

HOW CHRISTIANITY LAID THE FOUNDATION FOR MODERN SCIENCE

...AND MANY OTHER THINGS, SUCH AS HUMAN
RIGHTS AND INDIVIDUAL FREEDOM

PART II: THE WORK OF THE CHURCH

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LOS ALAMOS FAITH AND SCIENCE FORUM

LAST TIME, WE LOOKED AT EVIDENCE THAT:

- Around 500 CE, the cultural institutions of Europeans (and hence their psychology) were similar to those of most other human ethnolinguistic groups
- Today, the psychology of Western Europeans is quite different from other ethnolinguistic groups
 - It is **WEIRD** psychology
 - highly individualistic, self-obsessed, control-oriented, nonconformist, guilt-ridden, analytical
- Europe, even as late as 1000 CE, was “culturally stagnant, economically undeveloped, and geopolitically passive”
- As early as ~800 CE, Christianity led to expanding literacy and an appreciation for the “Book of Nature”



Frankish warriors of 5th century

<https://world4.eu/frankish-merovingian-costume/>

AND WE ASKED:

- Why is Western European **WEIRD** psychology so different from that of almost all other ethnolinguistic groups?
- Why and how did that psychology originate?
- When and how did Europe emerge from its underdeveloped state ca. 1000 CE?

It turns out that the answers to these three questions are related, according to Joseph Henrich*

*Joseph Henrich, *The WEIRDest People in the World: How the West Became Psychologically Peculiar and Particularly Prosperous* (Farrar, Straus and Giroux, 2020)

IN THIS TALK, WE'LL CONSIDER

- AN EXPLANATION FOR THE **WEIRD** PSYCHOLOGICAL CHANGE
- SOME OF ITS CONSEQUENCES
- Henrich's central thesis is that the Western Church changed European psychology through its rules about marriage
- These rules caused the destruction of the tribes and clans of Europe
 - Altered kinship patterns required new social structures and new psychology
 - No one knew this would happen; it wasn't planned
- New social/cultural phenomena included: urban growth, impersonal trade, legal systems, voluntary associations (trade guilds, universities, ...)



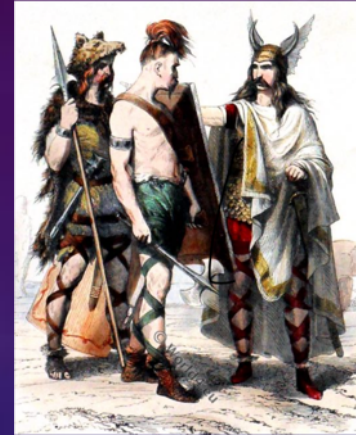
THE CHURCH'S "MARRIAGE AND FAMILY PROGRAM" (MFP)

- Henrich calls the Church's rules about marriage the "Marriage and Family Program" (MFP):
 - Prohibited marriage to blood relatives
 - Eventually extended up to 6th cousins
 - Prohibited marriage to in-laws
 - Prohibited polygynous marriage
 - No secondary wives, sex slaves, or public brothels
 - Prohibited marriage to non-Christians, unless converted
 - Created spiritual kinship – godparents
 - No marriage to spiritual kin
 - Discouraged adoption
 - Required public consent to marriage by both bride and groom
 - "I do"
 - Encouraged neolocal residence of newlyweds
 - Encouraged individual ownership of land, and inheritance by testament (wills)
- Some of these rules resemble the incest laws of Leviticus 18
 - But Leviticus 18 does not prohibit cousin marriage
 - Roman law sometimes banned cousin marriage
- The thesis that the Western Church changed European psychology through the MFP is actually due to British social anthropologist Sir Jack Goody (1919-2015)

HENRICH'S CAUSAL CHAIN GOES LIKE THIS:

The Church's Marriage and Family Program (MFP) forms

MFP reduces kinship intensity*



Henrich and co-workers took pains to examine many other factors:

- Agricultural fertility
- Navigable waterways
- Irrigation potential
- Terrain ruggedness
- Latitude
- Parasite stress
- Malaria
- Religiosity
- European colonization

...but always found "MFP dosage" to be the strongest effect

Reduced kinship intensity shifts psychological patterns in **WEIRD** ways

WEIRD psychological patterns lead to new social institutions

*Henrich's "Kinship Intensity Index" combines metrics of cousin marriage, nuclear families, bilateral inheritance, neolocal residence, monogamy vs. polygyny, within-community marriage customs

THE CHURCH'S IMPLEMENTATION OF THE MFP WENT ON FOR CENTURIES

TABLE 5.2. KEY MILESTONES IN THE MARRIAGE AND FAMILY PROGRAM (MFP)¹⁴

Year	Event
305-6	Synod of Elvira (Grenada, Spain) decrees that any man who takes the sister of his dead wife as his new wife (incest marriage) should abstain from Communion for five years. Those marrying their daughters-in-law should abstain from Communion until near death. ¹⁵
315	Synod of Neocaesarea (Turkey) forbids marrying the wife of one's brother (incest marriage) and possibly also sororal marriages.
325	Council of Nicea (Turkey) prohibits marrying the sister of one's dead wife as well as Jews, pagans, and heretics.
339	The Roman Emperor Constantine prohibits uncle-niece marriages, in accordance with Christian verbiage, and imposes the death penalty on violators.
384/7	The Christian Roman Emperor Theodosius reaffirms prohibitions against sororal and levirate marriages and bans first cousin marriages. In 405, the Western emperor Honorius softens the law by allowing dispensations. It is not clear how long this persisted in the West. The dissolving Western Empire makes continued enforcement unlikely.
396	The Eastern Roman Emperor Arcadius (Christian) again prohibits first cousin marriage, but without the harsh penalties. In 400 or 404, however, he changes his mind, making first cousin marriage legal in the Eastern Empire.
506	Synod of Agde (France, Visigoth Kingdom) prohibits first and second cousin marriage, and marriage to a brother's widow, wife's sister, stepmother, uncle's widow, uncle's daughter, or any kinwoman. These are defined as incest.
517	Synod of Epone (France or Switzerland, Burgundian Kingdom) decrees that unions with first and second cousins are incestuous and heretofore forbidden, although existing unions are not dissolved. The synod also forbids marriage to stepmothers, widows of brothers, sisters-in-law, and aunts by marriage. Many subsequent synods in the area of what would become the Carolingian Empire refer to this synod for incest regulations.
527/31	Second Synod of Toledo (Spain) prescribes excommunication for all engaged in incestuous marriages. The number of years of excommunication should equal the number of years of the marriage. This is affirmed by synods in 533, 652, and 743.
528	First documented letter between a Frankish king and the pope is about incest (marriage to the wife of a deceased brother). The pope disapproves, but he leaves decisions about penance to the bishops.
589	Reccared I, the Visigothic King (Spain), decrees the dissolution of incestuous marriages, punishing offenders with exile, and the transfer of their property to their children.

TABLE 5.2. KEY MILESTONES IN THE MARRIAGE AND FAMILY PROGRAM (MFP) (cont.)

Year	Event
596	The Frankish King Childobert II decrees the death penalty for marriage to one's stepmother but leaves the punishment of other incest violations to the bishops. If the convicted resists the Church's punishment, his property will be seized and redistributed to his relatives (making incentives to report violators).
627	Synod of Clergy implements the same punishment and enforcement procedures as those decreed by King Childobert II in 596. A systematic collection of incest legislation is compiled around this time and becomes part of the <i>Collectio vetus Gallica</i> , the earliest collection of canons from Gaul.
641	Lombard laws of Rothari forbid marriage to one's stepmother, stepdaughter, and sister-in-law.
692	At the Synod of Trullo (Turkey), the Eastern Church finally forbids marriage to one's first cousins and corresponding affinal kin. This prohibits a father and a son marrying a mother and a daughter or two sisters, and two brothers marrying a mother and a daughter or two sisters.
721	Roman Synod (Italy) prohibits marriage to one's brother's wife, niece, grandniece, stepmother, stepdaughter, cousin, godmother, and all kinfolk including anyone ever married to any blood relative. In 726, Pope Gregory II specifies that for missionary purposes the prohibitions are up to first cousins, but for others, prohibitions extend to all known relatives. In 731, Gregory III, clarifies this prohibition such that marriages of third cousins are allowed but marriages to all affinal kin within the prohibited degree are not. These decisions are widely disseminated.
741	Under the Byzantine Emperor Leo III, the prohibitions in the Eastern Church are increased to include marriage of second cousins and, slightly later, second cousins once removed. The penalty for cousin marriage becomes whipping.
743	Roman Synod under Pope Zacharius orders Christians to refrain from marrying cousins, nieces, and other kinfolk. Such incest is punishable by excommunication and, if necessary, anathema (see text).
755	The Synod of Verceil (France), convened under the Frankish King Pepin, commands that marriages be performed publicly.
756	Synod of Verber (France) prohibits the marriage of third cousins and closer and decrees existing marriages between second cousins are to be ended. Those married to third cousins need only do penance.
757	Synod of Compiègne (France) notes that existing marriages of second cousins or closer must be nullified. The Frankish king, Pepin, threatens secular punishments for any who disagree.

These edicts must have been frequently ignored, because the Church had to keep harping on them

- The Church had no secular power, only moral and spiritual power (e.g., excommunication)
- But kings sometimes helped

Etc. for two more pages

HOW DO WE KNOW THAT THE CHURCH'S MFP WAS HAVING AN EFFECT?

- “European marriage pattern” began to emerge by the end of Middle Ages
 - Monogamous nuclear families with neolocal residence
 - Newlyweds were less likely to live with parents
 - Late marriage
 - Average age at marriage of both men and women rises into mid-20s
 - Many women never marry
 - 15%-25% of northwestern European women remained unmarried at age 30
 - Smaller families and lower fertility
 - Fewer kin ties, less pressure from parents, later age at marriage, lack of polygyny
 - Premarital labor period
 - Young people often moved to work in the homes of non-kin, prior to marriage
- Kinship terminology transitioned away from that of kinship-intensive societies
 - Kinship-intensive cultures have special words for “mother’s brother” or “father’s brother’s son”
 - European languages gradually lost these terms
 - ~700 CE for Spanish, Italian, French
 - ~1100 for German and English
 - 17th century for remote parts of Scotland
- Church’s decrees about marriage tapered off by about 1215

WHY WOULD THESE PARTICULAR MARRIAGE RULES SPELL DOOM FOR THE CLANS AND TRIBES OF EUROPE?

- Less cousin marriage meant more diffusion of clan wealth
- Ban on marrying in-laws weakened clan ties
- It became harder to find someone you could marry
 - You might have to travel a long distance to find a non-relative
 - Distance reduced the influence of the clan hierarchy
- Many European dynasties died out
 - Ban on polygyny reduced number of heirs
 - Illegitimate heirs could not inherit
 - After divorce, remarriage was forbidden



Genseric's Vandals in Italy ~450 CE

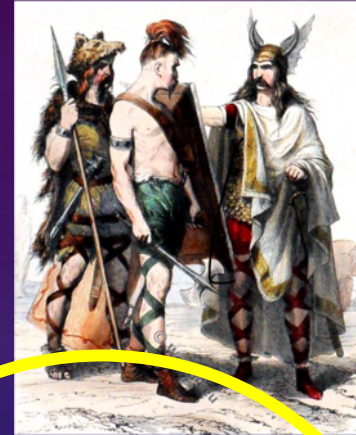
HENRICH'S CAUSAL CHAIN GOES LIKE THIS:

The Church's Marriage and Family Program (MFP) forms

MFP reduces "kinship intensity"

Reduced kinship intensity shifts psychological patterns in **WEIRD** ways

WEIRD psychological patterns lead to new social institutions



KIN-BASED INSTITUTIONS ←AFFECT→ PSYCHOLOGY AROUND THE WORLD TODAY

- Henrich and co-workers define two ways of measuring the intensity of kin-based institutions
 - Kinship Intensity Index (KII)
 - Uses metrics of cousin marriage, nuclear families, bilateral inheritance, neolocal residence, monogamy vs. polygyny, within-community marriage customs
 - Rates of cousin marriage (to 1st or 2nd cousins)
- They then show that “kinship intensity” can explain significant amounts of cross-national psychological variation

FREQUENCY OF COUSIN MARRIAGE VARIES WIDELY AROUND THE GLOBE

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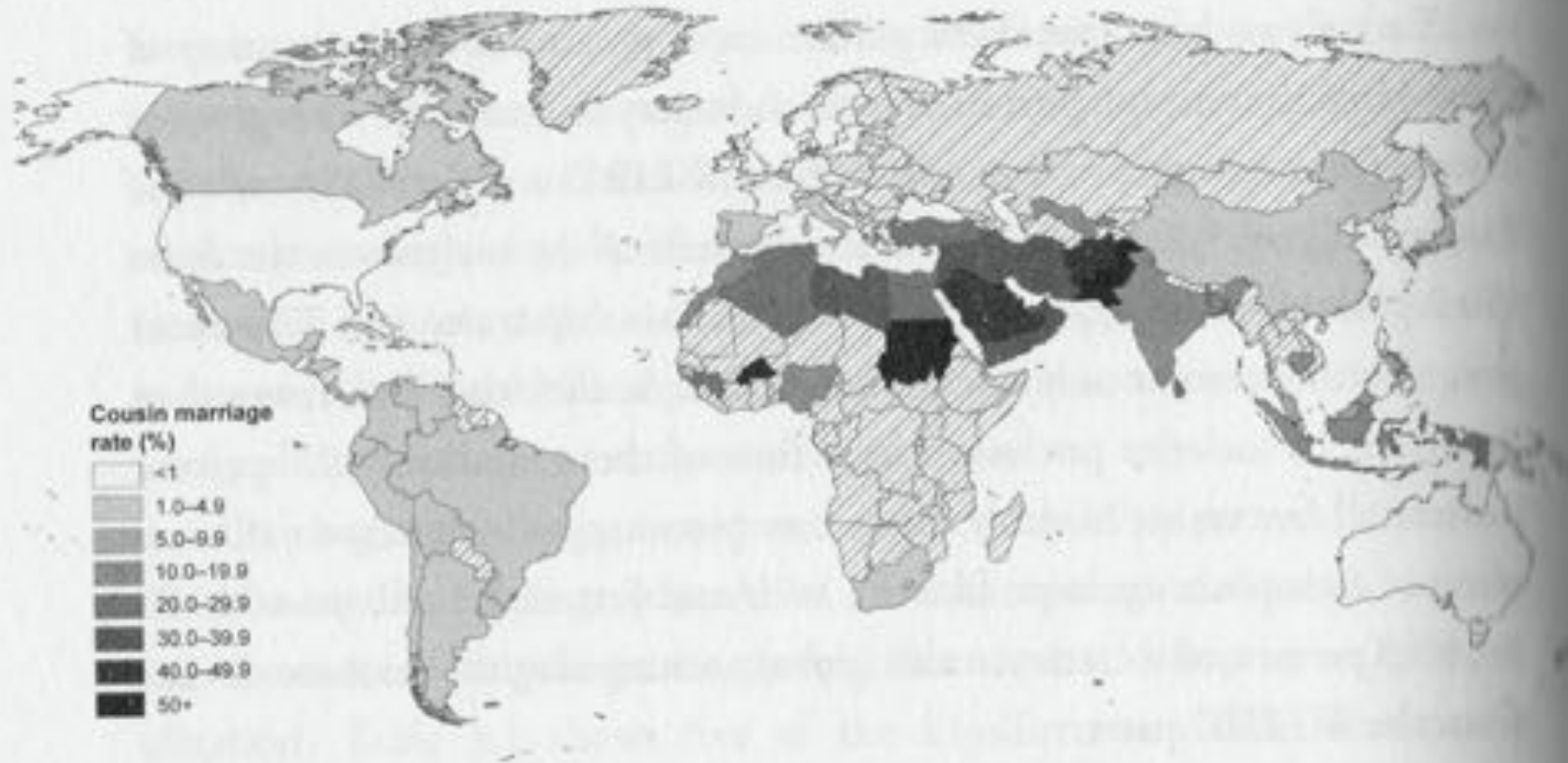
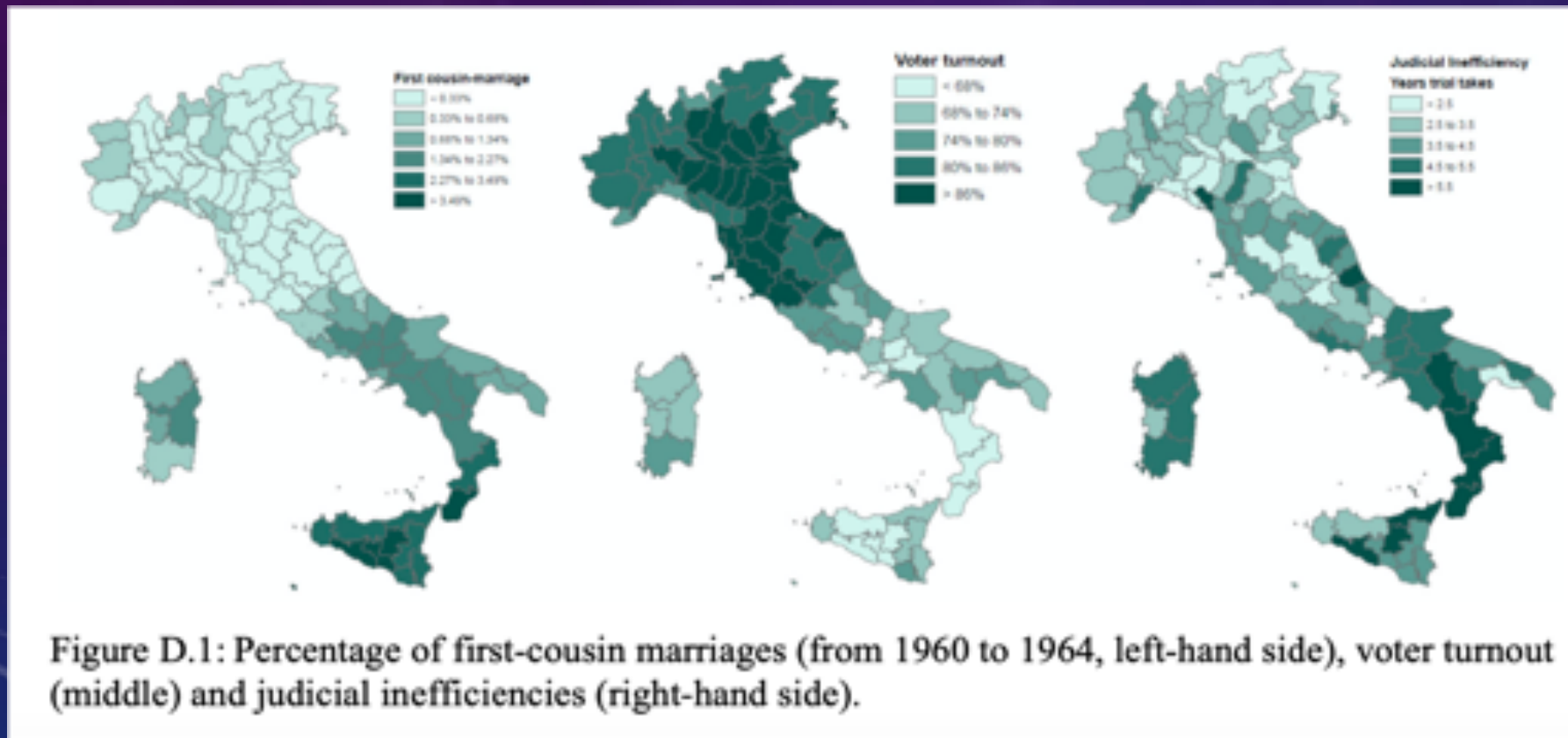


FIGURE 5.2. Cousin marriage rates. Rates of marriage between second cousins and closer relatives across countries based on data from the latter half of the 20th century. The darker the shading of a country, the higher the percentage of marriages among blood relatives. Hatched regions indicate that no data are available.⁴

- Some countries show a particularly high proportion of cousin marriages (>50%), indicating high “kinship intensity”

IT MIGHT BE HARD TO BELIEVE THAT COUSIN MARRIAGE MATTERS ALL THAT MUCH

But even in modern Europe, cousin marriage is correlated with other societal patterns, as this figure shows:



Jonathan F. Schulz, *Kin Networks and Institutional Development*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2877828 (2020)

KINSHIP INTENSITY IS CORRELATED WITH MUCH GREATER TRUST OF “IN GROUP” THAN “OUT GROUP”

- Everybody trusts their “in group” more than the “out group”
- But when kinship intensity is high, the difference between in/out level of trust is also high

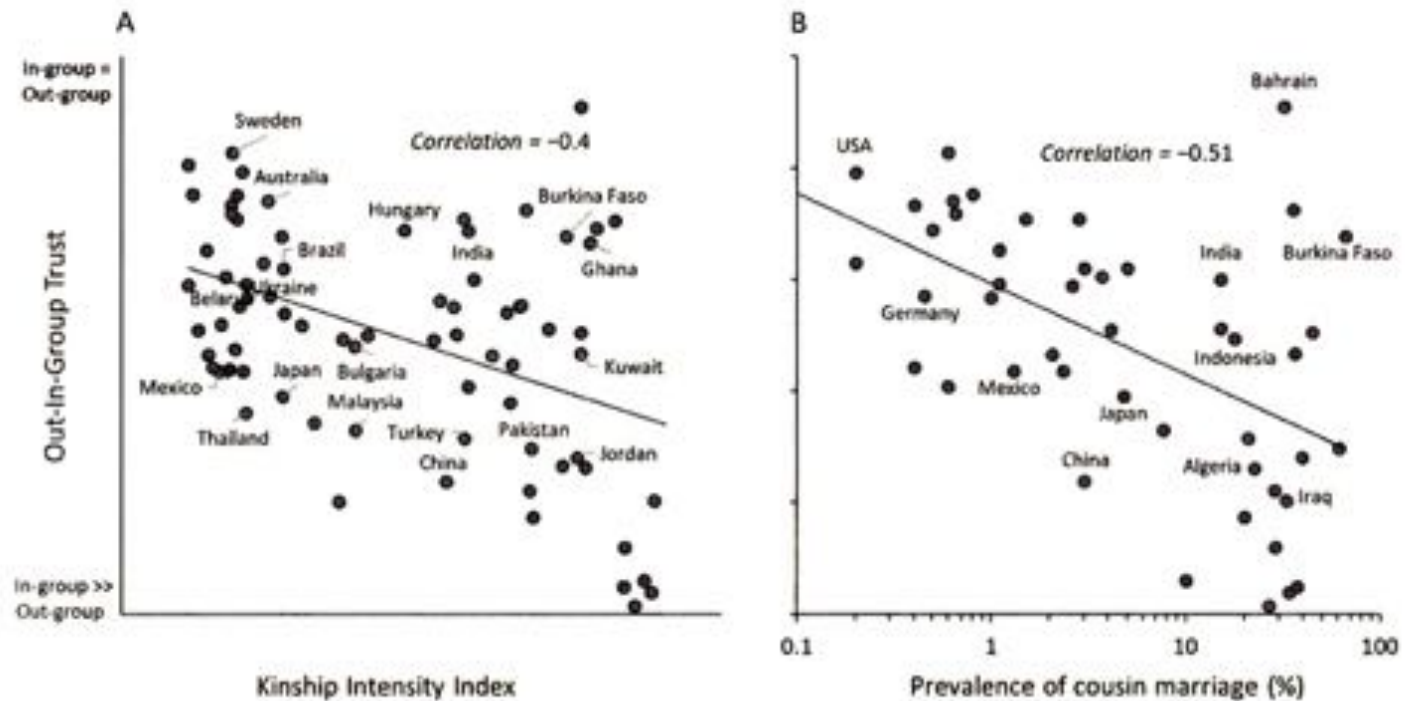


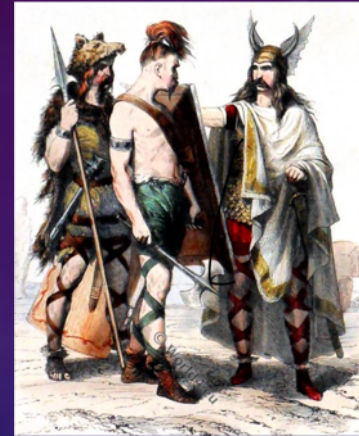
FIGURE 6.6. Relationship between Out-In-Group Trust (impersonal trust) and the (A) Kinship Intensity Index (75 countries) and (B) prevalence of cousin marriage (44 countries). The figure shows that countries with greater KII or more cousin marriage trust out-group members (people they’ve just met, foreigners, and adherents of other religions) substantially less than in-group members (family, neighbors, and people they know). Cousin marriage is plotted on a logarithmic scale.¹⁴

HENRICH'S CAUSAL CHAIN GOES LIKE THIS:

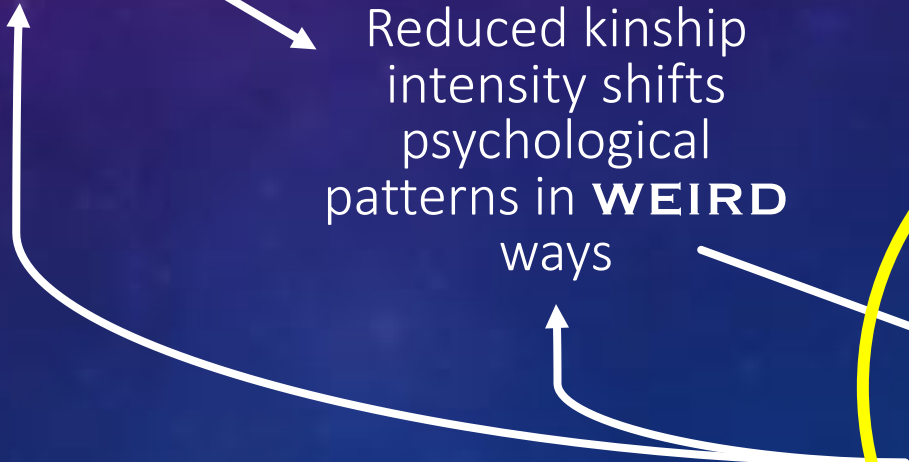
The Church's Marriage and Family Program (MFP) forms



MFP reduces "kinship intensity"



Reduced kinship intensity shifts psychological patterns in **WEIRD** ways



CHANGES IN KINSHIP PATTERNS LED TO PSYCHOLOGICAL SHIFTS AND NEW SOCIAL INSTITUTIONS

- Intensive kin-based institutions were no longer able to
 - Organize production
 - Provide security
 - Provide identity
- So individuals were socially compelled and personally motivated to
 - Relocate
 - Seek out like-minded others
 - Form voluntary associations
 - Interact with strangers
- ...with the result that
 - More people moved to the cities, which grew in size
 - New associations, such as monasteries, trade guilds, universities, corporations, and charter towns proliferated and competed



Members of the *bourgeoisie*, the new middle class, in a medieval city

MEDIEVAL GUILDS WERE ASSOCIATIONS OF ARTISANS ESTABLISHED TO DEFEND THEIR COMMON RIGHTS AND INTERESTS

- In France, guilds were authorized by the king to make special laws whereby they might govern themselves
- Members enjoyed particular privileges:
 - Right to assemble
 - To freely discuss their general interests
 - To modify their statutes, if confirmed by king or by authorities
 - Artisans of the same trade usually resided in the same quarter of the town, even on the same street
 - Were distinguished at public ceremonies by their special dress, arms, banners
- "Book of Trades", written in 1268 by provost of Paris, lists the rules and customs of one hundred different guilds or trade associations
 - Drapers, grocers, mercers, furriers, hatters, goldsmiths, carpenters, shoemakers, bakers, dyers ...



Medieval shoemakers

MEDIEVAL UNIVERSITIES DEVELOPED AS GUILDS OF PROFESSORS (*UNIVERSITAS MAGISTRORUM*) OR STUDENTS (*UNIVERSITAS SCHOLARIUM*)

- First universities were established in Italy, France, Spain and England in late 11th and 12th centuries
 - for study of arts, law, medicine, and theology
 - evolved from much older cathedral schools, monastic schools
 - among the earliest: Bologna (1088), Paris (1150), Oxford (1167), Modena (1175), Palencia (1208), Cambridge (1209)
- Development coincided with widespread reintroduction of Aristotle from Byzantine, Arab scholars
 - Typical European university put Aristotle, other natural science texts at center of curriculum
- As internally regulated corporation, university was protected from external intervention
 - Papal bull of April 1231 guaranteed University of Paris independence from local secular or church authority
 - directly under Papal patronage

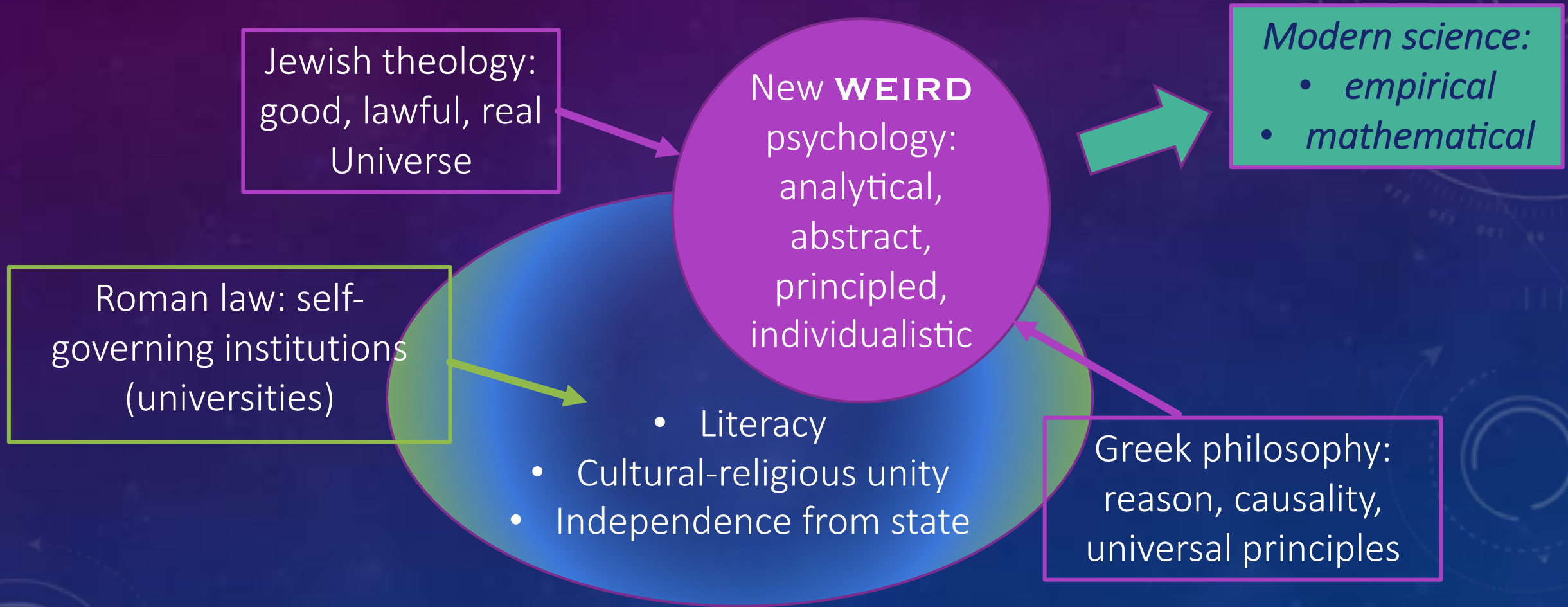


A university class in 1350s

WHAT ABOUT SCIENCE?

- We've been looking at psychological and social history
- Let's shift gears now to look at philosophical developments

CHRISTIANITY AND THE CHURCH BROUGHT TOGETHER THE CRUCIAL ELEMENTS OF MODERN SCIENCE



Toby Huff, *The Rise of Early Modern Science: Islam, China, and the West*, 2nd ed. (Cambridge University Press, 2003)

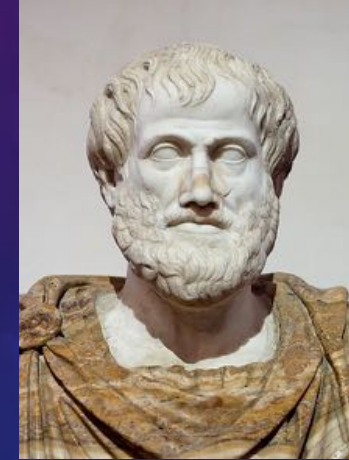
Lawrence Principe, *Science and Religion*, THE GREAT COURSES, Copyright © The Teaching Company, 2006

James Hannam, *The Genesis of Science: How the Christian Middle Ages Launched the Scientific Revolution* (Regnery, 2011)

Joseph Henrich, *The WEIRDest People in the World: How the West Became Psychologically Peculiar and Particularly Prosperous* (Farrar, Straus and Giroux, 2020)

IN 12TH CENTURY -- NEW, BETTER TRANSLATIONS OF GREEK THINKERS SUCH AS ARISTOTLE AND EUCLID BECAME AVAILABLE IN EUROPE

- Islamic thinkers and translators had access to these Greek philosophers several centuries earlier
 - Good Latin translations were now being made from the Arabic versions
 - Averroes (Ibn Rushd) and Avicenna (Ibn Sina) were important commentators on Aristotle
- Aristotle:
 - writings cover physics, biology, zoology, metaphysics, logic, ethics, aesthetics, poetry, theater, music, rhetoric, linguistics, politics and government
 - “...the first genuine scientist in history” (Encyclopedia Britannica)
- Euclid
 - *Elements* – one of the most influential works in history of mathematics
 - profound demonstration of power of human reason to discover new knowledge



Roman copy in marble of a Greek bronze bust of Aristotle by Lysippus, c. 330 BCE.



Euclid (central figure, marking a slate with a pair of compasses) as featured in Raphael's *School of Athens*.

ARISTOTLE POSED A HUGE PROBLEM FOR CHRISTIANS IN THE 13TH CENTURY

Before Darwin, before Copernicus, there was ... Aristotle

- Aristotle's writings covered "all knowledge" systematically
 - Emphasis on the concept of *cause*; theory of causality
 - His philosophy aims at the *universal*, and finding the universal in particular things
 - His works contain the earliest known formal study of logic
- But now European Christians had a problem, in the 1200s:
 - They had created autonomous self-governing institutions of higher learning: universities
 - Then they imported into the universities Aristotle's methodologically powerful cosmology
 - *Aristotle directly challenged and contradicted* many aspects of traditional Christian worldview
 - Aristotle said the universe was infinitely old, in direct contradiction of Genesis
 - His universe was governed by a God who is not a Creator
 - His universe has no immortal souls nor divine grace

EARLY ON, ISLAMIC THINKERS REJECTED ARISTOTLE AND CAUSALITY

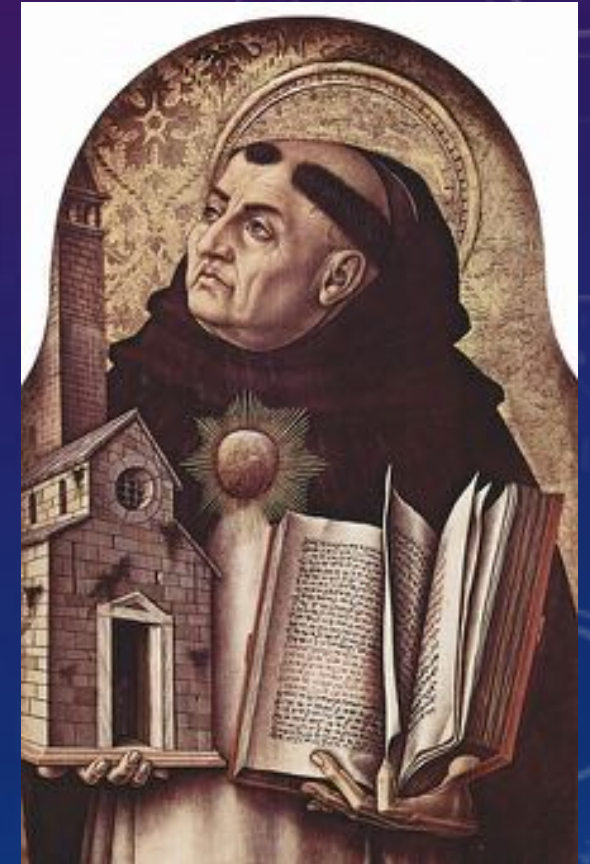
- Al-Ghazali (c. 1058 – 1111)
 - Abū Ḥāmid Muḥammad ibn Muḥammad al-Ghazālī
 - Vehemently rejected Aristotle and Plato
 - *Theological occasionalism*: belief that causal events and interactions are not the product of material conjunctions but rather the immediate and present will of Allah
 - *Causality* was viewed as a limitation on Allah's power:
 - "...the connection between what is usually believed to be a cause and what is believed to be an effect is not a necessary connection ... it is in God's power to create satiety without eating, and death without decapitation, and to let life persist notwithstanding the decapitation, and so on with respect to all connections."*
 - Averroes (Ibn Rushd) later wrote a rebuttal, but the course of Islamic thought had been set



Haruniyah (هارونیه) structure in Tus, Iran, named after Harun al-Rashid. The mausoleum of Al-Ghazali is thought to be situated at the entrance of this monument

THOMAS AQUINAS (1225-1274) SHOWED THAT ARISTOTLE'S PHILOSOPHY WAS COMPATIBLE WITH-- EVEN SUPPORTED BY-- SCRIPTURE

- Studied and taught at University of Paris
 - Teacher, Albertus Magnus, considered it important to reconcile Aristotle with Christian thinking
- Blended Greek philosophy and Christian doctrine
 - Rational thinking and study of nature, like revelation, were valid ways to understand truths of God
 - God reveals himself through nature, so to study nature is to study God
- Believed Reason and Revelation could not conflict, since both come from God
 - Knowledge comes not by separation from this world, but through the intellect's power to abstract unchanging truths from our changing sense perceptions
- Succeeded, with his teacher, in incorporating philosophy of Aristotle into the Christian West



Thomas Aquinas, an altarpiece in Ascoli Piceno, Italy by Carlo Crivelli (15th century)

AQUINAS HAD A NOVEL VIEWPOINT ABOUT THE ETERNITY OF THE WORLD (I.E., THE CONCEPT THAT THE UNIVERSE IS INFINITELY OLD)

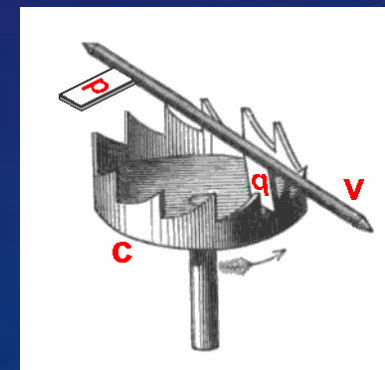
- The Eternity of the World
 - Many philosophers since Aristotle had opined for or against the Eternity of the World
 - Aquinas took a different approach than his predecessors
 - Claimed that neither the eternity nor non-eternity of the world could be proved by logical argument alone
 - So we need to rely on revelation [or gather more data ...]
 - Even if the universe is infinitely old, God could be an instantaneous and motionless creator, and could have created the world *without preceding it in time*
 - So he infers that God is outside of 4D space-time, 650 years before Einstein!

MUCH MORE WAS GOING ON DURING THE HIGH MIDDLE AGES

- The Crusades (1095-1291)
 - Reopened the Mediterranean to trade and travel
 - Bad for Middle East and European military
 - Good for European culture
- Travelers visited Asia
 - sought trade, diplomatic ties against the Muslims, missionary opportunities
 - Giovanni da Pian del Carpine, Ascelin of Lombardia in 1245, André de Longjumeau in 1249; William of Rubruck visited Great Khan of the Mongols during 1253-1255; Marco Polo (1254-1324)
- First eyeglasses were made in Italy in about 1286
- Mechanical clocks
 - began to replace water clocks by the end of the 1200s
 - spread rapidly across Europe during 1350-1400
- Black Plague (1346-1353 and thereafter)
 - Like suffering 30x World War I in a year, in England
 - Increased value of labor; capitalism began replacing feudalism



The 'Glasses Apostle' by Conrad von Soest (1403)



Verge ("crown wheel") escapement made possible all-mechanical clocks, as opposed to water clocks, 26

INDIVIDUALISM BECAME MORE WIDESPREAD SOMETIME BEFORE THE 15TH CENTURY

- High-quality glass mirrors were invented about 1300
 - Became available throughout Europe by end of 14th century
 - Mirrors allowed people to contemplate their unique appearance
- Portraits became more and more common throughout 15th century
 - Jan van Eyck may have painted a self-portrait (*Man in a Turban*) as early as 1433
 - Portraits invite the viewer to “Look at me!”
- Previously, only rare individuals thought of themselves as unique
 - Most people saw themselves as part of a community
 - That’s why exile, banishment, excommunication were so severe
- New individualism led to more autobiographies and personal letters
 - In religion, people began to stress *personal* relationship to God
- Privacy became more important
 - In earlier centuries, householders ate and slept in same hall as servants
 - Now they began to build private chambers for themselves and their guests



Jan van Eyck
Man in a Turban
[self-portrait?]
(1433)

THE CONCEPT OF “RIGHTS” EMERGED AS INDIVIDUALISM AND SELF-GOVERNING ASSOCIATIONS SPREAD

- The concept of “human rights” did not originate as a grand, coherent theory
- It formed slowly, piece by piece
 - Competing voluntary associations (towns, monasteries, guilds) needed to attract members, who were becoming more individualistic
 - Charter towns offered an expanding set of privileges to citizens
 - Legal process, tax exemptions, property rights, etc.
- By 1200, Church canon lawyers began to develop formal notion of “natural rights”
- Magna Carta (1215)
 - enumerates what later came to be thought of as human rights
 - right of the church to be free from governmental interference
 - rights of all free citizens to own and inherit property
 - right of widows who owned property to choose not to remarry
 - established principles of due process and equality before the law
- *Petition of Right* (1628) declares that Englishmen have various "rights and liberties"
 - No taxes may be levied without consent of Parliament
 - No subject may be imprisoned without cause shown

WHEN **WEIRD** PSYCHOLOGY GOES BAD

- **WEIRD** people wreaked havoc when they encountered other cultures
 - That people have “rights” is a **WEIRD** abstract concept
 - But as European nations came to dominate the Earth, “rights” were not initially extended to all humans
 - Imperialism, slavery, racism were the reason and/or result
 - Advanced technology produced environmental destruction and global warfare
 - We continue to deal with the effects of this sad history
- Modern **WEIRD** culture has fostered materialism, violence, *ressentiment*, alienation, loneliness, obsession, mental illness
 - “The conductor has left the podium , but the orchestra plays on”
 - Kierkegaard: “Sin is: before God in despair not to will to be oneself, or before God in despair to will to be oneself”

SOMETIMES THE CHURCH OPPOSED THE PROGRESS OF SCIENCE

Some church leaders opposed

- Aristotle
 - For example: Condemnation of 1277
 - Aristotle's ideas conflicted with Scripture
 - Atomism
 - Idea that matter is composed of atoms, with vacuum in between
 - Too materialistic and deterministic
 - Heliocentrism
 - Idea that Earth moves, and Sun is at center of solar system
 - Seemed to conflict with Scripture, and humans were no longer at the Center
-
- Yet the Church always harbored numerous competing viewpoints
 - Church opposition had almost no effect in slowing down the development of science

WE HAVE TRIED TO DESCRIBE THE FOUNDATION OF MODERN SCIENCE

...but not the actual emergence of Modern Science itself

Roger Bacon – empiricism (~1260)

Oxford Calculators (~1340)



MODERN (*EMPIRICAL MATHEMATICAL*) SCIENCE DEPENDED ON THE IDEA THAT *NEW KNOWLEDGE* WAS POSSIBLE¹

Modern Science was launched soon after people realized we can discover new things the Ancients didn't know about

- New explorations (1402)
- New World (1492)
- New Christianity (1517)
- *De Revolutionibus* (1543)
- Tycho's new star (1572)
- Galilean moons (1609)
- New discoveries opened new fields and provided new tools and techniques for investigating them²
- New words, new definitions, new books with the word "New" in the title¹ ...

1. David Wootton, *The Invention of Science: A New History of the Scientific Revolution* (HarperCollins, 2015)

2. Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago, 3rd edition 1996)

IN EUROPE, NEW KNOWLEDGE WAS SOUGHT WITH URGENCY AND DEDICATION NOT SEEN ELSEWHERE

- 12th century witnessed an “intellectual gold rush” when European scholars hurried to translate the work of Greek philosophers from Arabic manuscripts*
 - Arab libraries opened to Western eyes in Spain, Sicily, and southern Italy, as the Muslims were driven out
- 15th century: “The Age of Discovery”
 - Canary Islands (1402), Madeira Islands (1419), Azores (1427), ...
 - Driven by desire for trade and wealth, but produced much new knowledge
- 16th century and later: Scientific Revolution
 - Permeated by the sense that “it all mattered”, by a “little-remarked sense of urgency and seriousness” that was missing in other cultures**

*Jonathan Lyons, *The House of Wisdom: How the Arabs Transformed Western Civilization* (Bloomsbury Press, 2009), p. 142

<https://www.thoughtco.com/age-of-exploration-1435006>

https://en.wikipedia.org/wiki/Age_of_Discovery

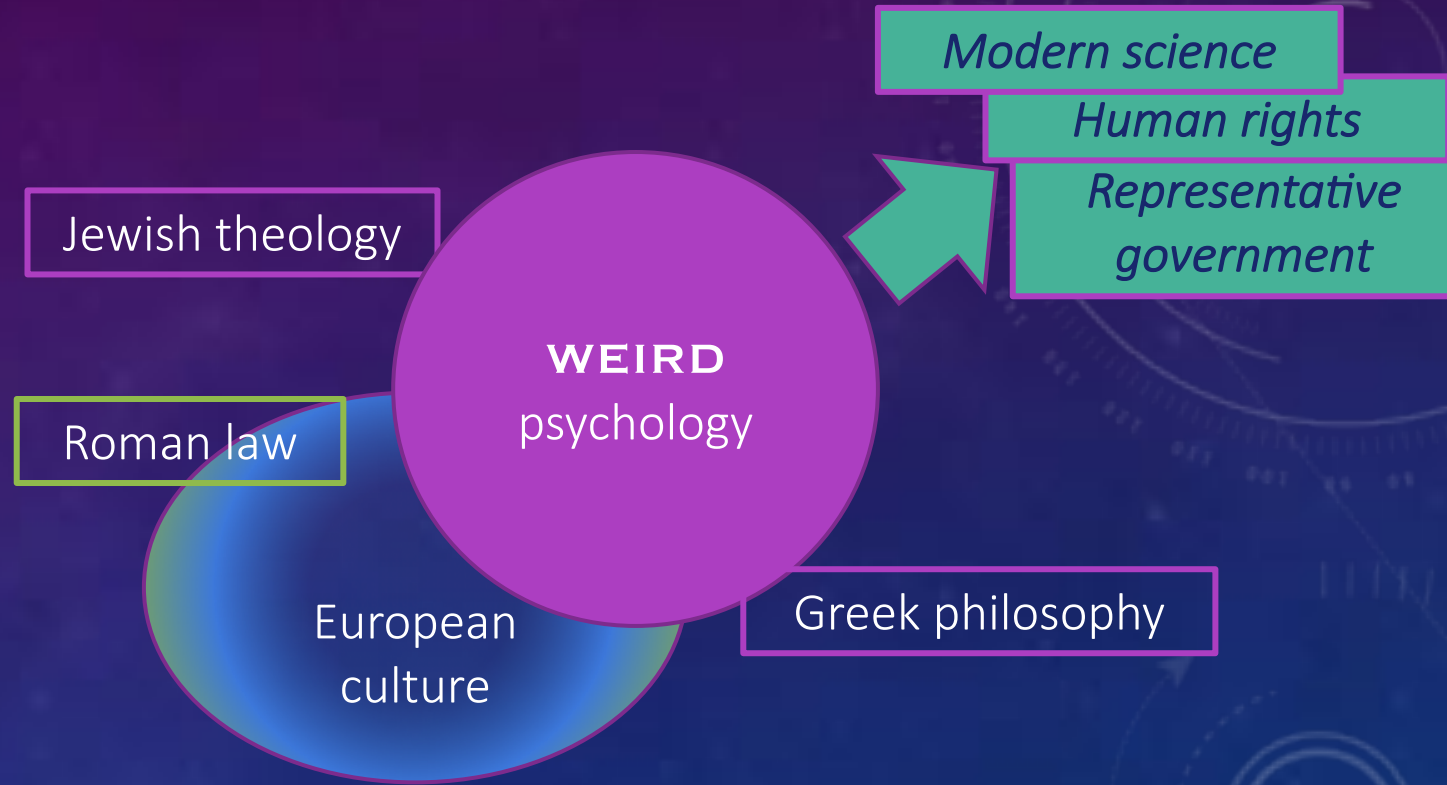
**Mark Elvin, introduction to v. 7 of *Science and Civilisation in China*, Joseph Needham, Kenneth Robinson, ed. (Cambridge, 2004), p. xlii

HENRICH ALWAYS IDENTIFIES “THE CHURCH” AS THE ACTOR IN THIS DRAMA OF PSYCHOLOGICAL CHANGE

- “The Church” means the Western, or European, or Roman Catholic church
 - Henrich finds that Eastern Orthodox church did not produce new psychology as much as Western Church did – so he concludes “Christianity” did not do the work
- But Eastern Orthodoxy differs theologically from Western Christianity
- So perhaps we should expand the investigation to include Christianity in total
 - Christianity is more than a set of rules about marriage and family
 - Examples: Christian attitudes towards
 - Wealth: “sell your possessions and give to the poor, and you will have treasure in heaven”
 - Revenge, forgiveness: “Love your enemies, and pray for those who persecute you”

GOD IN HISTORY

- God in Revelation
 - Scripture
 - Experience
 - Tradition
- God in Nature
 - The Book of Nature
 - “Natural theology”
- God in History
 - God’s hand in Jewish history
 - God’s hand in the history of the past 2000 years
 - “Historical theology”



BACKUP SLIDES

WHY DIDN'T LARGER, WEALTHIER CULTURES THAN EUROPE EXPERIENCE THEIR OWN SCIENTIFIC REVOLUTION?

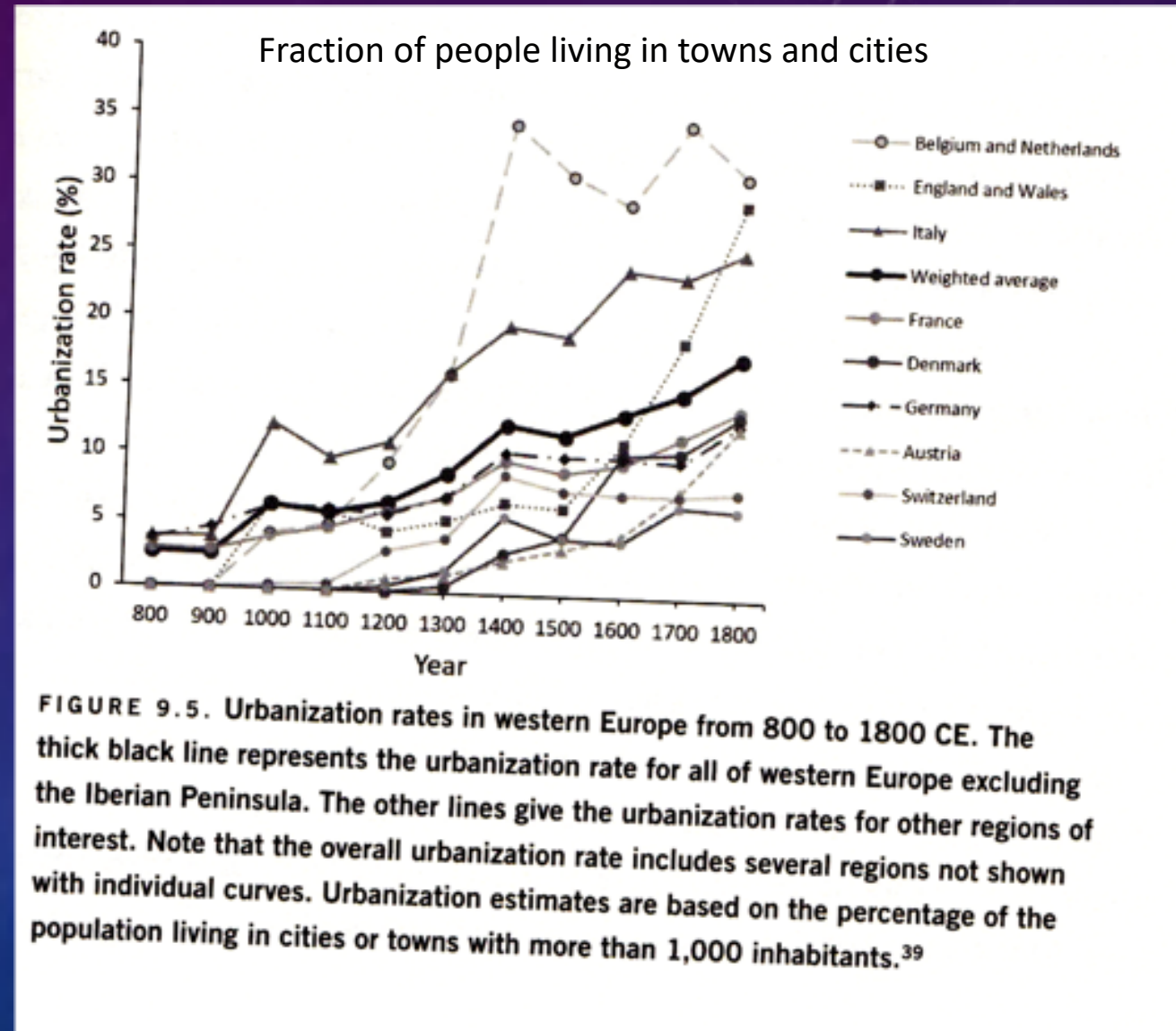
- The question of why Islamic, Indian, or Chinese cultures did not go through their own Scientific Revolution is heavily studied and quite controversial
 - There are dozens of answers
 - We don't have time here to pursue this question
- Joseph Needham, CH, FRS, FBA (1900-1995)
 - British scientist, historian and sinologist known for his research and writing on the history of Chinese science
 - "The Needham Question": Why was China overtaken by the West in science and technology, despite its earlier successes?
 - Joseph Needham, *Science and Civilisation in China, v. 7, part II: General Conclusions and Reflections* (Cambridge, 2004)
 - Simon Winchester, *The Man Who Loved China: The Fantastic Story of the Eccentric Scientist Who Unlocked the Mysteries of the Middle Kingdom* (New York: HarperCollins, 2008)
 - Possible factors
 - Imperial examination system channeled best minds into imperial bureaucracy
 - Political/religious unification didn't foster competition among small groups
 - Practical issues of ruling an enormous nation superseded abstract philosophizing about nature



N. J. T. M. Needham
(6 December 1900 - 24 March 1995)

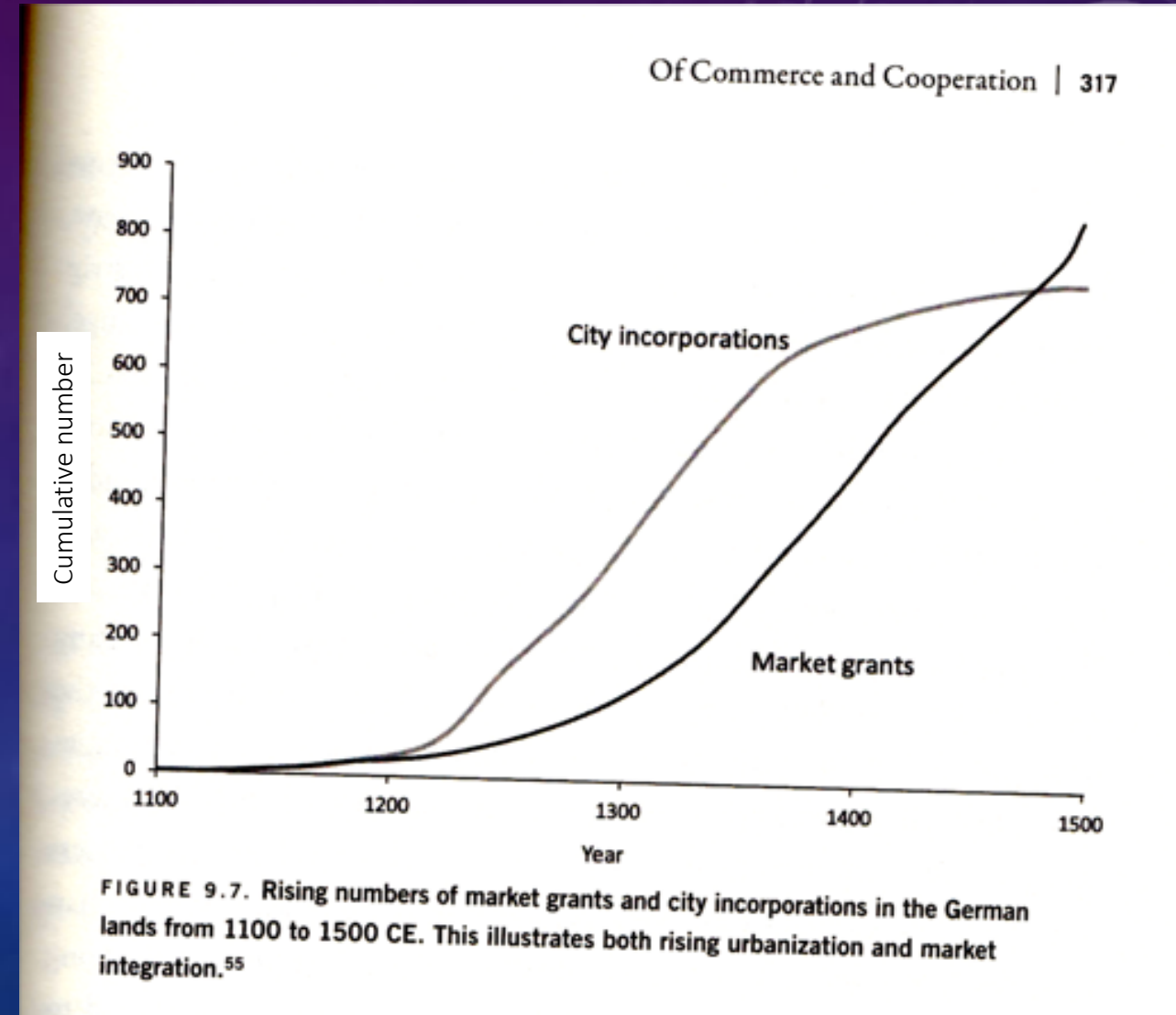
CITIES GREW LARGER

- Cities and towns were, in many cases, voluntary associations
- They competed to recruit artisans, merchants, lawyers
- Western Europe saw urbanization increase from 3% in 800 CE to over 13% by 1600
 - Much higher in Belgium, Netherlands, Italy
- Cities and towns had charters granted by local princes, bishops, dukes, kings
 - Were self-governing and relatively independent from local ruler
 - Exempt from some taxes and military conscription
 - No equivalent in China or Islamic world



COMMERCIAL ACTIVITY EXPANDED

- Cities were the site of increased commerce
- Rulers discovered benefits of free communities:
 - Generated economic prosperity
 - Caused population growth that enabled larger armies and greater security
 - Many towns were responsible for their own defense, although exempt from conscription
 - New charter towns could extend rulers' territory
- Markets enhanced impartial honesty and fairness
 - Merchant success depended on industriousness, patience, precision, punctuality → **WEIRD** psychology
 - *Lex mercatoria* (Merchant Law) – norms for fair exchange independent of family, class, clan, or tribe



KINSHIP INTENSITY IS INVERSELY CORRELATED WITH INDIVIDUALISM

- Kinship intensity doesn't explain all the variation in individualism, but it explains a lot of it
- Individualism data come from research on IBM employees around the world

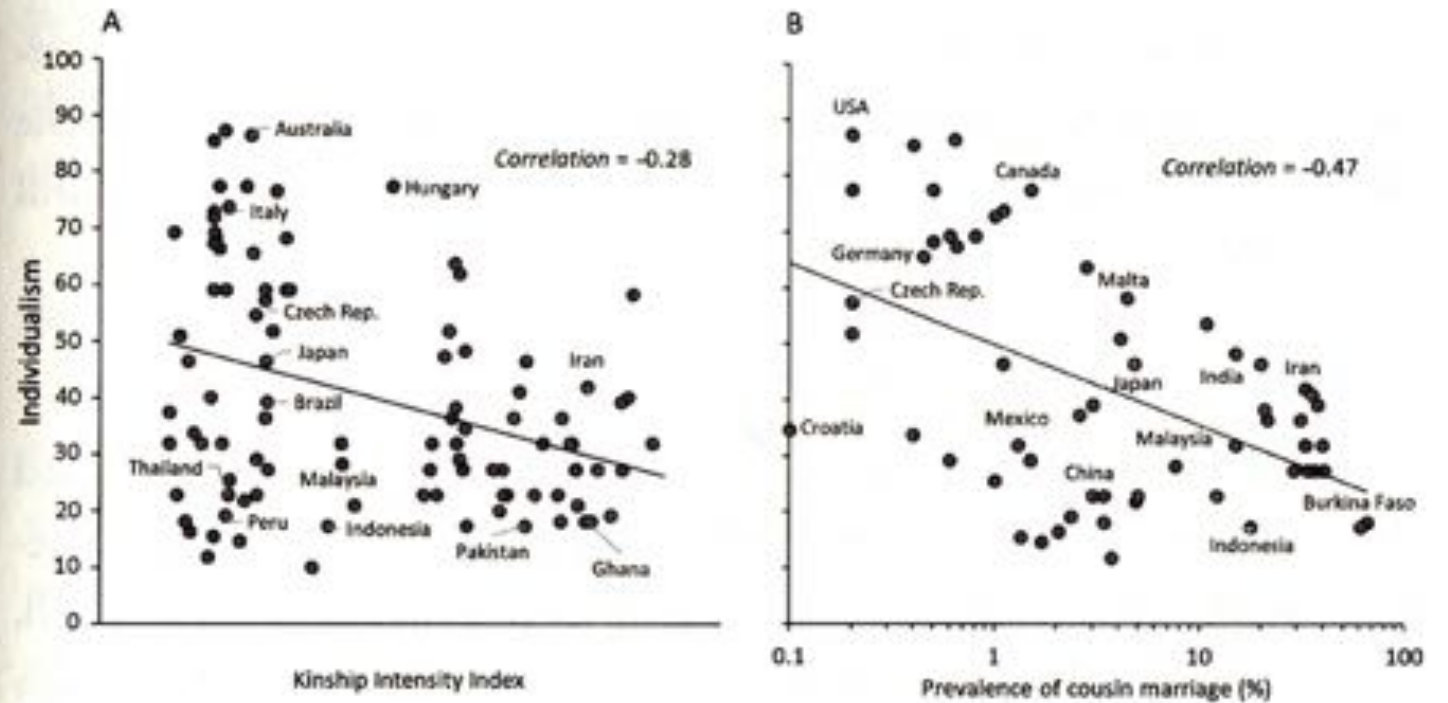


FIGURE 6.4. The relationship between individualism and the (A) Kinship Intensity Index (98 countries) and (B) prevalence of cousin marriage (57 countries). This omnibus measure of individualism comes from research among IBM employees and others around the world. Cousin marriage is plotted on a logarithmic scale.

COUSIN MARRIAGE IS INVERSELY CORRELATED WITH MORAL UNIVERSALISM

- Would you give false testimony in court to help a friend avoid prison for driving recklessly?
 - If not, that is “universalism”
 - If so, that is “particularism”

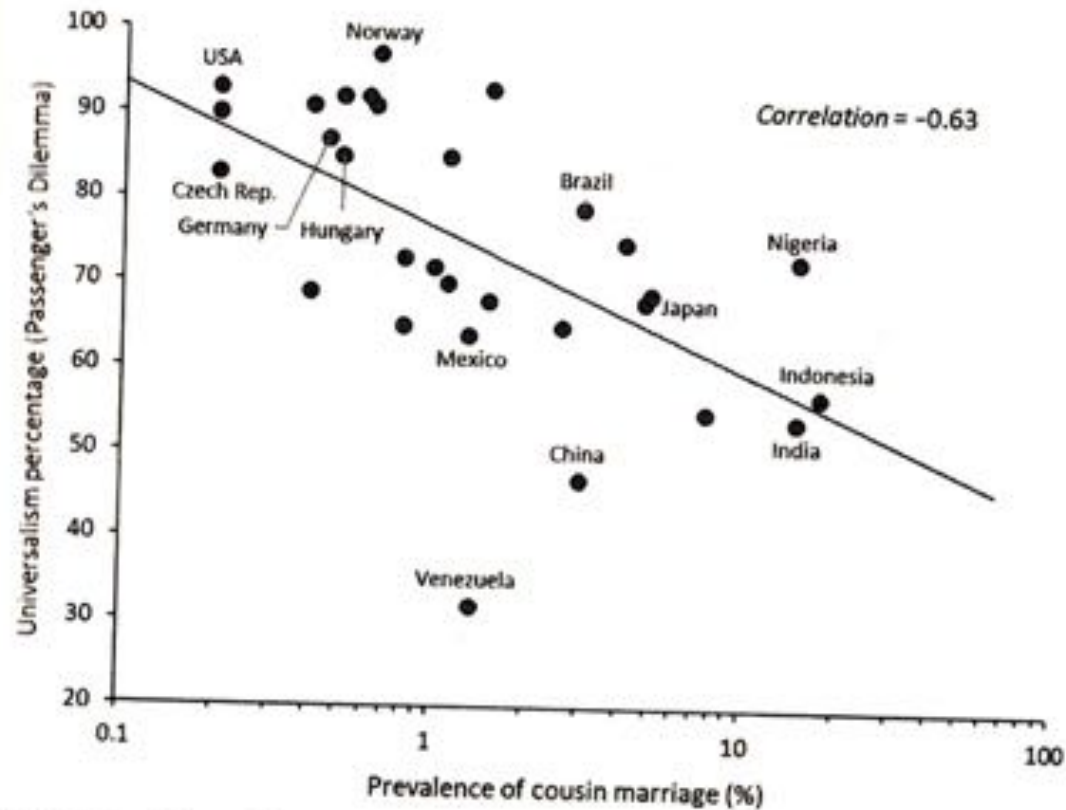


FIGURE 6.7. The relationship between universalism, captured as the percentage of universalistic responses to the Passenger's Dilemma, and the prevalence of cousin marriage. Cousin marriage is plotted on a logarithmic scale.¹⁷

WITHIN NATIONS, PSYCHOLOGY IS CORRELATED WITH FIRST- COUSIN MARRIAGE

- Greater prevalence of first-cousin marriage is associated with
 - Less individualism
 - Less impersonal trust
 - Less impersonal fairness
 - Greater conformity-obedience

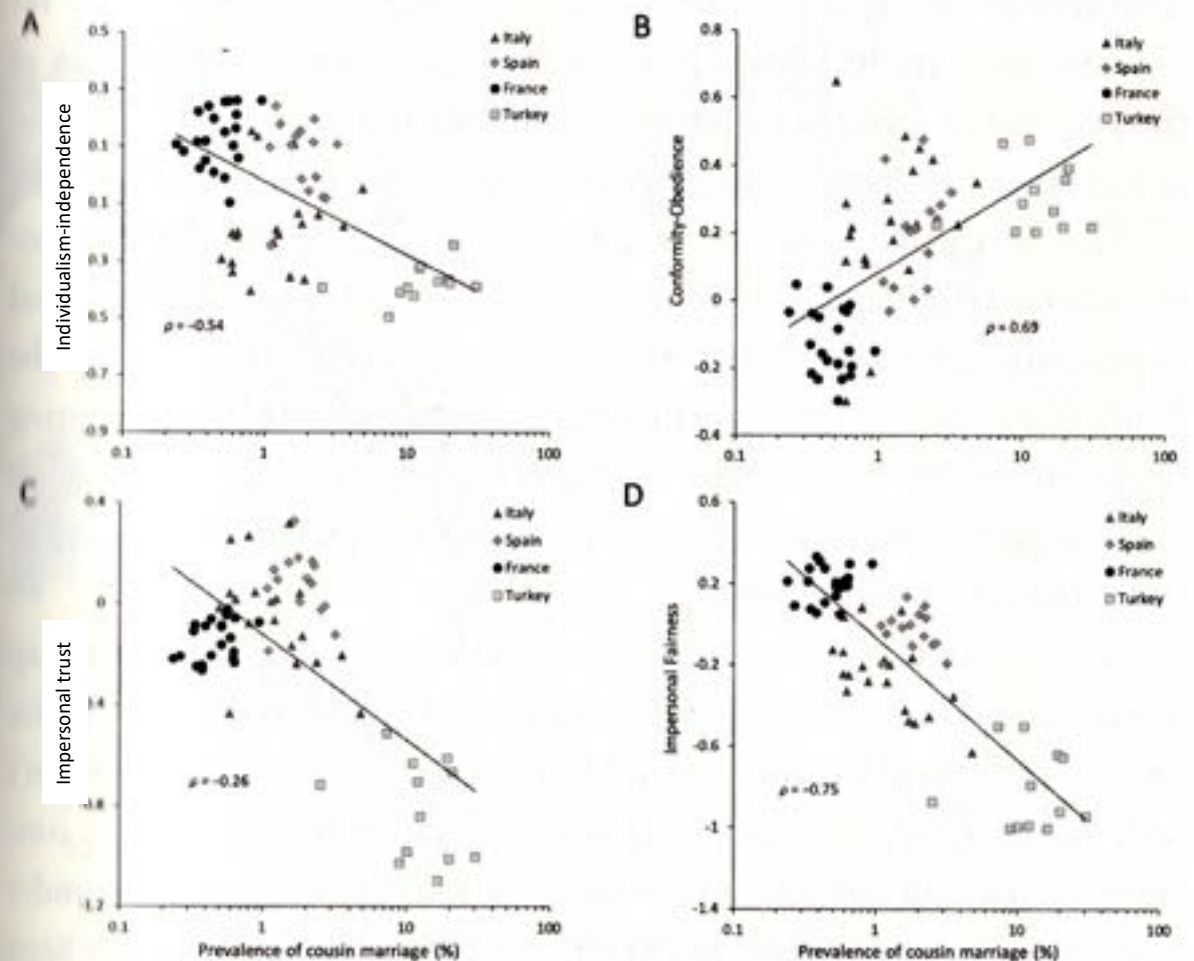


FIGURE 7.2. The relationships between the prevalence of first cousin marriage in regions of Spain, Italy, France, and Turkey and four dimensions of psychology: (A) Individualism-Independence, (B) Conformity-Obedience, (C) Impersonal Trust, and (D) Impersonal Fairness.