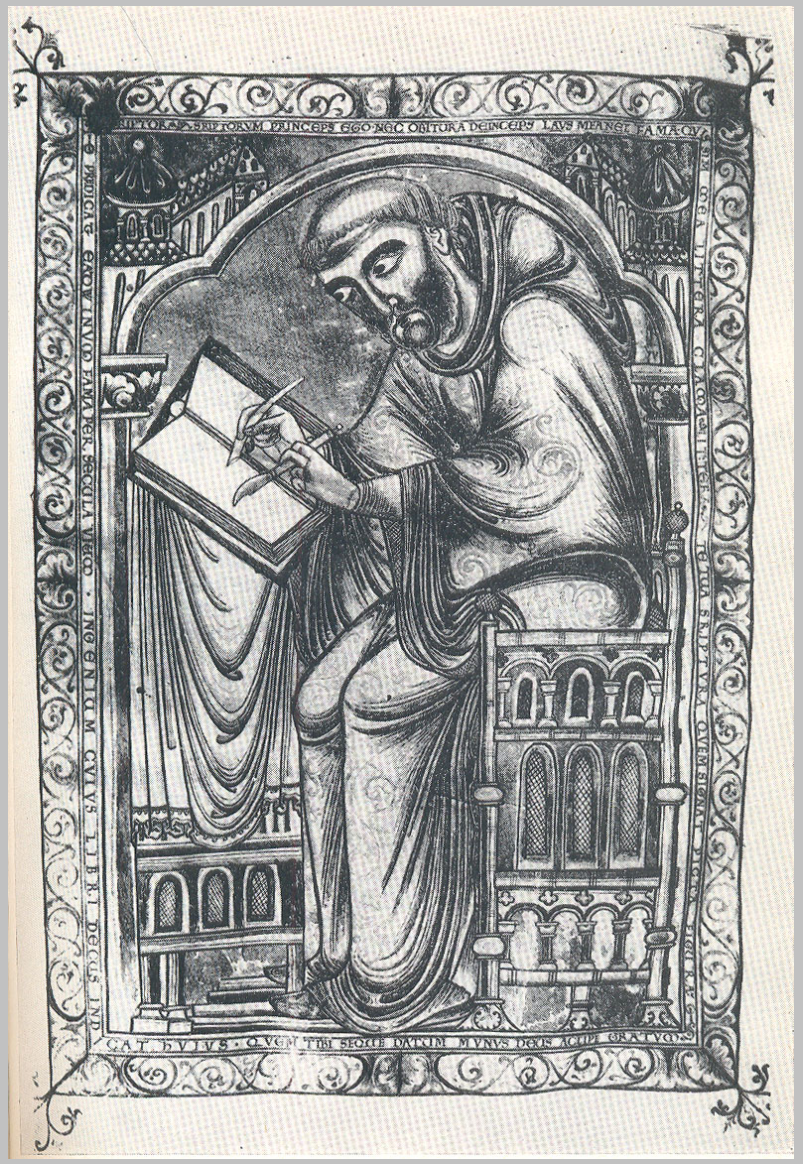
Teoria de expansão dos cavaleiros Kurgan (4.000 A.C.)



Teoria de expansão agrícola Anatoliana (7.000 A.C.)

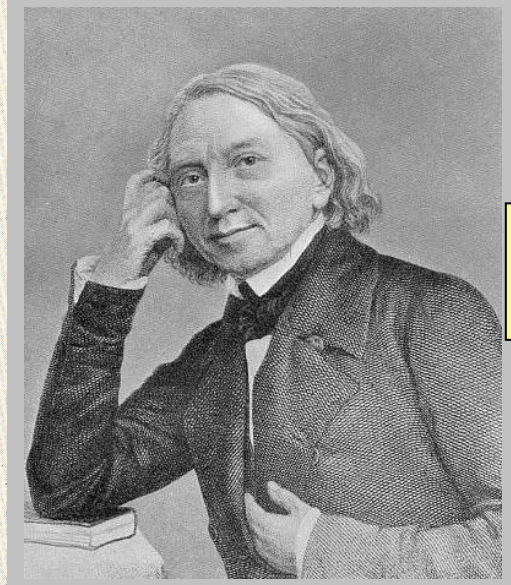
Gray, R. D.; & Q. D. Atkinson. 2003. Language-tree divergence times support the Anatolian theory of Indo-European origin. **Nature, 426**: 435-439.

Evolução cultural – Produção Textual



Estemática - registro, classificação e interpretação das *variantes dos testemunhos da tradição* (= versões textuais), com vistas a se definir as relações hierárquicas (descendentes, ascendentes ou colaterais) entre eles, e a reconstituir-se o processo de transmissão; culmina no **estema**.

Estema – *stemma*, Lat. = árvore da família, pedigree



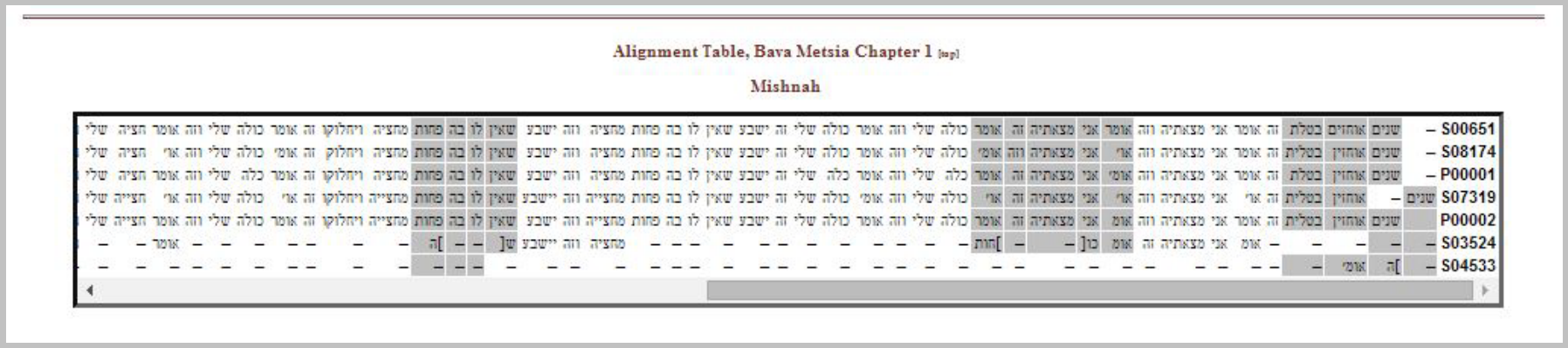
***Erro comum* = mesma origem**

Sinapomorfia

Karl Konrad Friedrich Wilhelm Lachmann (1793, Braunschweig - 1815)

Assimilação da evolução biológica pelas Humanidades – produção textual

Et rose elle a vécu ce que vivent les roses (1)
Et rose elle a vécu ce que vivent les oses (2)
Et rose elle a vécu ce que vivent les rosses (3)
Et rose elle a vécu ce que vivent les ruses (4)
Et rose elle a vécu ce que vivent les sesor (5)
Et rose elle a vécu ce que vivent les rsoes (6)
Et rose elle a vécu ce que vivent les (7)



Etapa Conjectural – homologia primária (similaridade)

Evolução cultural – Produção Textual

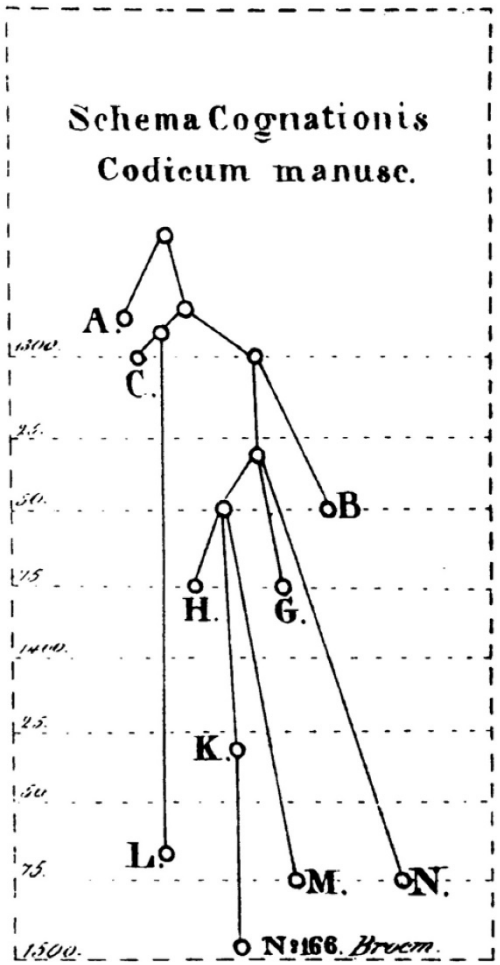


Fig. 1. Schlyter's stemma for *Västgötalagen* (1827)

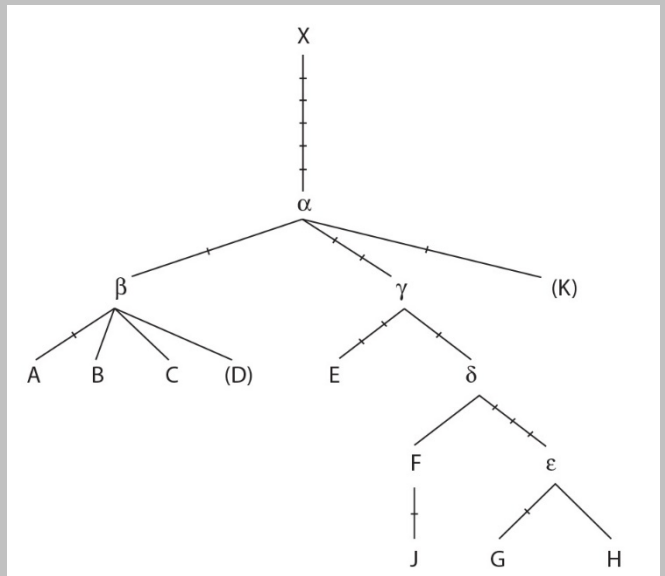


Fig. 4 A re-drawn version of the stemma in Paul Maas, *Textkritik* (1960, p. 7)

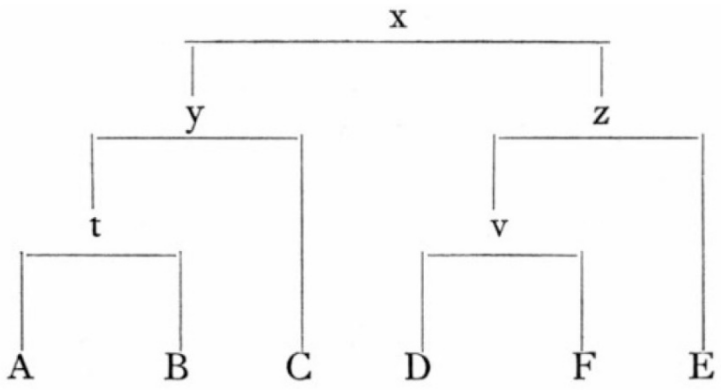


Fig. 1 The stemma in Joseph Bédier's edition of *Lai de l'Ombre* (1890, p. 19)

Evolução cultural – Produção Textual

Xilogravura da segunda edição de William Caxton de *Canterbury Tales* [= *Os Contos de Cantuária*] (1483) (Geoffrey Chaucer, 1387)

CLADISTIC METHODS IN TEXTUAL, LINGUISTIC, AND PHYLOGENETIC ANALYSIS

NORMAN I. PLATNICK AND H. DON CAMERON

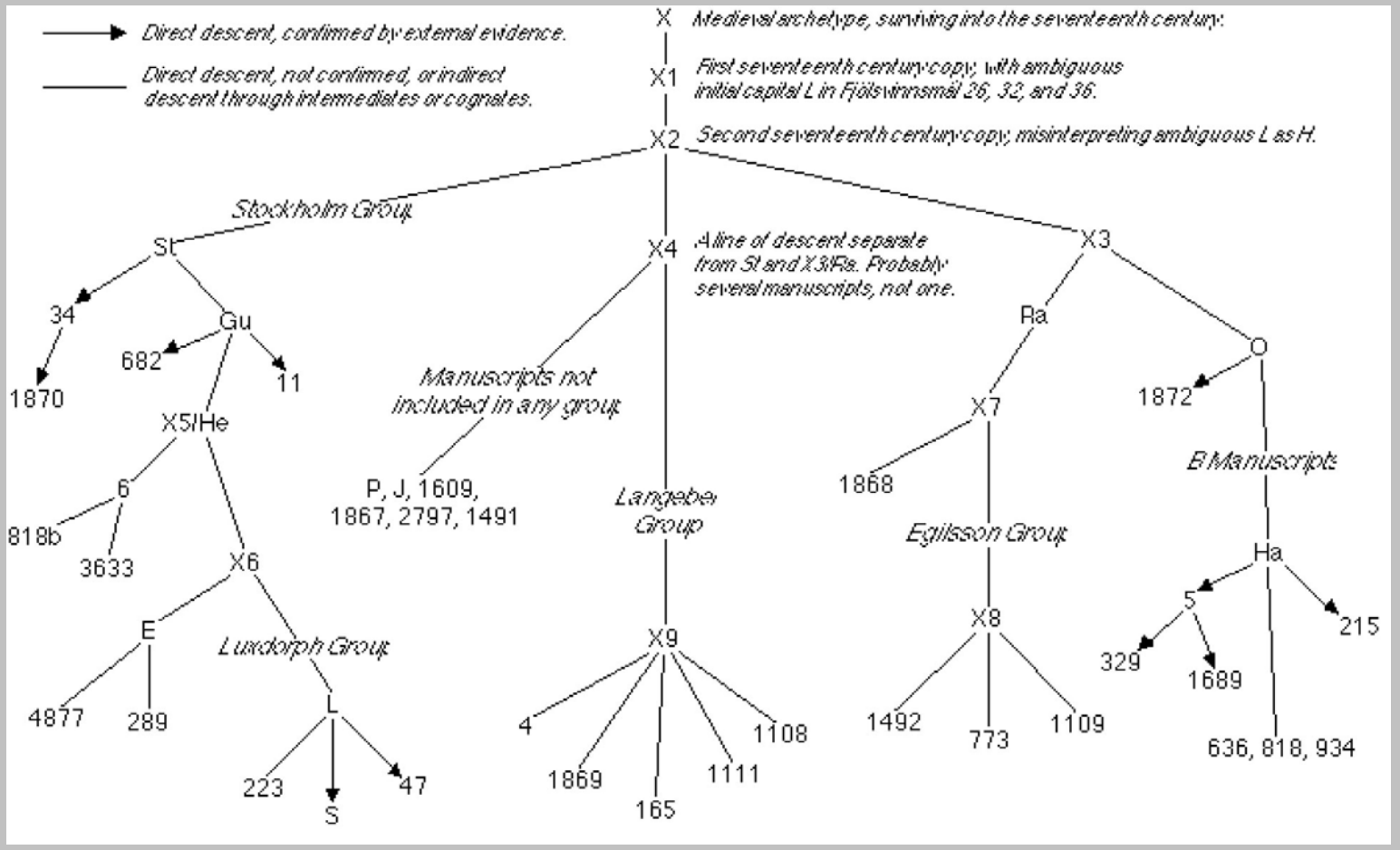
Abstract

Platnick, N. I. (Department of Entomology, The American Museum of Natural History, New York, New York 10024) and H. D. Cameron (Department of Classical Studies and Museum of Zoology, The University of Michigan, Ann Arbor, Michigan 48104) 1977. Cladistic methods in textual, linguistic, and phylogenetic analysis. Syst. Zool. 26:380–385.—The concept that historical interrelationships can be demonstrated only by the presence of shared innovations is fundamental to the fields of textual and linguistic, as well as phylogenetic, reconstruction. All three fields utilize analogous procedures in which data are organized into transformation series of homologous character states, the polarity of these transformation series is determined by out-group comparison, and shared innovations are used to construct internested series of three-taxon statements that operate at a level of generality above that of specific ancestor-descendant hypotheses. The acceptance of these methods as the standard operational tools in separate fields suggests that cladistic analysis is a general comparative method applicable to all studies of historical interrelationships based on ancestor-descendant sequences, and that biologists concerned with such questions can ill afford to ignore cladistic theory and methods. [Phylogeny reconstruction; phylogenetic systematics; cladism.]

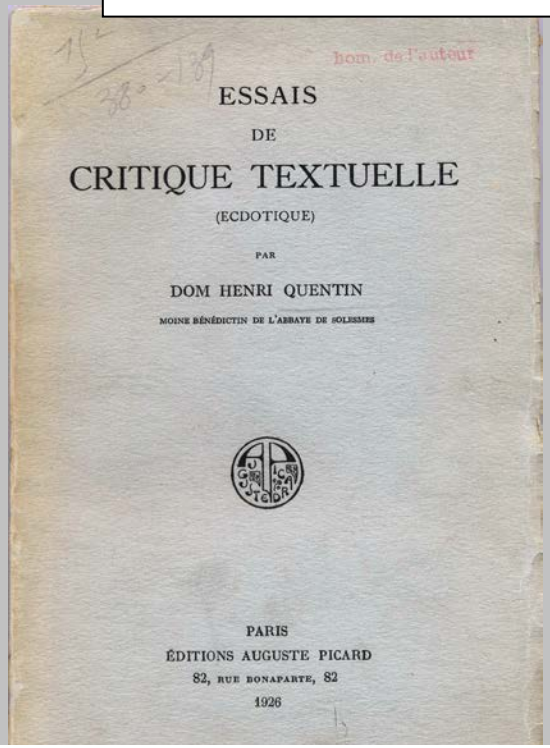
***Norman I. Platnick (1951-2020)*, American Museum of Natural History**

Platnick NI, Don Cameron H. 1977. Cladistic methods in textual, linguistic, and phylogenetic analysis. *Syst Zool* 26 (4): 380-385.

Evolução cultural – Produção Textual



Evolução cultural – Produção Textual



hom. de l'auteur

ESSAIS

DE

CRITIQUE TEXTUELLE

(ECDOTIQUE)

PAR

DOM HENRI QUENTIN

MOINE BÉNÉDICTIN DE L'ABBAYE DE SOLESMES

PARIS

ÉDITIONS AUGUSTE PICARD

82, RUE BONAPARTE, 82

1926

Systematics and Biodiversity (2016), 1–10

Taylor & Francis
Taylor & Francis Group

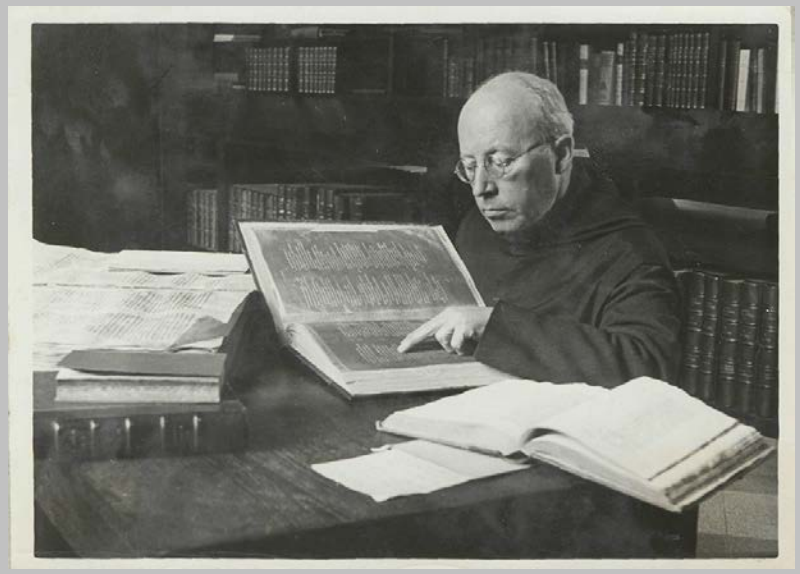
Perspective

Unrooted trees discovered independently in philology and phylogenetics: a remarkable case of methodological convergence

MÁRIO DE PINNA[1], FLÁVIO A. BOCKMANN[2] & RENÉ ZARAGUETA I BAGILS[3]

[1]Museu de Zoologia da Universidade de São Paulo, Av. Nazaré 481, São Paulo, SP 04263-000, Brazil
[2]Universidade de São Paulo, Faculdade de Filosofia Ciências e Letras de Ribeirão Preto, Departamento de Biologia, Av. Bandeirantes 3900, Ribeirão Preto, SP 14040-901, Brazil
[3]Sorbonne Universités, Université Paris 06, Institut de Systématique, Evolution, Biodiversité, Bâtiment de Géologie, CP48, Muséum national d'Histoire naturelle 57 rue Cuvier 75005 Paris, France

(Received 30 October 2015; accepted 28 January 2016)



***Dom Henri Quentin* (1872-1935)**

Evolução cultural – Produção Textual

	A	G	O	C	D	X	T	E	B	M	N			
1	O	O	O	O	+	O	O	O	O	O	+			
2	O	O	+	+	O	O	+	+	+	+	O			
3	+	O	+	+	O	O	O	+	+	O	O			
4	O	O	O	O	O	+	O	+	+	+	O			
5	+	+	+	O	+	+	+	O	O	O	+			
6														
7														
8														

Fig. 2. Quentin's matrix of variants (presence or absence), represented as Arabic numbers in rows, versus text versions (terminals), represented as uppercase letters in columns. From Quentin (1926a: 69).

	A	G	O	C	D	X	T	E	B	M	N
A	+	4	4	3	3	3	3	2	2	1	3
G	4	+	3	2							
O	4	3	+								
C	3	2									
D	3										
X	3										
T	3										
E	2										
B	2										
M	1										
N	3										

Fig. 3. Quentin's Pythagorean table, representing agreements between any two text versions (terminals). Numbers represent the summation of the total variants for which any given two versions are identical. From Quentin (1926a: 71).

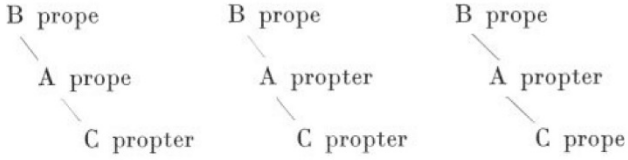


Fig. 4. Quentin's triplet analysis. From Quentin (1926a: 46, bottom).

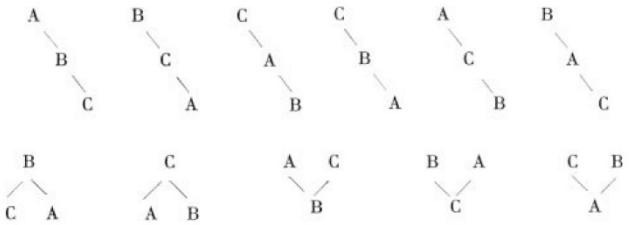


Fig. 5. Ordering and folding possibilities for hypothetical unrooted Quentin triplets with different intermediate elements. From Quentin (1926a: 45, 46)

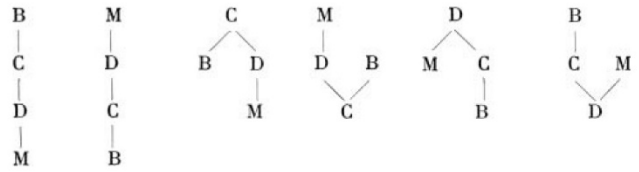


Fig. 6. Rooting possibilities for a hypothetical unrooted tree with four elements. Notice that the root is on top. From Quentin (1926a: 50).

Dendrograma de relações - Encadeamento e Orientação (enraizamento)

Evolução cultural – Produção Textual

***Dom Jacques Froger* (1909-1980)**

Evolução cultural – Produção Textual

(bonnes ou mauvaises), accessoires du texte tels que titres ou division en chapitres, etc. Le XVIIIe siècle applique, sans le formuler de façon absolument nette, le principe selon lequel « la communauté des caractéristiques (de quelque nature qu'elles soient) implique la communauté d'origine ».

§ 5. LA GÉNÉALOGIE DES MANUSCRITS ET LES PREMIERS STEMMES

Au XIXe siècle, on voit se dessiner peu à peu un principe nouveau : « La communauté des leçons implique la communauté d'origine ». C'est une précision apportée au précédent, ou plutôt une restriction dans le sens des données internes, et une étape dans la voie qui mène à la méthode des fautes communes.

En effet, la notion de « classe » élaborée au XVIIIe siècle contient en germe la méthode généalogique, celle qui consiste à déterminer ces relations des manuscrits comme ancêtres et descendants et se fonde sur les relations pour restituer le texte en reconstituant les exemplaires perdus, et notamment l'original, par l'accord de leurs descendants indépendants. Cependant les « caractéristiques communes » qui définissent la « classe » représentent une notion très extensive et indifférenciée, puisqu'elle inclut à la fois les caractéristiques externes et les caractéristiques internes. C'est donc un point de bifurcation, d'où l'on peut partir dans deux directions différentes.

Si on limite les caractéristiques communes à celles qui consistent en données externes, on s'achemine vers les méthodes généalogiques qui se fondent notamment sur les accidents matériels et les données codicologiques : nous en parlerons plus loin.

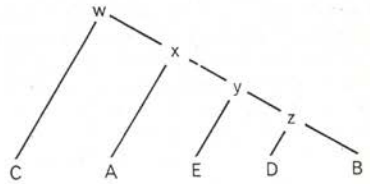
Si au contraire on restreint les caractéristiques communes à celles qui portent sur la teneur du texte, on se dirige vers les méthodes généalogiques qui se fondent sur les données internes, celles dont nous parlerons maintenant.

Le premier pas dans cette direction consiste à prendre comme caractéristiques communes *les leçons*, toutes les leçons, indifféremment les bonnes ou les mauvaises, les authentiques et les inauthentiques; c'est à ce stade que l'on en restera pendant la première moitié du XIXe siècle, et beaucoup de critiques s'y attarderont jusqu'à la fin du siècle. L'étape suivante, qui sera d'ailleurs atteinte graduellement, consistera en une précision nouvelle : les

leçons communes qui révèlent les relations généalogiques des manuscrits ne seront plus n'importe lesquelles, mais seulement les *fautives*, et cette note restrictive, excluant les « bonnes » leçons, conduira finalement à la méthode « des fautes communes ».

Cette évolution dans les idées se fit lentement et non sans hésitations : c'est dans un dessein de clarté que nous la résumons ainsi de façon schématique. Nous rencontrons en particulier, dans la première moitié du XIXe siècle et même dans sa plus grande partie chez certains critiques, une méthode bâtarde qui, ne pouvant se débarrasser de la conception qualitative héritée du passé, la combine curieusement avec la notion généalogique proprement dite. Le processus est le suivant. On range d'abord les manuscrits dans l'ordre de leur qualité décroissante, et il est d'usage de placer les bons à gauche et les mauvais à droite. Puis on considère qu'à chaque étape de la descente dans la hiérarchie qualitative correspond un ancêtre nouveau, moins bon que le précédent.

Supposons, par exemple, que nous ayons affaire aux manuscrits ABCDE, qui se rangent, du meilleur au pire, dans l'ordre CAEBD. On admet que le meilleur, C, descend directement de l'ancêtre commun *w*, dont il est le fidèle reflet, tandis que tous les autres, AEBD, procèdent d'un collatéral moins bon *x*; de celui-ci, A qui est le meilleur des mauvais, descend directement, tandis que les autres, EDB, dérivent encore une fois d'un collatéral moins soigné, *y*; et ainsi de suite, indéfiniment. Il en résulte un schéma du type que voici :



De la sorte, un classement purement qualitatif est accompagné d'une superstructure qui lui donne un aspect faussement généalogique.

On trouve aussi, dans cette première moitié du XIXe siècle où règne une certaine confusion, des schémas proprement généalogiques, et l'intérêt que

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, pp. 38-39.**

Evolução cultural – Produção Textual

Le premier pas dans cette direction consiste à prendre comme caractéristiques communes *les leçons*, toutes les leçons, indifféremment les bonnes ou les mauvaises, les authentiques et les inauthentiques; c'est à ce stade que l'on en restera pendant la première moitié du XIX^e^ siècle, et beaucoup de critiques s'y attarderont jusqu'à la fin du siècle. L'étape suivante, qui sera d'ailleurs atteinte graduellement, consistera en une précision nouvelle : les leçons communes qui révèlent les relations généalogiques des manuscrits ne seront plus n'importe lesquelles, mais seulement les *fautives*, et cette note restrictive, excluant les « bonnes » leçons, conduira finalement à la méthode « des fautes communes ».

O primeiro passo nesta direção consiste em tomar como características comuns as interpretações (versões), todas as interpretações, sejam elas boas ou ruins, as autênticas e as falsas; é neste estágio que estamos na primeira metade do século XIX e no qual muitos críticos ficarão até o fim do século. O próximo passo, que será atingido gradualmente, consistirá de uma nova precisão: **as versões comuns não serão aquelas mais significativas para revelar as relações genealógicas dos manuscritos, mas apenas aquelas *errôneas***, e esse detalhe restritivo que, excluindo as 'boas' interpretações, conduzirá finalmente ao método dos "***erros compartilhados***".

Informação filogenética está nas sinapomorfias!

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, pp. 38-39.**

Evolução cultural – Produção Textual

groupe lacunaire; le plus simple est donc d'épurer la collation avant de s'en servir, et d'éliminer d'emblée les lieux variants où une proportion notable des manuscrits font défaut.

§ 4. LES ANOMALIES

Abordons maintenant les anomalies proprement dites. Elles sont de deux sortes : les unes effacent dans un manuscrit des fautes qu'il devrait tenir de ses ancêtres, et les autres lui communiquent au contraire des fautes qui ont été commises par un collatéral et qu'il ne devrait pas contenir.

Au moment où il cherche à reconstituer l'enchaînement, le critique n'a pas à se demander quelles causes ont bien pu effacer des fautes ou les communiquer indûment et s'il faut incriminer la contamination ou le hasard; c'est une question qu'il se posera plus tard. Pour l'instant, il constate seulement les effets de causes inconnues, et s'efforce de découvrir la généalogie normale.

Expliquons les perturbations produites par les deux sortes d'anomalies que nous venons de dire; nous n'avons pas la prétention de passer en revue la variété infinie des éventualités qui peuvent survenir, et nous voudrions seulement illustrer le principe à l'aide d'exemples faciles à comprendre.

Nous ferons remarquer au passage que les anomalies sont visibles ou non, selon les circonstances. L'anomalie, en effet, saute aux yeux si elle se traduit par des groupes qui chevauchent les uns sur les autres, ce qui ne se produit jamais quand la généalogie est normale. Mais par malheur il y a des anomalies qui laissent aux groupes leur agencement harmonieux, de sorte que rien ne trahit leur présence. Un critique pointilleux pourrait donc soutenir que théoriquement un épais nuage d'incertitude plane sur tout arbre généalogique. Mais il ne faut pas exagérer. Nous dirons quelles précautions il convient de prendre et comment évaluer raisonnablement la marge d'incertitude.

a) Les fautes ancestrales effacées

Pour expliquer les perturbations que produit dans l'enchaînement l'anomalie qui efface des fautes ou variantes ancestrales, raisonnons sur un exemple : il sera facile d'en tirer la loi générale.

Plaçons-nous comme d'habitude d'abord dans l'orientation réelle, et parlons en termes de fautes.

Au moment où il cherche à reconstituer l'enchaînement, le critique n'a pas à se demander quelles causes ont bien pu effacer des fautes ou les communiquer indûment et s'il faut incriminer la contamination ou le hasard; c'est une question qu'il se posera plus tard. Pour l'instant, il constate seulement les effets de causes inconnues, et s'efforce de découvrir la généalogie normale.

Quando o crítico procura reconstruir o encadeamento [dos manuscritos ou versões], ele não tem que se questionar quais as causas que poderiam ter apagado os erros ou tê-los comunicado de forma inadequada e atribuir se foi por contaminação ou por acaso; isso é uma questão que será apresentada mais tarde. *Por enquanto, ele constata apenas os efeitos de causas desconhecidas e se empenha para descobrir a genealogia normal*.

O processo causal subjacente aos padrões não deve interferir na geração das hipóteses de homologia e na construção da árvore.

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, p. 103.**

Evolução cultural – Produção Textual

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	*b*	.	.	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	*b*	.	*b*	.	*c*	.
D	*b*	.	.	.	*b*	*b*	*b*	.	*b*	*b*	.	*b*	.	*b*	*b*	.	*b*
E	*b*	.	*b*	.	.	.	*b*	.	*b*	.	.	*b*	*b*	*b*	*c*	.	.
F	*b*	*b*	.	.	*b*	.	*b*	*b*	*b*	*b*	.	*b*	.	*b*	.	*b*	.
G	*b*	.	.	.	X	.	.	.	*b*	.	.	.	.	.	.	.	.

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, p. 131.**

Evolução cultural – Produção Textual

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	1	0	0	1	1	1	1	1	1	1	1	1	0	1	0	2	0
D	1	0	0	0	1	1	1	0	1	1	0	1	0	1	1	0	1
E	1	0	1	0	0	0	1	0	1	0	0	1	1	1	2	0	0
F	1	1	0	0	1	0	1	1	1	1	0	1	0	1	0	1	0
G	1	0	0	0	?	0	0	0	1	0	0	0	0	0	0	0	0

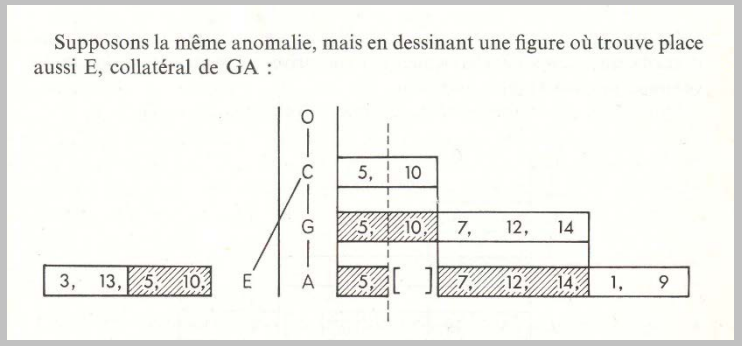
Etapa Conjectural – homologia primária (similaridade)

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, p. 131.**

Evolução cultural – Produção Textual

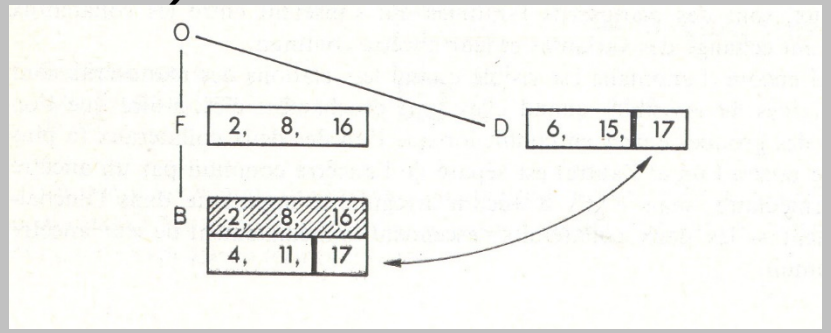
Les anomalies = anomalias

1) Les fautes ancestrales effacées = falhas ancestrais apagadas

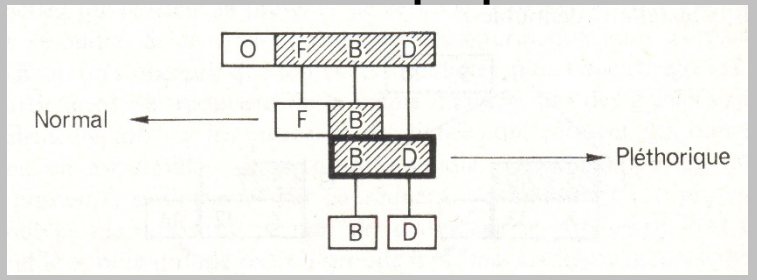


Reversão

2) Les fautes indûment communes = falhas comuns impróprias



Homoplasia



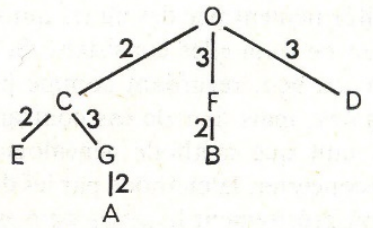
Grupo não-monofilético

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, pp. 104-109.**

Evolução cultural – Produção Textual

***a*) La méthode par les distances**

Reprenons notre arbre généalogique artificiel, et sur les lignes qui unissent un descendant à son ancêtre, inscrivons le nombre des fautes qu'il a commises sans nous soucier de leur nature ni des lieux où elles se sont produites :



Parcimônia

Fonte: **Dom J. Froger, 1968. *Les Méthodes de Critique Textuelle*, p. 129.**

Evolução cultural –Contos Populares

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Research

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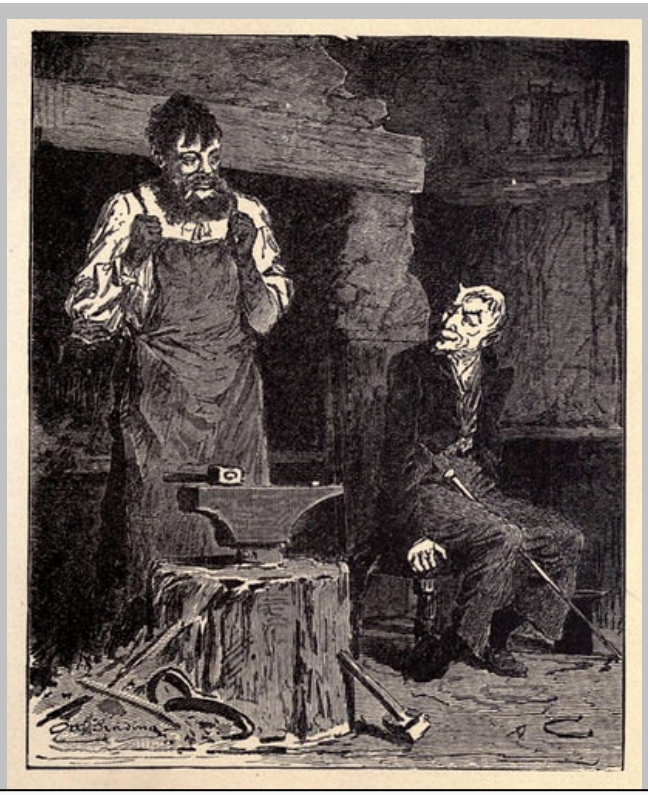
Comparative phylogenetic analyses uncover the ancient roots of Indo-European folktales

Sara Graça da Silva[1] and Jamshid J. Tehrani[2]

[1]Faculty of Social Sciences and Humanities, Institute for the Study of Literature and Tradition, New University of Lisbon, Avenida de Berna, 26-C, Lisboa 1069-061, Portugal
[2]Department of Anthropology and Centre for the Coevolution of Biology and Culture, Durham University, Durham DH1 1LE, UK



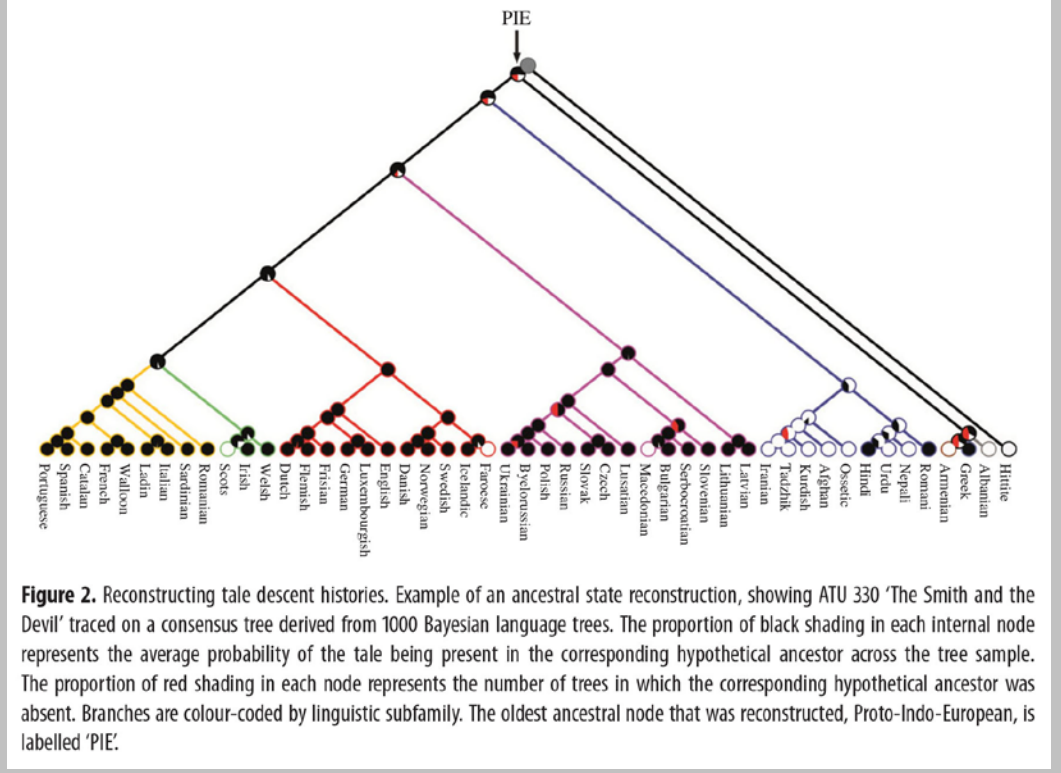


Figure 2. Reconstructing tale descent histories. Example of an ancestral state reconstruction, showing ATU 330 'The Smith and the Devil' traced on a consensus tree derived from 1000 Bayesian language trees. The proportion of black shading in each internal node represents the average probability of the tale being present in the corresponding hypothetical ancestor across the tree sample. The proportion of red shading in each node represents the number of trees in which the corresponding hypothetical ancestor was absent. Branches are colour-coded by linguistic subfamily. The oldest ancestral node that was reconstructed, Proto-Indo-European, is labelled 'PIE'.

***The Smith and the Devil (O Ferreiro e o Diabo)*, desenho à nanquim de 1916**

Evolução cultural –Contos Populares

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PLOS ONE

The Phylogeny of Little Red Riding Hood

Jamshid J. Tehrani*

Department of Anthropology and Centre for the Coevolution of Biology and Culture, Durham University, Science Site, South Road, Durham, United Kingdom

Abstract

Researchers have long been fascinated by the strong continuities evident in the oral traditions associated with different cultures. According to the 'historic-geographic' school, it is possible to classify similar tales into "international types" and trace them back to their original archetypes. However, critics argue that folktale traditions are fundamentally fluid, and that most international types are artificial constructs. Here, these issues are addressed using phylogenetic methods that were originally developed to reconstruct evolutionary relationships among biological species, and which have been recently applied to a range of cultural phenomena. The study focuses on one of the most debated international types in the literature: ATU 333, 'Little Red Riding Hood'. A number of variants of ATU 333 have been recorded in European oral traditions, and it has been suggested that the group may include tales from other regions, including Africa and East Asia. However, in many of these cases, it is difficult to differentiate ATU 333 from another widespread international folktale, ATU 123, 'The Wolf and the Kids'. To shed more light on these relationships, data on 58 folktales were analysed using cladistic, Bayesian and phylogenetic network-based methods. The results demonstrate that, contrary to the claims made by critics of the historic-geographic approach, it is possible to identify ATU 333 and ATU 123 as distinct international types. They further suggest that most of the African tales can be classified as variants of ATU 123, while the East Asian tales probably evolved by blending together elements of both ATU 333 and ATU 123. These findings demonstrate that phylogenetic methods provide a powerful set of tools for testing hypotheses about cross-cultural relationships among folktales, and point towards exciting new directions for research into the transmission and evolution of oral narratives.

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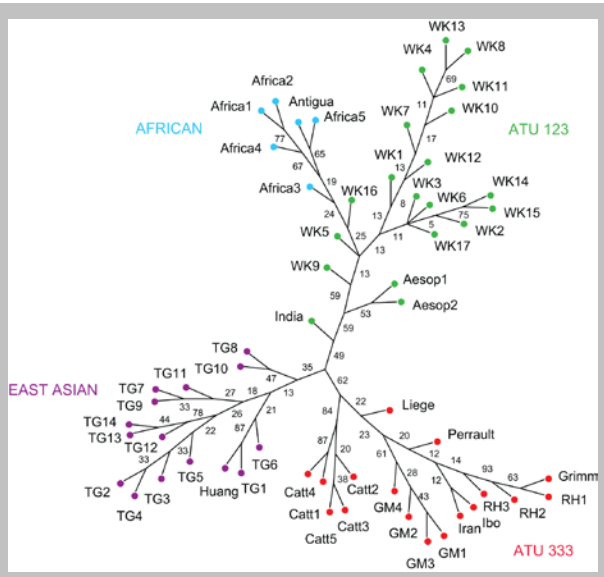
* E-mail: jamie.tehrani@durham.ac.uk



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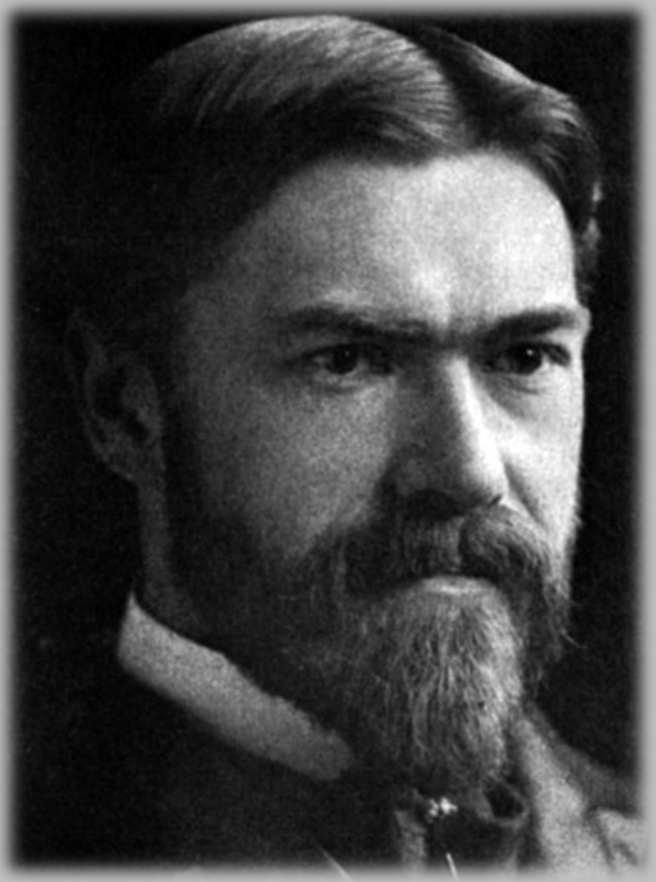
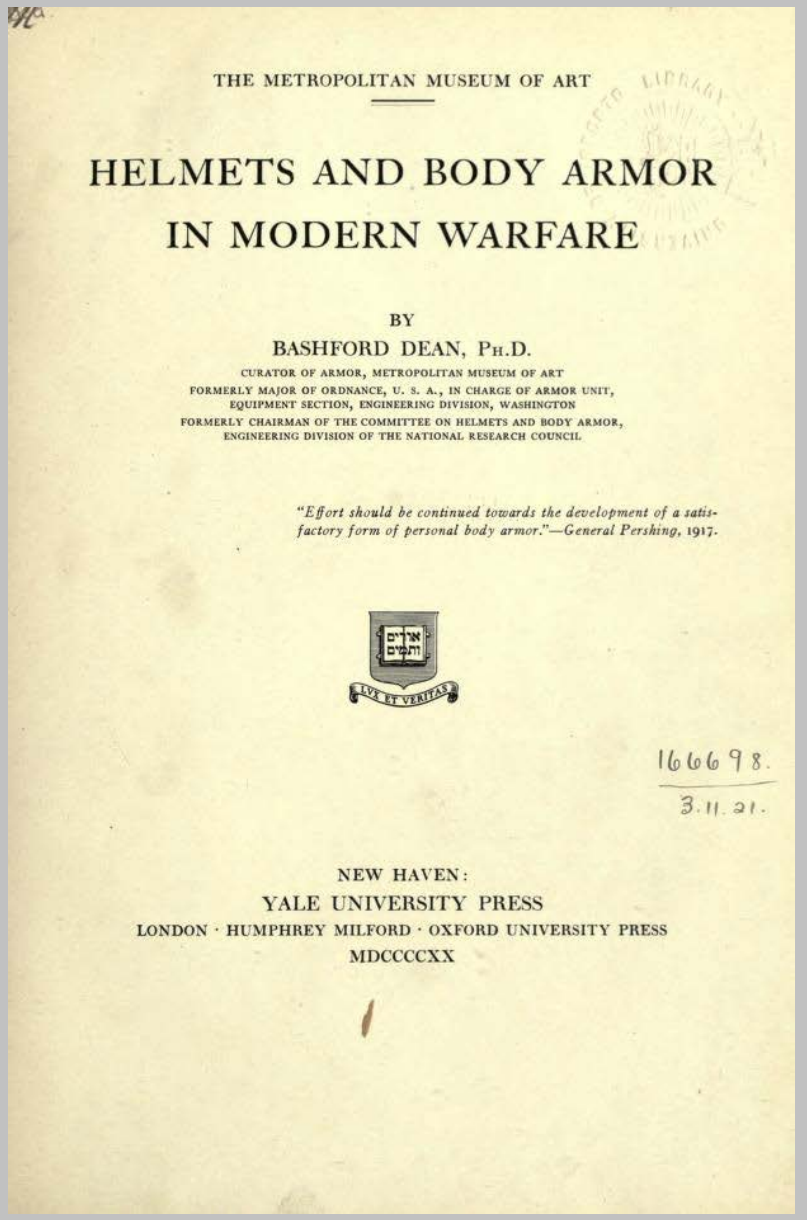


Bashford Dean (1867–1930), zoólogo, ictiólogo, paleontólogo e curador de peixes do American Museum of Natural History, New York

Evolução cultural – Arqueologia

Bashford Dean (1867–1930), curador de armaduras e armas do Metropolitan Museum



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IN MODERN WARFARE

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"Effort should be continued towards the development of a satisfactory form of personal body armor."—General Pershing, 1917.

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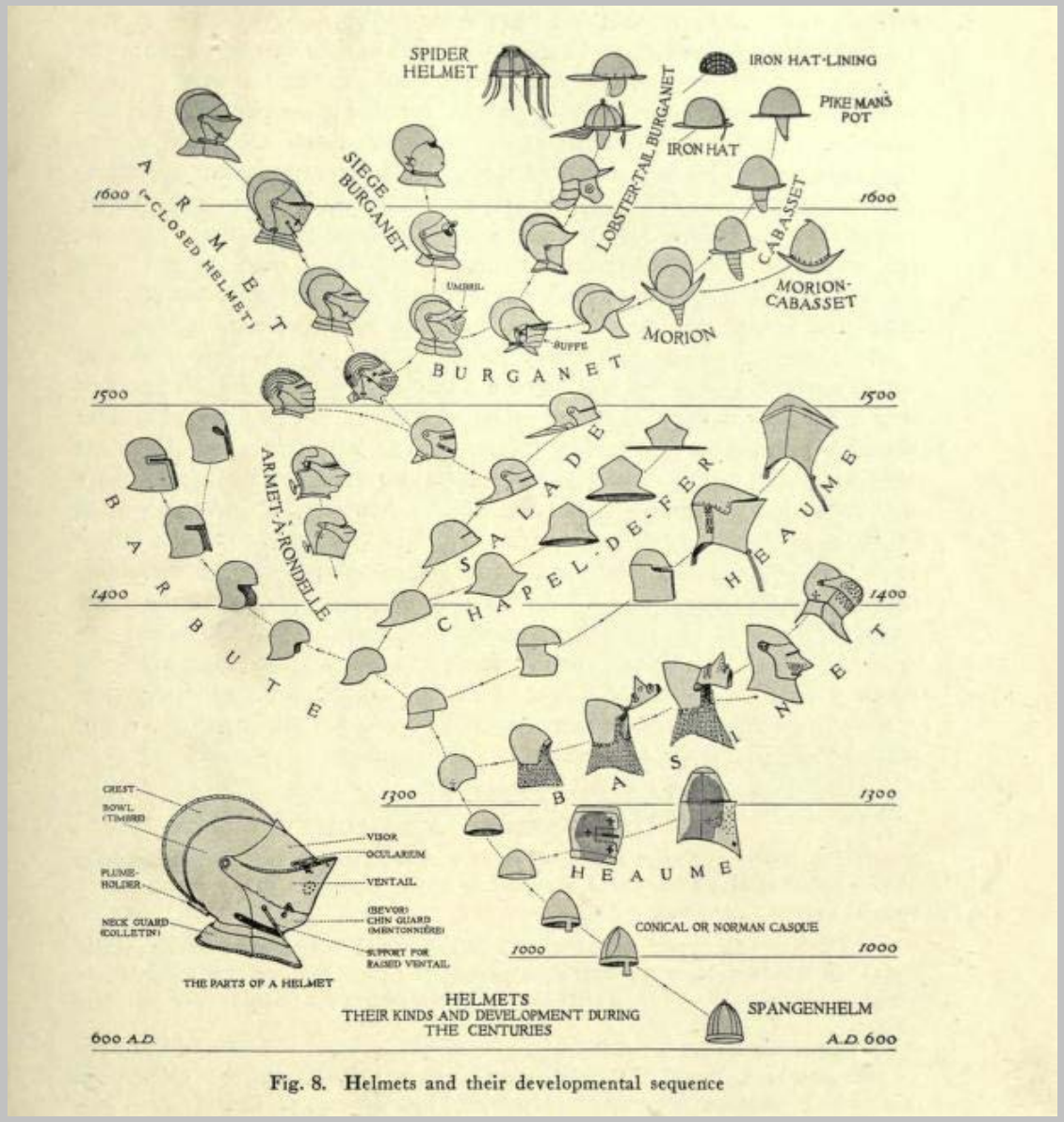


Fig. 8. Helmets and their developmental sequence

Bashford Dean (1920), *Helmets and Body Armor in Modern Warfare.*

Evolução cultural – Arqueologia

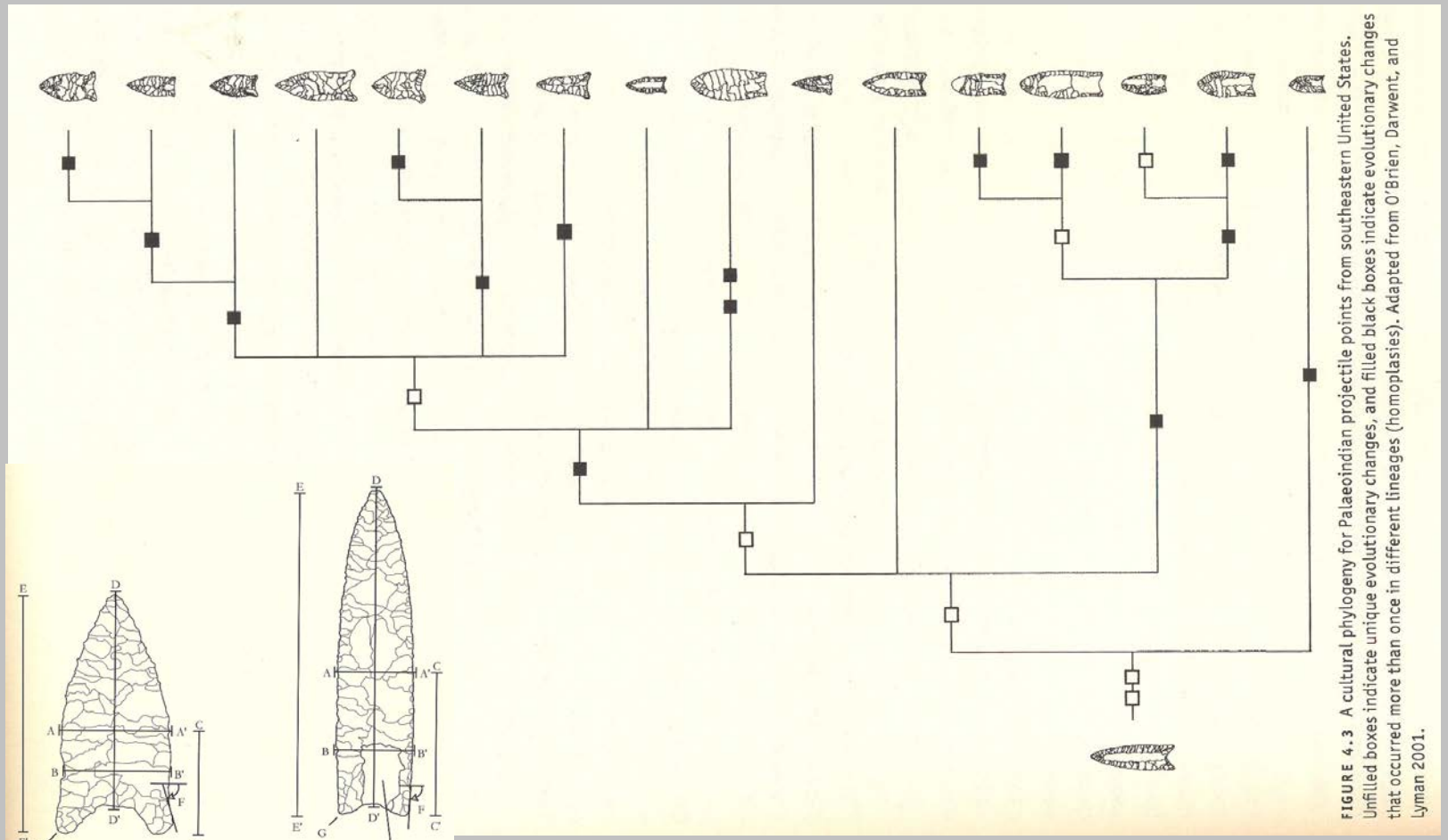


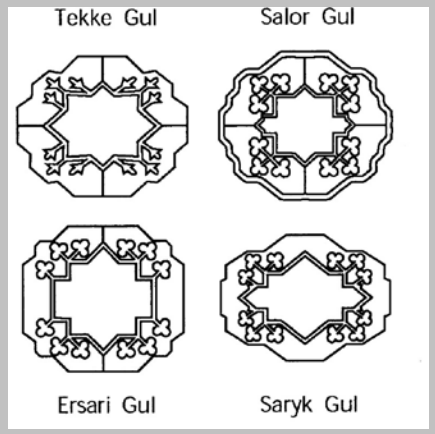
FIGURE 4.3 A cultural phylogeny for Palaeoindian projectile points from southeastern United States. Unfilled boxes indicate unique evolutionary changes, and filled black boxes indicate evolutionary changes that occurred more than once in different lineages (homoplasies). Adapted from O'Brien, Darwent, and Lyman 2001.

Figure 5.11. Locations of characters used in the analysis of projectile points. See Table 5.2 for character states; states for base shape are shown at the lower right.

Fonte: O'Brien, M.J. & Lyman, R. L. 2005. *Cladistics and Archaeology*.

Evolução cultural – Arqueologia

Distribuição geográfica dos grupos turcos Esari, Salor, Saryk, Tekke e Yomut durante o século 19 (Tehrani & Coolar, 2002)



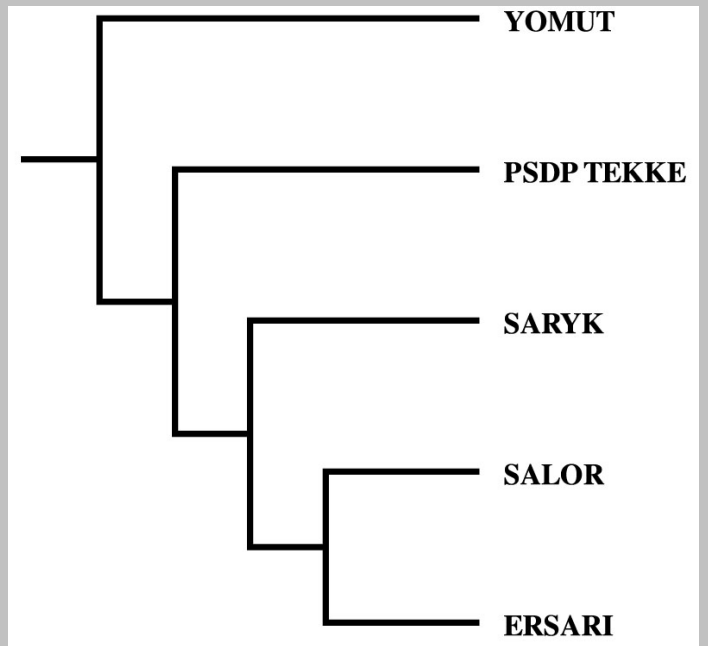


Fig. 3. Most parsimonious cladogram obtained in the analysis designed to determine the relative contributions of phylogenesis and ethnogenesis to the evolution of Turkmen textile designs, prior to the Russian invasion of Central Asia.

Fonte: Tehrani, J. & Collard, M. 2002 Investigating cultural evolution through biological phylogenetic analyses of Turkmen textiles. *Journal of Anthropological Archaeology, 21*: 443–463.

Evolução cultural – Arqueologia

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Research

Cite this article: Brown S, Savage PE, Ko AM-S, Stoneking M, Ko Y-C, Loo J-H, Trejaut JA. 2014 Correlations in the population structure of music, genes and language. *Proc. R. Soc. B* **281**: 20132072. http://dx.doi.org/10.1098/rspb.2013.2072

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evolution, genetics

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Author for correspondence:
Steven Brown
e-mail: stebro@mcmaster.ca

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Correlations in the population structure of music, genes and language

Steven Brown[1], Patrick E. Savage[2], Albert Min-Shan Ko[3], Mark Stoneking[3], Ying-Chin Ko[4], Jun-Hun Loo[5] and Jean A. Trejaut[5]

[1]Department of Psychology, Neuroscience and Behaviour, McMaster University, 1280 Main Street West, Hamilton, Ontario, Canada L8S 4K1
[2]Department of Musicology, Tokyo University of the Arts, Tokyo, Japan
[3]Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
[4]Graduate Institute of Clinical Medical Science, China Medical University, Taichung, Taiwan, Republic of China
[5]Mackay Memorial Hospital, New Taipei City, Taiwan, Republic of China

We present, to our knowledge, the first quantitative evidence that music and genes may have coevolved by demonstrating significant correlations between traditional group-level folk songs and mitochondrial DNA variation among nine indigenous populations of Taiwan. These correlations were of comparable magnitude to those between language and genes for the same populations, although music and language were not significantly correlated with one another. An examination of population structure for genetics showed stronger parallels to music than to language. Overall, the results suggest that music might have a sufficient time-depth to retrace ancient population movements and, additionally, that it might be capturing different aspects of population history than language. Music may therefore have the potential to serve as a novel marker of human migrations to complement genes, language and other markers.

1. Introduction

As human populations migrate to new regions of the world, their evolutionary divergence leaves its mark on both genes and culture. Correlations between cultural markers such as language and genetic markers such as mitochondrial, Y chromosome or autosomal DNA demonstrate that these features can co-migrate and coevolve over the course of thousands of years [1–3]. The same coevolutionary process has been proposed for music and genes [4–7], not least because music is a universal feature of human cultures [8,9] and because it shows quantifiable diversity both within and between populations [10,11]. However, this hypothesis has been criticized on the grounds that music evolution might occur at too rapid a rate [12] and therefore that music's time depth might be too shallow to be correlated with something as ancient and slowly evolving as genes. Although a few studies have found suggestive parallels between music and genes [5,13–15], none have demonstrated a statistically significant correlation between them. We wanted to examine this relationship quantitatively for the first time, to our knowledge, and explore whether music might have the potential to serve as a new type of marker for the study of human population history.

We decided to examine Taiwan as a test case as it has several clear advantages for such an analysis. Taiwan has a small number of well-characterized indigenous populations that are located in geographically distinct regions of the island [16]. These populations have been well studied musically, linguistically and genetically such that there exists ample material for performing correlational analyses. The indigenous musics have been extensively recorded and archived by ethnomusicologists since the 1920s [17–21], and genetic analyses of mitochondrial DNA (mtDNA) haplotypes for most of the indigenous groups have been published [22]. Therefore, the degree of musical and genetic sampling makes Taiwan an ideal case for analysis. In addition to this, Taiwan has been the focal point of theories about one of the most significant migrational events in human history, namely the expansion of the Austronesian-speaking peoples

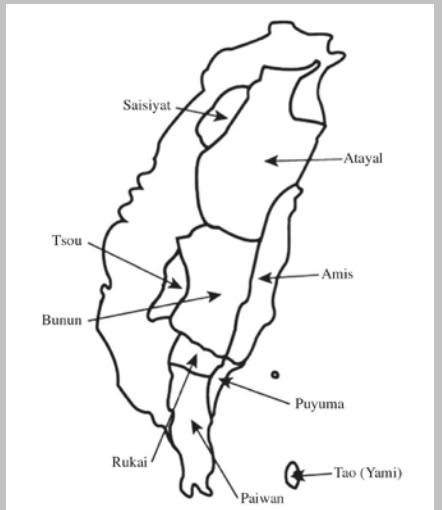


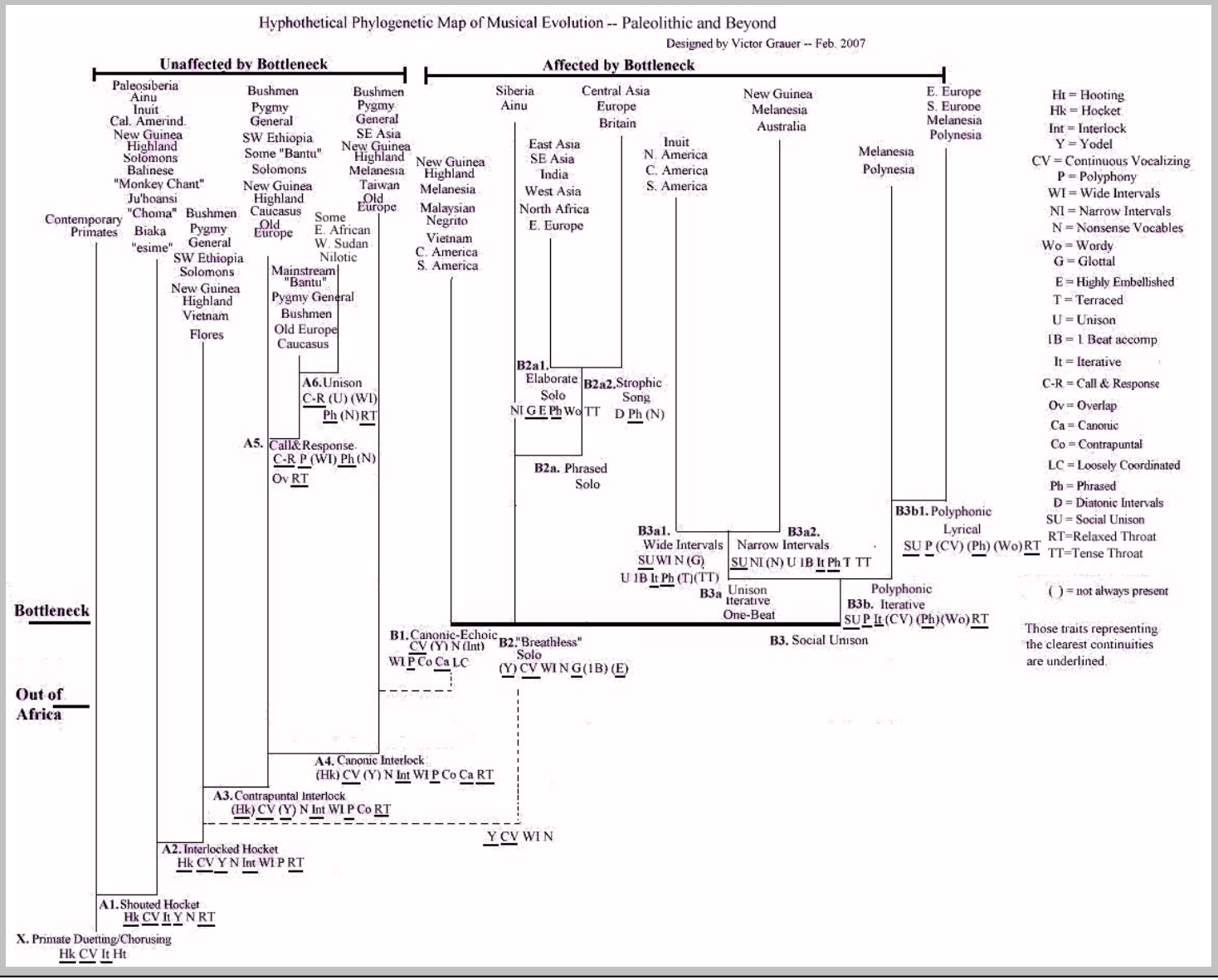
Figure 1. Map of Taiwan. A map of Taiwan showing the geographical locations of the nine indigenous populations included in the analyses.

Table 1. Correlations between music, genes and language. (Values in italic are significant at the 0.05 level.)

	r	*p*-value
full correlations		
music – genes	*0.417*	*0.015*
music – language	0.411	0.085
music – geography	0.174	0.248
language – genes	*0.492*	*0.006*
language – geography	*0.540*	*0.014*
genes – geography	*0.468*	*0.003*
partial correlations		
music – genes (geography)	*0.385*	*0.032*
music – genes (language)	0.271	0.054
music – language (geography)	0.382	0.101
language – genes (geography)	0.321	0.071
language – genes (music)	*0.387*	*0.031*

Fonte: Brown S, Savage PE, Ko AM-S, Stoneking M, Ko Y-C, Loo J-H, Trejaut JA. 2014 Correlations in the population structure of music, genes and language. *Proc. R. Soc. B* 281: 20132072.

Evolução cultural – Música



Fonte: Grauer V.A. 2011. Sounding the depths: tradition and the voices of history. CreateSpace Independent Publishing Platform

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Essay

Phylomemetics—Evolutionary Analysis beyond the Gene

Christopher J. Howe*, Heather F. Windram

Department of Biochemistry, University of Cambridge, Cambridge, United Kingdom

Evolução cultural – Arte (Grafismo)

4 anos, 1 mês

4 anos, 7 meses

5 anos, 1 mês

5 anos, 6 meses

6 anos, 2 meses

7 anos, 10 meses

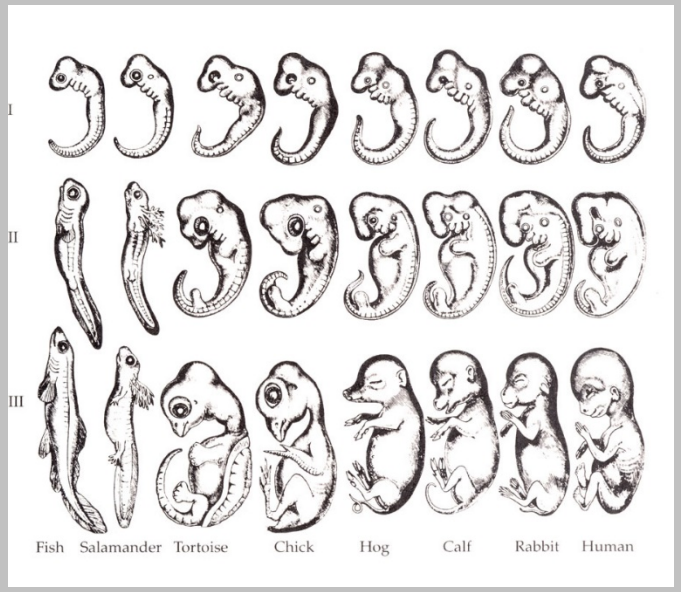
Evolução cultural – Arte (Grafismo)

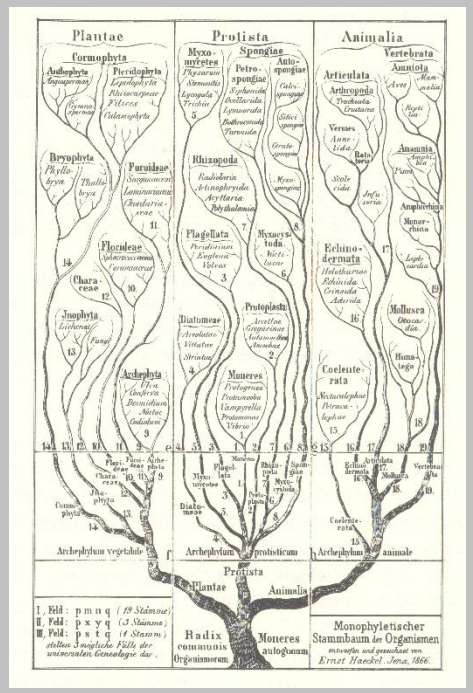
8 anos, 11 meses

Artista: Giovana Saur Bockmann (15 anos)

Evolução cultural – Arte (Grafismo) - Ontogenia

Ernst Haeckel (1834–1919)



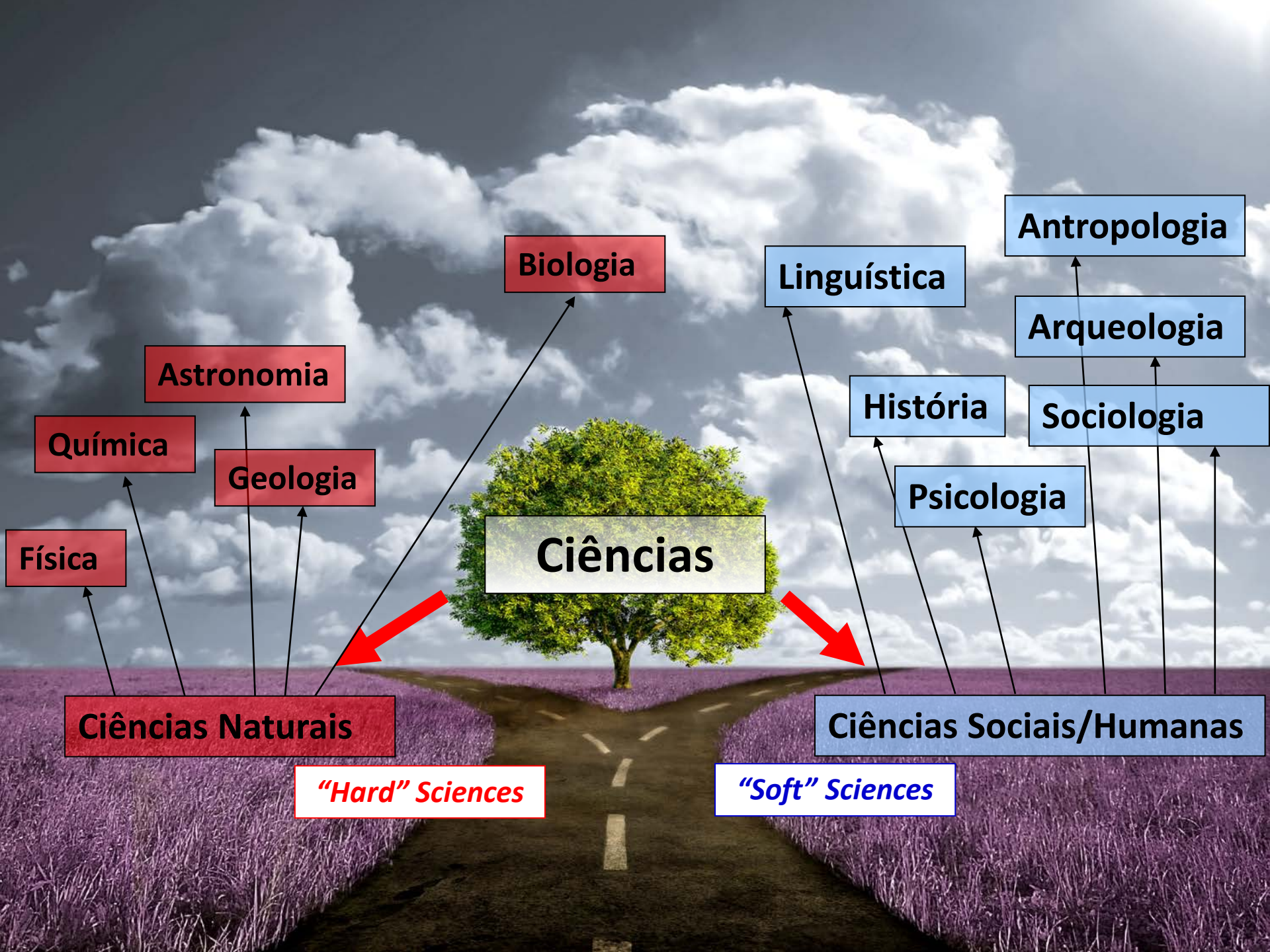


Karl Ernst von Baer (1792-1876)

Cultura – Arte (Grafismo - Pinturas Rupestres) - Biologia

Cavernas de Lascaux, França (17.500)

Caverna de Chauvet, França (30-32.000)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