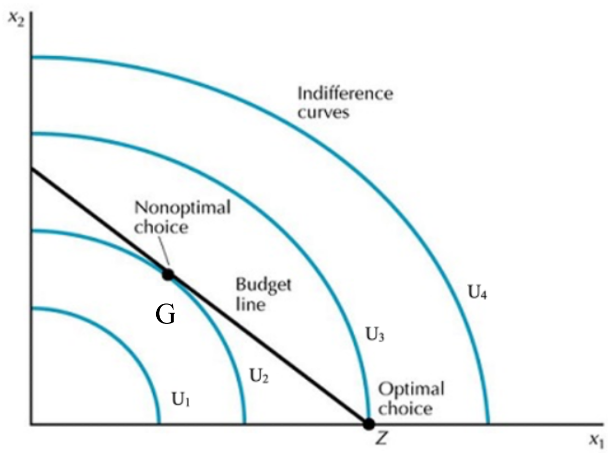
Microeconomics (Andrew Gates)
Lecture Notes 3 – Consumer Preferences, Consumption Choices, Indifference Curves

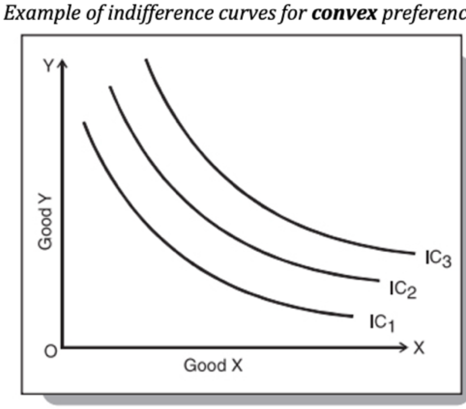
Consumer Preferences: Complements and Substitutes

While every point on indifference curve U_1 and point G on indifference curve U_2 are all feasible (affordable, attainable, achievable… since they are inside of the budget line representing the limits of feasibility for different combinations of x_1 and x_2) the highest feasible utility level is obtained by choosing point Z on indifference curve U_3. Any rational person with these ***concave preferences*** will choose Z as the optimal *consumption bundle*, which we can formally write as $(x^*_1, x^*_2) = (z, 0)$ to show that this means z units of x_1 and zero units of x_2.

Example of concave indifference curves representing concave preferences where "extremes" are preferred over a "mixture" of x_1 and x_2 (with monotonic increasing utility: $U_4 > U_3 > U_2 > U_1$)



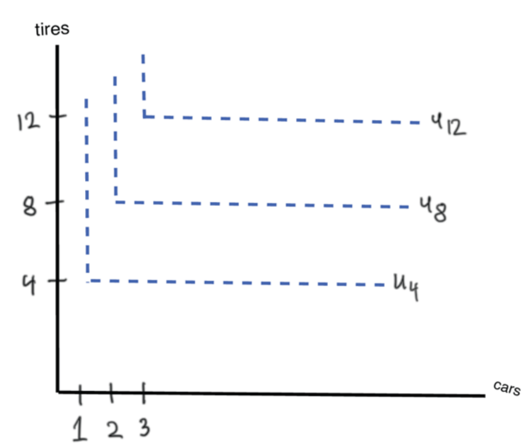
*Example of indifference curves for **convex** preferences:*



Convex preferences are the opposite of concave preferences. With convex preferences, some mixture of the two utility sources is always preferable over any allocation comprising only one utility source. In this case, the two things will be multiplied together somewhere in the utility equation, which indicates that more of either one also has utility benefits through the other. One example of convex indifference curves in a consumer choice problem might be coffee and bagels for Jay's utility function $\mathbf{U_J(c,b) = c * b}$. Here the optimal choice is allocating an equal share of available resources towards each of the two goods since the exponents are equal.Note the symmetry here: Jay's exponent is 1 on **c** and on **b**. His friend Kim with utility $\mathbf{U_K(c,b) = c^3 * b^2}$ would prefer more coffee. In both cases, utility is obviously equal to zero if they have zero of either good.

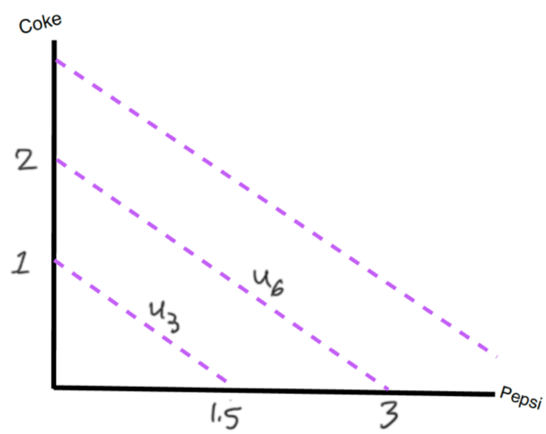
There is a specific case of convex preferences called ***perfect complements*** where indifference curves will be "L-shaped". This is a situation where things must be consumed together in a specific ratio to obtain more utility. Some examples might include pancakes & maple syrup, liquids & containers, phones & phone cases, left airpod & right airpod, left shoe & right shoe.

Consider cars and tires with someone's utility function $\mathbf{U(c,t) = min\ \{ 4c , t \}}$. This function returns the value of whichever argument is less: if you have 1 car and 4 tires then your utility is 4; if you have 1 car and 9 tires your utility is still 4; if you have 0 cars and any amount of tires your utility is 0; if you have 0 tires and any amount of cars your utility is also 0; if you have 2 cars and 7 tires your utility is 4; if you have 2 cars and 8 tires your utility is 8; if you have 3 cars and at least 12 tires your utility is 12.



The ***monotonicity*** of utility in almost all of our consumer choice examples represents the fact that both x_1 and x_2 increase utility: more of either one is always better. Utility is monotonically increasing over both x_1 and x_2. If more of either one of these was always worse instead, then we would say utility is "monotonic decreasing". With concave indifference curves, for some level of feasibility, a mixture of the two is not as good as prioritizing one. One example of these concave utility preferences could be a factory which is better off specializing in the production of one output instead of trying to produce a mixture of two different products and as a result being less efficient overall with lower profits. Monotonic curves indicate in this example that both products would always be profitable, but given the feasibility constraints of the factory, the highest profit would be obtained by choosing just one thing to do extremely well instead of trying to do both given the same set of conditions and inputs defining the budget constraint.

The case of ***perfect substitutes*** occurs when the sources of utility are added together and not directly mathematically linked in any term. An example would be someone who prefers Coke (**c**) over Pepsi (**p**) but monotonically benefits from both, with utility function **U(c,p) = 3c + 2p** .



In this case, and in the case of all perfect substitutes, the indifference curves are straight lines. The consumer will choose to drink only Coke if the price ratio $\mathbf{P_C / P_P}$ is less than the corresponding ratio of the utilities ("***Marginal Rate of Substitution***") which in this case is 3/2. If both drinks cost the same, any person with this utility function will choose to allocate all money towards Coke to maximize utility over these preferences. If Coke is more than 50% more expensive than Pepsi, however, the opposite will be true and the consumer will choose to allocate all money towards Pepsi. Suppose, for example, that this person has budget **m = $12** : if both cost $2 then utility is highest (18 utils) with 6 Cokes; if Coke costs $2 and Pepsi only costs $1, then utility is now highest (24 utils) with 12 Pepsis; and if Coke is $3 and Pepsi is $2 then this consumer is actually *indifferent* across all choices which spend all of the money since any combination of spending $12 on Coke and Pepsi results in exactly 12 utils. In this case, the price ratio has a slope (*Marginal Rate of Transformation*) which is exactly equal to the *Marginal Rate of Substitution* and therefore the highest attainable indifference curve will be a line that is identical to the budget constraint, intersecting at every point instead of only intersecting at one optimal point.