

On the probability of having a girlfriend and the possible types of relationships: A thermodynamical approach.

Diego Trujillo

The second law of thermodynamics says that entropy tends to increase. It has been proven by information theory and physical statistics that entropy increases because the states of the system in which entropy is high are much more likely to occur than the ones in which entropy is low.

Let us take for example the distribution of particles in a room, let us call the way in which particles distribute a macro-state and the set of the particular place of each particle a micro-state. There is only one combination of micro-states in which all particles are at the same place (particle1 at $[n,m]$, particle2 at $[n,m]$, particle3 at $[n,m]$..., particle i at $[n,m]$) so the probability of this is one over all possible micro-states.

Let us now consider the macro-state in which we have particles evenly distributed (equilibrium) in the room, this macro-state could have particle1 at $[0,0]$, particle2 at $[0,1]$..., particle j at $[n,m-1]$, particle i at $[n,m]$. Or it could have particle2 at $[0,0]$ and 1 at $[0,1]$ and all others in the same position. Or particle1 at $[n,m]$, particle2 at $[n,m-1]$..., particle i at $[0,0]$. And many other configurations.

So we see that equilibrium is much more likely than any other state since it can be coded by a variety of micro-states. Thus an increase in entropy is what we frequently observe. A decrease of entropy over time is considered a violation of the second law of thermodynamic unless work is being done (like in a refrigerator).

Like all systems people have macro-states and micro-states, in the case of having a partner there are two hypothetical states¹:

- 1) *I have a girlfriend*
- 2) *I don't have a girlfriend.*

The macro-state *I have a girlfriend* can be obtained by dating any girl from a set G , the *items* (no sexism intended) in G are the girls you like who like you back. For example if $G = [Nadia, Christina, Rebecca, Mary, Xixau]$ no matter who you date your macro-state will be *I have a girlfriend*, the sixth micro-state is *I don't have a girlfriend* so the chances are 5/6 that you do have a girlfriend. The remaining 1/6 is the probability of both the micro-state and macro-state *I don't have a girlfriend*.

To make this a general rule let us define $N(G)$ as the number of items in G and the number of states as $N(G)+1$. Therefore the probability of *I have a girlfriend* is $N(G)/N(G)+1$ and of *I don't have a girlfriend* is $1/N(G)+1$. So unless $N(G) \leq 1$ the probability of *I have a girlfriend* (P_g) is greater than the one of *I don't have a girlfriend* (P_n) thus $P_g \geq P_n$.

Since it is much more likely to have a girlfriend, we can suppose that in a random system (one without social standards, fear or psychological complexes) nearly everybody would have a girlfriend. Since this is not the case and we don't want to violate the second law of thermodynamics we can suppose that people without girlfriends do more work in order to go to a state of lower entropy.

1 If you are a woman substitute *girlfriend* for *boyfriend* throughout the entire document.

Relationship with the Drake-Backus Equation

A recent paper (Backus 2010?) written by Peter Backus modifies the Drake equation for estimating the proportion of intelligent alien civilizations in order to estimate the number of possible girlfriend in his area of residence (G). In order to estimate G he uses the following parameters:

Population growth.

The fraction of people in the UK who are women.

The fraction of women in the UK who live in London (his area of residence).

The fraction of the women in London who are age-appropriate.

The fraction of age-appropriate women in London with a university education.

The fraction of university educated, age-appropriate women in London who I find physically attractive.

The length of time in years that I have been alive thus making an encounter with a potential girlfriend possible.

He then says that the fraction of women who find him attractive, the fraction of women who are single and the fraction of women with whom he will get along should also be considered. According to his paper this is about 26 women or a 0.0000034% chance of getting a girlfriend any night in London.

If we go back to the inequality $P_g \geq P_n$ we can see that the Drake-Backus equation gives us the probability of having a girlfriend (P_g). Since the states are mutually exclusive we could then assume that $1 - P_g = P_n$. However if we use Backus's data we can see that $1 - 0.00000034 = 0.99999966$. This means that $0.00000034 \geq 0.99999966$ and $P_g \geq P_n$ are not true so there is a contradiction between thermodynamics and the Drake-Backus equation.

Such a contradiction emerges from the fact that we have only two mutually exclusive states, so if you are not in one state you are in the other. To solve this problem a third macro-state could be added so that the system has 1) *I have a girlfriend* 2) *I don't have a girlfriend* 3) *I have a non-girlfriend type of relationship*. State 3 obviously includes a lot of other possible macro-states such as *I date a goat*, *I have several hundred wives*, *I am my own girlfriend*, etc.

From the contradiction between the Drake-Backus equation and the second law of thermodynamics we can gather two possible conclusions:

1) The Drake-Backus equation is right and state 3 exists. Since the probability of states 1,2,3 (P_1, P_2, P_3) should add to one we get that $P_3 = 1 - (P_1 + P_2)$. So all *non-girlfriend type* relationships are more likely than getting a girlfriend with the parameters given by Peter Backus.

2) The Drake-Backus equation is wrong (mainly because Backus has had subjective judgment while choosing his parameters). State 3 may still exist but is negligible so people are likely to have girlfriends at least once in life if they don't do a lot of work and flow with entropy.

Whichever of these conclusions is true the general rule is that people with G sets with many items are more likely to get girlfriends, in order to have a large G set you mustn't be fuzzy about who you like and you must try to get as many girls as you can to like you. Hopefully this last paragraph didn't tell you anything new.