Barriers to Problem-solving

There are numerous obstacles to solving a problem. Generally, these obstacles are mental constructs that impede the ability to correctly solve problems. Some barriers do not prevent us from finding a solution, but do prevent us from finding the most efficient solution. Four of the most common processes and factors are mental set, functional fixedness, unnecessary constraints and irrelevant information.

Mental Set

Mental set is the tendency to solve certain problems in the same way based on how you have solved similar problems in the past. Mental set makes you blind to any alternative approaches. This tendency to use only those solutions that have worked in the past. An example could be Duncker's radiation problem. Mental set often creates a barrier to finding the optimal solution because you have already come up with one. The standard practice is to bombard the tumor with several low intensity rays converging from different angles. However, this might not be the optimal solution to the problem. In fact, you can also implant radiation pellets right inside the tumor in such a way that the surrounding flesh would not be affected. This has now become a common medical procedure called Brachytherapy.

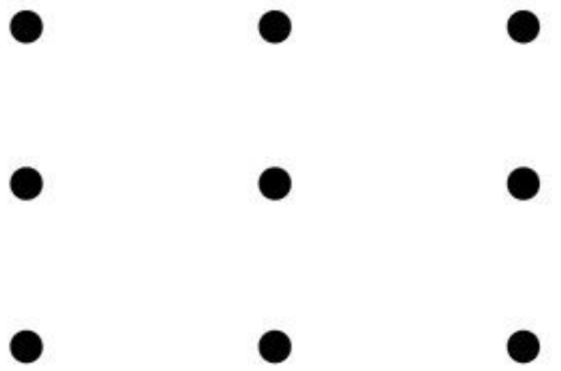
Functional Fixedness

Functional fixedness occurs when we only think about the most common purpose of an object. One of the most common examples is the so-called candle task. You are given a candle, a box of matches and a box of thumbtacks. How can you fix the candle to the wall and light it? In order to solve the problem, you must use the objects at your disposal in ways for which they are not generally intended. One solution to the problem is to empty box of thumbtacks, use it as a shelf and tack it to the wall. Then you just have to put the candle on your new shelf and light it.

Unnecessary Constraints

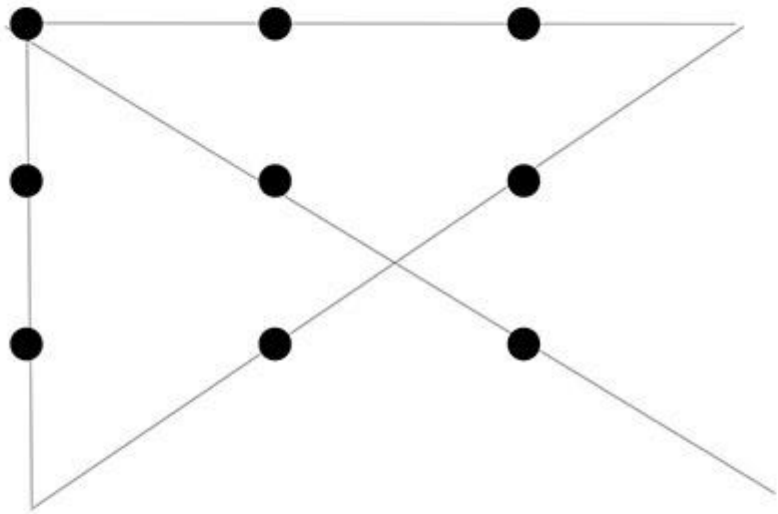
Another type of barrier is called unnecessary restraints. The most famous example is the nine dot problem. You have a pen and you must connect all of the dots without lifting the pen from the paper once you begin to connect them.

Nine Dot Problem



The constraint in this problem is that when you see the nine dots and think of it as a box, and strangely enough you don't want to draw a line outside of it, but that's exactly what you have to do in order to connect all the dots.

Nine Dot Problem



Irrelevant Information
Irrelevant information often acts as a barrier when you get anchored to all of the irrelevant information and lose sight of the real problem. A classic example of irrelevant information is the seven wives problem.

“As I was going to St. Ives, I met a man with seven wives. Every wife had seven sacks, every sack had seven cats, every cat had seven kits. How many were going to St. Ives?”

In order to solve this problem, you must disregard all the information about the number of wives, sacks, etc. Once you do, it is easy to see that just the person talking is going to St. Ives. The man and all his wives are going in the opposite direction.

Insight
When facing unfamiliar problems, you often draw on past experience to solve a problem, but what happens when the procedures that you have learned just cannot solve the problem? You get stuck, but how do you get past the impasse and figure it out in the end? Well, you have to represent the problem differently. Take a look at it from a different angle. The first thing that you can do is look at the relationship between the various elements of the problem and

break it down into a series of sub-problems. This is called chunk decomposition. The second thing that you can do is think about the restrictions that you have placed on the problem space. Many times there are unnecessary restraints, as with the nine-dot problem.

The following are classic matchstick problems and illustrate how you can gain insight through chunk decomposition and relaxing restraints. They are called matchstick problems because each of the lines represents a matchstick. To solve the equation you can move one and only one matchstick.

Matchstick Problems

Chunk Decomposition
Constraint Relaxation

XI = III + III

IX = VI – III

To solve the first problem, you have to break down the equation into its parts, its chunks. When you do, you see that the Roman numeral four is made up of a Roman numeral one and a Roman numeral five. If you simply invert the order of the two numbers, the new Roman numeral is a six: VI. At this point, the equation is balanced.

To solve the second problem, you have to relax a constraint. The constraint is that you think that only the matchsticks forming the numbers can be moved. In reality, the mathematical signs can be moved as well. So, in this case, if you take one of the matchsticks forming the equals sign and use it to make an equals sign on the other side of the equation it becomes 9 – 6 = 3.