

On Strange Loops and GEB

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The Apartment @ Portobello Star
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Agenda

- Welcome (19:30)
- **GEB Teaser** (15 min)
- Housekeeping
- On Strange Loop Society (10 min)
- ~break~
- **On Strange Loops and GEB** (~25 min)
- **Discussion**
- Finish (21:30)

- **Hofstadter's first book**
- **1979 publication, huge hit**
- **Engaging style, playful form**
- **Unique exposition of Gödel's Theorem**
- **Analogies on self-referential pattern**

Preface to the 20th ann. ed.

- **PSA: Get the 20th ann. edition of GEB**
- **Read the preface!**
- **The preface is a great starting point**
 1. After 20 years, a dense clarification
 2. Origin story, why GEB is a *personal* work
 3. Working title: key to GEB structure, a reader

GEB is not

- **Wishy-washy**
 - e.g., “reality is a system of interconnected braids”
- **About the titular characters**
- **About religion, mysticism, occult, etc.**
- **About some ultimate essence**
 - e.g., “math/art/music are the same at their core”
 - Perhaps most plausible, but a step too far
 - More like a *shared web of associations* (Ch XII, Fig 70)
- **A manual or blueprint for AI**

- **In a nutshell**

- “a very **personal attempt** to say how it is that *animate beings can* come out of *inanimate matter.*”

- **About a grand analogy**

- Drawing a parallel between a known thing and something else, something unrealised
- A:B :: C:D

Extra: Hofstadter and GEB

- **Born in NYC in 1945**
 - Son of Nobel prize winning physicist Robert Hofstadter
- **Academics**
 - Bsc in Mathematics, Stanford 1965
 - PhD in Physics, U of Oregon 1975
 - At Indiana U since 1977, briefly at U of Michigan
- **GEB**
 - Letter to pamphlet to seminar, shelved for PhD
 - Post-PhD, “two-year Hofstadter Fellowship”
 - *The intellectual passion of a young man*

Housekeeping



Hofstadter's Summary

“A very **personal attempt** to say how it is that *animate beings can* come out of *inanimate matter*.”

“What is a self, and how can self come out of stuff that is as selfless as a stone or a puddle? What is an “I”, and why [does it seem to only appear in our particular brain hardware]?”

Hofstadter's Summary

“GEB [builds] up **an analogy** that likens inanimate molecules to meaningless symbols, and further likens self (or ‘I’ or ‘soul’ [, etc.]) to certain swirly, twisty, vortex-like, and *meaningful patterns* that arise only in particular types of systems of *meaningless symbols*.”

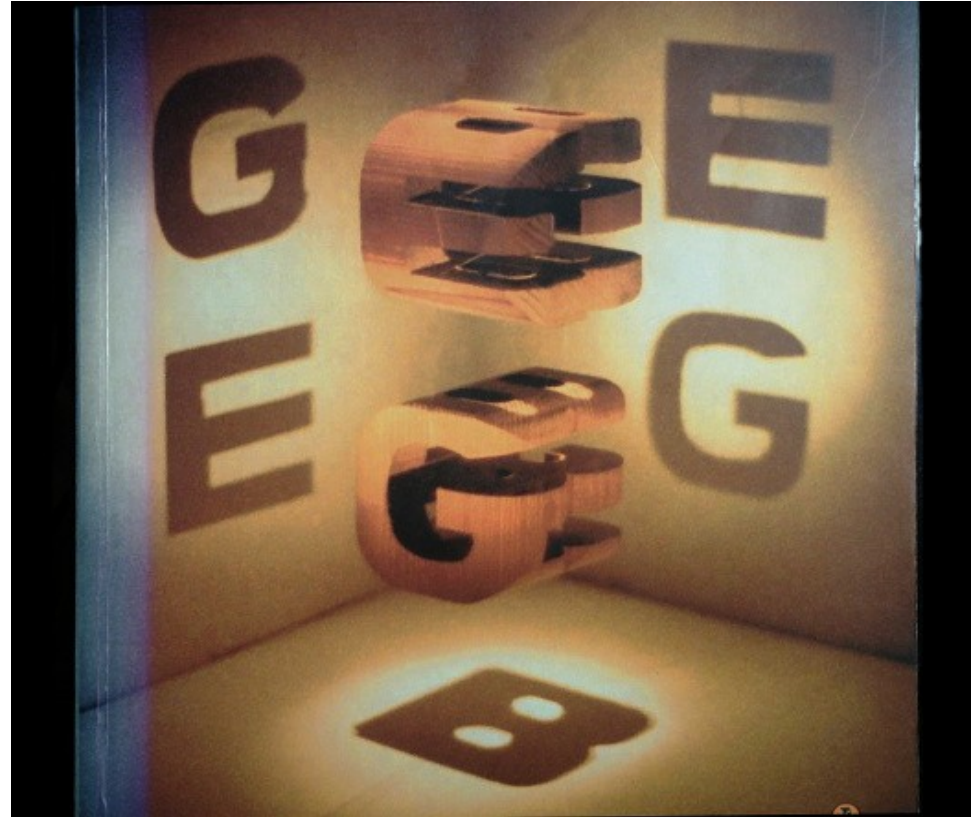
- **Hofstadter's unique musings and offerings are extras**
 - Escher and Bach and Zen, etc. are fuel for analogies

A Very Personal Attempt

- **Gödel's proof is the original strange loop**
 - GEB is Hofstadter's attempt to articulate what he saw
- **Hofstadter realised his wide interests were all linked**
 - "[T]o deprive my readers of the connection that I myself felt so strongly would be nothing less than perverse."
- **Young man at a rare intersection**
 - Interest in high culture and creative linguistic games *while* sensitive to the unique beauty found in formal systems
 - A romantic *and* a hard scientist

Strange Loop

- **Strange Loop aka Tangled Hierachy**
 - Ideas and patterns that captured Hofstadter's attention as shadows of the same abstract thing
 - Analogies are Hofstadter's tool for exploring and explaining ideas



Out of selfless stuff, a self

- **An audacious analogy**

- Ability to “talk about yourself” as primitive “self-awareness”
- Consciousness as a spectrum

- **The strange loop at the heart of Gödel’s theorem**

- “GEB was inspired by my long-held conviction that the ‘strange loop’ notion holds the key to unraveling the mystery that we conscious beings call ‘being’, or ‘consciousness’.”
- “I practically heard [the secret behind the nature of selves] screaming up at me from the pages of [Gödel treatise] Nagel and Newman.”

Interlude: Gödel's Proof

(with apologies to Nagel and Newman)

Gödel showed:

1. How to construct a formula G of PM (any system of *Principia Mathematica* power) that represents, via Gödel numbering, the meta-mathematical statement: "Formula G is not a theorem of PM". **(The strange loop)**
2. That G is a theorem in PM iff $\sim G$ ("not- G ", the opposite) is a theorem in PM: if PM is *consistent*, then theorem G is *undecidable*. **(The paradox)**
3. That G , while undecidable, is still a *true* formula, by claiming that no integer has a certain arithmetical property, which is the case. **(Side channel truth)**
4. That because G is both undecidable in PM, and true, PM must be incomplete. We cannot derive all arithmetical truths from axioms of PM (or any extensions). **(The trap)**
5. How to construct a formula A of PM that represents the statement "PM is consistent", that A implies G , and finally that A is not a theorem in PM. Consistency of PM cannot be established *within PM itself*. **(Incompleteness)**

Meaningless symbols, meaningful patterns

- **Gödel's proof is “just mechanical symbol shunting”**
 - Self-reference emerges from “mere” symbolic manipulation
 - No meaning/content/context/insight during the processing
- **Where and how is meaning added to G's proof?**
 - Is it by the “semantic magic” uniquely done by our brains?
 - Or by **patterns** that can come to exist in the stuff of brains?
- **Gödel's Great Gift**
 - Not the incompleteness result itself, but the notion that a statement's meaning can have deep consequences beyond its immediate reach

What If

- **Grand Analogy:**

 - meaningless symbols of a formal system

 - ↔ inanimate molecules of a brain

- **What if the patterns in one medium could yield analogous results in another medium?**

- **What if *selfhood* was one such pattern?**

 - “GEB is in essence a long proposal of strange loops as a metaphor for how selfhood originates.”

 - Certainly there’s more to *life*; point here is in the analogy

Self-awareness

- **What if “I” emerges, when the patterns in a brain mirror the brain’s mirroring of the world?**
 - As patterns connect with their model, the patterns become “real” causal entities
 - As Gödel’s misbehaving formula makes the whole system unstable, so you could perhaps draw wild emergent properties from a strange loop in the brain
- ***Some self-mirroring is inevitable in any system with sufficient fidelity to have self-representation***
 - Consciousness isn’t binary; measured on a spectrum

A GEB Reader: The Working Title

- **Hofstadter wrote GEB under the working title**
Gödel's Theorem and the Human Brain (GTatHB)
- **The book is in two parts: GEB and EGB**
 - An introduction to Gödel's theorem, and an “extension” towards the human brain; a grand analogy
- **All themes developed throughout, literary games**
 - GEB/EGB not a clean division, but a useful guide
 - Hofstadter's character at play

A GEB Reader: A Map of GEB

Part I: GEB	Part II: EGB
Preface to <i>GEB</i> 's 20th anniversary edition	Chapter X: Levels of Description, and Computer System
Introduction: A Musico-Logical Offering	Chapter XI: Brains and Thoughts
Chapter I: The MU-Puzzle	Chapter XII: Minds and Thoughts
Chapter II: Meaning and Form in Mathematics	Chapter XIII: Bloop, Floop, and Gloop
Chapter III: Figure and Ground	Chapter XIV: On Formally Undecidable Propositions of TNT and Related Systems
Chapter IV: Consistency, Completeness, and Geometry	Chapter XV: Jumping out of the System
Chapter V: Recursive Structures and Processes	Chapter XVI: Self-Ref and Self-Rep
Chapter VI: The Location of Meaning	Chapter XVII: Church, Turing, Tarski, and Others
Chapter VII: The Propositional Calculus	Chapter XVIII: Artificial Intelligence: Retrospects
Chapter VIII: Typographical Number Theory	Chapter XIX: Artificial Intelligence: Prospects
Chapter IX: Mumon and Gödel	Chapter XX: Strange Loops, Or Tangled Hierachies

Legend:

Gödel's theorem

Brain, biology, computing, AI, theory of mind

Misc.: Zen, related mathematics

A GEB Reader: Notable Dialogues

- ***Contracrostipunctus***

- Perhaps the central dialogue (also according to H)
- Introduces self-referencing, and a system collapsing loop in the form of a perfect record player and unplayable record

- ***Crab Canon***

- Short and sweet, quintessential GEB piece, perfect Escher match

- ***Prelude... + Ant Fugue*** (*also found in “The Mind’s I”, /w Dennet*)

- P: Questions about the relationship between the whole and its parts
- AF: Continues the discussion towards the notion of consciousness in an ant colony, and varying levels of thought processes

- **(Six-Part Ricercar)**

- The grand finale

Conclusion

- **Analogies are the map to Hofstadter's world**
- **GEB is a grand analogy**
 - Hofstadter saw multitudes in Gödel's remarkable result and was driven to write as colorful an exposition of it as he could
 - The book is a wild paeon to the abstract pattern of the strange loop, and the many shadows it casts
- **Strange Loops**
 - *Perhaps* the missing link between the inanimate and the animate: a solution to the mystery of consciousness

Extra: Trivia

- **Something in the water in 1979...**
 - *The Madwoman in the Attic* by Gilbert & Gubar
 - Co-finalist for the 1980 General Nonfiction Pulitzer
 - Look at the cover!

