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THE ROLE OF PROBLEM SOLVING WHEN ATTEMPTING AN ESCAPE ROOM

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ABSTRACT

In recent years, escape rooms have become a fan favorite form of entertainment among kids and adults of all ages. The thrill of trying to solve a puzzle against a clock is even greater when put in a themed room with friends and family, but the reality is that sometimes they can be very hard to solve! This difficulty comes from the unusual scenario of an escape room that forces the brain to adjust how it views everyday objects and taps into all of its problem-solving abilities. This paper aims to break down different aspects of problem solving and understand the obstacles encountered when trying to solve an escape room. This includes the different approaches to problem solving, mental sets, the functional fixedness that many people encounter, as well as the *Aha!* moment that follows solving certain problems.

INTRODUCTION

An escape room is a game where a team works to solve a series of seemingly disconnected puzzles to escape a locked room in a limited amount of time. These puzzles may include code breaking, finding a missing key, and solving riddles. Escape rooms are a wonderful way to test one's ability to problem solve and 'think outside the box'. We'll explore the process of beating an escape room, discuss problem solving, why we get stuck, and the infamous *Aha!* moment that comes with finding solutions.

Imagine the following scenario: you're in an escape room, and you've solved a series of puzzles that reveal new hints, prompting you to pull down on a lever which reveals a locked glass box on a table with pieces of paper, envelopes, and a pencil. Time is running out. You notice there is a key in the glass box and one of the papers has the following riddle: *Here lies the key to your escape, for one lock the perfect shape. Your salvation hidden in plain sight, the door behind you accepts what's right.*

PROBLEM SOLVING

Understanding the basics of problem solving will help guide the approach to decipher the riddle and escape the room, illustrated in **Figure 1**. Whenever we approach a new problem, we bring all the information we've learned from past experiences to create our mental set. The Gestalt approach suggests that our mental sets grow as we learn in new situations, which is useful in expanding our problem-solving toolset. However, our mental sets can also inhibit us from finding novel solutions we may have never considered before. This concept was demonstrated in a study by Abraham Luchins (1942) to observe how mental sets affect problem solving efficiency.

Luchins (1942) told participants that they had three jugs with different volumes of water. Their task was to move the water around to obtain a specific volume using the empty jugs as measuring tools. He gave all participants eight of these problems, all of which could be solved with one general formula except the last two, which could be solved using a simpler formula. Participants were divided into two groups. In the Example group, Luchins established a mental set by providing an example formula for

how to solve the first problem, then had each person solve all eight problems. In the second group, Luchins didn't provide an example, and participants were asked to solve the last two problems. The results revealed that only 23% of the Example group found the simplest solution for the last two problems, while everyone in the non-example group found the simplest solution to the simpler problems. These results demonstrate that mental sets influence the way we solve problems, often clouding our ability to see the best solution. The example group had become fixated on the solution given to them by Luchins, so they weren't able to think of a better solution. Escape rooms capitalize on this concept by presenting everyday problems in ways that do not conform with most mental sets.

FUNCTIONAL FIXEDNESS

While mental sets are helpful in some settings, when confronting an unfamiliar puzzle or obstacle in an escape room, they can often prevent us from seeing the right solution—a concept called functional fixedness. Carl Dunker (1945) investigated this phenomenon by asking participants to use only candles, matches, and tacks to mount a candle to the wall, so that the lit candle's wax would not drip on the floor. Half the participants were given the materials inside a box, and the other half were given the materials next to an open box. The solution was to use the tacks to mount the extra box, with the candle inside it, so the wax would drip into the box rather than the floor. He found that the group given the materials that were placed inside the box performed consistently worse. These participants experienced functional fixedness by only seeing the box as a container to hold the materials rather than a platform for the candle.

Robert Adamson (1952) also studied this idea by asking participants to solve different problems. One problem asked participants to attach four small cardboard squares to a large square, and then hang the large square from a beam using a paperclip. The problems involved an experimental group in which the items were presented so that the object required for the solution was already being used for

a different function (like the box with materials already inside in the Dunker (1945) study), and a control group where the solution object was given without a designated function. For example, in the *paperclip* problem, the control group was given paper clips that were bent like hooks to hold the squares together versus the squares being stapled together for the experimental group, as depicted in **Figure 2**. The results showed that in each case, the experimental group performed worse than the control group. When the crucial object for completing the task was presented already serving a function, participants were less likely to recognize that it could have a non-conventional use.

Similar to these studies, escape rooms may seem hard because of functional fixedness—we have difficulty imagining non-conventional functions for everyday objects. In the imagined escape room scenario, for example, only seeing the pencil as a writing utensil is an example of functional fixedness rather than a tool for unlocking the box or maybe even the door.

However, separating the pencil's function and its physical appearance could be used to overcome this mental block. Tony McCaffrey (2012) used a method called the generic-parts technique (GPT) to understand this phenomenon. GPT involves breaking down an object into its most basic description and separating it from any previously designated function. He asked two groups of participants, a GPT-trained group and a non-trained group, to complete a series of insight problems, such as the candle problem. He found that subjects trained with GPT were better able to solve the problems because separating the object from its normal function allowed them to see other unique purposes while the control group was bound by functional fixedness. Perhaps the pencil, though presented among paper, is not intended for writing at all.

THE AHA! MOMENT

In escape rooms, a person can be stuck on a problem for a while, but suddenly, they feel a spark of knowledge and can immediately solve it, this *Aha!* moment is known as insight, and it can be induced in unconventional ways. A study by Thomas and Lleras (2009) tested how directed movement can affect insight in problem-solving. Participants attempted Maier's two string problem, where they tried to tie two strings that are hanging from the ceiling together aided by other objects in the room. The solution is to tie an object to one of the strings and use the weight of the object to allow the string to swing back and forth, so it can be caught and tied to the other string. In the middle of the trial, participants took an exercise break during which one group swung their arms back and forth while the other group stretched their arms out wide. The results showed that the swinging group solved the insight problem faster than the stretching group, illustrated in **Figure 3**. Since the solution more closely resembles the swinging exercise instead of the stretching exercise, the participants' motion influenced how they solved the problem. In the escape room, if one rapidly moves around the room, checking under tables, lifting up objects, opening drawers, pushing or pulling on doors, a certain motion could spark an insight solution.

Movement is just one way we can intentionally modify our brain states to be more susceptible to solving problems. A study by Kounios et al. (2006) tested this idea by measuring participants' brain activity while they were given remote associate tests. In these problems, one is given three words and has to determine a fourth word that can create a compound word or phrase with all of them. For example, the words hall, car, and swimming can all create a phrase with pool. Brain scans while participants solved the problems showed high frontal lobe activity prior to moments of insight. Therefore, given that the frontal lobe is required for planning and goal-oriented behavior, intentionally thinking creatively and proposing as many solutions as possible could prime your frontal lobe and spark an Aha! moment in an escape room.

Conclusion

Many aspects of problem-solving play into successfully completing an escape room. Returning to our imagined scenario, you can use the Gestalt approach to analyze an escape room using your mental sets, but are often limited in finding novel solutions. The difficulty of an escape room often comes from breaking free of functional fixedness. By applying GPT, the pencil would be broken down into a thin cylindrical piece of wood with a graphite point and a flat eraser, rather than a writing tool. As we notice a pencil-sized hole on the door next to the keyhole, our frontal lobe is activated and we reach an

Aha! moment, realizing the pencil itself could be the key! You venture over to the door, insert the pencil and hear a ‘click’, the door swings open, and you’ve solved the escape room

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AUTHOR BIOGRAPHY

Sydney Fleishman is a student at Vanderbilt, majoring in Neuroscience and Medicine, Health, and Society and minoring in Business on the pre-health track. She is fascinated by the brain and how much is still unknown about it and wants to continue exploring this in her future studies and career. As a doctor, she wants to donate time to underserved populations and get involved in the healthcare innovation world after working at a healthcare entrepreneurship company last summer. In her free time, she likes to spend time with friends, family, and her dog, hike, ski, travel, play and watch sports, and be active and outdoors.