The Advent of Mathematical Jurisprudence

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Introduction

The People v. Collins case shows the fear of mathematics in the court of law. We see another extreme in another court: the court of science. In that court, people worship mathematics. Scientists and evolutionists want to position mathematics at the place of God, the Creator. Scientists want to reduce every existence in the universe by a matter of random probability. Both science phobia in court and science worship in cosmology are the two undesirable extremes of how we see science. Science is a tool and thus should be used in a mechanic's shop, not in church. That is, the rightful place for probability theory is the evidence proceeding in court, not in explanation of the origin of the world, the purpose of our existence, what we are, who we are, and why we are. This essay is a scientific exposition, a philosophical rhapsody, a societal satire, and an intellectual prophesy. Let us begin the journey.

1. Probability 101 for Lawyers

1.1. Set Theory and Initial Setting

A set is a collection of defined individuals, or elements that share a common traits. A universal set U consists of all individuals and is the universe of discourse, that is, the universe of reference, a universe that we are confining our discussion to. In People v. Collins, U is the set of all citizens living in Los Angeles County ("LA"). Let us simplify the discussion by establishing a hypothetical crime committed in LA: a man[2] steals a penny from a gas station counter, hides it in his pocket, and drives away in his car. There is one witness, the attendant in the gas station.

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[1] Alaska Bar candidate for 2016. Why is the author doing this? In short, give and take. The author has been educated by the support from scholarships, fellowships, federal grants, and GI Bill. This is the occasion for the society to get its return on investment.

[2] By 'man,' the author means a person in a gender-neutral context. Call me the sexiest sexist, I don't care. The author is not a feminist. One comment on feminists: how aesthetically displeasing is it to use 'he or she' every time we mention one person, and how inconvenient to pronounce 'Ms.' as opposed to Miss or Mrs.? Why make the world such an awkward and unseemly place? Why not encourage women to be feminine, to grow long hair, to wear skirts, to keep in shape, and make it a more beautiful world for everyone? Feminism dominates the West. This is yet another indication the West is on the declining path. Don't get me wrong here. The author is all for women at work setting, as it makes the workplace more agreeable to men. Plus, an educated woman staying home where there is a nanny with a washing machine and a vacuum cleaner may constitute a waste of talent capital and educational investment. What he does not agree is the feminist agenda that women being womanly is a stereotype to rebel against. Gender difference is a gender diversity and a woman is most beautiful when she is feminine. The author abhors in horror the feminists' attempt to persuade women to be manly, or, even to be like men who like women, that is, to be lesbians. The author's anti-feminism isn't just to please the eyes of men, one of whom he is. It is for the sake of women as well, for women are the happiest when they are as beautiful as their

1.2. Random Variable

Let us assume the following:

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gender potential endows them to be. Why do lesbians so desperate to raise their gay flags everywhere? Because they are still women, and they are desperate to get attention. But it is a wrong, ugly way to get attention from people. They should return to their natural femininity, cherish it, cultivate it, be grateful for it, and be happy and please themselves and others the right way by contributing to the beauty of the natural humanity. And here is for gay men. We grown men are genetically, evolutionarily programmed to feel sexual excitement by the image of a slender woman's naked legs. But how difficult is it for us men to get women into bed? And how easy is it for a gay man to get a one-night-stander in a gay bar? And how similar are the legs of women and legs of human men? After all, we are all homo sapiens. Thus, it is not that hard for a sex-hungry man to fool himself that he find another man's legs sexually attractive. This is why so many straight men turn into gayism in all-male prisons. And this is why promiscuity is a heightened problem in male gay population, and why 63% of new AIDS patients are male gays, over-representing the 2% of gay males in the entire population. Now, as gay marriage state legislation legitimizes gay life style, more males will give up on getting girls and turn into gayism, spreading AIDS and other STD like there is no tomorrow. The SCOTUS (Supreme Court of the U.S.) decisions that sanctifies anal sex between two males do so in the name of the U.S. Constitution. What these Justices of the highest court of the land are saying is that the Constitution gives a man the right to insert his penis into another man's anus. Listen to yourself! What an insult, what a relegation of the Constitution! True, sex is a vulgar act. The sex between a man and a woman is nonetheless justified as a means to reproduction: after all, that's how we all were born. How about a condom or barren sex? Well, the similarity is enough to justify and the lessening of the stress from sexual gratification has a societal utility. Then why draw the random line at homosex? It is because the line has to be drawn somewhere in order to prevent disorder in sexuality in society. Otherwise, sexuality will start to spread outside bedrooms, into offices, into friendships, into familial relationships, everywhere like in the ending era of the great Rome and Greece. With all low down honesty, in all stripped bare naked truth, homosex is nothing but a cheap imitation of heterosex, an aided masturbation. The Lady Gaga's "I was born this way" theory of innate homosexuality? Come on, she is a singer and none more. A perfect social brainwashing by repetitive listening. Scientists who side with Gaga gayism? The same politically biased human beings. A man who has been married to a woman declaring he "realized" he is gay? He just found a way to get out of the jaded marriage, an escape from his midlife crisis, conveniently dodging the blame of 'abandoning the aging wife for a younger woman.' Behold, he is being irresponsible for abandoning his wife and kids, but now that progayism is the prevalent propaganda of the day, he will not only evade moral blame, but also be applauded for the 'courage' to come out with honesty! This is what gay marriage advocacy, i.e., progayism, does to society. For a more thoroughly detailed discussion on the fallacy of progayism, *see* Huhnkie Lee, The Law of Antigayism (2015, unpublished), available at ... For the final note, does the reader know why it is more acceptable for men to be killed than women? It is because women are the bottleneck of reproduction. An island with one man and ten women has a better chance to survive as a humanity than the one with one woman and ten men. A man can fertilize many eggs, but a woman does not have enough eggs to be fertilized by multiple men. It doesn't matter how many male homo sapiens fertilize an egg: only one sperm gets the egg. Is a clitoris as big as a penis? Doesn't the size explain why men want sex more than women, why men approach women, why men buy women drinks and dinners? How many thousands of eggs do a woman ovulate in her life time and how many millions sperms does a man produce a day? As you can see, women and men are fundamentally different, they are the opposite, the complement. The feminist advocacy that denies this truth about gender difference is built on lies and ignorance. Why do we say nobody should kill 'women and children?' It is because we need only one man for humanity to survive to the next generation: he can impregnate 365 women a year for five decades. But if there is only one woman in the world, the humanity will cease to exist, as men will fight for that one woman and she will die of multiple rapes per day. Even without rape, she can only have so many children. Do you see why men and women are different? It's not because we want to demean women, not at all. The difference just is. The truth may as well be flattering to women, as it says men are more expendable than women are. Feminists don't have to lie to themselves and the world to honor the female gender. If they are true to themselves, the truth will take care of the rest, including fairness.

Assumption 1.2. The gas station attendant ("g") did not see the culprit ("c"), but g knows somebody stole a penny that was lying on the counter. G saw the penny, then went to the backroom, returned to the counter, and the penny is gone.

C can be anyone in LA because g has not sensed c's looks, sounds, smells, etc. But it is certain that one person in LA committed the theft, as g did hear the chime ring when X entered and exited the gas station entrance, which is electronically equipped to chime once per the passage of a person. G reports the incident to police ("p") and p picks a random person ("x") in LA to question if x committed the petty penny pilferage. Now, what is the probability that x is c?

Probability Value 1.2. $P(x = c \mid x \in U) = \frac{n(C \cap U)}{n(U)} = \frac{n(C)}{n(U)} = 1 / n(U)$

The notation n(U) means the number of elements in set U. Here, n(U) is the population size in LA. C is a set that consists of one person, the real culprit c who committed the penny theft. x is a random citizen in LA[3]. $P(x = c \mid x \in U)$ means, in English, the probability that x is the criminal, given x is located in LA (*see* the next section). "$x \in U$ " means x is an element of the set U, here meaning x is a citizen of LA. We are assuming that the time gap between the theft, the report, and the interrogation was short enough to preclude x from escaping out of LA. Finally, " $\cap U$ " in "n($C \cap U$)" means the intersection of the sets C and U, which is simply C, as C is a subset of U[4].

1.3. Conditional Probability

1.3.1. Temporal Condition

Let us roll the dice twice. The rolling act occurs in the same place but in different times. Thus the succession of the events are temporal. And the first rolling does not affect the random distribution, or possibilities, of the latter rolling of the same dice. Thus the two events are independent. Now, let us put a set of billiard balls in a black box with a small opening for the wrist. You pull one out, put it aside, and pull out the second ball. Then, the second ball can't be the same as the first ball, as you just changed the distribution of the numbered balls in the second trial by putting aside the first ball. That is, the second pulling is now dependent upon the first draw inasmuch as the second ball cannot be the first ball pulled out. But if you have put back the first ball, shaken the box, then pulled out the second ball, the two events are temporally independent.

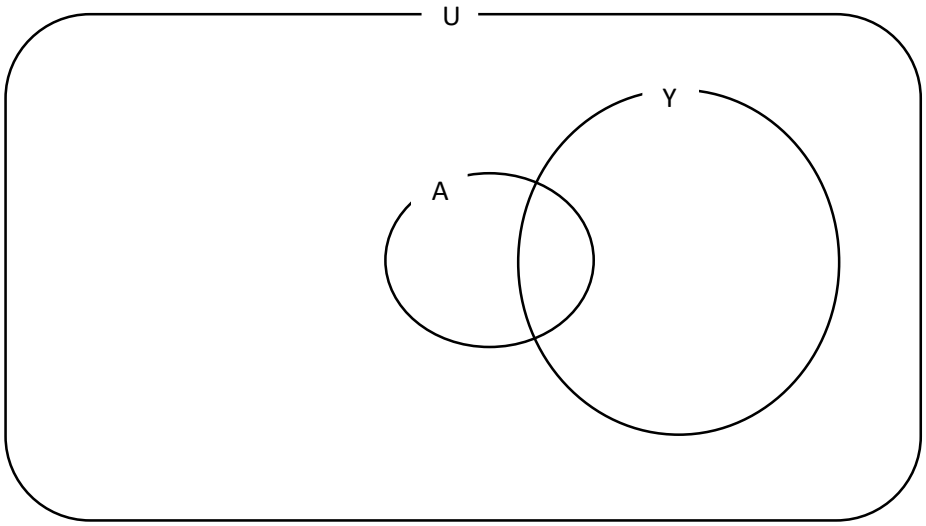
1.3.2. Spatial Condition

This kind of conditionality is central to our discussion. Look at LA. There are Asians and there are yellow cars, among others. At the same time, one man can both be an Asian and have a yellow car. The two events, i.e., being an Asian and having a yellow car, are spatial in that the two are traits that can

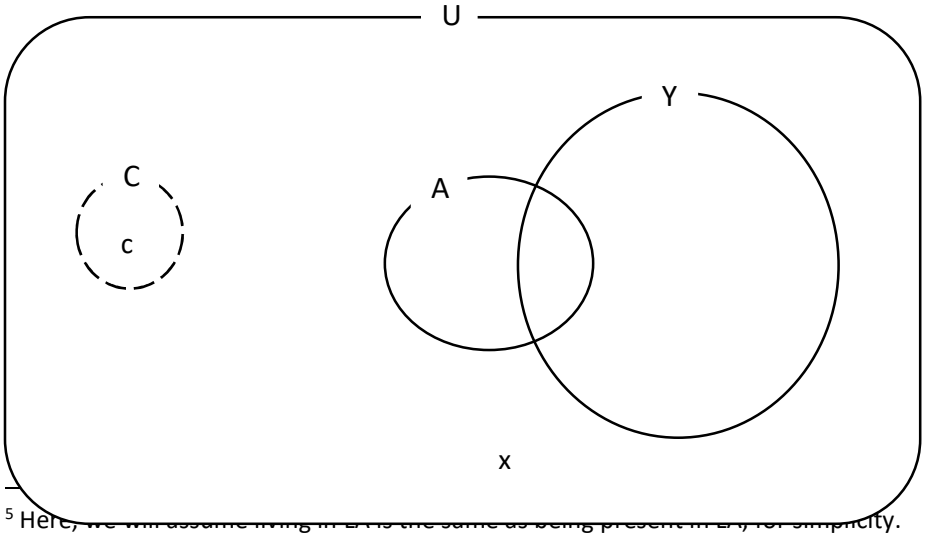
[3] Of course, p grabbed x randomly here, purely hypothetically. No police officer would make such an irrational decision. Despite all the contemporary mindless, groundless accusation on police of racism, the author sincerely appreciates the service of police that requires the risk of losing lives and limbs to protect us all.

[4] For a primer of the set theory, please *see* …

coexist in a given time in the 'trait space.' A pictorial representation would assist the reader's visualization of the situation:



As before, U is the set of people located currently in LA. A is a set of Asians living[5] in LA. Y is the set of LA citizens owning yellow cars. Then, the set $A \cap Y$ denotes the yellow-car owning Asians in LA.

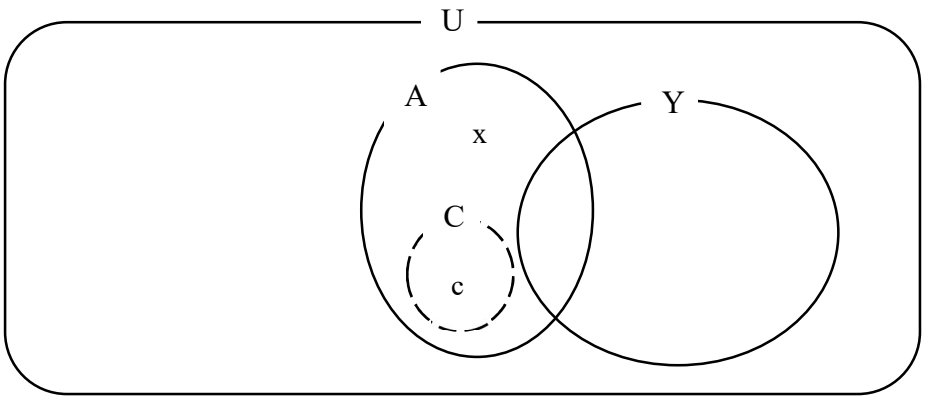


[5] Here, we will assume living in LA is the same as being present in LA, for simplicity.

To add to the picture are c, C, and x. c is the criminal individual who stole the penny at the gas station, and C is the set that contains the single element, c. x is a random individual that our police officer, p, decides to interrogate. The only thing that is invariable about x is that x belongs to U, that is, x is a citizen of LA. Other than that, x is our discrete random variable[6]. The set C is not a variable, but a constant. The borderline of C is dashed to indicate that C is *unknown*. That is, as of *Assumption 1.2*, we do not know whether c is Asian or has a yellow car or whatever. But as more information comes in, the set C moves around. It is not that c's race can change, but that the status or knowledge of the identity of c's race is changed from unknown to a race, e.g., Asian. In contrast, the sets A and Y are definitely known sets, as race is visually identifiable and the ownership of yellow cars is also verifiable via DMV records. Race is a constant, for sure. The ownership of a yellow car is not a constant trait, but for the simplicity, let us say it is: the whole time span of theft, investigation, arrest, and trial is assumed to be so short that no one changes his car for during that time[7].

Let us make a second assumption[8] to the story:

Assumption 1.3.2. g saw c, the thief, and identified him as an Asian.



As a result, now C is a subset of A.

1.3.3. Contraction of the Universe of Discourse

One thing the author glossed over is the conditional probability formula:

[6] For a primer for random variables, *see* www.wyzant.com/resources/math/lessons/statistics_and_probability/probability_distributions

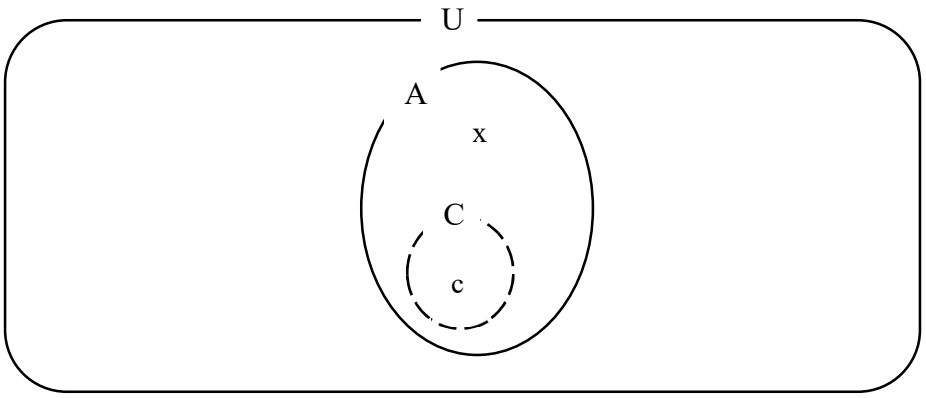
[7] As it turns out later, this assumption of 'no car purchases occur in LA during the theft investigation' does not matter and is a non-issue. The reason is that even if people constantly should change the colors of cars by selling and buying new ones, the color-preference distribution among racial demographics does not change, but rather, stay relatively constant. *See …*

[8] Hereafter, a new assumption replaces all the previous, conflicting assumptions.

Probability Formula 1.3.3. P(A|B) = P(A∩B) / P(B) = { n(A∩B) / n(U) } / { n(B) / n(U) }

= n(A∩B) / n(B).

Let us go back to the basic once again and draw an even simpler Venn diagram with only one set:



And let us think of an old day when everyone was innocent and there was no crime whatsoever. Now, what is the probability that a random LA citizen ("Laker") is an Asian?

Probability Value 1.3.3. P(A) = P(x ϵ A) = P(x ϵ A | x ϵ U) = P(A|U) = P(A∩U) / P(U) = P(A) / 1 = P(A).

The equation may seem tautological but it is pedagogical as well. When we say P(A|B), the set B is the 'universe of discourse' for the probability at issue. When the universe of discourse itself is the universal set, U, then we can shorten P(A|U) as P(A), just like 10/1 can be simply written as 10.

For those who are lost in space and time, here is the down to earth version of explanation. We want to find the probability that a random person in LA, wearing a mask from head to toe, is an Asian. We picked that person, x, from LA. So the probability that x is located in LA is 1, or 100% certainty. This is what we mean by P(U) = P(x ϵ U) = 1.

1.4. Probability Function

As the reader might remember from primary school, a simple function has an input and an output. We call the input an independent variable, and the output a dependent[9] variable. A probability function's variable is the random variable x, the individual randomly picked by our investigator, p. The probability function's output is the probability that x, our suspect, is indeed the culprit of the petty penny theft, c.

Probability Function 1.4. P(x) = P(x=c).

1.5. Preliminary to Spatial Dependency

For now, let us go back to the first *Assumption 1.2*, where our gas station clerk, g, knows nothing more than that the penny thief, c, is one man living in LA. Then, the probability that a randomly picked x is the culprit c is:

[9] The dependency here is a disparate concept not to be confused with the dependency of events (*see* §§ 1.3) or traits (*see* …).

Probability Value 1.5. $P(x=c) = P(x = c \mid x \in U) = n(C) / n(U) = 1 / (\text{the entire population of LA}).$

As noticed, this is nothing but a review of *Probability Value 1.2.* Now, Let us assume that another customer, h, identified c as an Asian and notified g and p of the eye-witnessing fact. Then, we narrowed down the suspect pool greatly from the whole population of LA to the Asian population of LA. In the language of mathematics, we can state it as:

Probability Value 1.5.1. $P(x=c) = P(x \in C \mid x \in A) = n(C \cap A) / n(A) = 1/n(A) = n(U) / \{ n(U) * n(A) \}$

$= 1 / [n(U) * \{ n(A) / n(U) \}] = 1 / [n(U) * \{ n(A \cap U) / n(U) \}]$

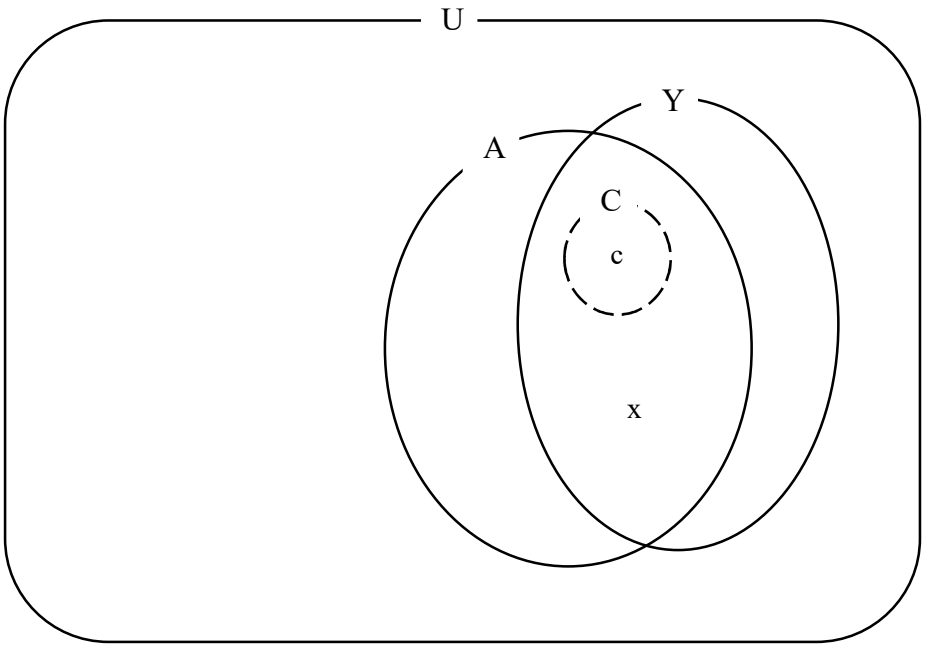
$= 1 / \{ n(U) * P(A \mid U) \} = 1 / \{ n(U) * P(A) \} = 1 / n(A).$

That is, by narrowing down the number of suspects from the entire LA population, n(U), down to the Asian population, n(A), now the probability that a randomly picked Asian man is the culprit is greater than the probability that a randomly picked man of any race living in LA is the culprit.

Lastly, for the sake of easy memory, a probability that a suspect drawn from the trait-universe is indeed the culprit is simple 1/(size of the trait-universe). In our example, if we know the culprit is an Asian and we look only into Asians for a suspect, the probability that a random Asian is the culprit is 1/n(A), i.e., the inverse of the Asian population.

1.6. Spatial Dependency

Let us throw a yellow car into the picture to demonstrate the dependency or independency between two traits. Let us assume that yet another customer, i, witnessed that c drove away in a yellow car[10]:



[10] All the Venn diagrams are not to scale. The only thing that matters in a Venn diagram is the topological relationship (i.e., how they are connected with each other) between the sets represented.

Let us examine this picture mathematically:

Probability Value 1.6. $P(x=c) = P(x \in C \mid x \in A \text{ and } x \in Y)$[11] $= P(C \mid A \cap Y) = P(C \cap A \cap Y) / P(A \cap Y)$

$= \{ 1/n(U) \} / \{ n(A \cap Y) / n(U) \} = 1 / n(A \cap Y)$

In this case before us, the universe of discourse, i.e., the pool of suspect of the gas station penny theft, is the individuals living in LA (the set U), who are Asians (the set "A∩U", which simply is A), who also have yellow cars (the set "A∩Y∩U", or simply "A∩Y"). That is, thanks to the witnesses g and i, we now know that the culprit c is an Asian driving a yellow car. So our investigator p is looking only into Asians owning a yellow cars[12] living in LA.

Note that the probability that a random suspect x is indeed the culprit c increases as we 'zero in' on the added traits on c, by adding more witnesses. This confirms our natural intuition that the narrow the suspect pool it is, the more likely it is that a random individual in that pool is the culprit. Without a witness, the initial probability that x is c was 1/n(U) (*see Probability Value 1.2.)*. After knowing that c is an Asian, the universe of discourse contracts from LA citizens to LA Asians, and probability increases to 1/n(A) (*see Probability Value 1.5.1.)*. After knowing c has a yellow car, the suspect pull further shrinks and the probability becomes 1/n(A∩Y) (*see Probability Value 1.6.)*. In other words, as the denominator in the probability decreases, the probability itself increases. Here is the same thought process in mathematical terms: let us make a mathematical saga out of this in both directions, forward from the beginning, and then backward by reverse engineering the previous thought process:

Inequality 1.6. $P(x \in C \mid x \in AY) = P(C|AY) = P(CAY) / P(AY) = \{ n(CAY) / n(U) \} / \{ n(AY) / n(U) \}$

$= n(CAY) / n(AY) = 1/n(AY)$

$> 1/n(Y) = n(CY) / n(Y)$

$= \{ n(CY) / n(U) \} / \{ n(Y) / n(U) \} = P(CY) / P(Y)$

$= P(C|Y) = P(x \in C \mid x \in Y).$

2. Correlation of Traits

2.1. Zero Correlation

Let us assume that Asians are no more or less likely to own yellow cars than other ethnic groups. For instance, in this scenario, 10% of every race, including Asians, own yellow cars. That is, yellow cars are evenly distributed over race space. If that is the case, there is no correlation[13] between Asian-ness

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[11] Hereafter, $P(x \in A)$ is shortened as P(A).

[12] Again, for simplicity, we will assume that in Los Angeles, people drive only the cars they own, not a rental or stolen or otherwise borrowed or job cars. Then again, such simplification does not lessen the strength of the discourse, as what car they drive does not affect the probability distribution. The only thing that matters is the correlation between Asian-ness and the preference to drive a yellow car. *See* …

[13] Here, the correlation is a relative concept. That is, we are not talking about what percentage of Asians own yellow cars. Such would be an absolute correlation. What we are up to here is whether Asians are more likely to own yellow cars compared to, or relative to, other racial groups. We will call this relative correlation, 'correlativity.' Please *see* § 4.1.3. Correlation *et seq.*

and yellow-car ownership, and we can say that Asians neither prefer nor abhor yellow cars more or less that other race does. Let us examine how this concept looks like in mathematical terms.

Probability Formula 2.1. P(Y|A) = P(Y∩A) / P(A) = n(YA)[14] */ n(A)*

= P(Y|U) = P(Y∩U) / P(U) = P(Y) / 1 = P(Y) = n(Y) / n(U).

The first line above shows the probability of yellow car ownership in the universe of Asian Lakers. The second line shows the probability that any Laker owns a yellow car. And the two probability equals because an Asian living in LA is equally likely to own a yellow car as anyone in LA. That is, there is no correlation between the two traits of Asian-ness and yellow-car ownership[15]. Yet in other words, as far as yellow-car ownership is concerned, Asian population is a miniature, a micro-cosmos, an epitome version of LA population, because the two population has the same percentage of yellow-car ownership of all car colors. The 'zero correlation' between two spatial traits is analogous to 'independence' between two temporal events.

2.2 Positive Correlation

What if Asians do prefer yellow cars? That is, Asians in LA are more likely than others in the city to own yellow cars:

Assumption 2.2. P(Y|A) > P(Y|U) = P(Y).

Inequality 2.2. P(Y|A) = n(YA) / n(A)

> P(Y|U) = n(Y) / n(U).

Remember, the right side of "|" is the universe of discourse. In the universe of Asian Lakers, the yellow-car ownership is 'over-represented' compared to the LA population as a whole.

Here, let us take a step back and get back to the California Supreme Court case of *People v. Collins.* In the trial, the prosecutor assumed the zero-correlation, or 'independence' between two traits, and assumed that P(Y|A) equals P(Y|U). Of course, the two equals only when there is no correlation. But what happens if we assume that they are equal anyways? Is it a good thing or a bad thing? As it turns out in this and next sections, it depends. When there is a positive correlation, it is bad.

*Inequality 2.2.1. P(AY) = P(A) * P(Y|A)*

*> P(A) * P(Y|U) = P(A) * P(Y).*

That is to say, substituting P(Y) for P(Y|A), or using the LA demographic percentage of yellow-car ownership instead of that of LA Asians, will result in an under-estimated value of P(AY), which is the probability that a random x is both an Asian and yellow-car owner. Note that this is not the same as the probability that x is the culprit. Such probability, in its full glorious detail, is the probability that x is the

[14] Hereafter, the intersection operation "X∩Y" *will be shortened as "XY."*

[15] Note that this statement does not preclude the possibility that Asians prefer black cars, or Hispanics prefer yellow cars. It only states that, in a LA population as a whole, about xx % of people own yellow cars, and xx% of Asians in LA also own yellow cars, just like LA citizens as a whole.

culprit after we know that the culprit c is an Asian yellow-car owner, and also after we draw the suspect x from the pool of Asian yellow-car owners in LA.

*Probability value 2.2 P(C|AY) = P(CAY) / P(AY) = { n(CAY)/n(U) } / P(AY) = 1 / { n(U) * P(AY) }.*

Note once more that the under-estimated P(AY) results in over-estimated P(C|AY), because P(AY) is a part of denominator in P(C|AY).

*Inequality 2.2.2. P(C|AY) = 1 / { n(U) * P(AY) } = 1/[n(U) * {P(A) * P(Y|A)}]*

*< 1/[n(U) * {P(A) * P(Y)}].*

Let us get back to plain English language. Intuitively, if most Asians own yellow cars, the witness testimony that the culprit 'ran' away in a yellow car doesn't really add much, or narrow down the suspect pool by much, because we already know that: (1) the culprit is an Asian; and (2) most Asians own yellow cars anyway. But if the prosecutor ignores such strong correlation between Asian-ness and yellow-car ownership, he is over-appreciating the value of the additional witness testimony that the culprit drove away a yellow car. In other words, in a city where every Asian drives a yellow car, the testimony that the culprit has a yellow car is useless, if we already know that the culprit is an Asian.

2.3. Negative Correlation

As the reader may have correctly guessed, the previous section was only half of the story. The other half is that it was actually a great thing for the prosecutor to assume the independence, or zero-correlation of the two traits. In this case, if the prosecutor assumes no correlation, he is being conservative, and being self-sacrificial and more generous to his opposing defense counsel to himself. This time, please allow the author to give the reader the bottom line upfront: it is a fair and reasonable to assume that all the traits are not correlated with each other, i.e., independent of one another, if the prosecutor uses multiple traits to narrow down the suspect pool. The reason is simple. It all evens out eventually, like this:

*Mathematical Expression 2.3. ¼ * ¼ * ¼ = ½ * ¼ * 1/8 = 1/8 * ¼ * ½.*

Some traits may be positively correlated, and the resulting probability would be overestimated by assuming the no correlation. On the other hand, other traits may be negatively correlated, resulting in underestimation of the probability. All together, they will cancel out each other, like a mountain gets sliced in the middle to fill the valley next to it. An even ground will result at the end of the multiplication.

The following is the anti-parallel to the previous section, so let us keep it short and sweet. And let us add some color to the dull grey mathematical discourse by throwing some racial jokes to it. Suppose Asian Lakers don't desire to look overly race-conscious and are averse to the color yellow. So the only Asians in LA who drive yellow cars do so because the cheapest available cars at the car dealer's happened to be yellow, and such few Asians also happened to have shallow pockets at the moment. Then, the yellow-car ownership is underrepresented in Asian population as opposed to the LA population:

Assumption 2.3. P(Y|A) < P(Y|U) = P(Y).

*Inequality 2.3. P(AY) = P(A) * P(Y|A)*

*< P(A) * P(Y|U) = P(A) * P(Y).*

*Inequality 2.2.2. P(C|AY) = 1 / { n(U) * P(AY) } = 1/[n(U) * {P(A) * P(Y|A)}]*

*> 1/[n(U) * {P(A) * P(Y)}].*

In the last inequality, left hand of it, P(C|AY), denotes the probability that a random suspect pulled from the yellow-car owning Asians in LA is the culprit. The right had of the inequality, i.e., the bottom line's expression, is the calculation of the probability substituting P(Y) for P(Y|A), reflecting the prosecutor's assumption that Asians are equally likely to own a yellow car as anyone else in LA. That is, the prosecutor's probability that an Asian yellow car driver x is the culprit is less than the actual probability of P(C|AY). That is, the prosecutor's theory is saying that the defendant x is less likely to be the guilty one than the true probability of P(C|AY), where we factor in the Asian Lakers' aversion toward yellow cars.

Intuitively, the way to make sense of this concept is as follows. Most Asians hate yellow cars. So, only a very few Asians like yellow cars. Then, if we know that the Asian penny thief drove away in a yellow car, we are homing in to a very rare characteristic, and the suspect pool rapidly dries up to yield a very small pot hole of water, the cult group of rare Asians who like yellow cars. But if the prosecutor kindly ignores the fact that Asians rarely drive yellow cars, he is treating Asians like anyone else, who neither hates nor likes yellow cars. The prosecutor is under-appreciating the value of the key witness who said the Asian man drove away in a yellow car. And such oversight underestimates the probability that x is the culprit. The author promised the reader to keep this section short, so let us stop here.

3. Interlude: a Story

Mr. Laurence Tribe was a law clerk in California Supreme Court in 1968. A clerk is an aid to a judge or justice, but that is an understatement and that is only how a clerk is supposed to be[16]. A judge, or a judge plus his clerks that they collectively refer to as 'the court,' is supposed to be an impartial, detached observer of a case, not an advocate of one side. A partial advocacy is the job of a defense lawyer or a prosecutor. The same applies in appellate level as well- an appellate judge or his posse are supposed to be neutral. An appellate judge is supposed to confine the consideration of arguments already put out and recorded in the trial, or in lower appellate court decision. An appellate judge's job is to review the decision of the lower court, and not to add another argument that would favor one party over the other. This inappropriate partiality in an appellate court is exactly what happened in *People v. Collins* case ("*Collins*"). What is worse, such partial, added advocacy favoring one party is done not by an appellate judge, but by his clerk, Mr. Tribe.

Mr. Tribe was a math major in Harvard. He graduated with honors, went to Harvard law school, graduated with honors again, and soon thereafter became a clerk in the highest court in California. Then came along the Collins case. The original prosecutor for the Collins trial, Mr. Raymond Sinestar, is the shining star who started all this. He is the one who came up with the idea that a mathematical calculation of probability can be a powerful tool in evidence proceeding in court, when other evidences are seldom available. Of course, Mr. Sinestar assumed independence of traits observed on the suspect, and proceeded with such assumption without explaining or justifying why the zero-correlation

[16] For a detailed discussion on undue influence of law clerks in American court of law, *see* Huhnkie Lee, A Call for an Overhaul of the Federal Court System of the U.S. (2015, unpublished).

assumption is a valid one. As explained in the previous section, the independence of multiple traits is a fair and reasonable assumption. The only error Mr. Sinestar made was to omit such explanation in court, probably because he himself did not know of the rationale of why it is a valid assumption. But the result is the same. It is highly likely that the Collins couple was indeed the guilty party in the robbery of an old lady's tote bag.

4. Defending the Prosecutor

4.1. Multiple Traits

4.1.1. Dependency

*Mathematical Law 4.1.1. P(ABCDEF) = P(A)*P(B|A) *P(C|AB)*P(D|ABC)*P(E|ABCD)*P(F|ABCDE)*

The formula above is known as the chain rule of conditional probability. In a hybrid language of English and math, it goes like this: the probability of random man to be an Asian with Beard owning a yellow Car is the P(Asian man) times P(bearded men in the universe of Asian males) times P(yellow-car owner in the universe of bearded Asian men). There is another law of math relevant here:

Mathematical Law 4.1.1.1. ABC = BAC = BCA = ACB = CAB = CBA

The intersection operator between sets is similar to the multiplication between numbers inasmuch as the two operators are commutative, meaning any order of operation yields the same result.

In *Collins*, our star prosecutor postulated six traits that several witnesses testified of the culprit of the tote bag robbery:

Traits Observed	**Occurrence Rate (Probability) of the Trait in Los Angeles Population**
Black man with beard	1/10
Man with mustache	1/4
White woman with pony tail	1/10
White woman with blonde hair	1/3
Yellow motor car	1/10
Interracial couple in a car	1/1000

What happened was, according to the prosecutor and his witnesses, the blonde ponytailed girl snatched the tote bag from the old lady, got in the yellow car waiting for the blonde girl, and both took off and the car's driver was a black man with beard and mustache.

Let us conduct a mathematically rigorous analysis, fixing the errors along the way. First, let us start with the universe of discourse where every man is with a woman in a car, both of whom are in their mid-thirties. Then we will perform the contraction of the universe by all the added traits, one by one.

"Black man with beard" is a composite trait. Let us assume that in this universe that we just constructed, 33% of all males are black and 33% of all males have beards. Reasonably assuming that all

races are equally likely to grow beards, the probability of a random male being a black bearded man is about 10%, and this is to match the original 10% probability in the table above. Now, let us examine how accurate, harsh, or generous this number of 10% is. We are talking about Los Angeles in the sixties. Out of 10 male Lakers, how many are blacks? Right now, blacks are about 13% of the U.S. population. Now, let us be generous to the defense counsel and assume that as much as 50% of black males have beards. Then the probability that a random male is a bearded black man is 6.5%. Our prosecutor was extra generous to bump up this number to 10%! Even after we consider that Los Angeles may have more black population than America as a whole, 1 bearded black man out of 10 men in Los Angeles is a generous assumption at least.

Let us recall what 'generosity' means here. The prosecutor is being generous if the defendant is less likely to be the real criminal, helping the defense's case. What helps the prosecutor's case is to reduce the likelihood that a trait occurs in the general population, to identify the rare and unique traits, so that the suspect pool shrinks smaller and smaller, increasing the probability that a randomly chosen suspect in the pool is indeed the criminal. Thus, the prosecutor would want, barring generosity, the occurrence number (10% in this example) to be as small as possible.

Next, "Man with mustache, 1/4." This, again, is a generous assumption, as in reality, less than 25% of men have mustache in their mid-thirties. "White woman with ponytail, 1/10" is also a composite trait. Today, about 72% of Americans are white. To reduce this number down to 10%, we would have to assume that about $1/7^{th}$ of women wear ponytails[17]. That does not sound too off. Also, Los Angeles is a big city and there are more ethnics, i.e., non-whites, in any big cities in America than in rural towns. Imagine that you are walking down the street of Los Angeles. Is it that unreasonable to see one woman out of ten is a white woman with a ponytail? Remember, LA is where Hollywood is, and more than any other American big cities, women put money in their hair in that Tinseltown. Again, in such a racially diverse city where every woman does a lot of things to their hairdos, 10% sounds pretty generous.

Next, "White woman with blonde hair, 1/3." This is generous from the outset. First of all, only white women have blonde hair, barring hair dyes. This is an interesting instance, mathematically, so let us review:

Probability Value 4.1.1. $P(B|W) = P(BW) / P(W) = P(B) / P(W)$.

The law in set theory used above is called "absorption rule," where an intersection of a set W (white women) and a set B (blonde women) is simply B, because B is a subset of W[18]. In this case,

Probability Value 4.1.1.1 $P(BW) = P(WB) = P(W) * P(B|W) = P(W) * P(B) / P(W) = P(B)$[19].

Thus, the occurrence probability of a white blonde is simply the probability of a randomly picked person being blonde. This is also a case where there is a perfect dependency between two traits. It's been a while, so let us resort to the Venn Diagrams:

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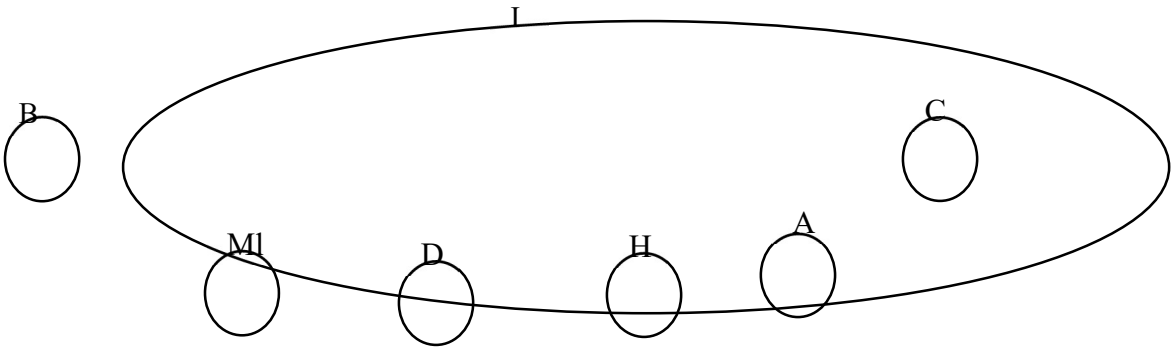
[17] Of course, we also reasonably assume that white females are not more likely than other races to have ponytails. It is ok, however, if white females are in fact less likely to have ponytails than others, as ignoring such negative correlation would underestimate the significance of the trait, resulting in generosity toward the defense counsel. *See* §2.3. Negative Correlation.

[18] That is, all blondes are white, and only whites are blonde.

[19] The long winded equations are for instruction purposes. P(BW) = P(B), simply because B is a subset of W.



Here, I is the set of people with skin color that can be described as ivory. B is the set of African Americans, A the set of Asian Americans or native Americans, C of Caucasian Americans, D of Americans whose ancestors are from India, Ml for Arabic Americans, and H for Hispanic Americans. For the sake of facile demonstration[20], let us assume that none of blacks have ivory skin, some of Asians do, and all of whites have such skin color.

In sum, none of B, a few of Ml, a half of D, 70% of H, most of A, and all of C have ivory skin. Let us further assume that out of all Americans, 70% have ivory skin[21]. This illustration is a review of §§ 2. Correlation of Traits in a more thorough manner. Let us examine the dependency, harshness, and generosity of each case. The prosecutor won't suspect a member of B, as he knows the culprit is ivory-skinned, and none of B has ivory skin. By assuming the independency, the prosecutor is being generous to a suspect in Ml and D. That is, being ivory-skinned is a rare trait in Arabs and Desi's compared to the population as a whole, and ignoring such valuable cue is doing the defense a huge favor. For Hispanics, the prosecutor can safely assume zero-correlation, as Hispanics are the miniature of American skin colors in terms of the color ivory. Only H is independent of the set I. But if the prosecutor assumes independence in Asians and Caucasians, he is cheating. The reason is that having an ivory skin is not a valuable or distinctive description of the culprit, as most of Asians and all of Caucasians have ivory skin anyway. So using the 70% ivory occurrence on Asian/Caucasian suspects would result in overestimation of the probability that an Asian or Caucasian suspect is the culprit[22].

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[20] Call me a racist, I don't care. The author hates racism and he receives racist treatment from all races including whites, blacks, Hispanics, etc. The typical racist treatment that he gets is when a so called 'all American' person regard him as a foreigner, due to his verbal accent, non-English first name, or his Asian ethnic origin. The author, however, objects racial over-sensitivity that some blacks seem to demand to police nowadays. The over-restriction on racial comments hinders the freedom of speech and preclude the innocent joy of racial humor. If one is proud of one's own race already, why should one be so sensitive about it?

[21] Again, the picture is not drawn to scale. If it were, the percentage of ivory people would be something like: (100+90+70+50+10)/600 = 53.3%

[22] *See* § 2.2. Positive Correlation.

For mnemonics, remember that positively correlated traits result in overestimation of the probability, meaning that the probability obtained from independence assumption is larger than the actual probability with no such assumption. Here,

Mathematical Expression 4.1.1. P(I | A) = 90% > 70% = P(I | U).

*Mathematical Expression 4.1.1.1. P(C | AI) = 1 / { n(U) * P(AI) } = 1 / [n(U) * {P(A) * P(I | A)}]*

*< 1 / [n(U) * {P(A) * P(I | U)}].*

That is, using the 70% instead of 90%, for the percentage of ivory-skinned person in Asian results in an exaggerated probability that a random suspect in ivory-skinned Asian is the real culprit.

The reader might ask, then, why is the independence assumption so valuable? It is because such assumption keeps the calculation simple: just multiply all the numbers. What we need to know to use such excellent tool is when such assumption is valid, and how much it errs when not valid, and whether it self-corrects such errors when there are multiple traits.

Now, let us get back to the Collins case. Remark that the prosecutor did not assume independence so that he can come up with a low occurrence percentage number to favor his case. The prosecutor said 1 in 3 women are blonde girls. This is an extremely generous of the prosecutor. Even in the universe of white women, blondes are rare[23]. To assume that 1 in every three women in Los Angeles is a blonde is like the prosecutor throwing candies at the defense counsel!

Let us finish up the last two items real quick and move to the next section, shall we? "Yellow car, 10%." This, again, is very generous, as most cars are either black, dark blue, grey, or something else in neutral color. A yellow car is fairly rare, even in the sixties in LA, presumably. Today, the author invites the reader to count cars on the street and see how many cars pass by the reader until the reader sees one yellow car.

Lastly, "Interracial couple in a car, 0.1%." In 1970's, about 2% of married couples were interracial. In 2010, 12% of interracial couples are black and white. Let's make a ton of assumptions: that things didn't change much from 60's to 70's; that the composition of race in married couples are similar to unmarried couples; and that black/white couples comprise 12% of interracial couples back in the 60's. Then the correct number would be 0.24%. Yes, 0.1% does favor the prosecutor compared to 0.24%. But not by much. We are talking about 1 person in a thousand, and 2 to 3 people in a thousand. The order of magnitude is remarkably close here, and the prosecutor, who arguably came up with the number 0.1% does deserve a tremendous credit here, for guessing the number so closely.

4.1.2. Set Theory

4.1.2.1. Subsets

We need to get back to the basics at this point. As it turns out, the concept of a subset is a critical aspect in the discourse of traits. So let us begin by definitions.

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[23] That's why blondes are especially prized and preferred among 'gentlemen.' A hypothesis other than scarcity would be blonde's similarity to gold in color. From the author's personal experience, not every blondes are dumb, although they are typically not the smartest.

Definition 4.1.2.1. The set A is a subset of B if and only if[24]all elements A are also elements of B.

Definition 4.1.2.2. The set A is a proper subset of B iff A is a subset of B and there exists an element of B that is not an element of A.

Definition 4.1.2.3. The set AB is the intersection of A and B, iff every element of AB is also an element of A and an element of B.

Mathematical Property 4.1.2.1. If A is a subset of B, then AB equals A. (a.k.a. 'the law of absorption.')

In reality, most subsets are proper subsets. So in this paper, it is safe to assume that a mention of 'subset' denotes a proper subset. For instance, Bl, the set of blondes, is a proper subset of C, the set of Caucasians, because all blondes are white, only whites are blondes, and there are hair colors other than blondes, like brunettes or auburns, in white people's scalps. Let us examine what happens between conditionality and subsets.

Probability Statement 4.1.2.1. P(Bl | C) = P(Bl ∩ C) / P(C) = P(Bl) / P(C)

> P(Bl | U) = P(Bl ∩ U) / P(U) = P(Bl) / 1 = P(Bl).

Notice that, since P(C) < 1, dividing P(Bl) with it amplifies P(Bl). In pure English, the probability that a random white person is a blonde is bigger than a random American is a blonde. Since blondeness is a white people's trait, you will see more blondes in a white-only club than in a multiethnic club. Next,

Probability Statement 4.1.2.1. P(C | Bl) = P(C ∩ Bl) / P(Bl) = P(Bl) / P(Bl) = 1.

This is a trivial but an interesting point. In a blonde-only club, you will see only whites, as only whites are blonde[25].

Let us make another example, a more non-racist one. What is the probability that a random person is a man and he is a bearded man?

*Probability Value 4.1.2. P(BrM) = P(Br) * P(M | Br) = P(Br) * P(MBr) / P(Br) = P(Mbr) = P(Br).*

*Probability Value 4.1.2.1. P(MBr) = P(M) * P(Br | M) = P(M) * P(BrM) / P(M) = P(BrM) = P(Br).*

The absorption law comes in handy when we consider that only men have beards[26]. A caveat here is that we should caution not to 'double count' the probability.

*Probability Statement 4.1.2. P(BrM) = P(Br) * P(M | Br) = P(Br) * 1*

*> P(Br) * P(M |U) = P(Br) * 0.5*

Recall that P(M) is just a shorthand for P(M|U), as P(M|U) = P(MU)/P(U) = P(M)/1 = P(M). In the probability statement above, note what a double counting does. In the second line, the two traits of beardedness and a manhood are treated as if the two traits have no correlation. There is a definite correlation, as a man is more likely to have beards than a male-female population as a whole. So what is

[24] Hereafter, iff denotes 'if and only if.'
[25] For simplicity, we will not consider albino or hair dyes in this example. The purpose of the example is to demonstrate mathematics, not to advocate for civil rights.
[26] Again, we exclude from discussions ladies with fake or unshaven beards.

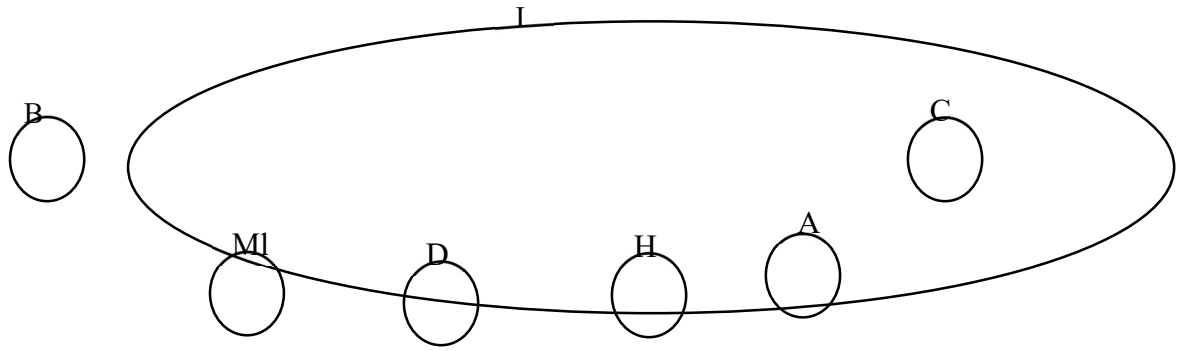
correlation exactly? Let need to take another step back, go back to the drawing board, and start from the definition[27].

4.1.3. Correlation

Like anything else, there is absolutivity and relativity in correlation. Hereafter, we will refer to absolute correlation as correlation, and relative correlation as correlativity.

4.1.3.1. Absolute Correlation Quotient

Please allow the author copy & paste a previous Venn diagram for the reader's convenience.



A correlation is a characteristic of a relation between two sets. And a correlation has both a quantity and a direction, like a vector in mathematical parlance. Conceptually, the absolute correlation from the set A to the set B is A's preference, or tendency toward B. In the picture above, the members of C, A, and H tend to be ivory-skinned. D is neutral. B and Ml tend not to have ivory skins. Can we quantify the degree of tendency? Yes, we can:

*Definition 4.1.3.1. Absolute Correlation Quotient[28] of A to I = C(A, I) = { n(AI) / n(A) } / 0.5 = 2 * P(I|A).*

Definition 4.1.3.1.1. The absolute correlation is: positive iff C(A, I) > 1;

zero iff C(A, I) = 1; and

negative iff C(A, I) < 1.

It gets easier with English. Simply put, we set a reference point, a standard, an even ground zero. One half of D, i.e., the set of South Asian Americans, has ivory skins and the other half non-ivory skins. So there is perfectly no correlation here. African Americans has the lowest possible quotient value, that is, 0, but notice that this zero still means a negative absolute correlation[29]. Caucasian Americans has the highest quotient value of 2. Every other race's quotient falls between 0 and 2. If the quotient falls

---

[27] The journey is full of obstacles, it seems. Then again, there is no adventure without setbacks and no thrill without peril.

[28] Hereafter, we will refer to absolute correlation quotient, as 'quotient, or 'correlation quotient,' all interchangeably.

[29] Confused yet?

between 1 and 2, the absolute correlation is positive. If it is between 0 and 1, the absolute correlativity between the race and ivory-skin-ness is negative. Easy does it.

4.1.3.2. Relative Correlativity Coefficient

The relative correlation, or simply correlativity, is the protagonist at the central stage in this essay. Let us jump right to it.

Definition 4.1.3.2. Relative Correlation Coefficient[30] of A to I = C(A, I) = P(I | A) / P(I | U) = P(I|A)/P(I).

Definition 4.1.3.2.1. A relative correlation[31] is: positive iff C(A, I) > 1;

zero iff C(A, I) = 1; and

negative iff C(A, I) < 1.

The value of a coefficient is similar to quotient, except that a coefficient's value has no upper bound. Let us travel to the continent of Africa. Temporarily for now, the universe of discourse is Africa, where there are very few Asians and most of the population is either Arabs or Africans. As before, let's assume that P(I|A) is about 90%[32]. Assuming there are very few light-skinned races in Africa, P(I) = P(I|U) = 0.001%. Then, C(A,I) = 90/0.001 = 90,000. You got the idea.

4.1.3.3. Directionality of Correlation

Does the fact that most Asians own yellow cars means that most yellow-car owners are Asians? Does the fact that Asians is more likely to own yellow cars than all races as a whole, mean that yellow-car owners is likely to be Asians rather than all races as a whole[33]? In addition, is there some identifiable, provable relationship between absolute correlation and relative correlation?

[30] Hereafter, we will refer to relative correlation coefficient, as 'coefficient, or 'correlativity coefficient,' all interchangeably.

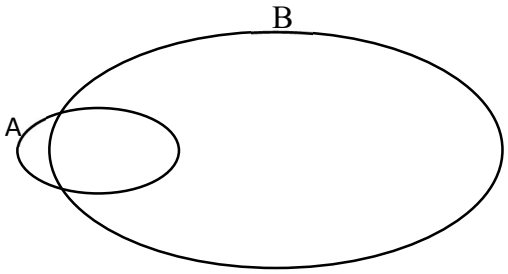
[31] Again, in this paper, 'correlativity' refers to this relative correlation. We will interchangeably use 'correlativity,' 'relative correlation,' and 'relative correlativity' to mean the same thing.

[32] For simplicity of mathematical illustration, we assume that Asians don't get tanned. This is not a biological discourse.

[33] Obfuscated yet? The first question pertains to the absolute correlation and the second the relative correlation. LOL!

4.1.3.3.1. Absolute Correlation[34]

This is an easy one:



By now, we all got weary of racist examples, so let us be abstract this time. Also, the Venn diagram above is drawn to scale. Here, most of A belongs to B, but most of B does not belong to A. Thus, the positive correlation from A to B does not necessarily mean a positive correlation from B to A. Mathematically speaking,

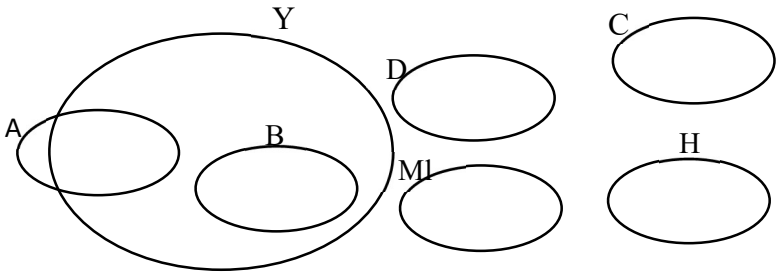
Mathematical Statement 4.1.3.3.1. Q(A, B) ≠ Q(B,A).

Or more precisely,

Mathematical Statement 4.1.3.3.1.1. Q(A, B) > 1 ≠> Q(B,A) > 1.

That is, the fact that most of A is B does not necessarily mean most of B is also A. In our car example, the fact that most Asians own yellow cars does not mean, imply, or entail that most yellow-car owners are Asians, as Asians in America constitute a minority group and there are tons of other ethnic groups who own yellow cars.

Now let us examine the relationship between absolute correlation and relative correlativity. Does the fact that most Asians own yellow cars mean that Asians are more likely than others to own yellow cars? No, is the answer.



[34] Yet again as a reminder, hereafter we will not use the terms correlation and correlativity interchangeably, as the former is absolute and the latter is relative.

It is conceivable that in some alternate parallel universe, all races have an equal number members, and most people own yellow cars. The only ones who does own yellow cars are most Asian Americans and all African Americans. In this universe[35],

Probability Statements 4.1.3.3.1. P(Y|A) = 90%;

$$P(Y|U) = P(Y) = (90 + 100)/600 = 190/600 \approx 32\%.$$

Hence, P(Y|A) < P(Y|U).

Therefore, Q(A, Y) > 1 ≠> C(A, Y) > 1.

The above statement, in math lingo, is what's known as 'disproof by counterexample.' We just disproved a proposition that a positive correlation implies a positive correlativity. In other words, we proved by an example a proposition that a positive correlation does not imply a positive correlativity.

4.1.3.3.2. Relative Correlativity

The question is, "if Asian Americans are more likely to own yellow cars than all Americans as a whole, does that mean that yellow car owners are more likely to be Asians than other races?" Counterintuitively, the answer is a Yes.

Proposition 4.1.3.3.2. C(A, Y) > 1 => C(Y, A) > 1.

Proof 4.1.3.3.2. Assume that C(A, Y) > 1.

*Then, C(A, Y) = **P(Y|A)** / P(Y) > 1.*

*By Bayes' Theorem[36], **P(Y|A)** = P(A|Y) * P(Y)/P(A).*

*By substitution, C(A, Y) = { P(A|Y) * P(Y)/P(A) } / P(Y)*

*= { P(A|Y) * P(Y)/P(Y) } / P(A)*

*= **P(A|Y) / P(A)** > 1.*

*Now, by definition, C(Y, A) = **P(A|Y) / P(A)**.*

Hence, C(Y, A) > 1.

---

[35] We started at a non-racial, abstract world but ended up in a racial world. Why? It is because we are living in a racial world and ethnic examples are thus convenient tool for illustration. This is why racial oversensitivity is a harmful advocacy that begets inconvenience and deters the advancement of knowledge and education. Racial remarks are and should be acceptable as long as the intention of the utterer is not an intentional racial insult, which, of course, is one of the meanest insults that a minority person can get in America. Even racial jokes are and should be acceptable if the circumstance surrounding the joke is an amicable one, even between two strangers who just met in a bar. For instance, the author would not be offended if someone at a bar calls him, 'hey you Geek Chink Gook,' even though he is not of Chinese descent, as long as the utterer of the expression intended to make fun with him, not at him. But the author was offended when a Caucasian auto mechanic etched the word 'chineeze' on his car key unbeknownst to him, when an African American man hollered at him 'small dick!', and when a Hispanic man said to him, 'you are not American,' which, all three events, actually happened in the author's past.

[36] Here is a simple proof of Bayes' Theorem: P(AB)=P(A)P(B|A)=P(BA)=P(B)P(A|B). Thus, P(A|B)=P(B|A)P(A)/P(B).

Therefore, C(A, Y) > 1 => C(Y, A) > 1.

Q.E.D.

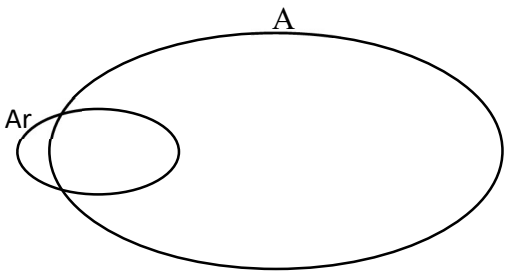
The arrow can go either way in the proposition above, as the other direction can be proven by replacing Y with A in the proof above. In sum, relative correlativity, unlike absolute correlation, is a bi-directional characteristic.

Let us try to understand why this is the case, pictorially. But in our dear everyday English first. Go to an Asian cuisine restaurant. In the set of Asian restaurants, Asians are overrepresented in the Asian cuisine patronage. Even though only roughly 5% of Americans are Asians, 95% of patrons in Asian restaurants are Asians. A positive correlativity is a heavy statement with a weighty implication. The fact that Asian Americans ("Amerisians") s are more likely than all Americans to dine at Asian restaurants Does mean that a random patron in an Asian restaurant is more likely to be an Asian than other races.

Probability Statement 4.1.3.3.2. C(A, Ar) > 1 <=> C(Ar, A) > 1.

That is, if Asians prefer Asian cuisine compared to other races, then Asian cuisine patrons tend to be Asians than other races, and vice versa.

It is high time to draw a picture.



Let us imagine an America where most Asians prefer burgers and fries. In this universe, Asian cuisine is quite unpopular, but still, Asians are still more likely than other races to go to Asian restaurants. In a mathematical tongue,

Probability Statement 4.1.3.3.2. C(A, Ar) > 1.

By definition, P(Ar|A) / P(Ar) > 1.

Then, P(Ar|A) > P(Ar) = P(Ar|U).

So, P(Ar|A) > P(Ar|U).

Let's make the discourse more concrete by the numbers. About 10% of Asians go to Asian restaurants. About 1% of Hispanics go there. No other races do. And every race has an equal number of ethnic members. In such a universe parallel to our own, most patrons in Asian restaurants are Asians, even though only a few Asians do eat in Asian restaurants. In another tongue,

Mathematical Statement 4.1.3.3.2. C(A, Ar) > 1 ≠> Q(A, Ar) > 1.

Back in English palate, the fact that Asians are more likely than others to go to Asian restaurants does not mean that Asians prefer Asian cuisine, or that most Asians go to Asian restaurants. It is because it may be the case that Asian restaurants run their business by serving a 'niche market' of an Asian subgroup, a minority within a minority, that is to say, a group of a few good Asians who are loyal to their Asian tradition and heritage[37].

4.2.3.3.3. A Side: The Connectivity between Time and Space

Near the beginning of this essay, we discussed temporal succession of events and dependency thereof. When we discussed spatial dependency, we introduced the concept of correlation between two spatial traits in lieu of dependency between two temporal events. What a shame it would be if we talk about relativity but omits the relationship between time and space[38]?

You have a dice. You toss it in the air, the dice lands on the table, and it shows 3. You toss it the second time, and it lands with 4 on top. At this moment, we can conceive a hypothetical parallel universe where the first trial landed with 2, instead of 3. This way, now we have five alternative parallel universes where the first toss ended up with 1, 2, 4, 5, and 6, respectively. Unless we have a time machine, however, only one universe exists with us in reality, the one where the dice showed 3. But the five parallel universes do exist in our wild imaginations.

Now it is incumbent upon us how the dependence of temporal events is equivalent to the correlation of spatial traits. A universe is primarily a spatial concept. By spreading out six hypothetical universes representing the six possibilities of the first toss of dice, we can reduce the temporality into spatiality.

Let us get down to the earth for a moment and keep it tangible. What is the probability that your dice lands at 3, then lands at 4 next?

Probability Value 4.2.3.3.3. $P(x1=3 \text{ and } x2=4) = P(x1=3) * P(x2=4 \mid x1=3)$

$= P(x1=3) * P(x2=4 \mid U3)$

$= P(x1=3) * P(x2=4 \mid U)$

$= P(x1=3) * P(x2=4)$

$= 1/6 * 1/6 = 1/36.$

What the reader is witnessing here is the application of a sci-fi concept of parallel universe, back into a science itself[39]. Let us make a Cartesian query into this[40]. How come U3 = U? It is because in our

[37] Of course, this statement is not a political one, but just to add some humor and humanity to the dry, robotic discussion of numbers and equations.

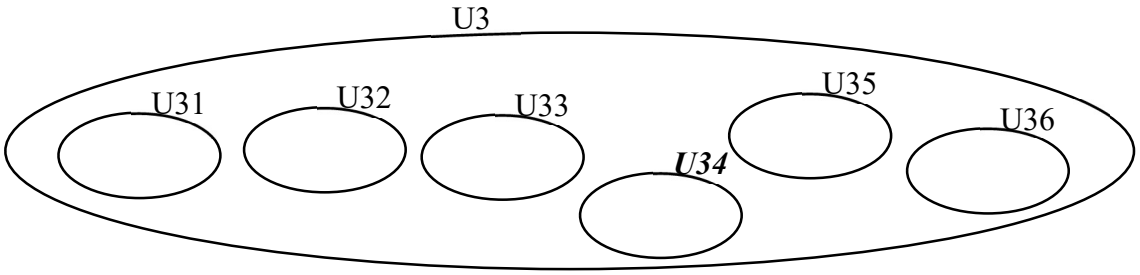
[38] The following discussion is inspired by the timeless American classic, *Twilight Zone.* As the director Robert Zemeckis acknowledge in his audio commentary for *Back to the Future*, most of Hollywood flicks and TV shows got the ideas from the storylines in *Twilight Zone*, but a few expressly acknowledge it. *Twilight Zone* itself is a collection of short stories written by various authors, but the show never omitted to acknowledge the authors of those fascinating imaginations.

[39] Life imitates art, art imitates life. So does science and fiction. What a wonderful cross pollination.

[40] French Philosopher Rene Descartes is famous for doubting the undoubtable, questioning the unquestionable. This is the attitude every scholar should have.

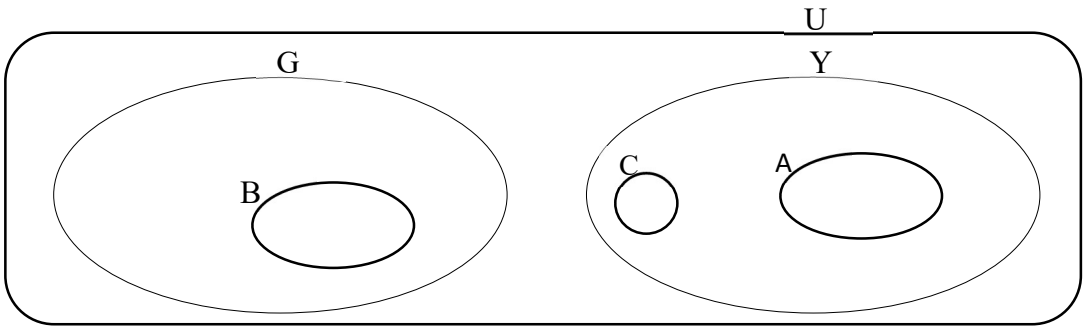
imagination, or in our assumptive universe, the first dice 'did' landed on 3. Of course, neither the author nor the reader has a dice at hand. We are experimenting with our brains here. In that imaginary universe that we call U3 where the first toss ended up in 3, we are continuing the journey by tossing the dice the second time, and it landed at 4. In this moment, which is a brief extension of U3, we are precluding the possibilities of all the other five alternate universes from materializing themselves into reality in our world of imagination that we call, U. That is, by the time we imaginarily toss the dice the second time, the state that the first toss landed at 3 has become a 'certainty,' a 'fact,' although none of these things actually happened except among the neurons of the reader's and the author's brains, in the fifth dimension of the *Twilight Zone*.

Let us be more graphic this time.



Believe or not, the six possibilities, the six sub-universes are the subsets of U3. It is no surprise that an evolution is happening in our brains, now that our imagination can contain multiple universes. By the moment the second toss lands on our neurons, only the sub-universe of U34 gets selected and survives to the 'reality,' or further consideration for the next progeny of tossed, rolled, and stopped dice generation.

Now, let us get back to the easy scenario- the Asians and yellow cars. In this scenario, there are only Blacks and Asians and Caucasians in the Universe, and there are only Yellow cars and Green cars. All Asians and Caucasians own yellow cars and all Blacks own green cars. Note that Y is less than U, because of the existence of B. In English, because of the existence of Blacks who own non-yellow cars, the yellow-car manufacturer can't say he is the monopolizing the Universe.



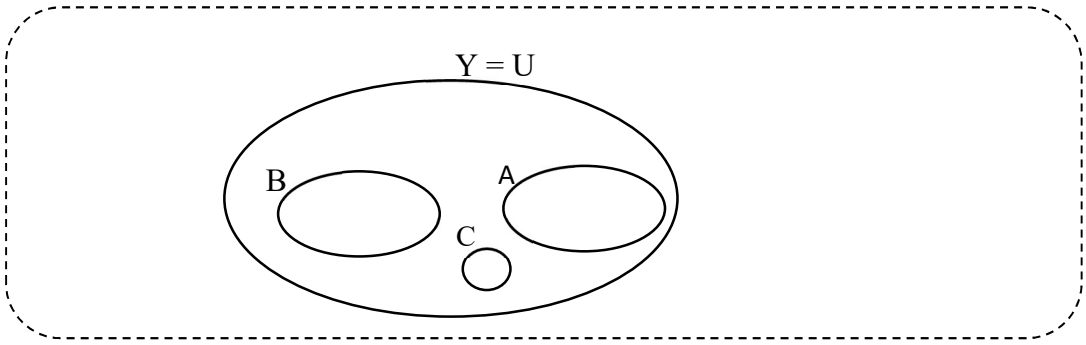
Probability Value 4.2.3.3.3. P(A|Y) = P(AY)/P(Y) = P(A)/P(Y).

*Probability Value 4.2.3.3.3.1. P(AY) = P(A)*P(Y|A) = P(A)*

*> P(A)*P(Y|U) =P(A) * P(Y).*

Recall that P(Y|A) denotes the percentage of the yellow-car owners in the universe of Asians, and P(Y|U) the percentage of yellow-car owners in the universe of Universe[41]. That is, P(Y|A) is the probability that an Asian owns a yellow car, or Asians' tendency to own such cars. And P(A|U) is the probability that a random person is an Asian. Here, we cannot say that Asians have an equal tendency to own a yellow car as anyone in the Universe, because Blacks are a substantial portion of the population in the Universe, and none of Blacks own a yellow car.

Now, today in this Universe, let's assume that all Blacks purchase yellow cars and ditch green cars. All green cars are sold to scrap metal shop and get disassembled, and recycled. After that, the U collapses and merges into Y:



Now we can say that Asians tend to own yellow cars as equally as other races, because everyone in the Universe owns a yellow car.

4.2.3.3.3.1. The Ontology of Time and Space

Why don't we take a break and take a drive to the fascinating intersection between philosophy and physics? Let's do this.

Time is not a separate concept from space, but is a subset of space. To be more precise, time is the fourth axis of space[42]. To illustrate this, let's assume that our physical, material universe is in the

[41] Of course 'universe' here means the universe of discourse for a given conditional probability, and 'Universe' means the superset of all sets in this scenario.

[42] This idea is similar to and inspired by the famed physicist Einstein's special theory of relativity, but not quite the same. Philosophy tends to lag behind science, as it takes time for philosophers to learn the new development of math, physics, etc. Behold, the time is now. In the past, the theory of relativity has been misunderstood and misapplied in philosophy. A prominent gaffe is the concept of moral relativity, a branch of modern ethics that says morality is a product of a society, and thus, relative, not absolute. The author disagrees. The fundamental premise behind Dr. Einstein's special relativity is the axiom that the speed of light is a universal constant that is independent of moving observers with all different relative speeds. Light is a traditional metaphor for truth in Judeo-Christianity. If we equalize light and moral truth, then the morality is an absolute invariant across space, time, and cultures. For instance, no society legalizes murder or theft, as such activities are harmful both biologically and socially. The same holds true for gayism, i.e., the activity that people call homosexuality nowadays. No society on earth has ever legalized gay marriage except for the contemporary Western countries. In every era, new ideas appear and disappear. Very few new ideas survive to see the light in the next generation

form of a gigantic globe filled with masses and vacuum in between[43]. Let's say, God, has a 3-D holographic picture machine, i.e., a super camera, which can take a 3D holographic picture of the entire universe. God can take the pictures once per second, and then align those 3D holographic images on a single line. And if God takes the pictures not every second but every milli-second, nano-second, or the smallest zzz-second that a human can perceive, He merely increased the number of pictures. All those so many pictures can still be aligned on a long, but single line. This line, the fourth axis of four-dimensional space is what we call, time. Don't let the language and convention or convenience fool you: time is just like x-axis, y-axis, or z-axis. It is just the fourth dimensional axis where we align the 3D space

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and on. The idea of gay marriage, in the author's prediction based on his belief and knowledge of Bible, human history and science, will be forever remembered as a failed attempt, a doomed social experiment on human lives.

[43] This notion is inspired by *War of the World* directed by Steven Spielberg, many of whose seemingly ingenious ideas are from the original *Twilight Zone* TV series. As Ecclesiastes of Bible says, there is nothing new under the sun. A corollary is, there is no such a thing as a self-made man. A self-made man, if he claims so, is a liar and ingrate who omits the mention of contributions from everyone else when he is alone on the center stage under the spotlight. Then what is the phenomenon that we call, a 'genius?' A genius is nothing but a man who is brave enough to defy the idea of the mass majority of a given era, a society, and who also is capable of using his learned knowledge and creative intellect to construct a new schema of knowledge that defeats the prevailing but imperfect ideas of his day. In this sense, yes, Dr. Albert Einstein was a genius. And so was Georg Cantor, who came up with the set theory, which now we take for granted, but also which prominent mathematicians of his era, including Wittgenstein and Kronecker among others, vehemently vilified and jeered at. The periodic table now in every chemistry classroom around the world was just one man's idea. This man, Mendeleyev, was also unaccepted and no serious scientists in his days took him seriously. Gregor Mendel's contribution on genetics also had to wait a generation to be correctly appreciated. It's all too common and this phenomenon, i.e., the persecution of 'prophets,' has long been known since the dawn of A.D.: "Blessed are you when people insult you and persecute you, and falsely say all kinds of evil against you because of Me. Rejoice and be glad, for your reward in heaven is great; for in the same way they persecuted the prophets who were before you." Matthew 5:12-13. Back to the context of cinema, all the Hollywooders in this age uses to attract audience is to use sex, violence, computer graphics, and nowadays, gayism, as it is the fat, 'fag,' fad and idolatry of today's West. What they should learn from *Twilight Zone* is the power of imagination. *Twilight Zone* fascinates the audience with nothing but a bizarre, unearthly storylines. There is no blood, no nudity, no fancy special effects, no foul languages, and no gays, lesbies, or trannies. Just a pure cerebral power of imagination is all a movie or TV show needs, and what entertains people. Here is a social commentary inspired by an episode of *Twilight Zone.* Why does a Western man wear a tie? Does it symbolize aplomb that he will do things not of necessity but of honor, a tie having no practical and mundane purposes? Or does it represent an uprightness similar to a tie that hangs perpendicular to the ground level? Or is it an epitome of the fate of the man whose neck is on the line if he fails to conform to society, given how easy it is to kill a necktied man by grabbing, yanking, dragging, and hanging the man by tie with one hand, like numberless number of Westerners in Amerias, Europe, and Australia get fired over the expression of their antigayist stance based on their political belief, religious faith, and moral conviction? The contemporary generation of the West is a shameful generation: the only new thing, the only innovation, the only achievement that they came up with is the new institution of legalized gay marriage. That is, this Western generation is perverse at its best. Gay pride? According to Bible, pride comes before a fall. Proverbs 16:18. What becomes of the West, where progayists pops Champaign bottles over fired antigayists all over the 'civilaized and enlightened' West? Is this queer conquest any different from Hitler's map-coloring of the 1940's Europe? Didn't the Nazists' re-drawn European borderlines all went right back to where they were after the demise of Hitler? Behold, those who learn not from history shall repeat it. Every progayist advocacy that is rampant in the West shall collapse to nil, as the castle is built on the sand pile of lies. Then, why does gayism exist and how come progayism dominates the West in this era, from a teleological point of view? It a test, a sieve to cull out half-smarts from real smarts. Judges, CEOs, politicians, academics, once acclaimed to be the apexes of their towns, once knelt down before the foreign idol of gay god, will forever be remembered as the absurd, the silly, turncoats, and go down in the history in shame, disgrace, infamy, and ignominy. Wars make heroes. Stars shine not without darkness.

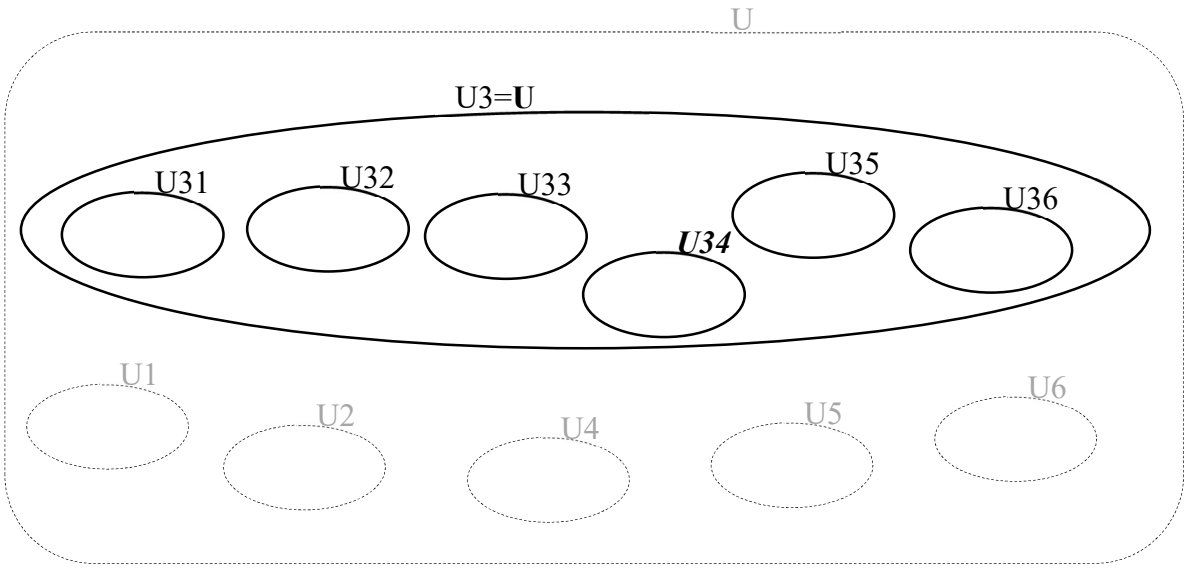
upon. What is x-axis? It is an infinite alignment of dots, i.e., the zero-dimension of space. What is 2-dimension? It is an infinite alignment of x-axis along the y-axis. The 3-dimension is nothing but an alignment of x-y plane along one line that we named as the z-axis. Just like that, and nothing more, we are aligning the 3D cube miniatures where everything in it is frozen still, along yet another line, say, t-axis. This way, the collection of the 3D pictures becomes a motion picture where everything in it gives us an illusion of moving, frame by frame.

Why do we stop here? If the 3D world plus time is 4D, what is the world of the 5th dimension? It is the world of possible parallel universes, one of which being our own. It is the world of wild imagination, or the *Twilight Zone*[44]. We already established that our world is an alignment of 3D holographic images of the world along the axis that we call time. If we add the lines of the aligned 3D images of the world on top of another, that is the 5th dimension 'plane.' What this 5D plane is, is the collection of novels, movies, poems, and stories, as they all alternate realities, the plausible storylines that could have been, or might as well be one day, a real history.

Finally, it should be noted that even though time can be thought of a subset of spatial axes, time does differ from the rest of x, y, and z spatial axes. First, time axis is uni-directional. We can move an object back and forth along the x axis, but we can't do so with the time axis barring a time machine. Second, time axis has its own engine that moves the universe in a constant speed, ignoring the small variation caused by moving inertial frame in the spirit of Einstein's special relativity. Third, the displacement of an object along the time axis is irreversible, again, without the fictional notion of a time machine. All in all, the commonsensical instinct that time is different from space is a correct notion.

4.2.3.3.3.2. Space-time equivalence

Let's get back to the table with a dice on it.



[44] Whether the writers have realized or not, their idea that the 5th dimension is indeed mathematically equivalent to the world of imaginations!

What happened to the parallel universes where the first roll of the dice could have been 1, 2, 4, 5, or 6? They got annihilated in our imagination! And if we actually roll a dice, and it lands on 3, the five alternate universes of possibilities also disappear into the thin air, as we cannot go back in time and recast the dice. What happened cannot be reversed, even in our brain experiment of dice rolling. Before the first roll of the dice, the universe (the dotted outermost boundary with the greyed 'U') used to accommodate the entire possibilities that the first dice might be 1 (greyed and dotted U1 in the picture), 2, 4, 5, or 6. But as soon as the firstly tossed dice stopped rolling, that universe contracted and merged into U3, precluding the five possibilities. This is the thoroughly detailed explanation behind 'why we say that two separate rolls of a dice are independent.'

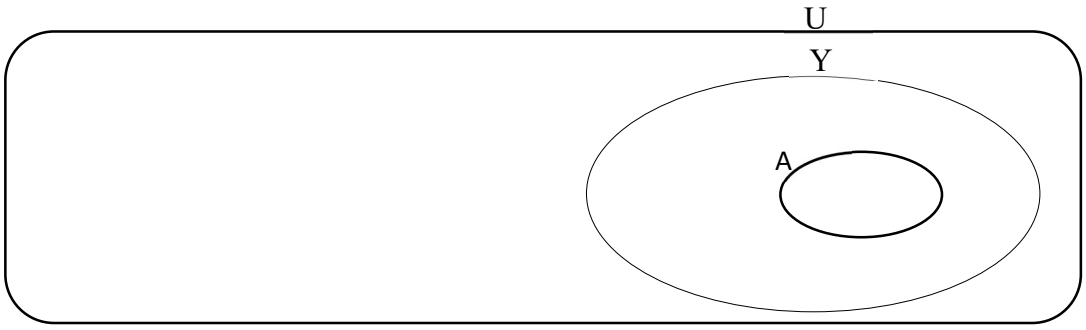
This temporal events and dependency thereof are analogous to the correlation between spatial traits, as exemplified with car ownership example aforementioned. It is all because two separate temporal events is nothing but two spatial event along the 4th spatial axis that we especially named as 'time.'

5. The Universes in Action

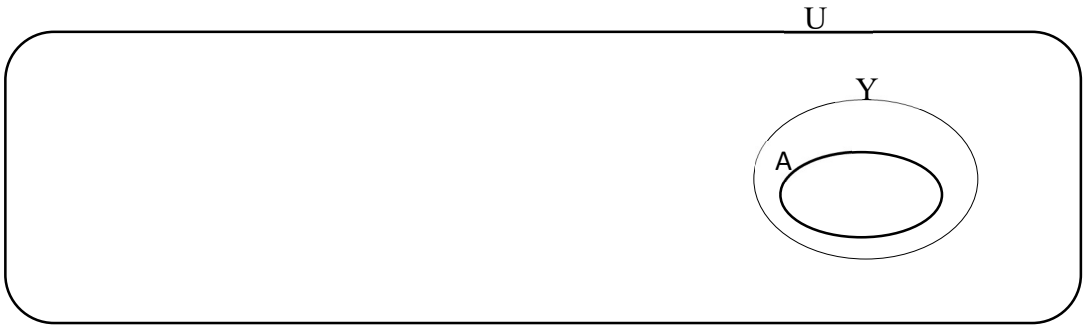
It is obvious both the reader and the author got weary of long labeling of subsections. So let us leave everything behind and make a brand new start.

5.1. Subsets and Correlativity

Let's imagine an America where and when the very first group of Asians migrated to it. These only and the first Asians in America started out with an unusual sense of cohesion and cultural identity, and collectively decided buy only yellow cars, yellow being the symbol of their race.



Other races feel odd toward this brand new race in America. Reminding them of the Jews in Europe in 1800's, these Amerisians (i.e., Asian Americans) keep things to themselves, refuse to integrate into American mainstream, and they all drive yellow cars. So all other races begin to distance themselves from Asians as well, and one by one, they sell off their yellow cars, if they have one, and purchase non-yellow cars. As a result, the market share of yellow cars shrinks.



What happens to correlativity?

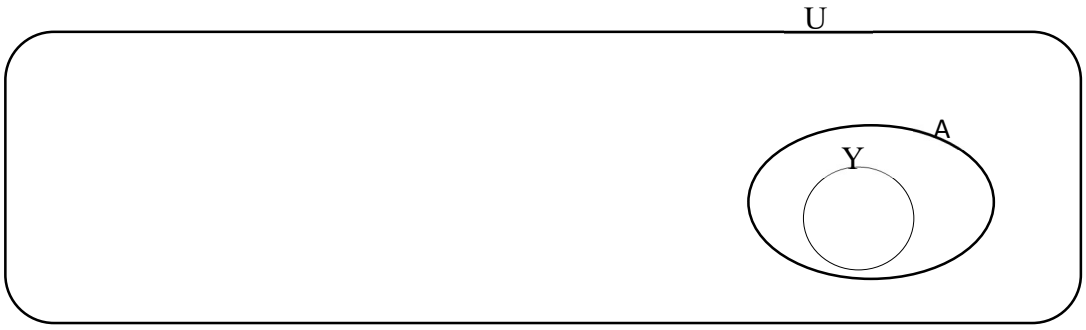
Correlativity 5.1. C(A, Y) = P(Y|A) / P(Y|U) = { P(YA) / P(A) } / P(Y) = { P(A)[45]/P(A) } / P(Y) = 1/P(Y) > 1.

That is, A's prevalence[46] in Y compared to U's prevalence in Y is just the inverse of the percentage market share of yellow cars. Observe that as the market share of yellow cars shrinks and Asians still stick with only yellow cars, the correlativity from A to Y increases. That is, Asians become more and more likely to own yellow cars compared to other races. In other words, in the past, all Asians and all Hispanics owned yellow cars. But as Hispanics panics at Asian-ness like other races does, they gradually moved out of yellow car market, in order not to look like Asians in the eyes of general American public. Of course, 100% of Asians has always owned yellow cars. But Asians used to be equally likely to buy yellow cars as Hispanics when 100% of Hispanics used to own yellow cars. Now that Hispanics switch to non-yellow cars, only 1% of Hispanics own yellow cars. Here, Asians are more likely than Hispanics to own yellow cars, because 100% > 1%. In addition, the C*orrelativity 5.1* holds true as long as Y is a superset of A, and even when Y becomes equal to A.

Time changes. After three decades or so, a new generation of Asians emerges. This America-Born-Asians ("ABA") are now defying their 1st generation Amerisian parents, all of whom are immigrants from Asia. More and more ABA's want to define themselves by rebelling against their parents, by proving themselves different from them. Also ABA's aim to identify themselves as Americans rather than as Asians. So none of ABA's purchase a yellow car:

[45] We used the absorption rule, as A is a subset of Y, and thus the intersection thereof is A.

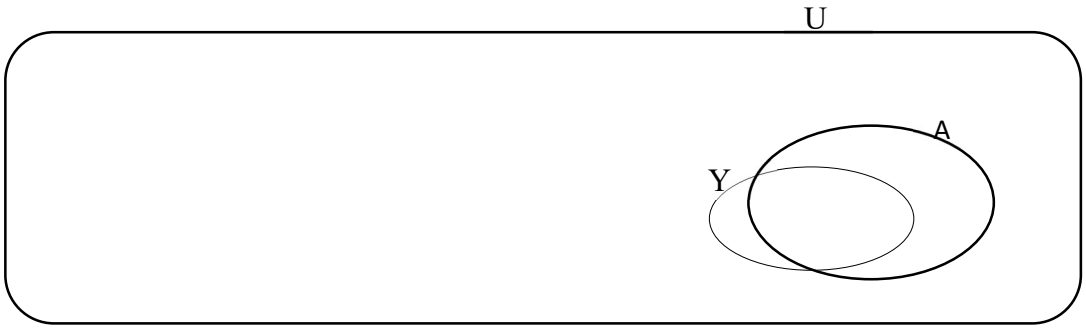
[46] That is, C(A, Y) denotes the degree of how much Asians like yellow cars, compared to how much any Americans like yellow cars. That is, C(A, Y) = P(Y|A)/P(Y|U) > 1 when in the world of Asians, the yellow cars' market share is overrepresented compared to the yellow cars market share in America. On the other hand, C(Y, A) = P(A|Y)/P(A|U) denotes the degree that Asians prefer yellow cars compared to the degree that Asians like any color of cars. If 30% of Americans are Asians, but in yellow car market Asians are 40% of their buyers, then we can say that Asians prefer yellow cars. But as it turns out, the Asians' prevalence in the yellow car market and Asians' preference on yellow cars are equivalent, as C(A, Y) = C(Y, A). Please *see Equality 5.2.*



Notice that by this time, only Asians own yellow cars, as anti-Asian sentiment has so perfected itself in America that every non-Asian race moved out of yellow car market. Plus, even none of the 2nd generation Amerisians buy a yellow car. So the only yellow car owners are the 1st generation Amerisians. Then, the correlativity looks like this:

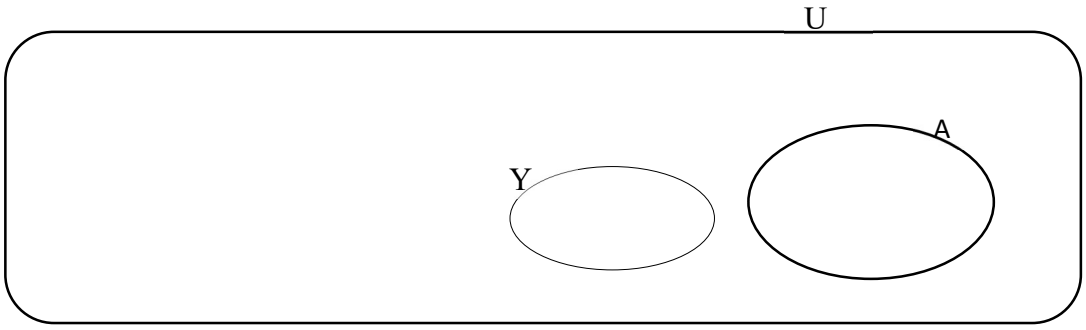
Correlativity 5.1. C(A, Y) = P(Y|A) / P(Y|U) = { P(YA) / P(A) } / P(Y) = { P(Y) /P(A) } / P(Y) = 1/P(A) > 1.

Americans are watching Amerisians. They are looking at ABA's being more like any other Americans and realize that Asians ain't too bad. And also Americans looked at the Asian traditions that have been retained and preserved by the 1st generation Amerisians. They are fascinated by the unique, authentic, and original Asian culture that is so different from their own. What happens next is the expansion of the yellow car market, as non-Asian race comes to like, or not hate, Asian-ness:



That is, non-Asian races are now starting to buy yellow cars. As we can see, Y is gradually moving out of A. In this transitionary state, C(A, Y) is: larger than 1 if Asians are still more likely to own yellow cars then all Americans; equal to 1 if Asians are equally likely to own them as any American; and less than 1 if they are less likely.

What happens next is a happy ending. By now, Asian culture is very much prized, appreciated, and cherished by Americans in general. The 1st generation Amerisians now no longer feel the need to preserve their Asian traditions themselves, as other Americans are now building museums and libraries dedicated to Asian Studies. So the 1st generation Amerisians now decide to acculturate to American mainstream culture, and sell off all of their yellow cars:



Now none of Asians own a yellow car. Then the correlativity becomes definitely negative, as its coefficient becomes 0, which is less than 1:

Correlativity 5.2. C(A, Y) = P(Y|A) / P(Y|U) = { P(YA) / P(A) } / P(Y) = { 0 /P(A) } / P(Y) = 0 < 1.

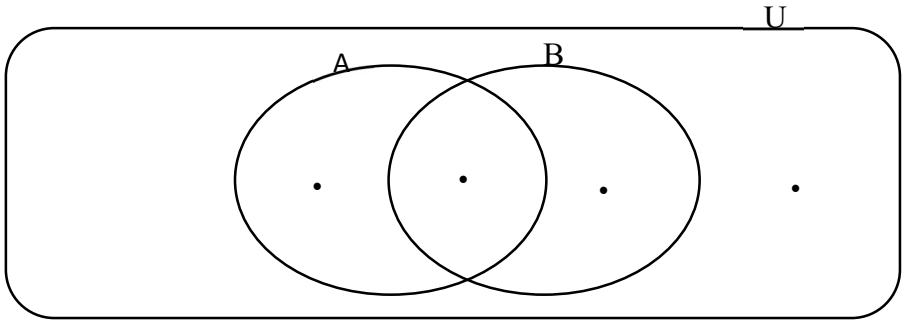
That is, if no Asian buys a yellow car, and if there is at least one Hispanic who buys a yellow car, then Asians are now less likely to buy yellow cars than Hispanics, and therefore than Americans as a whole.

5.2. Non-inclusion and Correlativity

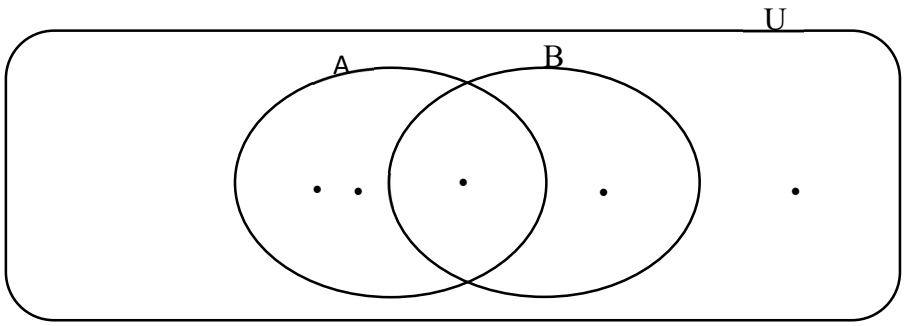
We covered enough politics and economics, so let us return to the pure pristine world of mathematics. We already learned about the directionality of absolute correlation in *Inequality 4.1.3.3.1.*, that is, Q(A, B) ≠ Q(B,A). Surprisingly, relative correlativity is not directional. That is, correlativity is a commutative operation.

Equality 5.2. C(A, B) = C(B,A).

We will prove the above by a simple deduction. Here is the most familiar Venn Diagram that the reader probably has seen before somewhere else:



A dot represents an element that belongs to the set that is defined by the boundary around the dot. In the diagram above, the elements are perfectly in even distribution. Let us skew the distribution by throwing another dot in.



Here,

Correlativity 5.2. $C(A, B) = P(B|A)/P(B|U) = \{ P(BA)/P(A) \} / P(B)$

$= \{ (1/5) / (3/5) \} / (2/5)$

$= (1/3) / (2/5) = 5/6.$

Correlativity 5.2.1. $C(B, A) = P(A|B)/P(A|U) = \{ P(AB)/P(B) \} / P(A)$

$= \{ (1/5) / (2/5) \} / (3/5).$

$= (1/2) / (3/5) = 5/6.$

Now, the proof:

Proof 5.2. $C(A,B) = P(B|A)/P(B|U) = \{ P(BA)/P(A) \} / P(B) = \{ P(AB)/P(B) \} / P(A) = C(B, A).$ *Q.E.D.*

So we now know that the degree that Asians prefer yellow cars is the same as the degree that yellow-car owners tend to be Asians.

Now what we want to know is when the correlativity between two traits is positive.

Mathematical Statement 5.2. $C(A,B) > 1.$

$\Leftrightarrow P(B|A)/P(B|U) > 1.$

$\Leftrightarrow \{ P(BA)/P(A) \} / P(B) > 1.$

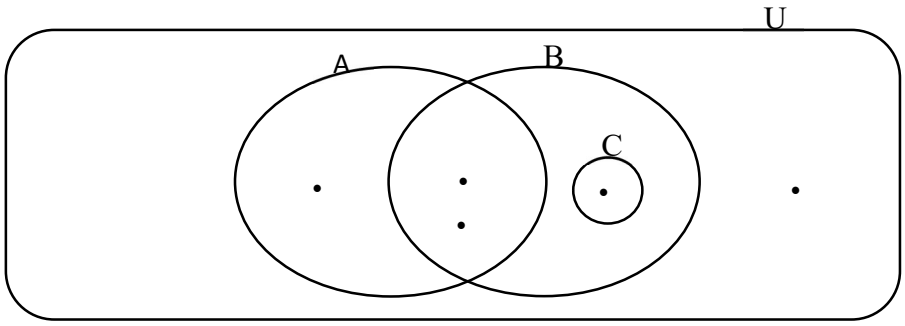
$\Leftrightarrow P(AB) > P(A)P(B).$

Let us recall the original Collins trial. By the probability table about witnessed traits, the prosecutor wanted to demonstrate how rare those combinations of trait are, and the how probable it is that the suspect matching all the witness traits. Let us assume that if the relative correlation between A and B are positive as in the mathematical statement above. By using P(A)P(B) (i.e., smaller number) instead of P(AB) (i.e., bigger number), the prosecutor is exaggerating the scarcity of the combined traits, and thus overestimating the probability that the suspect is the culprit. Of course, if there is a negative correlativity between A and B, the prosecutor is downplaying the scarcity, and thus underestimating the probability of the suspect being guilty. Then, what we need to know is the distribution of correlativity between random traits. That is, is positive correlativity more, equally, or less common than negative correlativity, given two randomly selected traits?

5.3. Correlativity Distribution

5.3.1. Intransitivity of Correlativity

We all know that if a < b, and b < c, then a < c. This is known as the law of transitivity. Is correlativity transitive? As the section's title suggests, the answer is no. Let us prove by counterexample.



Proposition 5.3.1. C(A, B) > 1 and C(B, C) > 1 ≠> C(A, C) > 1.

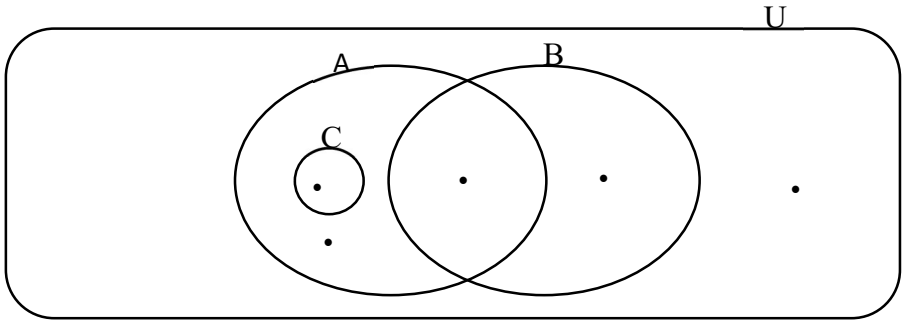
Proof 5.3.1. In the example above, C(A, B) = P(B|A)/P(B) = (2/3)[47]*/(3/5) = 10/9 > 1.*

Also C(B, C) = P(C|B)/P(C) = (1/3) / (1/5) = 5/3 > 1.

But C(A, C) = P(C|A)/P(C) = 0/P(C) = 0 < 1.

Q.E.D.

Let us examine intransitivity in negative correlativity.



Proposition 5.3.1. C(A, B) < 1 and C(B, C) < 1 ≠> C(A, C) < 1.

Proof 5.3.1. In the example above, C(A, B) = P(B|A)/P(B) = (1/3)/(2/5) = 5/6 < 1.

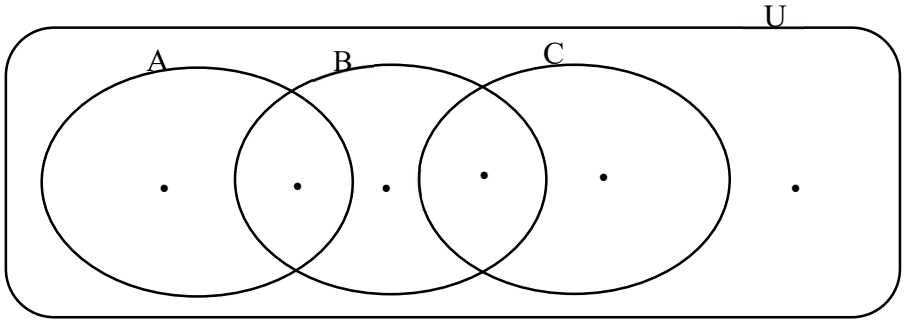
Also C(B, C) = P(C|B)/P(C) = 0 / (1/5) = 0 < 1.

But C(A, C) = P(C|A)/P(C) = (1/3)/(1/5) = 5/3 > 1.

[47] Remember, P(B|A) means the number of B's members in the universe of A, so here it is simply 2 out of 3.

Q.E.D.

Next, let us see the intransitivity in zero correlativity.



Proposition 5.3.1. C(A, B) = 1 and C(B, C) = 1 ≠> C(A, C) = 1.

Proof 5.3.1. In the example above, C(A, B) = P(B|A)/P(B) = (1/2)/(3/6) = 1.

Also C(B, C) = P(C|B)/P(C) = (1/3) / (2/6) = 1.

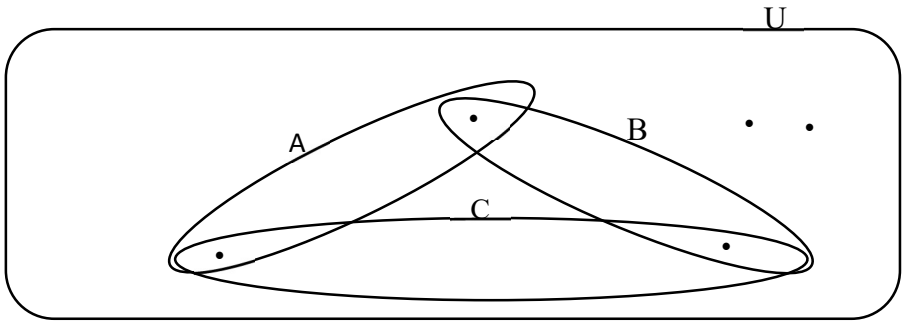
But C(A, C) = P(C|A)/P(C) = 0 / (2/6) = 0 < 1.

Q.E.D.

Finally, let us examine the existence of correlativity between an intersection of two sets, AB, and a third set C. Let's assume that there is positive correlativity between A and B, A and C, and B and C. Does that mean there is a positive correlativity between AB and C? The answer is no and let us prove it.

Proposition 5.3.1.1. C(A, B) > 1 and C(A, C) > 1 and C(B, C) > 1 ≠> C(AB, C) > 1.

Proof 5.3.1.1. Consider the following counterexample:



Here, C(A, B) = P(B|A)/P(B|U)[48] *= (1/2)/(2/5) = 5/4 > 1.*

*Likewise, C(A, C) = (5*1)/(2*2) = 5/4 > 1; and*

C(B, C) = 5/4 > 1.

[48] Here is a more convenient formula: C(A, B) = P(B|A)/P(B|U) =n(AB)/n(A) / n(B)/n(U) = **n(U)n(AB) / n(A)n(B)**.

But C(AB, C) = P(C|AB) / P(C) = { P(ABC) / P(AB) } / P(C) = {0 / (1/5)}/(2/5) = 0 < 1. Q.E.D.

Note that C(AB, C) is zero because the three sets, A, B, C, have no triple intersection. Set theory speaking, ABC = ϕ, the Greek alphabet phi meaning an empty set.

5.3.2. Introduction to Binomial Distribution

Binomial distribution is neat. But first thing first:

Definition 5.3.2. nCr denotes the number of possibilities of selecting an unordered set of r distinct items out of n distinct items.

For example, say you have three dices, black, white, and green. How many combinations of two dices are there? It is three, or 3C2:

Mathematical Value 5.3.2. {B, W, G} C 2 = n({ {B, W}, {B G}, {W, G} }) = 3.

A neat thing about binomial distribution is the ease of symmetrical calculation.

Equation 5.3.2. nCr = nC(n-r).

In our example, 3C2 = 3C(3-2) = 3C1 = 3. That is, there are only three cases in choosing one dice out of three, that is, B, W, and G.

Another neat thing about binomial distribution is its applicability in algebra:

Equation 5.3.2. $(a + b)^n = nC0\ a^n + nC1\ a^{(n-1)}\ b + nC2\ a^{(n-2)}\ b^2 + \ldots$

$$+ nC2\ a^2\ b^{(n-2)} + nC1\ a\ b^{(n-1)} + nC0\ b^n.$$

If we substitute 1 for a and for b, we get a picture of nice binomial distribution:

Equation 5.3.2.1. $(1 + 1)^n = nC0 + nC1 + nC2 + \ldots + nC(n-2) + nC(n-1) + nCn$

$$= nC0 + nC1 + nC2 + \ldots + nC2 + nC1 + nC0.$$

Let us bring the numbers down to earth.

Mathematical Values 5.3.2.

$20 = 0C0 = 1.$

$2^1 = 1C0 + 1C1 = 1 + 1.$

$2^2 = 2C0 + 2C1 + 2C2 = 1 + 2 + 1.$

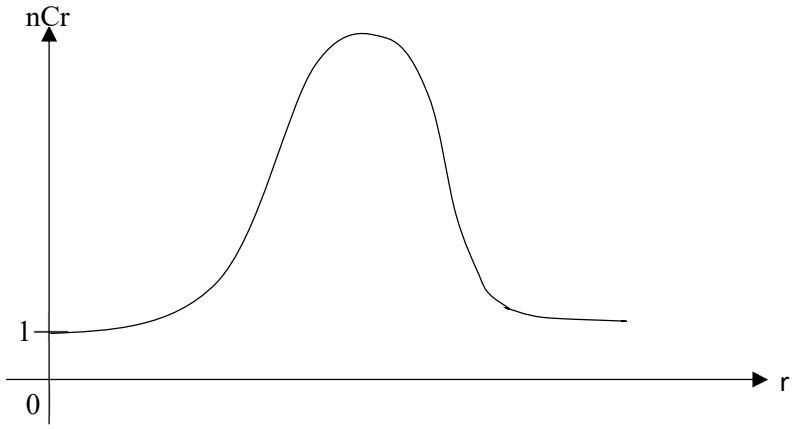
$2^3 = 3C0 + 3C1 + 3C2 + 3C3 = 1 + 3 + 3 + 1$

$2^4 = 4C0 + 4C1 + 4C2 + 4C3 + 4C4 = 1 + 4 + 6 + 4 + 1$

$2^5 = 5C0 + 5C1 + 5C2 + 5C3 + 5C4 + 5C5 = 1 + 5 + 10 + 10 + 5 + 1$

In the above pyramid of numbers, observe that a brick of the pyramid can be calculated by summing the two numbers directly above it. For instance, look at 10 at the bottom rung of the pyramid. The two shoulder numbers above it are 4 and 6, which sum up to 10 together[49].

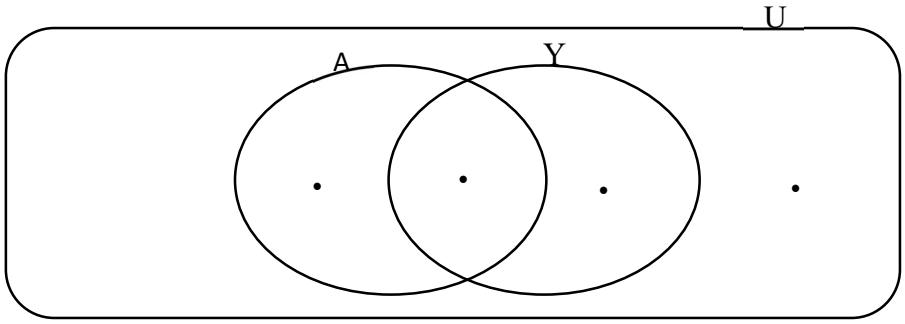
As one can see, a binomial distribution makes a perfect symmetry around the center[50].



What a binomial distribution tells us is essentially this: it maxes at the center. Suppose we have ten dices with all different colors. There is only one way to have ten dices, or no dices. But there are ten different ways to pick one dice. There are 45 different ways to pick two dices. And the number of possibilities reaches its maximum at 252[51], which is the number of combinations of five colors out of ten dices.

5.3.3. Binomial Distribution in Trait Space

Let us draw a pictur of an America where there are two Hispanics and two Asians, and two yellow cars and two red cars, and every American has exactly one car.



[49] It is from an equation in combinatorics: nCr = (n-1)C(r-1) + (n-1)Cr. Also, here is a convenient formula to find nCr: nCr = nPr / r! = n(n-1) … (n-r+1)/r!. A couple of notes. r! means r(r-1)(r-2) … *3*2*1. That is, the multiplication of all numbers from 1 up to r. The numerator "n(n-1) … (n-r+1)" simply means the product of 'r' numbers, starting from 'n' and downward.

[50] Please disregard the apparent asymmetry due to the author's awkwardness in digital curve-drawing.

[51] 10C5 = 10 9 8 7 6 / (5 4 3 2 1) = 42 * 6 = 252.

Here, U-A[52] = -A = H. That is, anyone in this universe not an Asian is a Hispanic. Similarly, U-Y = -Y = R. Right now, we have an even distibution where,

*Probability Value 5.3.3. C(A, Y) = C(A, R) = C(H, Y) = C(H, R) = n(U)n(AY)/n(A)n(Y) = 4*1/(2*2) = 1.*

That is, there is no preference or correlativity between a race and car color whatsoever.

5.3.3.1. A Side: Unipetal Theorem

The world of probability is full of positive fractions. In this world, there is a handy dandy formula that we will call unipetal theorem.

Theorem 5.3.3.1. If a < b and n > 0, then a/b < (a+n)/(b+n).

Proof 5.3.3.1. Assume a < b. Then, a/b < 1.

lim (n -> ∞) {(a+n) / (b+n)} = lim (n -> ∞) (n/n) = 1 > a/b.

But since a < b, a + n < b + n.

Then, (a+n)/(b+n) < 1.

But (a+n)/(b+n) = a/b when n = 0, and it gets closer and closer 1 as n increases.

Therefore, when n > 0, (a+n)/(b+n) > a/b.

That is, as n gets bigger and bigger, or if we add more and more same numbers to both numerator and denominator, a proper fraction[53] gets bigger and bigger as approaches closer and closer to 1, which is bigger than the original fraction a/b.

The other side of the story goes like this: when a/b is an improper fraction, the number gets smaller and smaller to approach 1, as we add the same number upstairs and downstairs.

Corollary 5.3.3.1. If a > b and n > 0, a/b < (a+n)/(b+n).

Proof 5.3.3.1.1. Assume a > b. Then, a/b > 1.

lim (n -> ∞) {(a+n) / (b+n)} = lim (n -> ∞) (n/n) = 1 < a/b.

But since a > b, a + n > b + n.

Then, (a+n)/(b+n) > 1.

But (a+n)/(b+n) = a/b when n = 0, and it gets closer and closer 1 as n increases.

Therefore, when n > 0, (a+n)/(b+n) < a/b.

Whatever fraction a/b is, (a+n)/(b+n) becomes more close to 1. Hence the name, unipetal theorem.

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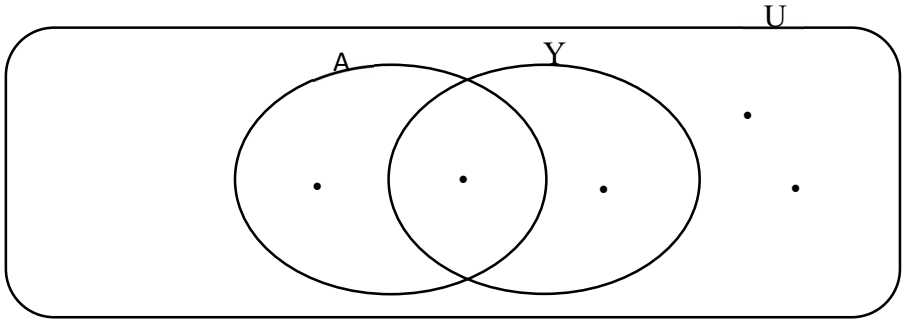
[52] This operation is known as set difference: A-B = A∩B^c, where B^c = U-B = -B, that is, B's complement in U. B^c is the set of elements in U that is outside of B.

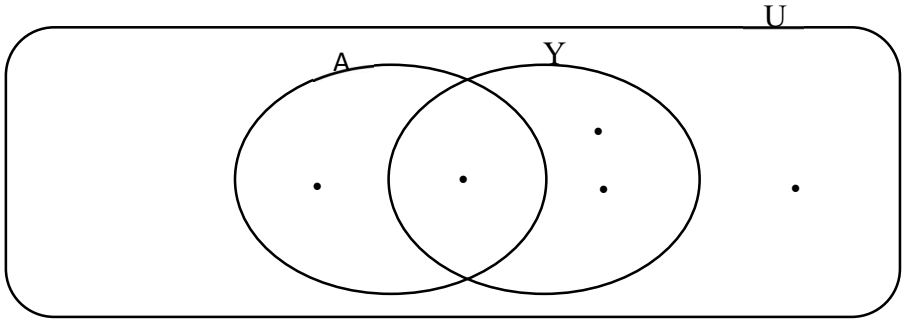
[53] A fraction is proper when denominator is bigger than numerator, and improper when it's the other way around.

5.3.3.2. Perturbation in the Universe[54]

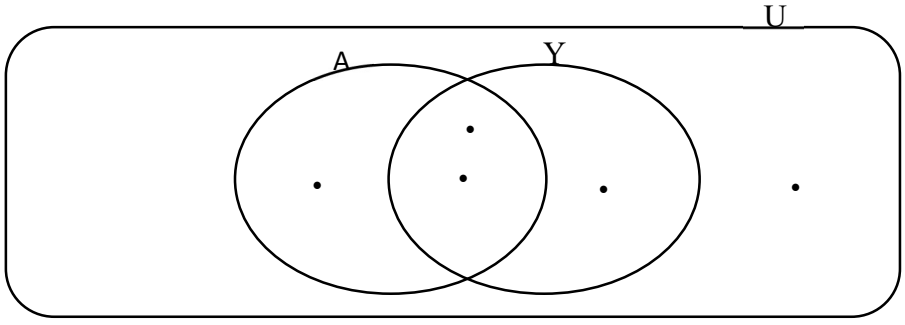
Now, let us disturb this equanimous distribution by throwing some immigrants into America.



This is what happens after a Hispanic immigrated to America in his red car.

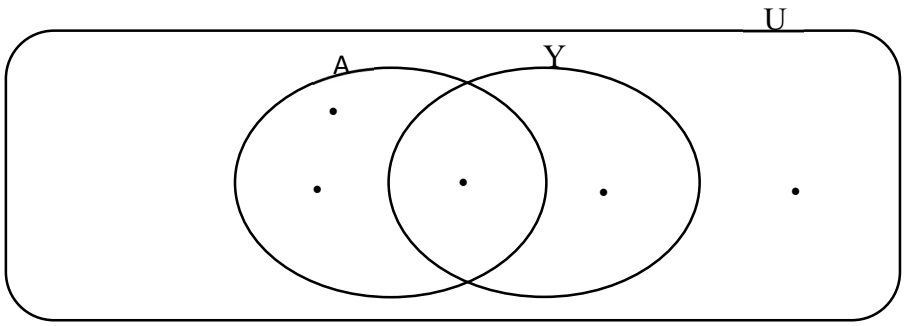


This happens when a Hispanic man comes to America with a yellow car.



This is after a new Asian arrives in the land of opportunity in a yellow car.

[54] Of course, the title of this section is inspired by a Nobel-prized field of physics known as perturbation theory.



This is when an Asian comes with a red car in pursuit of his American dream.

6. Correlativity and Causality

Assume that traits A and B are relatively correlated, that is, have a positive correlativity coefficient. Also assume that the relative correlation is not by chance but by causation. Causality, of course, is well known to be a complex philosophy, a hard-to-prove entity. The determination of causality is crucial in social policy determination, that is, in legislation, presidential executive decisions, and case law judgment in courts. Causality plays pivotal roles in decision makings in any micro-cosmos of a nation, such as a company, a family, even an individual. This section is more qualitative than quantitative: both the reader and the author can use a break in the quantitative side of the brain. To exemplify linkage between correlativity causality, and will discuss tabooed topics such as sex and violence: you and I can use some entertainment along the way.

6.1. Connectivity

Icecreams tend to sell more in summers than other seasons, as there is a definite and definitive linkage between icecream and seasonality: the temperature. Since icecream is cold, it cools down, or mitigate, the heightened temperature of a person in a hot weather, making her feel better than otherwise. The correlativity between icecream purchase and summer is by far more definite and non-random than that between a yellow car purchase and a ponytail hairstyle of a purchaser.

6.2. Sexuality

Are married men more prone to cheat than married women? Adultery is a sexual intercourse between a married person and another person who is not married to the former. If men and women are 50/50 in composition, how is it possible that men cheat more? It is possible by the existence of a 'broad,' a 'slut,' whom every married man resort to. If there is one promiscuous woman in town, in theory, every man in town can commit adultery.

There is both positive absolute correlation and positive correlativity between female gender and prostitution: most prostitutes are female and a prostitute is more likely to be female than male. It has been this way since the beginning of the history[55] and still is, and the phenomenon is true across

[55] Many say prostitution is the oldest profession, but such allegation is false. The people who say that are people who are judgmental about prostitutes, who want to make fun of them, or who want to sympathize with a

cultures, i.e., spaces. If there is a correlation and correlativity that is so unchanging, there must be a causality.

In the previous section, the causality of the correlativity between icecream and summer is the temperature. Homo sapiens is a biological entity whose nervous system is programmed to preserve physiological homeopathy, i.e., consistent state, and a constant body temperature is just one of it. A person or animal 'feels good' when a raised body temperature goes back down to the normal body temperature, because the 'good feeling' is the nervous system's reward when the host does something good to preserve the body. Such reward of good/bad feeling is a product of evolution, as individuals who feel bad at danger to self and who feel good at self preservation tend to survive to beget the next generation.

Now back to sexuality. Flowers are the genitals of plants. Such vegetative genitals are 'beautiful' or 'fragrant' because they are evolved, or 'designed,' to attract the attention of pollinating insects. Insects are animals, whose nervous systems and biochemistry have many in common with us, humans. For instance, both a bee and a person feel good when they taste sugar, as sugar is an instant source of energy, helping self-preservation. Bears love berries, and they are major spreader of berry seeds, as they don't chew berries but swallow them, preserving the integrity of the seeds, and shed droppings potentially far away from where they ate the berries. And bears eat the berries as they are sweet with sugar in them.

Is beauty in the eyes of a beholder? It is not, when it comes to sexuality. Sexuality is a biological entity, and thus it is absolute, not relative as the adage suggests. Evolution sculpted a man's psyche such that he is attracted to a woman with big breasts to feed the baby, a woman with slender body ensuring health and longevity to raise the baby well, and a woman with pretty face reflecting balanced intelligence and well-rounded personality to educate the baby well. This is why a magazine model is always a slim woman. This isn't a social conditioning of stereotype or manipulation of the industry as a feminist may say. It is an implication, a repurcussion from an absolute biological penchant of humans shaped by evolution.

6.2.1. Promiscuity

A man produces more sperms a day than eggs a woman ovulate in her lifetime. Of course, one ejaculation event of his also releases that many sperms while only one egg, if any, is involved in sex for her. Nonetheless, the turnover rate of sperms is many-order-of-magnitude larger in men compared to the counterpart in women. A man constantly produce tens of millions sperms daily, while a woman is born with about a million eggs and never produce new ones. A man is pressured to release the sperms, while a woman is pressured to hold on to her eggs diminishing in number every month. The asymmetry between men and women gets bigger when we considers pregnancy. Only women get pregnant. He can walk away from sex but she can't, if the condom broke or leaked. It is only her who is left with a baby inside her. So naturally, she is by far more cautious than him about sex, even though both she and he enjoy sex. These are the two reasons why men are more willing to have sex than women are: sperms outnumbering eggs, and pregnancy affecting only women's bodies. Evolutionarily, a male with heightened sexual desire will sire more progeny than other lesser virile males, as the 'stud' will have

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snobbish, condescending attitude. The truth is, the oldest profession is farming, as the earliest homo sapiens used to hunt and gather, and farming of animals and plants is the natural extension of it.

more sexual intercourses with more females than the passive males. So there is not only sperm pressure, but also evolutionary pressure for men to have sex with as many women as possible.

Then why a man just have sex with one woman? He can, but he can't, if she is pregnant. He wouldn't, if she is old. As a flower shed its petals once pollinated, a woman shed her beauty once her reproductive possibility ends with menopause. Why men are not sexually attracted old women? It is because evolution is a stickler, a miser, a perfectionist, an economist, who allows absolutely no waste. If a man is attracted to postmenopausal women, he would waste his energy, time, and sperms that could have been invested to fertile women who would have preserved his genes to the next generation. There is no man-o-pause, that is, no man pauses sperm production until he dies.

In conclusion, yes, there is both absolute and relative correlation between male gender and sexual aggressiveness. The existence of correlation is confirmed by empirical evidence that the vast majority of exotic dancers are females because there are by far more male patrons than female patrons who want to experience sexual entertainment[56]. The existence of correlation is also proved by evolutionary and physiological argument above.

6.2.2. Gayism[57]

According to CDC statistics, 60% of new AIDS patients are male gays while they constitute 2% of population. Male gays are the harbingers of AIDS epidemic and they came to the world with a 'bad news,' when a group of male gays entered the center stage of humanity in San Francisco with deadly disease now known as AIDS.

What the statistics means is that male gays are 30 times more likely to have AIDS than a random person in America. That is, if there is 1 person with AIDS in 100 average Americans, there are 30 people

[56] Yet another reason of the disparity in the numbers of male and female exotic dancers is the asymmetry in the directionality of sexual appreciation. In plain terms, a man is sexually aroused when he appreciates a woman, and a woman is sexually aroused when she is appreciated by a man. To a man, all it takes a good-looking young woman. But for a woman, she cares about a man's personality, and wealth, as she is a product of evolution that favors the success in the survival her progeny, which is enhanced by the security of a man's wealth and stable character. She gets 'turned on' the most when a wealthy gentleman appreciates her. Does a reader disagree? Here is an empirical evidence: look at a statistics from any online dating website. Isn't it the youngest female with most attractive profile picture? What male suitors get the most response from females? Isn't it the rich? What women get the most request? Yes, there are exceptions, but the correlativity of a man's income level and his sexual popularity is undeniable. Any 'Bachelor' TV show would feature a rich man, and any 'Bachelorette' TV show would feature a young woman with a pretty face and a slim body. It would be a scripted comedy show, not a reality TV, if the grand prize for a hypothetical program named 'The True Love' is a handsome and muscular but bankrupt, indebted, unemployed man; or a rich woman with fat potbelly, wrinkled face, wide shoulders, stocky hairy legs, flat chest, heavily tattooed skin, multiply piercings, always pants and never skirts, and that short hairdo, at least most of which by the way fit the description of a wretched prototypical lesbian, hmm? But rest assured: anyone can improve one's economic status and appearance, if one wills. As Jesus said, "knock, the door will be opened to you." There is another saying that says that beauty is only skin deep. The author disagrees with this proposition too, as a deeper man can perceive the beauty of lifelong wisdom in the face of an aged lady. Sexuality is not all that a beauty is, as a human man is more than a blood and flesh.

[57] For an in-depth analysis of gayism, *see* the author's carta magnum as of 2015, *The Law of Antigayism*. Just google the author's full name and it will show on top.

with AIDS in 100 gay male Americans. This is a definitive positive correlativity. There must be a causality. Let's find it.

As examined in the previous section, males have more desire for sex, and males also want more diverse sex partners than females do. Such sexual aggressiveness and promiscuity is preserved in male gays. Go to a gay bar and you will find out: everyone is looking for someone, and everyone gets one. In the world of male homosexuality, no one is left out, nobody says no, no one rejects or gets rejected, nobody judges, nobody is lonely: they got each other, altogether. They understand each other's need for a lot of sex, and a lot of partners. Male gays not only are permissive of promiscuity, but also in need of promiscuity. As a gay anal sex is nothing but an imitation of real vaginal sex, it is not as good as a real sex, and they compensate for the dissatisfaction by promiscuity. They switch and rotate partners like there is no tomorrow, and if they keep doing that, there will be no tomorrow. But a good news for them is, now gay marriage is legal, and as a consequence, a gay relationship, even unmarried, are now more legit than ever before. The legalization of gay marriage declares out in the public, even make it a law of the land, that there is nothing wrong with gay. There will be more gays, more gay relationships, more gay sex, and as a consequence, more AIDS. A 'bi' man serves as a bridge between male gay population and straight population, importing AIDS viruses from male gay population into strictly straight population. If a cancer is localized, it may not kill a person. The person dies when the cancer metastasizes using the lymph vessels like a highway to propagate the cancer to the rest of the host's body. A society whose laws and media propagate gayism is like a body handing over lymph vessel system to the group of localized cancer cells. Gayism is a metaphysical pathogen to society and progayists, i.e., gay marriage advocates and activists, are the carriers thereof.

Why AIDS and gays? There are two reasons. First, male gays do anal sex and as anus is not designed to repetitive in and out motions, it involves bleeding, increasing the chance to exchange AIDS viruses. Second, as mentioned earlier, males are more promiscuous than females, and such male promiscuity is multiplied, compounded, and amplified if we put two of the more promiscuous gender together. Wouldn't a legalized gay marriage[58] make male gays less promiscuous? Consider this: the gay marriage introduced a brand new institution of open marriage, where the two 'husbands' start their marriage with a mutual agreement by which each man is free to have sex with men other than his 'husband.' Open relationship is not a common pattern but more of a norm in any male gay relationship. Thus it is not surprising but very well expected that a gayly married couple would practice the same type

[58] Technically, a court overturning a law that bans gay marriage does NOT make a gay marriage legal. A gay marriage is legal only if a legislature legislate a new law that defines a marriage between two adults regardless of their genders. Until that happens in a state via its state legislature, there is no such a thing as a gay marriage in the state. A court, of course, has no power to legislate or force a legislature to legislate such law, as doing so would violate the constitutional principle of separation of powers in executive, legislative, and judicial branches. Progayists are the culprit of propagation of legal ignorance by saying that the June 2015 Supreme Court decision on gay marriage. Now most people think gay marriage is legal but that is not so. Marriage is strictly a state matter, not a federal matter. A federal court does not have a power to dictate what Congress legislates, and a fortiori, has even less power to dictate what law a state legislature, as the 10th Amendment of the Constitution guarantees state's autonomy away from the federal government. The June 2015 decision itself is a gross violation of the Constitution by the five Justices, as they usurped the right of the states and the People reserved and guaranteed by the 10th Amendment. Gay marriage ban does not violate equal protection clause of the 14th Amendment, as it does not prevent a gay person from marrying an opposite sex. A law that bans gay marriage is like any other law that prohibits a socially harmful behavior. For a more extensive legal analysis of gay marriage issue, *see* A Call for an Overhaul of Federal Court System by the author.

of agreed promiscuity, an open marriage, a marriage with the promised guarantee of adultery. Gays are the ones who already overturned the traditional taboo against same-sex sex. So why should they stop there? Why not break another taboo against adultery? What's stopping them? Most of lawyers, judges, legislators, media, and even church pastors (!) are right behind them, giving them full and hearty supports. Talk about lemmings rushing to the cliff.

6.3. Criminality and Correlativity

Let us make a smooth criminal transition from the previous sextion with the case of rape.

6.3.1. A Female Rapist?

The set of rapist is a proper subset of the set of males. There is no such a thing as a female rape on a male. Assume a woman drugs a man. He is unconscious, so he can't get it up. In the Old Testament, there is a story of Lot and her two daughters. The girls got their father drunk and had him have sex with them, as they reasoned that no men other than their father were good enough to be their husbands. Is this a rape? It is an incest, but not exactly a rape, as no man can erect his genital without being sexually aroused, and sexual arousal by definition presupposes sexual attraction, which is a result of sexual desire. Suppose a woman drugs a man, ties him up, waits until he wakes up, and sexually arouse him by giving him a hand job and a mouth job, and have him have sex with her. Is this a rape? Again, it is not, as he desired it. Come on, folks. Who in the world of potent males would refuse a free sex where he has all the excuses of a 'forced' sex in the world[59]?

6.3.2. Sex and Crime

More males are in prison than females. Why so? Probably because the male is the more aggressive gender than the female. The most muscular person on earth is a male, not a female. By far more males than females serve the country in uniforms as firefighters, police officers, and military personnel. Anything that involves physicality, whether good or bad, is engaged by males than by females. And criminality is just a subset of that.

6.3.3. Poverty and Criminality

There are two ways to get rich: by hard-working, or by stealing. Nobody can be rich by being solely smart, as no idea alone makes a product that sells. Theft or its kindred-spirit crimes like fraud, drug-dealing, Ponzi scheme, or embezzlement, eventually get caught by police and thus riches therefrom are short-lived. But look at the prison. How many are they rich people? Very few. There is a definite correlation between poverty and criminality. Is there a causality therebetween?

Poverty causes relative dearth of education, which again causes poverty in the next generation. If a man has no money to buy bread and nobody is helping him, he is more likely to steal than a man born with a silver spoon in his mouth. Then again, of course, a poor man cannot afford a top-selling,

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[59] Of course, such a world exists only in movies and novels and in men's fanciful imaginations. A woman in the real world would never sexually tempt a man unless she is getting paid by doing so. It is always men who chase after women, and not the other way. The reason, of course, is all biology, which endows men penises that is by far larger than clitorises, the disparity of whose sizes sums up the disparity of sexual energy between the two genders. All a man wants is a good sex, while all a woman wants is to have a family and to bear children. That is why women always play hard to get, to test the man's faithfulness and seriousness.

top-sellout lawyer that a rich man can buy. Also, even if we assume poverty causes criminality, criminality also causes poverty, as in this day and age of background check[60], a marred background would prevent the ex-convict from getting a decent-paying job.

A solution is to subsidize the education based on income level, which has already been done by federal grant programs for college tuition assistance. Another solution is to encourage private employers[61] to not conduct any background checks at all, giving people with past a brand new chance to restart their lives. Why punish a person twice, once by imprisonment and the second by unemployment? Doesn't this violate the spirit of the double jeopardy clause of the Fifth Amendment and the cruel and unusual punishment clause of the Eighth Amendment of the U.S. Constitution?

7. Correlativity Convergence Theorem

7.1. Preliminary Concepts

7.2. Functions

[60] The contemporary American employers tend to overdo the background checks. Many even ask for your facebook account before hiring, invading a job candidate's privacy, abusing the superior bargaining power as an employer.

[61] One way to implement such encouragement to hire an ex-convict is to make the employee's salary deductible to the company for up to two years in the federal and/or state income tax return. This serves a state or a nation's interest, as more ex-convicts get jobs, there will be less need for them to commit crimes, and thereby there will be less crimes on streets. Employers, citizens, and the legislators should make this leap of faith that trusting and hiring ex-convicts will make a crime-free society, a utopia.