Welkin
An Information Language

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Preface

To be written...

Chapter 1

Introduction

Startng Outline:

- Describe the ways philosophers and mathematicians have approached organizing the world around them.
  - Look at Cantor, Dedekind, Frege, Russell, Goedel, and up to the present.
  - Look at modern philosophers
- Reflect on two major shortcomings of these approaches: having little metaphysical explanation about *how* things can be combined, and a lack of generality for several concepts
  - No explanation for what *is* a set fundamentally, or, more importantly, how two entities can be combined into one.
    - Include formal and informal definitions
    - Recognize the prior *tool* used to start math in the first place (again, the ability to combine objects or ideas)
    - Explain that, while category theory may make these constructions more precise, it *still relies on predetermined tools.* These tools are physiological in nature, but they are *ultimately metaphysical.*
  - Lack of generality for: structures, the real numbers, logic (particularly paraconsistent logics). Specifically, mention:
    - Cryptomorphisms and Voldemort's Theorem. This is not part of official literature, but has been given in an extensive document. It serves an important philosophcial point (which will be rexammined in Chapter 2)
    - Mention the number of models for the reals, and how it still has not been decided what the official model is. Mention constructive concerns (overarrching with generality). (Cite Lesnik's paper as a step in the right direction, but critique the lack of generality)

        * Mention the role of bifrucation, and that there is opportunity to expand upon it more (into a generalized fuzzy logic)

- Explain the essential goals of Welkin, built upon CFLT
- Describe target audience
    - This document is geared towards philosophially or mathematically inclined persons. The official version is in English, but, in time, translations will be added.
    - In a different document (separate from this repo), there will be a more accessible version as a part of my program on "humanistic logic".

Chapter 2

Background

Possible beginning quote (at least for Western philosophers). "The Fold: Leibniz and the Barouqe"

> the two instances . . . have no windows, . . . for Leibniz, [this! is because the monad's being-for the world is subject to a condition of closure, all compossible monads including a single and same world. For Whitehead, on the contrary, a condition of opening causes all prehension to be already the prehension of another prehension. . . . Prehension is naturally open, open to the world, without having to pass through a window.

2.1 Western and Eastern Thought

- Contrast the distinct philosophies pervasive in Western and Eastern philosophy. Some key points to emphasize:
  - Mechanistic vs spiritual leaning
  - Classical logic vs Different Logics (particularly involving contradictions)
  - Brief mention in other philosophies (possibly ethics or other non-epistemology related fields?)
  -

2.2 Sets: Georg Cantor and Others

- Cover most of Cantor's writings, including "Beiträge zur Begrundung der transfiniten Megenlehre".
  - Touch upon other thinkers that built upon Cantor, including Frege, Dedekind, etc. Dedekind particularly has a section on systems that

he later uses to define naturals (and is extremely relevant to Cantor's definition).

  - Cover the core issues behind Cantor's original definition, including pyschological components. Use modern crtiqiues in current literature. (See references in: "New Essays On Peirce's Mathematical Philosophy")
  - Poin

- Explain the overreaching implications of set theory, as well as its materialistic issues. Briefly explore the possible resolutions to this (e.g., type theory), and demonstrate that they do not sufficiently resolve the materialistic roots.
- Explore the issue of defining an object, claiming a more general theory is possible. Argue that Cantor and others have used foci
- Touch upon the formalist response to set theory, and rebuttal against the claim that formalism alone can be used for mathematical thought.
- Helpful: look at the references in the metamath book

2.3 The Role of Foci

- Explore the issue of defining an object, claiming a more general theory is possible. Argue that Cantor and others have used foci (in a specialized form, collections)
- Justify the existence of different paradoxes the applicability of non-classical logics (particularly paraconsistent logic)
- Explain the shortcomings of foci alone in explaining both new phenomena and generality

2.4 Early Attempts at Continua: Cantor, Dedekind, and Others

- Revisit Cantor, particularly with Cantor's Theorem. Explore the different models of the real numbers.
- Referencing foci, explain how these models do not completley generalize the reals. Eve mention how category theory does not resolve this either (in both a mathematical and philosophical sense).
- Analyze Zeno's paradoxes and Aristotle's original definition of a continuum. Explain set-theoretic continua do not constitute full fleged continua (and are missing key metaphysical properties)

2.5 Continua: Charles Peirce

- Discuss Peirce's role in mathematics, logic, and ontology.
- Briefly mention Pragmatism and Peirce's search for its proof.
- Explain what Perice thought about Cantor's theory, and introduce his concept of multitudes
  - Elaborate on his initial readings of Cantor's theorem and definition of sets
  - Explore Peirce's shortcomings in his definition of collection
  - Mention some of his misconceptions, e.g., his presumption that the Continuum Hypothesis must hold
- Informally justify the mathematical value of Peirce's writings, arguing that more concrete axioms need to be developed from his ideas. In particular, explain why Perice was closer than Cantor to getting to a definitin of a bona fide continuum.

2.6 Folds: Deleuze

Possible quote to include about Deleuze, "The Fold: Leibniz and the Baroque", page 81 (maybe this is better suited for the introduciton?)

> For Leibniz... bifrucations and divergencies of series are genuine borders between incompossible worlds, such that the monads that exist wholly include the compossible world that moves into existence. For Whitehead (and for many modern philosophers)... bifrucations, divergences, incompossibilites, and discord belong to the same motley world that can no longer be included in expressive units, but only made or undone according to prehensive units and variable configurations or changing captures. In a same chaotic world divergent series are endlessly tracing bifurating paths. It is a "chaosmos" of the type found in Joyce, but also in Maurice Leblanc, Borges, or Gomrowicz.

- Describe Deleuze's work in epistemology and relevance throughout modern philosohpy.
- Connect Deleuze to some concepts in Eastern thought, particularly tying his idea of folds with origami. Also mention how he challenged Leibniz's metaphysics.
- Explain how Deleuze's concept of a fold resolves Peirce's previous inquries into collections.

Chapter 3

Continuum Foci Logic and Theory

3.1 Axioms

- Figure out how to write all of the axioms in Lean.
  - Lean is based on the Calculus of Inductive Constructions (see ths link for a relative strength of this theory: `https://mathoverflow.net/questions/69229/proof-strength-of-calculus-of-inductive-constructions`)
  - However, we want to generalize this to ANY theory... how could this be done?
  - I am still pondering on a solution. Here is what I am thinking so far: I think we need to recognize how the continuum is secretely hidden in any theory. It is similar to the incompleteness theorems: maybe we can generate a corresponding theorem or property of continua, but we cannot prove it.
  - Then, for a proof of the principle, we go back to CFLT. My hope is that, because CFLT is the complete opposite of purely finitistic systems (combinatorial logic or DFAs), we can prove, once and for all, properties about CFLT, under possible metaphysical assumptions. (Much more background needs to be written before I can discuss this in depth, but for now, I believe I must assume that a continuum exists. That may be the ONLY unproven assumption out of everything else, but beyond that, the axioms are purely structural (and may be unneeded).)

3.2 Fundamental Properties

- Define and prove properties of (generalized) theories

- Semantic Lifting Lemma
- Justify how every possible theory (in the MOST general since) is definable in CFLT
- Prove the consistency, completeness, and uncomputability of CFLT. In particular, show that CFLT can solve *any* possible generalization to the Halting Problem. Heavily connect to Harvey Friedman's unpublished manuscript on Boolean relation theory and incompleteness: `https://bpb-us-w2.wpmucdn.com/u.osu.edu/dist/1/1952/files/2014/01/0EntireBook061311-wh0yjy.pdf`

3.3 Key Implications

Chapter 4

The Welkin Standard

4.1 Preliminaries

4.1.1 Character Encodings

4.1.2 EBNF Variant

- While there is an ISO standard for EBNF, several authors have noted it has issues. References: `https://dwheeler.com/essays/dont-use-iso-14977-ebnf.html`, `https://www.grammarware.net/text/2012/bnf-was-here.pdf`. As recommended by David Wheeler in the first reference, we use the BNF Notation defined in the W3 standard (at `https://www.w3.org/Notation.html`).

4.2 The Welkin Language

- First Define character encodings in general. Helpful reference: `https://www.w3.org/International/questions/qa-what-is-encoding`
  - For wide spread use, there should be different character encodings used for *direct comparison* with Welkin files. Ultimately, every Welkin file will be converted into a standard binary (or possibly text) file to store the object
- Determine a suitable BNF for Welkin, which can be parsed with LALR (or otherwise a more efficient parser)
  - Key goal: make Welkin's syntax fully decidable and efficient to parse. An important component of CFLT called the Semantics Lifting Lemma (TBD) essentially says we can embed a complex syntax into a semantics. (This proof will hopefully be constructive and work for any random syntax, no matter how crazy it might be). In other words, using an efficient parser does NOT limit how expressive Welkin is.

  - Presuming the result above, there will be two variants: the finite (regex) and full versions.
    * The finite, or regex, version is purely for regex-definable files.
    * The full version will be LALR parsed, as it is generally a standard for programming languages. Not only is it efficient (both in speed and memory), but any grammar written in LALR is unambiguous (reference needed!).
    * Now that the idea of these two versions is solidifed, we need some common terms. Most of these should come from graphviz, but also in other note taking formats.
  - The standard format should read just like an ordinary programming language. It may be akin to graphviz, but it should prioritze on the contents of each node and edge, not necessarially how they are rendered. (A better thought would be to put rendering information in a standard *library*, which could then be minimized when browsing through a Welkin file/project.)
    * Welkin essentially needs the key elements from set theory: conjunction, disjunction, negation, implication, etc. We can use corresponding symbols for these: $\&\&, ||, \neg, \rightarrow$. In *customizable files*, these symbols can be overloaded and added upon.
    * Key goal: make this FULLY compatible with dot. (In fact, for a prototype, we can work with dot directly, but we should make it helpful for our needs).
    * Another important point: we want to say that graph ALWAYS refers to a metagraph (to avoid redundancy)

- Following CFLT, explain a suitable semantics for Welkin.
  - We need to determine how to implement all of the axioms.
  - We also need to use a suitable proof system (e.g., Hilbert, Gentzen, etc.). Maybe that could be decided in CFLT?

Draft of full-power BNF (with recursion and references to self):

term	::=	**graph** | **connection** | **ident** | **string**
graph	::=	**ident? ‘{’ term ‘}’**
connection	::=	**term connector**
connector	::=	**edge** | **arrow**
edge	::=	**‘--’**
arrow	::=	**‘->’**
ident	::=	**CHAR***
string	::=	**‘ CHAR* ’** | **ÒCHAR* ´**

Here, the slahes next to quotes means they are included within the grammar itself, CHAR means a character in a given encoding. The official grammar file can be found in welkin-book/chapters, where every nonquoted instance of the symbol = means ::=. In Welkin, we informally write the BNF above as follows:

```
term -> { graph connection ident string}
graph -> {{ident {}}->‘{’--term--‘}’}
connection -> {term--connector--term}
connector -> {edge arrow}
edge -> ‘--’
arrow -> ‘->’
ident -> CHAR*
```

Every .welkin file has a corresponding configuration. It may either be put as a comment or (preferred) written in a separate file, which, by default, is called config.welkin. It has the following format:

- Encoding
  - Options: ascii, utf-8, utf-16, other
  - In the case of other: we need to specify how to define an encoding. (We need a light-weight API for implementations)
- Grammar
  - Strength: bounded (only finitely nested graphs with a given nesting limit, no recursion), no-self (arbitrary nesting limit, but no recursion), full (recursion allowed)
  - Customized: use a builtin template or custom welkin file. These can be used to change any part of the grammar, including adding keywords, the symbols used, adding new symbols, etc. Essentially, this will be a way to built new grammars from the original specification; we will need a separate parser for this (i.e., a parser of BNF/Welkin accepted notation).
- (Optional) Language
  - Defaults to English. Can be written in the writer's desired language (as long as it has been configured in Encoding above)

Alternatively, a file with a different name may be used; see the section “Graph Application Behavior” for more details. For subsequent chapter, we refer to the file above as the **welkin-config.**

4.2.1 Customization

All Welkin files are infinitely customizable via the welkin config file.

4.3 Core Algorithms

4.3.1 Graph Encoding

4.4 General Application Behavior

Chapter 5

Expanding Complexity