# GP - GEB Reading Assignment: Introduction + Three-Part Invention

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**Abstract**: This is the first reading assignment from Douglas Hofstadter's "Gödel, Escher, Bach" book. It is intended to provide an introduction Hofstadter's writing style, and to set the stage for subsequent assignments associated with the book. Canon's and Fugue's are illustrated, and various paradoxes are listed and described in both art/music, and mathematics/logic.

## Ten Salient Ideas from "Introduction: A Musico-Logical Offering"

1. A canon is one single theme played against itself, which is done by having "copies" of the theme played by different voices.

2. The first escalation in complexity for canons is when the copies of the theme are staggered in both time and pitch.

3. The second escalation in complexity comes when the speeds of the copies aren't equal. If the voice is singing twice as quickly, it is called diminution, and if the voice is singing twice as slowly, it is called augmentation.

4. The third escalation in complexity comes when the theme itself is inverted, and makes the melody jump down when the original theme jumps up, and vice versa, by the exact number of semitones.

5. Lastly, there is an escalation in which a copy plays the theme backwards in time, also known as a crab cannon.

6. Some canons have "free" voices in the sense that they don't explicitly play the original theme but harmonize well with it.

7. A fugue is like a canon, a theme being played in different voices and keys with occasional different speeds or alterations from copy to copy. However, with a fugue there is more leeway with the copies and their accuracy to the original copy, giving it more artistic end emotional value, and less likely to be produced by formula.

8. In the Canon per Tonos, it creates an endlessly rising canon which is an example of the notion of "Strange Loops". The Strange Loop is a phenomenon whereby moving up or down within a hierarchical system, we find ourselves back at the beginning.

9.  The Epimenides paradox is also known as the liar's paradox where Epimenides the Cretan says, "all Cretans are liars", which then creates a paradox in which you switch from the statement being false and true endlessly.

10. Russell's paradox (the barber paradox) is a paradox dealing with set theory. In a village, the barber shaves everyone who does not shave himself/herself, but no one else. Who shaves the barber?

## Reaction to "Three-Part Invention"

This is an intriguing paradox created by Zeno, because it seems so easy to answer, yet if we are to follow his procedure it creates a paradox of Achilles constantly moving to gain ground on the tortoise. The paradox gives a very different view on space and time, and how motion works. In one moment, Achilles is reaching a certain point to catch up to the tortoise, yet in the moment, the tortoise moved ever so slightly upwards. In this respect, Achilles will always have a distance to cover behind the tortoise, thus being paradoxical. The view on space and time is also puzzling because the paradox seems to change points of reference whenever the tortoise or Achilles make new ground, rather than referring to previously accumulated knowledge throughout the race. If there is anything I would like to learn more from this is how this paradox affected people's view on time and space.