

# **From Cross-World Predication to Cross-World Travel: Building a Bridge between Worlds**

**MSc Thesis** (*Afstudeerscriptie*)

written by

**Brandon Ryan Hoogstra**

(born June 15, 1996 in Phoenix, Arizona, United States of America)

under the supervision of **Arthur Schipper** and **Maria Aloni**, and submitted to the Examinations Board in partial fulfillment of the requirements for the degree of

**Master of Science in Logic**

at the *Universiteit van Amsterdam*.

**Date of the public defense:** **Members of the Thesis Committee:**

*June 24, 2020*

Paul Dekker (Chairperson)

Maria Aloni

Luca Incurvati

Arthur Schipper

Katrin Schulz



INSTITUTE FOR LOGIC, LANGUAGE AND COMPUTATION

# Acknowledgments

The present research initiative has benefited substantially from the intellectual contributions of a plethora of talented and insightful individuals.

## Universiteit van Amsterdam

- Maria Aloni (Faculty) (Faculteit der Geesteswetenschappen) (Institute for Logic, Language and Computation)
- Arthur Schipper (Faculty) (Faculteit der Geesteswetenschappen) (Institute for Logic, Language and Computation)
- Michiel van Lambalgen (Faculty) (Faculteit der Geesteswetenschappen) (Institute for Logic, Language and Computation)
- Jacopo Guzzon (Student)

## Arizona State University

- Richard Creath (Faculty) (School of Life Sciences)
- Andrew Khoury (Faculty) (School of Historical, Philosophical and Religious Studies)
- Steven Reynolds (Faculty) (School of Historical, Philosophical and Religious Studies)
- Michael Joe White (Faculty) (School of Life Sciences)

Especially immense appreciation is extended to Jeffrey John Watson of the School of Historical, Philosophical and Religious Studies at Arizona State University. Throughout the drafting of the present research initiative, Dr. Watson offered an unprecedented caliber of guidance and support. Several components of the present research initiative were directly influenced by his insights, including, though not limited to, the definition of an event and the exposition concerning the form of cross-world interaction that insurance policies exhibit upon the entities contained within the actual world.

Additional appreciation is extended to Michael Robert Hoogstra and Mary Elizabeth Maruna for financial support throughout the duration of the completion of the Master of Science Degree in Logic program by the author of the present research initiative.

Efforts have been undertaken to ensure that all of the individuals who have contributed towards the success of the present research initiative have been duly acknowledged for their contributions. Nevertheless, the author sincerely apologizes for any omissions that may have occurred.

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## Abstract

Within his book *On the Plurality of Worlds*, David Kellogg Lewis provides an extensive elucidation of his theory of modal realism, which states that all possible worlds are concrete particulars with ontological status equal to that of the actual world. The general conceptualization of modal realism advocated for by Lewis is highly beneficial for the purposes of comprehending such notions as cross-world predication, cross-world interaction, and cross-world travel. Cross-world predication is the process of identifying a relation between entities contained within distinct possible worlds. For example, the proposition ‘I could have been wealthier than I actually am’ involves predicating between the inhabitants of distinct possible worlds, as the actual individual referenced within such a proposition and his or her wealthier counterpart reside within different worlds. Properly understanding the proposition ‘I could have been wealthier than I actually am’ requires imagining a counterfactual scenario in which the closest counterpart to the referent of the term ‘I’ possesses a higher caliber of wealth than the individual who is instantiating the proposition. Expanding upon the theme of cross-world behaviors, cross-world interaction occurs when the events that transpire within one possible world causally impact the events that transpire within another possible world. Furthermore, cross-world travel occurs when an entity that is contained within one possible world departs from said world and arrives within another possible world. Although Lewis himself explicitly denies the potential for both cross-world interaction and cross-world travel, it is possible to account for such ideas with a few relatively minor modifications to his theory of modal realism. The primary hypothesis of the present research initiative may be tersely summarized as the theory that a formal language with an expressive power sufficient to adequately represent propositions involving cross-world predication is simultaneously capable of representing both propositions involving cross-world interaction and propositions involving cross-world travel. An alternative way of understanding the preceding idea is that when a formal language is able to satisfactorily account for the notion of cross-world predication, the distinct notions of cross-world interaction and cross-world travel can be had “for free”, without any features or qualities being added to the language. The first main objective of the present research initiative is to demonstrate that a formal language that is capable of representing cross-world predication is able to represent the distinct notions of cross-world interaction and cross-world travel as well. The second main objective of the present research initiative is to provide a description of the logical coherency of such notions as cross-world interaction and cross-world travel, as well as their usefulness for philosophical theorizing, particularly within the context of an appropriately-modified form of the Lewisian theory of modal realism. Finally, the present research initiative illustrates its significant philosophical utility through the practical application of a case study of the sophisticated system of modal metaphysics of the DC Extended Universe.

# Chapter 1

## Introduction

Cross-world predication is the process of attributing properties to the entities of distinct worlds, such as within the proposition ‘I could have been wealthier than I actually am’. The process of predicating between distinct worlds inherently invokes engagement with counterfactual scenarios, and typically involves reference to the entities contained within distinct worlds. Through a two-sorted variation of type theory known as Ty2, it is possible to formally represent propositions involving cross-world predication. Additionally, through the appropriate application of a formal language such as Ty2, it is possible to formally represent propositions involving cross-world interaction, in which the entities of distinct worlds can causally influence the transpiring of events within worlds other than the ones that they themselves inhabit. Furthermore, the interaction between distinct worlds can be extended to include traversing the metaphysical boundaries between worlds, thus enabling cross-world travel. The objective of the current research initiative is to illustrate the logical connections between all of the aforementioned forms of cross-world behavior.

The primary hypothesis of the current research initiative may be tersely summarized as the theory that a formal language with an expressive power sufficient to adequately represent propositions involving cross-world predication is simultaneously capable of representing both propositions involving cross-world interaction and propositions involving cross-world travel. An alternative way of understanding the preceding idea is that when a formal language is able to satisfactorily account for the notion of cross-world predication, the distinct notions of cross-world interaction and cross-world travel can be had “for free”, without any features or qualities being added to the language.

To aid with the comprehension of cross-world predication, it is described in relation to the theory of modal realism initially proposed by David Kellogg Lewis, whereas cross-world interaction and cross-world travel are both analyzed in contrast to the Lewisian conception of modal realism. Whilst numerous different metaphysical considerations and philosophical theories may be described and utilized in an attempt to illustrate both the sincerity and the plausibility of the primary hypothesis under consideration, it is perhaps ideal to conceive of the current research initiative as a technical exploration of logic. Ultimately, the current research initiative spans the gap between cross-world predication and cross-world interaction, as well as the gap between cross-world predication and cross-world travel, through the intermediary notion of cross-world causation.

Whilst perhaps a bit unconventional in both its scope and its methodology, the present research initiative has the potential to serve as a valuable addition to the academic literature of logic and philosophy. In fact, the present research initiative addresses a significant gap in the preexisting philosophical literature concerning particularly interesting notions that are associated with possible worlds, and which have substantial metaphysical implications. As of February 26, 2020, the website PhilPapers.org contains exceedingly few entries of academic journal articles concerning such topics as cross-world predication, cross-world interaction, and cross-world travel. More specifically, initiating an exact search, in which the search terms are typed with encapsulating quotation marks within the search bar, on the aforementioned website yields an underwhelming three results for the search term “cross-world predication”, a mere four results for the search term “trans-world causation”, and absolutely no results at all for a variation of other combinations of search terms for

similar subjects. The quantities of results generated by an exact search for sixteen different search terms by the website PhilPapers.org on February 26, 2020 can be visually represented nicely by a table of values, within which the rows represent the nouns of the search terms and the columns represent the hyphenated adjectives that precede such nouns.

**Exact Search Results for the Website PhilPapers.org on February 26, 2020**

	cross-world	trans-world	inter-world	other-worldly
predication	3	0	0	0
causation	0	4	0	0
interaction	0	0	0	0
travel	0	0	0	0

Perhaps a worthwhile stipulation, one of the four results for the search term “trans-world causation” appears to be a duplicate of another, meaning that the unique results for the search term “trans-world causation” may constitute a measly trio. With all of the aforementioned considerations, it ought to be apparent that the present research initiative has the capacity to compensate for a profound lack of academic literature on the various different forms of cross-world behaviors. In fact, it is a direct consequence of the oversight of the professional philosophical community, and not of a negligence of the author of the present research initiative to undergo due diligence in performing a literature review, that the sections of the present research initiative addressing such topics as cross-world causation, cross-world interaction, and cross-world travel are occasionally lacking in references to academic literature, as such literature does not, as of yet, exist in large quantities. Nevertheless, there exists a limited quantity of academic publications that are particularly relevant to the present research initiative, and a collection of one dozen such publications is systematically analyzed within a literature review within Appendix E.

It is certainly not the primary objective of the present research initiative to elucidate an argument for modal realism, nor is its purpose to argue for a certain metaphysical structure of reality. Whilst a plethora of references to the ontological theory advocated for by Lewis are incorporated into the present research initiative to bolster the intuitive plausibility of its primary hypothesis, articulating a detailed defense for modal realism is well beyond the scope of the present research initiative. For an extensive articulation of modal realism, as well as numerous arguments against potential criticism, it would be best to simply refer to the book *On the Plurality of Worlds*, which is, debatably, the pinnacle of the philosophical publication career of Lewis. For the purposes of the current research initiative, the conceptualization of modal realism advocated for by Lewis is largely presupposed to be true.

In addition to the introductory and concluding chapters, which are relatively standard, the present research initiative features five chapters that address the plethora of subjects of relevance to its primary hypothesis. Beginning with a linguistic analysis of cross-world predication, Chapter 2 describes a two-sorted variation of type theory known as Ty2, and subsequently utilizes the Ty2 system to produce eight distinct formal translations of the proposition ‘I could have been wealthier than I actually am’, which involves cross-world predication. The analysis of cross-world predication within Chapter 2 is replete with interesting considerations that are of relevance to both ontology and the philosophy of language, including, though not limited to, rigid identification, two-dimensional semantics, and Meinongianism. As it is of quintessential importance to both

modal realism and Meinongianism, the notion of existence is contemplated in detail, and three distinct interpretations of existence are proposed. In culmination, Chapter 2 first identifies which of the three different interpretations of existence is the best for the purposes of the present research initiative, and then identifies which one of the eight formal translations of the proposition ‘I could have been wealthier than I actually am’ is the most desirable option available. Proceeding to a more metaphysical subject, Chapter 3 articulates a thorough analysis of the counterfactual account of causation that Lewis relies upon throughout his development of modal realism within *On the Plurality of Worlds*. Critically, to aid in clarifying precisely what causation is, exposition is provided concerning how causation is distinct from both causal influence and truth-making. Departing from the ideology of Lewis, Chapter 3 proposes a counterfactual account of cross-world causation, and considers how the potential for cross-world causation could involve the possibility for there to exist a World to End All Accessible Worlds. Expanding upon the account of cross-world causation developed throughout Chapter 3, Chapter 4 describes the mutual influences that actual entities and merely possible entities can exert upon one another, and illustrates how such cross-world interaction can be represented through cross-world predication. Investigating what is perhaps the most intriguing application of cross-world causation, Chapter 5 articulates the potential for, and considerations of pertinence to, cross-world travel. Finally, Chapter 6 demonstrates the philosophical utility of the present research initiative by applying the ideas and the theories developed within the preceding chapters to a case study of the sophisticated system of modal metaphysics of the DC Extended Universe.

The fundamental purpose of the present research initiative is to illustrate how a strategically-selected formal language, with an appropriate accompanying semantics, can be utilized to coherently describe sophisticated systems of modal metaphysics, such as that of the DC Extended Universe. Unfortunately, despite the best efforts of the most talented minds, any ambitious theory will almost inescapably have at least a few minor flaws, and the present research initiative is no exception.

It is perhaps worth explicitly acknowledging that certain notions contained within Chapter 2 are similar to ideas developed as a component of a research project proposal for the Structures for Semantics course at the Universiteit van Amsterdam within the Spring 2019 semester, which was taught by Maria Aloni. In particular, topics of commonality between the current research initiative and the aforementioned research project proposal include, though are not necessarily limited to, the restriction of quantification over the actual world within the formalism of Ty2 and the utilization of “ontologically neutral” alternatives to both existential quantification and universal quantification.

### **General “Spoiler” Alert:**

As a final precautionary disclaimer, it is perhaps worth explicitly acknowledging that the present research initiative includes numerous segments of exposition concerning various different movies, video games, and other elements of popular culture. The references contained herein to such works of fiction often include “spoilers”, and the reader is hereby duly forewarned as such.

## Chapter 2 Cross-World Predication

### Modal Realism and Rigid Identification

In accordance with the philosophical contemplations of Lewis, it is not possible to inhabit two distinct possible worlds simultaneously. In fact, Lewis himself denies the notion of cross-world identity, as is explicitly acknowledged within his declaration that, “Nevertheless trans-world identity, in the sense of overlap of worlds, is to be rejected” (Lewis, 1986, page 199). Indeed, such a notion would appear to violate the spatiotemporal isolation of distinct worlds, and perhaps the causal isolation of distinct worlds as well. In an effort to account for such a consideration when attempting to engage within cross-world predication, it is possible to associate both the individuals and the objects contained within one world with their respective counterparts within another possible world. For the sake of simplicity, it may be beneficial to presuppose rigid identification across worlds, such that a single linguistic description of a particular individual or a particular object is sufficient to identify it, regardless of the world in which the linguistic description is instantiated.

Despite its ubiquitous presence within colloquial speech, attempting to account for cross-world predication linguistically has proven to be unexpectedly challenging for both linguists and philosophers. For example, the proposition ‘I could have been wealthier than I actually am’ involves cross-world predication in the form of identifying a counterfactual situation. The proposition ‘I could have been wealthier than I actually am’ represents a situation in which the closest counterpart of the referent of the indexical ‘I’ is wealthier within his or her world than the referent of the indexical ‘I’ is within the world within which the proposition is instantiated. Although admittedly perhaps not perfect, the proposition ‘I could have been wealthier than I actually am’ can be approximately linguistically represented within a two-sorted variation of type theory known as Ty2, which features three basic types. The first basic type is the type  $e$ , which represents entities, such as objects and individuals that are contained within a particular world. The second basic type is the type  $t$ , which represents truth-values. As classical logic is presupposed to be true within the present research initiative, and is utilized throughout the present research initiative accordingly, the truth-values shall be restricted to the binary distinction between  $\top$  and  $\perp$ . The third basic type is the type  $s$ , which represents the philosophical conception of worlds. Importantly, within the Ty2 system, worlds are not considered to be entities, and hence the distinction between entities, which are of type  $e$ , and worlds, which are of type  $s$ .

Whilst certain philosophers would argue for applying a different style of logic when attempting to formally represent cross-world predication, such as Alexander Kocurek, who argues for utilizing a system of quantified hybrid logic, Lewis himself advocated for applying a particular two-sorted variation of formal language, known as  $\mathcal{L}^{2S}$ , within analyses involving cross-world predication (Kocurek, 2016, page 697, page 710). One relevant consideration that may arise when considering utilizing a two-sorted variation of formal language is to evaluate the expressive power of such a language in its capability, or lack thereof, to adequately generate formal translations of propositions involving cross-world predication. In fact, two-sorted variations of formal language, such as the  $\mathcal{L}^{2S}$  system and the Ty2 system, are sufficiently powerful for the purposes of producing formal



representations of propositions involving cross-world predication, as is illustrated within the observation that, “It should be *obvious* that a language as powerful as the two-sorted language has the capacity to express cross-world predication” (Kocurek, 2016, page 710). Ultimately, although it may require a minor deviation from the initial intentions of Lewis, the Ty2 system is adequate for the purposes of formally representing cross-world predication, whilst remaining mostly truthful to the theory of modal realism that he advocated for so determinedly, and shall consequently be utilized for the present purposes of philosophical analysis.

For the purposes of attempting to formally represent cross-world predication, it is often beneficial to incorporate a constant  $v$  of type  $s$  that represents the actual world within linguistic analysis. In an effort to remain consistent with the conception that the word ‘actual’ is an indexical term, as advocated for by Lewis, the semantic interpretation of the word ‘actual’ shall be designated as ‘the world within which you (the reader) are currently located’ for the purposes of the present analysis. Importantly, quantification over the constant  $v$  shall be restricted, and it shall be further stipulated that the actual world is unique from all other worlds.

With the critical distinction between entities of type  $e$  and worlds of type  $s$ , the Ty2 system can supersede classic first-order modal logic in its capacity to adequately formally represent several different interpretations of the proposition ‘I could have been wealthier than I actually am’.

### **Strong Rigid Identification Lewisian Interpretation**

$$\exists w((v \neq w) \wedge \exists!x(L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_v(\mathbb{I})(x))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’

All of the eight different formal representations of the proposition ‘I could have been wealthier than I actually am’, including the aforementioned representation, are juxtaposed within Appendix B.

Within the Strong Rigid Identification Lewisian Interpretation of the proposition ‘I could have been wealthier than I actually am’, the formalism  $C_v(\mathbb{I})(x)$  represents the expression ‘ $x$  is the counterpart of  $\mathbb{I}$ ’ evaluated at the actual world, and incorporates right-to-left currying, in accordance with common linguistic convention. A fundamental feature of the Ty2 system, evaluation of predication occurs at a specified world, hence the designation that the “counterpartness” property ought to be evaluated at the actual world, denoted by the presence of the constant  $v$  within the subscript. Similarly, the formalism  $L_v(v)(\mathbb{I})$  represents the expression ‘ $\mathbb{I}$  is located within the actual world’ evaluated at the actual world and the formalism  $L_v(w)(x)$  represents the expression ‘ $x$  is located within world  $w$ ’ evaluated at the actual world. Perhaps unsurprisingly, the location property specifies within which world a particular entity is located, which ought not be conflated with the world at which the location property is evaluated. Technically, since strong rigid identification has been presupposed, the evaluation of both the “counterpartness” property and the location property could occur at any world, since all worlds ought to agree upon the status of a particular individual within one world as the respective counterpart of another particular individual within another world, as well as upon within which world a particular entity is located. As such, the formalization of the Strong Rigid Identification Lewisian Interpretation could potentially be revised and generalized, though such an interpretation arguably sacrifices simplicity by permitting for arbitrary selection of worlds for predication evaluation.

### Generalized Strong Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \exists! x(L_{\omega_1}(v)(\mathbb{I}) \wedge L_{\omega_2}(w)(x) \wedge C_{\omega_3}(\mathbb{I})(x) \wedge W_{\omega_4}(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4\}$  represent arbitrary worlds of evaluation

For the sake of attempting to best represent the philosophical assertions of Lewis, it is imperative to assert that the counterpart to a particular individual within another world is both actualized relative to the other world and unique, therefore mitigating concerns, initially introduced by Willard van Orman Quine, of both “disorderliness” between possible worlds and issues of individuation between different people or distinct objects (Lewis, 1973b, page 87). Additionally, in an effort to appropriately adhere to the modal realism advocated for Lewis, it is important to conceptualize other worlds as being metaphysically concrete particulars that are genuinely and literally as real as the actual world. For the purposes of analysis throughout the present research initiative, concreteness is simply defined as the state of being extended within both space and time, and abstractness is simply defined as the state of not being extended within both space and time. By associating concreteness and abstractness with extension within space and time, such definitions are reminiscent of what Lewis deems the Negative Way of defining such notions (Lewis, 1986, page 83).

Whilst accepting the ontological existence of other worlds as concrete particulars may be difficult for philosophers who desire an ontological theory that is maximally parsimonious in all possible regards, it is nevertheless exceedingly beneficial for the purposes of representing counterfactual scenarios and engaging in analyses of cross-world predication. Importantly, the adherence to modal realism ought to be motivated by such considerations as its logical structure and its instrumental value, rather than by dubious ontological commitments arising from dramatic analyses of propositions within the philosophy of language, as is articulated well within the assertion by Scott Soames that, “In my opinion, the idea that by analyzing the meanings of ordinary truths involving locutions like *could*, *would*, *possibly*, and *necessarily*, we come to learn of the existence of alternate concrete universes is one of the most bizarre ideas in the history of a discipline known for such ideas” (Soames, 2005, page 201). Indeed, it is perhaps most ideal to accept a theory of modal realism, such as that advocated for by Lewis, on the basis of its practical utility for logical analysis, rather than on the basis of controversial linguistic origins.

One manner in which to understand the philosophical position that Lewis maintains is by evaluating his theories in contrast to alternative views. As may be apparent, Lewis is directly opposed to the theory of actualism, which simply states that the actual world is the sole world that exists as a concrete object. In accordance with such a theory of actualism, which is prevalent within both the philosophical literature and colloquial speech, whilst it may be the case that other worlds exist as theoretical notions, or perhaps as purely imaginary fictional constructs, that are useful for philosophical theorizing, they do not possess an ontological status that is comparable to that of the actual world. In fact, Lewis himself identifies three distinct forms of “ersatz modal realism” that are actualist competitors to his theory of modal realism, which are namely linguistic ersatzism, in which possible worlds are simply linguistic representations or “stories” of the way the actual world could have been, pictorial ersatzism, in which possible worlds are mere visual representations of possible states of affairs that represent through isomorphism, and magical ersatzism, in which possible worlds simply represent alternative ways of being without any further explanation

as to precisely how they do so (Lewis, 1986, page 141). It would seem to be the case that Takashi Yagisawa, among other philosophers, would qualify as an advocate for some form of linguistic ersatzism, as a result of his association of possible worlds with universes of discourse within a Tarskian semantics (Yagisawa, 1992, page 89). Additionally, within his book *On the Plurality of Worlds*, Lewis himself specifically identifies several other philosophers who endorse linguistic ersatzism, including Rudolf Carnap, Richard Jeffrey, and Brian Skyrms, as well as, to a certain extent, Quine (Lewis, 1986, page 141). Alternatively, Lewis explicitly attributes Robert Stalnaker as adhering to “nondescript ersatzism” by refraining from commenting on the means by which possible worlds are related to the actual world, though Lewis does consider the possibility that Stalnaker may, in fact, be implicitly relying upon a form of magical ersatzism (Lewis, 1986, page 141). Ultimately, the theory of actualism conflicts with the ontological theory proposed by Lewis, as it overemphasizes the importance of the actual world in an egocentric way, whereas Lewis claims that the actual world is equal to all other possible worlds with regards to its ontological status.

One particular feature of the Strong Rigid Identification Lewisian Interpretation of the proposition ‘I could have been wealthier than I actually am’ is that it inherently presupposes an objective conception of wealth, which is advantageous for certain purposes and disadvantageous for others. In general, strong rigid identification presupposes an objective conception of truth in the process of assigning truth-values to propositions. Within the context of the Ty2 system, such a consideration implies that the selection of the world at which a particular predicate ought to be evaluated is entirely arbitrary, and therefore enabling considerable freedom associated with the evaluation of predication.

A significant advantage of the arbitrary nature of world selection for predication evaluation afforded by strong rigid identification is that it enables simple comparisons between different worlds. For example, it may be the case that the non-actual counterpart of an actual wealthy individual possesses a greater quantity of monetary units than his or her counterpart within the actual world, yet is nevertheless considerably poorer than his or her counterpart, as a result of the fact that the monetary units within his or her world are inflated one thousand times more than the monetary units within the actual world. To further clarify such a situation, it may be beneficial to imagine a situation in which Actual Alice possesses five billion actual monetary units, whereas the counterpart of Actual Alice, known as Non-Actual Alice, possesses ten billion non-actual monetary units. Despite the fact that the numerical value that represents the monetary wealth of Non-Actual Alice is double the numerical value that represents the monetary wealth of Actual Alice, which may initially produce the illusion that Non-Actual Alice has a greater repertoire of monetary wealth than Actual Alice, when the conversion rate between actual monetary units and non-actual monetary units is appropriately accounted for, it is observable that Non-Actual Alice possesses the equivalence of a mere ten million actual monetary units, meaning that Actual Alice possesses five hundred times the monetary wealth of Non-Actual Alice.

It would not be possible to accurately evaluate predicates between possible worlds without understanding such concepts as the metaphysical laws and the cultural norms that govern the existence of other worlds if not for the adoption of strong rigid identification, which is information that may be difficult, if not impossible, to acquire without voyaging to such worlds, a feat not to be underestimated in its difficulty. As such, strong rigid identification enables meaningful compar-

isons between worlds without requiring much information concerning the nature of such worlds, which is exceedingly useful for representing the ignorance of the ways of other worlds that could otherwise be potentially troublesome in attempts to engage within cross-world predication.

## **Variation of Meaning and Two-Dimensional Semantics**

Despite its success in representing the notion that different calibers of wealth can be comparable between different worlds, such a conception of rigid identification inadvertently presupposes that there exists an objective conception of wealth, meaning that it suffers from the disadvantage that it fails to account for the fact that different worlds may have different conceptions of wealth. Consequently, it may be strategic, in general, to relativize predication to particular worlds, whilst maintaining that referential terms, such as terms that identify subjects or objects, remain strictly rigid across all worlds. As such, it may be beneficial to distinguish between two different forms of rigid identification, which may be labeled as strong rigid identification and weak rigid identification. Expressed in the technical terminology of Ty2, strong rigid identification applies the notion of rigid identification to all objects, regardless of their type. Alternatively, weak rigid identification applies the notion of rigid identification solely to objects of type *e* and to objects of type *s*, whilst it does not apply the notion of rigid identification to objects of other types. For example, by refraining from rigidly identifying objects of type *t*, truth-values can be relativized to the particular worlds at which propositions are evaluated. Such a consideration enables greater capacity in accounting for discrepancies between different conceptions of truth that may exist between different worlds.

As it does not presuppose an objective conception of truth, weak rigid identification can be useful for capturing such notions as that of cultural relativism, which may be of interest in a variety of different philosophical applications. In fact, the effort to satisfactorily account for cross-world travel, as articulated within Chapter 5, is one of the primary sources of motivation for accepting weak rigid identification, thus acknowledging that the meanings of such linguistic items as predicates may vary from one world to another, whilst maintaining that the referents of both objects of type *e* and objects of type *s* remain constant, which is beneficial for the sake of ease and simplicity of reference when entities are voyaging from one possible world to another.

Accounting for the distinction between strong rigid identification and weak rigid identification, it is possible to generate a Weak Rigid Identification Lewisian Interpretation of the proposition ‘I could have been wealthier than I actually am’ as an alternative to the Strong Rigid Identification Lewisian Interpretation, as well as a corresponding Generalized Weak Rigid Identification Lewisian Interpretation. Syntactically, the Generalized Weak Rigid Identification Lewisian Interpretation is identical to the Generalized Strong Rigid Identification Lewisian Interpretation, though semantically, the two differ in their respective applications of weak rigid identification and strong rigid identification within the process of interpreting predicates, in accordance with their names.

### **Weak Rigid Identification Lewisian Interpretation**

$\exists w((v \neq w) \wedge \exists!x(L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_w(\mathbb{I})(x))$   
where  $\mathbb{I}$  represents the referent of the indexical ‘I’

### **Generalized Weak Rigid Identification Lewisian Interpretation**

$\exists w((v \neq w) \wedge \exists!x(L_{\omega_1}(v)(\mathbb{I}) \wedge L_{\omega_2}(w)(x) \wedge C_{\omega_3}(\mathbb{I})(x) \wedge W_{\omega_4}(\mathbb{I})(x))$   
where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4\}$   
represent arbitrary worlds of evaluation

By rejecting an objective conception of truth, weak rigid identification successfully circumvents the challenges associated with attempting to produce a satisfactory definition of truth that can be applied to all worlds. As an aside, it can be argued that endeavoring to generate a logically consistent nontrivial definition of truth is an exercise in futility as a result of Alfred Tarski’s Theorem on the Undefinability of Truth. The Weak Rigid Identification Lewisian Interpretation of the proposition ‘I could have been wealthier than I actually am’ captures the notion that the conception of wealth may differ from one world to another.

The Weak Rigid Identification Lewisian Interpretation involves deciding between whether to evaluate the wealthier property by the “standards of interpretation” of the actual world or by the “standards of evaluation” of the world within which the relevant counterpart of the referent of the indexical ‘I’ resides, which may differ from one another. For example, accounting for the conversion rate between currencies within different worlds, it may be the case that Actual Alice possesses five billion actual monetary units within the actual world and Non-Actual Alice possesses the equivalence of ten million actual monetary units within a world other than the actual world. Under the influence of an objective conception of wealth, it would appear as though Actual Alice is immensely wealthier than Non-Actual Alice, though such a comparison of the discrepancy in wealth between Actual Alice and Non-Actual Alice is perhaps incomplete or misleading. It may be the case that the world within which Non-Actual Alice resides abounds with natural resources in quantities far greater than that of the actual world. As a result of the vast abundance of natural resources, the prices of goods are unprecedentedly lower within the world of Non-Actual Alice than within the actual world. Consequently, Non-Actual Alice may be capable of purchasing a far greater supply of resources and products within her world than Actual Alice can within the actual world. Despite the fact that the monetary wealth of Non-Actual Alice is equivalent to a mere one five-hundredth of the monetary wealth of Actual Alice, the opportunity for Non-Actual Alice to acquire a far greater quantity of non-monetary material wealth than Actual Alice is a potential indication that the general wealth of Non-Actual Alice vastly surpasses the general wealth of Actual Alice.

Indeed, there exist measures of wealth that are entirely independent from, and perhaps far more important than, the largely artificial conception of money. For example, it may be the case that the material wealth of Actual Alice, including her monetary wealth, vastly surpasses that of Non-Actual Alice. Nevertheless, Non-Actual Alice is fortunate to have many close friends that she enjoys spending time with, a career that she is truly enthusiastic about, and a general sensation of fulfillment with her life. Alternatively, Actual Alice lacks all of the aforementioned qualities, and remains consumed within a state of chronic depression that is absolutely debilitating to both her physical health and her psychological health. As such, it may be more appropriate to assert that

Non-Actual Alice is incredibly wealthy, whilst Actual Alice is terribly poor, despite the fact that the material wealth of the two women would likely generate the impression that the opposite is true, and which is perhaps more suggestible when evaluating wealth through an objective conception of wealth.

Yet another important consideration is that it is not unreasonable to argue that the evaluation of wealth is highly dependent upon the societal values of the community in which a particular individual resides. As such, the status of wealth of a particular individual could vary dramatically from one world to another, further strengthening both the justification for and the expressive power of relativization of predication evaluation. For example, it may be the case that Actual Alice resides within a particular community within the actual world that values monetary wealth above all else, whereas Non-Actual Alice is a member of a radically different community within another world where stupidity is ironically considered to be the ultimate form of wealth. Whilst Actual Alice may possess a substantial quantity of monetary wealth within the actual world, and Non-Actual Alice possesses a vast supply of intellectual talent within her world, it may not be appropriate to assert that both women are wealthy. Since the community that Actual Alice resides within places great value upon monetary wealth and Actual Alice possesses a substantial quantity of monetary wealth, it would seem appropriate to claim that the proposition ‘Actual Alice is rich’ is true when evaluated at the actual world. Since the community that Non-Actual Alice resides within places great value upon stupidity and Non-Actual Alice possesses a vast supply of intellectual talent, it would seem appropriate to claim that the proposition ‘Non-Actual Alice is rich’ is false when evaluated at her world. Thus, it is apparent that the capacity to relativize predication evaluation to particular worlds is a non-negligible advantage for weak rigid identification.

A further consideration that is of relevance when evaluating propositions through the utilization of weak rigid identification, the context-sensitivity of certain expressions ought to be appropriately accounted for within their respective formal representations. Without an objective conception of truth, and consequently, without an objective conception of wealth, it can be argued that such terms as ‘rich’ and ‘poor’ are ultimately vague, and that the evaluation of propositions involving such vague terms is directly dependent upon the context within which the proposition is instantiated. Perhaps it may initially be tempting to claim that such formalisms as  $R_v(x)$  and  $P_w(y)$  ought to be three-place predicates, rather than two-place predicates. For example, within the Weak Rigid Identification Lewisian Interpretation of the proposition ‘The rich could have all been poor’ within Appendix C, the formalism  $R_v(x)$  is a two-place predicate that represents the expression ‘ $x$  is rich’ evaluated at the actual world, where the first input-value, namely  $x$ , is simply a bound variable of type  $e$  and the second input-value, appearing within the subscript of the formalism, is the constant  $v$  of type  $s$  that represents the actual world. In an effort to account for the notion of contextualism that may be relevant within the evaluation of vague terms, one potential revision of such a formalism would be to amend  $R_v(x)$  to be  $R_v(x)(c)$  where  $c$  represents the context within which the predicate is instantiated. Despite the tantalizing allure of including an additional input-value for all predicates that represent vague terms, it is possible to account for the context-sensitivity of such vague terms as ‘rich’ and ‘poor’ without introducing a specific input-value that represents the context in which the predicate is instantiated. If contexts are believed to be fundamental constituents of worlds, then the context that is of relevance to a particular predicate is represented by the world at which the truth-value of the predicate is evaluated. Essentially, the world at which a particular

predicate is evaluated, which appears within the subscript of the predicate within the formalism of Ty2, includes as a component of its structure the context that is relevant for the particular predicate, meaning that including an additional input-value that specifies the context of relevance would be entirely extraneous, and therefore unnecessary.

One clever linguistic strategy for capturing the notion of context-sensitivity, as well as a variety of other linguistic phenomena, is to accept a two-dimensional interpretation of semantic meaning, such as that initially introduced by Stalnaker. A distinct advantage for interpreting linguistic expressions through a two-dimensional conceptualization of semantic meaning is that it enables coherent analyses of sentences that represent states of affairs that, as a result of presupposing rigid identification, are rendered metaphysically impossible, despite the fact that they are intuitively epistemically possible. The notion of two-dimensional semantics proposed by Stalnaker accomplishes such a feat by proclaiming that assertions, as well as their respective contexts, ought not be interpreted with regards to their propositions, though rather with regards to their propositional concepts, which are functions that map from possible worlds to propositions (Stalnaker, 1987, page 180).

For a particular propositional concept, the possible world that is provided as its input-value ultimately specifies the “standards of interpretation” by which the proposition that is returned as the output-value of the propositional concept is evaluated. For example, suppose that  $p$  is the propositional concept that represents the linguistic expression ‘Bruce Wayne is Batman’ and that  $g$  is the world of Gotham City. As such,  $p(g)$  is the proposition that results from interpreting the linguistic expression ‘Bruce Wayne is Batman’ by the “standards of interpretation” of Gotham City. To clarify, the “standards of interpretation” determine such details as the objects specified by referential terms, such as ‘Bruce Wayne’ and ‘Batman’, as well as the respective meanings of vague terms, such as ‘rich’ and ‘poor’, which are relativized to the specified world. Consequently,  $p(g)$  specifies that both the name ‘Bruce Wayne’ and the name ‘Batman’ identify the individuals that are determined by the standards of Gotham City, who are in fact identical. Since ‘Bruce Wayne’ and ‘Batman’ are names that specify identical individuals by the “standards of interpretation” of Gotham City, the proposition that is returned as the output-value of the propositional concept that represents the linguistic expression ‘Bruce Wayne is Batman’ shall necessarily be true. For comparison, suppose that  $h$  is an alternate possible world where Damien Wayne, the son of Bruce Wayne, is the sole Batman, and where Bruce Wayne was never Batman. Within  $h$ , the name ‘Bruce Wayne’ refers to the man Bruce Wayne, whereas, contrary to within the world of Gotham City, the name ‘Batman’ refers to the man Damien Wayne, who is certainly not identical to Bruce Wayne. Since the name ‘Bruce Wayne’ and the name ‘Batman’ refer to different individuals by the “standards of interpretation” of  $h$ , the proposition that is returned as the output-value of  $p(h)$  is necessarily false.

In general, the proposition that is returned as the output-value of a particular propositional concept is itself a function, namely a function that maps from possible worlds to truth-values (Stalnaker, 1987, page 178). When the truth-value of a particular proposition is determined solely by the details specified by the world that was provided as an input-value to the propositional concept that returned the particular proposition, the world that is supplied to the particular proposition is irrelevant.

For the sake of comprehension, it is common to represent the two-dimensional notion of semantic meaning that Stalnaker advocates for in the form of a square matrix for a particular propositional concept. Within such a matrix, the specified truth-values correspond to the truth-value returned when the world written above it is provided as an input-value to the proposition that is returned when the world written to the left of it is provided as an input-value to a particular propositional concept (Stalnaker, 1987, page 181).

	<i>g</i>	<i>h</i>	<i>v</i>
<i>g</i>	⊤	⊤	⊤
<i>h</i>	⊥	⊥	⊥
<i>v</i>	⊤	⊥	⊤

With such a conception of contexts, it is possible to robustly interpret linguistic expressions with regards to their propositional concepts, thus enabling semantic meanings to vary between different contexts, as is articulated well within the assertion that, “One way to reinterpret – a way that is appropriate to the violation of a particular pragmatic maxim – is to diagonalize: to take the assertion to express the diagonal proposition of the propositional concept determined by the utterance and its context” (Stalnaker, 1987, page 185). By interpreting propositions through a two-dimensional notion of semantics, as advocated for by Stalnaker, the context that is of relevance for the evaluation of a particular propositional concept is adequately accounted for, meaning that the appropriate interpretation of linguistic expressions can be adequately captured, and that the vagueness of natural language can be successfully dispelled altogether. Having two worlds contained within the subscript of a predicate is the formal technique for representing two-dimensional semantics. As it pertains to linguistic analyses of propositions involving cross-world predication, the two-dimensional notion of semantic meaning is the one that is instantiated when weak rigid identification is presupposed.

The notion of other worlds is of the utmost pragmatic utility for both philosophers and linguistics within their attempts to articulately describe counterfactual situations. Indeed, the idea that alternative states of affairs are realized within other worlds provides a useful conceptual framework with which to analyze the semantic meaning of propositions and sentences that are of genuine interest to the academic community, though which do not directly pertain to the actual world. Nevertheless, the Lewisian conception of other worlds presupposes modal realism, a philosophical theory that is undoubtedly mired in controversy. Throughout his philosophical publications, Lewis consistently maintains that other worlds are metaphysically concrete particulars that are constituted of a similar ontological structure as that of the actual world. Addressing concerns associated with ontological parsimony, Lewis asserts that although his theory of modal realism may sacrifice quantitative parsimony by stipulating the substantive existence of other worlds, it successfully preserves qualitative parsimony, and is therefore not as obscene a theory as other philosophers may accuse it of being (Lewis, 1973b, page 87). Despite such considerations, resistance to the Lewisian conception of other worlds remains persistent within the contemporary philosophical literature and the general academic community.



## Modal Realism and Meinongianism

In an effort to barter a reasonable compromise between the “liberal” Lewisian conception of other worlds and more “conservative” ontological theories, it may be beneficial to develop a means by which to formally represent propositions concerning counterfactual situations without committing to the ontological existence of other worlds or their alleged constituents. In an effort to achieve such an objective, it is possible to incorporate certain aspects of Meinongianism into the linguistic analysis of propositions describing counterfactual situations. Within a Meinongian conception of reality, the realism of both worlds and objects is not automatically presupposed, meaning that the existence of such items must be explicitly stated. Contrary to the numerous arguments presented by a plethora of prominent philosophers preceding him, including Immanuel Kant, Alexius Meinong courageously resists the “conventional” conception that predication implies existence. Alternatively, Meinong asserts that it is possible to attribute properties to nonexistent objects without generating logical contradictions or departing so far from reality as to be absurd.

One distinct advantage of adopting a Meinongian conception of reality is the ability to articulately represent objects and events that are logically possible though absent from the actual world. For example, it is possible to produce a coherent and comprehensible description of a building that has ninety-six floors and an enormous dodecahedral structure consisting of solid zirconium levitating above it, despite the fact that such a structure does not exist within the actual world, and possibly does not exist within any other world. Indeed, the capacity to describe such notions as merely possible objects and nonexistent events is a feature of Meinongianism that is particularly useful for representing fictional entities. As such, through an appropriate application of Meinongianism, it is possible to describe the characters, the locations, and the scenarios that are prevalent within works of fiction and which are of great interest to both philosophers and linguists, despite the fact that such characters, locations, and scenarios are all absent from the actual world.

As a result of the fact that Meinongianism rejects the notion that predication implies existence, the existence of objects is not automatically guaranteed by the fact that properties are attributed to them, meaning that it is necessary to explicitly assert that such objects exist by directly attributing the particular property of existence to them through an existence predicate. Since the property of existence must be attributed to both entities and worlds directly through an existence predicate, it is important that the quantifiers do not implicitly presuppose the existence of the entities or the worlds they are quantifying over. For the purposes of satisfying such a condition, quantification ought to be restricted to two distinct quantifiers, which are expressed symbolically as  $\Lambda$ , which represents universal quantification and is articulated verbally as ‘for all’, and as  $\Sigma$ , which represents particular quantification and is articulated verbally as ‘for some’ (Berto and Plebani, 2015, page 101). Neither  $\Lambda$  nor  $\Sigma$  presuppose the existence of the entities or the worlds that they quantify over, meaning that it is possible to quantify over entities and worlds that do not exist. Importantly, particular quantification ought not be conflated with existential quantification, as particular quantification is an “ontologically neutral” counterpart to universal quantification that does not presuppose existence, whereas existential quantification does presuppose existence under its typical interpretation, as its name suggests. Interestingly, although he does not explicitly identify a unique set of quantifiers, Donald Williams appears to advocate for a highly similar approach of understanding quantification in a way that does not rely upon the dubious notion of existence at all

(Williams, 1962, page 763). With the adoption of Meinongianism, and the accompanying modification of quantifiers, it is possible to generate formal translations of the proposition ‘I could have been wealthier than I actually am’ for both strong rigid identification and weak rigid identification, as well as their corresponding generalizations.

**Strong Rigid Identification Meinongian Interpretation**

$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_v(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_v(\mathbb{I}) \wedge \varepsilon_v(x) \wedge L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_v(\mathbb{I})(x))$   
 where  $\mathbb{I}$  represents the referent of the indexical ‘I’

**Generalized Strong Rigid Identification Meinongian Interpretation**

$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_{\omega_3}(\mathbb{I}) \wedge \varepsilon_{\omega_4}(x) \wedge L_{\omega_5}(v)(\mathbb{I}) \wedge L_{\omega_6}(w)(x) \wedge C_{\omega_7}(\mathbb{I})(x) \wedge W_{\omega_8}(\mathbb{I})(x))$   
 where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8\}$  represent arbitrary worlds of evaluation

**Weak Rigid Identification Meinongian Interpretation**

$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_w(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_v(\mathbb{I}) \wedge \varepsilon_w(x) \wedge L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_w(\mathbb{I})(x))$   
 where  $\mathbb{I}$  represents the referent of the indexical ‘I’

**Generalized Weak Rigid Identification Meinongian Interpretation**

$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_{\omega_3}(\mathbb{I}) \wedge \varepsilon_{\omega_4}(x) \wedge L_{\omega_5}(v)(\mathbb{I}) \wedge L_{\omega_6}(w)(x) \wedge C_{\omega_7}(\mathbb{I})(x) \wedge W_{\omega_8}(\mathbb{I})(x))$   
 where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8\}$  represent arbitrary worlds of evaluation

Since neither predication nor quantification ought to presuppose existence within formalizations involving Meinongianism, it is necessary to directly attribute the property of existence to both existent objects and existent worlds. Accordingly, within the Meinongian interpretations of the proposition ‘I could have been wealthier than I actually am’, the existence predicate is applied to all relevant objects and worlds, which is represented symbolically as  $\varepsilon$ . Importantly, it may be noticeable that the symbol  $\varepsilon$  is an overloaded term within the aforementioned linguistic formalisms, which is done intentionally. Although it is possible to designate two distinct formal representations of the existence predicate, one of type  $\langle e, \langle s, t \rangle \rangle$  that attributes existence to an entity at a particular world of evaluation and one of type  $\langle s, \langle s, t \rangle \rangle$  that attributes existence to a world at a particular world of evaluation, it ought to be clear from the particular context in which it appears which one of the two versions of the existence predicate is applicable, meaning that utilizing two distinct symbols for existential predication is unnecessary.

Perhaps a worthwhile reiteration, weak rigid identification relativizes truth to particular worlds, and consequently, predication must correspondingly be relativized to particular worlds. For example, within the Weak Rigid Identification Meinongian Interpretation of the proposition ‘I could have been wealthier than I actually am’, the existence of  $\mathbb{I}$  is evaluated at the actual world, whereas the existence of  $x$  is evaluated at world  $w$ . Such a formalization of existence captures the notion that existence is a property that is relativized to individual worlds, as well as the idea that different worlds may disagree on precisely what exists. For a moment, suppose that Gotham City is to be

understood as a merely possible world that is accessible from the actual world and that can access the actual world. Since there exists mutual accessibility between Gotham City and the actual world, it is possible to generate meaningful comparisons between the two worlds concerning such concepts as their structure, their constituents, and other similar worldly properties. Importantly, though, despite the mutual accessibility that exists between the two different worlds, they may nevertheless disagree on what, or who, exists. For example, the proposition ‘Batman exists’ may be represented symbolically as  $\varepsilon_{\omega}(b)$  where  $\omega$  is an arbitrary world of evaluation. If  $\omega$  represents the actual world, then  $\omega = v$  and  $\varepsilon_{\omega}(b) \equiv \perp$ . If  $\omega$  represents the world of Gotham City, then  $\varepsilon_{\omega}(b) \equiv \top$ . Indeed, under the standard Quinean ontological theory, Batman does not exist within the actual world, meaning that the existence of Batman ought to be rejected when evaluating claims concerning his existence within the actual world. Alternatively, it does not seem unreasonable to assert that Batman exists within the world of Gotham City, meaning that the existence of Batman can be reasonably accepted as true when evaluating claims concerning his existence within the world of Gotham City.

One feature of the Meinongian interpretations of the proposition ‘I could have been wealthier than I actually am’ that remains persistent is that there must be a counterpart for the referent of the indexical ‘I’ who resides within a merely possible world. Similarly as to within the Lewisian interpretations, when strong rigid identification is presupposed, the evaluation of both the “counterpartness” property and the location property could occur at any world, since all worlds ought to agree upon the status of a particular individual within one world as the respective counterpart of another particular individual within another world, as well as upon within which world a particular entity is located. An additional similarity to the Lewisian interpretations is that it is presupposed that entities, such as individuals, cannot inhabit two distinct worlds simultaneously, meaning that cross-world identity between the inhabitants of different worlds is strictly prohibited. Whilst properties concerning such notions as wealth and existence must be relativized to particular worlds, one characteristic that all worlds ought to agree on is the “counterpartness” property, hence the designation that the evaluation of the “counterpartness” property may occur at an arbitrary world within the Generalized Weak Rigid Identification Meinongian Interpretation.

It is perhaps debatable if the assertion that the actual world exists need be stated explicitly within the Meinongian interpretations of the proposition ‘I could have been wealthier than I actually am’. Since the semantic interpretation of the word ‘actual’ has been designated as ‘the world within which you (the reader) are currently located’, it may seem obvious that the actual world must exist, for in order for a particular token of the proposition to be properly read, there must exist a reader to read the particular token, and that reader must necessarily reside within a world, which, from the perspective of the reader, is the actual world, by definition. Similarly, the existence of the non-actual world within which the counterpart of the actual referent of the indexical ‘I’ resides is perhaps apparent from the particular context, especially when it is explicitly stated that the counterpart himself or herself exists and it is stated that the world that he or she resides within is a world other than the actual world. Nevertheless, for the sake of completeness, the existence of both the actual world and the non-actual world within which the counterpart of the actual referent of the indexical ‘I’ resides is explicitly asserted. Furthermore, by explicitly asserting the existence of the two aforementioned worlds, their significance as existent worlds is emphasized within the formal translations of the relevant proposition, and they are perhaps therefore distinguished from the arbi-

trary worlds of evaluation within both of the generalized Meinongian interpretations, which need not necessarily exist.

### **Three Different Interpretations of Existence**

A philosophical challenge that is particularly daunting, and that warrants attention within the context of cross-world predication, is the task of providing a reasonably satisfactory account of precisely what existence itself is. It can be argued that a significant portion of the confusion and the difficulty that is associated with identifying a plausible articulation of existence is due to the fact that numerous different equivocations of the term ‘exists’, and relatedly with the term ‘existence’, prevail within both the philosophical literature and the colloquial speech of commonplace discourse. In fact, Lewis himself confesses some wonderment as to precisely how distinct forms of existence would function, as is illustrated within his implicitly inquisitive assertion that, “I do not have the slightest idea what a difference in manner of existing is supposed to be” (Lewis, 1986, page 2). As such, in certain ways, an effort to analyze numerous different notions of existence may be understood as a direct response to Lewis. Although certainly not an exhaustive list of all possible or proposed interpretations of the term, the author of the present research initiative proposes three distinct interpretations of the notion of existence that may be of particular prevalence.

The first prevalent interpretation of the notion of being an existent object, which may reasonably be referred to as the Actual Concrete Interpretation of existence, is that of being a spatiotemporally extended metaphysically concrete object within the actual world. Undoubtedly the most common interpretation of the notion of existence within colloquial speech, the Actual Concrete Interpretation restricts the notion of existence to the actual world, prioritizing the constituents of the actual world over and above such items as merely possible objects. Indeed, the Actual Concrete Interpretation exerts a powerful hegemonic influence upon both the discourse and the mentality of the general public. The interpersonal exchanges that occur between the members of communities within the twenty-first century are replete with sociolinguistic evidence for the claim that the Actual Concrete Interpretation of existence is the dominant interpretation. For example, when a caring parent asserts that “monsters don’t exist” in an effort to comfort a child who may have anxiety about a demonic creature lurking under his or her bed, it would seem as though the caring parent is attempting to reassure the frightened child that he or she is safe from an unpleasant attack by a monster within the actual world. In doing so, the caring parent implicitly restricts the domain of discourse to the actual world, and consequently places a limitation upon the objects that may be deemed existent objects, namely the constituents of the actual world and the actual world itself.

The Actual Concrete Interpretation of existence excludes the ontological possibility of such objects as triangles and spheres. Although there exist objects within the actual world that approximately resemble geometric figures such as triangles and spheres, the material constituents of the actual world do not successfully encapsulate the ideological nature and the flawless physique of true geometric figures. Supposing that contemporary theories of molecules and materials in general is accurate, then regardless of the attention to detail and the caliber of engineering expertise that is applied, no rubber ball within the actual world could possibly be manufactured so as to be perfectly smooth as a result of the gaps that would persist between the particle constituents of the ball. Since a sphere is, in virtue of its mathematical definition, perfectly smooth, the aforementioned rubber ball may serve as a reasonable approximation of a sphere, though it shall seemingly

inevitably fail to exhibit the perfection that is necessary to exist as a sphere. Similarly, in accordance with metaphysical convention, since all geometric figures and all mathematical objects are idealistic flawless objects, it can be argued that the Actual Concrete Interpretation precludes the existence of both geometric figures and mathematical objects, as perfection is unattainable within the actual world. The restriction of the domain of discourse to the actual world is an exceedingly commonplace practice, so much so that it is rarely questioned within colloquial speech exchanges. It is therefore perhaps no wonder that theories advocating for the modal realism of other possible worlds, such as the ontological theory proposed by Lewis, are so readily dismissed by the vast majority of the population as absurd nonsense. Without so much as a single iota of compelling empirical observation or experimental evidence to discredit the realism of other worlds as concrete particulars, it is solely by means of cultural appropriation that the Actual Concrete Interpretation has superseded alternative interpretations of existence. The influence of the Actual Concrete Interpretation of existence is in fact so pervasive that it deludes both the general public and experienced philosophers into hastily abandoning other conceptions of existence.

The second prevalent interpretation of the notion of being an existent object, which may reasonably be referred to as the General Concrete Interpretation of existence, is that of being a spatiotemporally extended metaphysically concrete object within at least one world, which need not be the actual world. As may be obvious, the General Concrete Interpretation of existence is rather similar to the Actual Concrete Interpretation of existence, with the notable distinction that the Actual Concrete Interpretation dictates that the objects relevant to the domain of discourse must be either contained within the actual world or the actual world itself, whereas the General Concrete Interpretation enables the attribution of existence to objects that are neither contained within the actual world nor the actual world itself. For example, in accordance with the General Concrete Interpretation of existence, it may be possible to truthfully assert the proposition ‘Batman exists’. Since Gotham City may be understood as a merely possible world and Batman exists within Gotham City, the proposition ‘Batman exists’ is realized within the world of Gotham City and is therefore true within the world of Gotham City. As is perhaps apparent, the General Concrete Interpretation is beneficial for the purposes of linguistic analysis of works of fiction, where the existence of fictional characters and fictional scenarios can be realized at any world of evaluation, rather than being restricted to being realized at the actual world.

Interestingly, the General Concrete Interpretation can be utilized to provide a caliber of concreteness to certain objects and certain notions that are typically ascribed to be metaphysically abstract objects under the Actual Concrete Interpretation of existence. For a moment, suppose that the “Realm of the Forms” initially proposed by Plato, also known as “Plato’s Heaven”, is a merely possible world where there exist counterparts for all of the constituents of the actual world. The aforementioned counterparts that reside within the “Realm of the Forms” exist in the pinnacle of perfection as idealized versions of the actual constituents of the actual world. For example, although it may be exceedingly delicious and at the optimal level of ripeness, a particular apple within the actual world could undoubtedly be better in at least one of its qualities, whereas the counterpart of the particular apple within the world of the “Realm of the Forms” is insurmountably delicious, infallibly ripe, and as perfect as possible in all other regards as well. Similarly, whilst there may not exist genuinely ideal geometric figures within the actual world, all geometric figures and all mathematical objects exist in their literal perfection within the “Realm of the

Forms”. Although perhaps not a perfect rendition of the original philosophical deliberations of Plato, understanding the “Realm of the Forms” as a metaphysically concrete possible world that is accessible from the actual world and that can access the actual world is a means by which to incorporate Platonic ideology into a theory of modal realism.

The third prevalent interpretation of the notion of being an existent object, which may reasonably be referred to as the All-Inclusive Interpretation of existence, is that of being existent by any standard at all, including by incredibly trivial standards. As its name implies, the All-Inclusive Interpretation admits a vast array of different objects into ontological theories that incorporate it. Similarly as to the General Concrete Interpretation, the All-Inclusive Interpretation encompasses all spatiotemporally extended metaphysically concrete objects, regardless of their world of origin. Dissimilarly as to the General Concrete Interpretation, the All-Inclusive Interpretation includes metaphysically abstract objects that lack corporeal form and that are not spatiotemporally extended. As is perhaps apparent, the All-Inclusive Interpretation of existence is unprecedentedly generous in its ontological scope, which can be beneficial for certain analytical purposes or for explaining certain phenomena. For example, in accordance with the All-Inclusive Interpretation of existence, merely by uttering the name ‘Batman’, Batman exists within the actual world as a vibration of atmospheric particles that generates a resulting sound. Reducing the existence of Batman to a sound wave that reverberates throughout the air may seem contrary to the initial intention of the character, though it does provide an explanation as to precisely how Batman can exist within the actual world, namely as a sound wave uttered by an actual person. More generally, it would be appropriate within the context of the All-Inclusive Interpretation to assert that Batman exists within the actual world as a piece of language, as the name ‘Batman’ could be uttered aloud, transcribed upon a sheet of paper, generated visually through the arrangement and the coloration of pixels upon a digital screen, or produced in a variety of other means, all of which would constitute a form of language being instantiated in one way or another.

An additional means by which Batman could exist within the actual world is as a thought within the mind of a particular actual person. When a particular actual person imagines the personage of Batman within his or her mind, Batman exists within the actual world as a form of cognitive processing that occurs within the mind of the particular actual person. Analogous as to within the case of uttering the name ‘Batman’, it may seem strange to reduce the notion of Batman from one of existing as a human being to one of existing merely as a thought within the mind of a human being. Nevertheless, such an account of the existence of Batman supplies a plausible explanation of the manner in which Batman can exist within the actual world, albeit in an abstract way. In fact, the cognitive processing that produces thoughts within the minds of human beings and the corresponding linguistic expressions of such thoughts may not be entirely unrelated, hence the similarities between the linguistic forms of existence and the cognitive forms of existence that are captured by the All-Inclusive Interpretation. It has been argued by Andy Clark that the physicality of linguistic expressions itself generates unique mental spaces, known as “cognitive niches”, in which advanced forms of thought, which would not be possible without the prevalence of such linguistic and cognitive interactions, can occur (Clark, 2006, page 370). Perhaps a worthwhile observation, the initial inception of Batman, and indeed, the initial inception of all fictional characters, as well as all inventions, began as a mere thought within the mind of an individual person, meaning that it is perhaps not unreasonable to attribute existence to thoughts and other similar cog-

nitve processes within the mind, as it is imaginative thoughts within the mind that are the primary source of creation.

It can be argued that the process of creation is a quintessential component of the notion of existence, for without the initiation of creation, it is not possible for an object or an entity to exist at all. Debatably, without a primary creative inception, a particular object would lack the “metaphysical history” that is necessary to properly attain ontological existence, mysteriously materializing within the world without a coherent origin story, in direct violation of the Principle of Sufficient Reason. Interestingly, a clever and persuasive argument for the ontological existence of fictional characters within the philosophical literature essentially generalizes from the particular case that Sherlock Holmes exists as a result of the fact that he was created by Sir Arthur Conan Doyle, and is summarized eloquently within the assertion that, “. . . to create something is to make it exist” (Schaffer, 2008, page 359). As a result of its generosity with regards to its ontological commitments, the All-Inclusive Interpretation may endure accusations of trivializing the notion of existence by attributing the property of existing to all objects, including such objects as ones that exist merely as words upon the page of a book or as thoughts within the minds of a particular human being. It can be argued, though, that such allegations of triviality are misguided, for although the All-Inclusive Interpretation does attribute existence to all objects, it does not universally dismiss the importance of ontological inquiries. Rather, the All-Inclusive Interpretation redirects the emphasis of ontological inquiries from ones of questioning as to what exists to ones of questioning as to precisely in what manner particular objects exist. Indeed, the All-Inclusive Interpretation of existence may be understood as investigating the ontological grounding of the objects that it evaluates, rather than merely positing the existence, or lack thereof, of entities and worlds. With appropriate application, the All-Inclusive Interpretation attributes existence to all of the objects that the General Concrete Interpretation does, as well as a variety of other objects that may be of interest, such as linguistic expressions and cognitive processes, and emphasizes the significance of the ontological grounding of such objects.

Ultimately, the three aforementioned distinct interpretations of the notion of existence may be compared to one another on the basis of their expanse of ontological commitment. The set of objects designated as extinct objects in accordance with the Actual Concrete Interpretation is a proper subset of the set of objects designated as existent objects in accordance with the General Concrete Interpretation, which is itself a proper subset of the set of objects designated as existent objects in accordance with the All-Inclusive Interpretation. For the sake of comprehension, such a relationship may simply be represented symbolically within the notion of set theory.

$$ACI \subset GCI \subset AII$$

### **Existence of Metaphysically Abstract Objects**

It is perhaps observable that neither the Actual Concrete Interpretation nor the General Concrete Interpretation grants the existence of genuinely metaphysically abstract objects. Whilst the General Concrete Interpretation may feature provisions for certain metaphysically abstract objects in the form of acknowledging that objects that are metaphysically abstract within one world may be metaphysically concrete within another world, it certainly does not permit for the existence of necessary objects. As necessary objects are identical within all possible worlds, they are indiscernible

from their respective counterparts within other worlds. In an effort to remain truthful to the theory of modal metaphysics initially advocated for by Lewis, in which a particular object or a particular individual can reside solely within one world, the existence of necessary objects must be rejected, thus circumventing the concerns identified by Quine of the “disorderliness” that may be associated with individuation when other possible worlds are accepted as concrete particulars that are as real as the actual world (Lewis, 1973b, page 87). Indeed, denying the ontological existence of necessary objects prevents circumstances in which a particular object is present within all possible worlds simultaneously, which could potentially jeopardize the ability to distinguish certain worlds from one another.

In accordance with the standard Quinean ontological theory, as well as the “typical” metaphysical commitments that are prevalent throughout the contemporary philosophical literature, numbers and geometric figures, as well as other similar mathematical objects, are believed to be necessary objects. Suppose that  $\alpha$  and  $\beta$  are two distinct existent possible worlds that are devoid of any contingent objects, though which do contain all of the necessary mathematical objects. Since necessary objects are identical within all possible worlds and  $\alpha$  and  $\beta$  are two distinct existent possible worlds that are devoid of any contingent objects, all of the constituents of  $\alpha$  are identical with their respective counterparts within  $\beta$ . Since all of the constituents of  $\alpha$  are identical with their respective counterparts within  $\beta$ ,  $\alpha$  and  $\beta$  are indiscernible from one another. Since  $\alpha$  and  $\beta$  are indiscernible from one another,  $\alpha$  and  $\beta$  are identical, in accordance with the Identity of Indiscernibles. Since  $\alpha$  and  $\beta$  are identical,  $\alpha$  and  $\beta$  are not distinct from one another. Since  $\alpha$  and  $\beta$  are not distinct from one another, there exists a contradiction with the presupposition that  $\alpha$  and  $\beta$  are two distinct existent possible worlds. Thus, tolerating the existence of necessary objects within an ontological theory diminishes the capacity to distinguish between certain distinct possible worlds.

The severity of the aforementioned consideration is amplified when all of the necessary mathematical objects are ascribed to be metaphysically abstract objects, which is often the case within the contemporary philosophical literature. If all of the necessary mathematical objects are ascribed to be metaphysically abstract objects, then it would be blatantly impossible to meaningfully distinguish between two possible worlds that solely contain all of the mathematical objects. Since metaphysically abstract objects are not extended in either space or time, they cannot be identified on the basis of their relative orientations to one another within space at a particular instant of time. Consequently, possible worlds that contain all of the necessary mathematical objects, and which lack any contingent objects, would be identifiable and representable solely on the basis of their constituents. Worlds that solely contain necessary mathematical objects would be entirely indiscernible from one another, and as such, identical to one another, in accordance with the Identity of Indiscernibles. Furthermore, it can be argued that all necessary objects are metaphysically abstract objects, as the existence of a metaphysically concrete object that is simultaneously present within all possible worlds seems to be incoherent with the notion of concreteness of possible worlds defended by Lewis. Ultimately, for the purposes of engaging in linguistic analyses of cross-world predication that are compatible with the theory of modal realism advocated for by Lewis, the existence of necessary objects must be rejected.



## Additional Considerations of Relevance to Existence

Another prevalent solution to the problem of attempting to define existence is to assert, as Peter van Inwagen does, that existential quantification successfully encapsulates the notion of existence in its entirety, and consequently, existence may be understood simply in terms of the technical jargon of formal logic (van Inwagen, 1998, page 237). Perhaps the most significant advantage of such a solution, by reducing the philosophical notion of existence to the logical formalism of existential quantification, a logical definition of existence is readily available, and the imminent hazard of obscure philosophical pontification is averted entirely. Alternatively, in direct opposition to van Inwagen, Williams claims that the existential quantifier is a syncategorematic operator, such that an attempt to associate existence with the existential quantifier ultimately implies an effort to dispose of the notion of existence entirely (Williams, 1962, page 762). Indeed, defining existence by merely associating its meaning with the existential quantification of logic may ultimately be problematic.

As is perhaps apparent, the designation of existential quantification as the meaning of existence itself directly conflicts with the replacement of existential quantification with particular quantification that is beneficial for the sake of Meinongianism. The entire purpose of forsaking existential quantification within logical formalisms that incorporate Meinongianism was to liberate the formal linguistic translations of propositions from automatically presupposing the existence of the objects that were both being quantified over and having properties attributed to them. By introducing the unique notion of particular quantification, an “ontologically neutral” counterpart to existential quantification is available, such that objects may be quantified over within the formalism of the logical language without presupposing their ontological existence within the context of the situation described by the logical language. Associating existence with the existential quantifier entirely negates the purpose for introducing particular quantification, and mitigates the capacity to coherently discuss existence within the context of Meinongianism.

Interestingly, an alternative solution, or perhaps more appropriately a dissolution, to the problem of attempting to define existence, is to deny the existence of existence altogether, thus significantly diminishing the precedence of needing to generate a definition for existence. In fact, as may be apparent from the title of his journal article “Dispensing with Existence”, Williams advocates for the idea of forsaking the notion of existence completely, as is summarized succinctly within his declaration that, “There is no Being or Existence as such, even in the sense in which there *are* singing, desires, societies, shapes, numbers, and even perhaps *if, and, and but*” (Williams, 1962, page 749). Although perhaps seemingly paradoxical, the denial of the ontological status of existence as a genuine entity is philosophically justifiable, and is beneficial for various different reasons.

One source of motivation for denying the ontological prevalence of existence is that it can be argued that the notion of existence as an object is a misconceptualization that is the result of undue substantiation. The ubiquitousness of existential predication within both Meinongianism and colloquial speech may produce the illusion that existence is an object, when it is in fact merely a property that is attributable to objects. The dubious inference that from a proposition of the form ‘*x* exists’ a synonymous proposition of the form ‘*x* has existence’ can be derived is precisely the source of a considerable caliber of the confusion that is associated with the notion of existence. The

illicit transition from verb to noun alters the linguistic functionality of existence from one of a way of being to one of an entity. In general, from the fact that a particular property may be attributable to a particular object, it is not necessarily implied that there exists an analogous substantive entity that is the incarnation of the particular property which, as in the case of its alternative representation as a property, can be associated with the particular object. For example, although it may be entirely appropriate to attribute the property of being conscious to a particular human being, it is not necessarily therefore implied that there exists a corresponding entity, often called consciousness, that the particular human being can be said to be in possession of. It is not philosophically justifiable to allegedly ascertain the ontological existence of an entity from the fact that there exists a property of similar nature that can be attributed to existent objects, as is apparent within the case of consciousness, as well as within the case of existence. Indeed, it is not unreasonable to believe that the search for an object that constitutes existence within the actual world, or within any other world, would prove futile, as it is entirely unclear what such an object would be. The attribution of existence to a particular object is merely an assertion that the property of existing may accurately be ascribed to the particular object, rather than an affiliation of the particular object with a “special” entity known as existence. In fact, by refraining from granting credence to the idea of existence as an entity, the resulting ontological theory, which enumerates the constituents of the world, is consequently more qualitatively parsimonious, which is beneficial for the sake of simplicity.

### **Deciding between the Three Different Interpretations of Existence**

Ultimately, the General Concrete Interpretation of existence is arguably the best for the purposes of analysis of cross-world predication, when integrated with the presupposition that the ontological status of existence as a genuine entity in and of itself ought to be rejected. Whilst both the Actual Concrete Interpretation and the All-Inclusive Interpretation are beneficial in their unique ways, neither one of them adequately captures the notion of existence that is most desirable for comparing objects and entities between different worlds. The Actual Concrete Interpretation of existence is relatively conservative with regards to its ontological commitments. Reminiscent of the standard Quinean ontological theory, which is pervasive within both the contemporary philosophical literature and colloquial speech, the Actual Concrete Interpretation denies the ontological existence of other worlds, as well as the objects and the entities contained within such worlds. Furthermore, of the three prevalent interpretations of existence, the Actual Concrete Interpretation is by far the most parsimonious, incorporating not merely qualitative parsimony, but quantitative parsimony as well, as is exemplified by its denial of the existence of other possible worlds, including the merely possible worlds that are of a practically identical ontological structure as the actual world. Consequently, the Actual Concrete Interpretation of existence is not particularly desirable for the purposes of analysis involving cross-world predication.

Although it may be theoretically possible to compare the actual world to other worlds without committing to the ontological existence of the other worlds, such a methodological approach is perhaps ideologically unfulfilling, as it may be questionable what the value of other worlds is, or what the value of cross-world predication in general is, when the actual world is postulated to be the sole world of existence. Engaging in cross-world predication whilst denying the ontological existence of other worlds may suffer from responses that are reminiscent of the common expression “Who cares?”, as it is perhaps conceptually strange to raise a kerfuffle about entities and

worlds that are ascribed to be entirely nonexistent. For example, presupposing that the proposition ‘I could have been wealthier than I actually am’ is true, then the closest counterpart of the referent of the indexical ‘I’ is especially wealthy within his or her possible world, under the most natural interpretation of the proposition. Though it is perhaps dubious as to precisely how the enhanced state of wealth of such a non-actual counterpart could be ascertained when the counterpart himself or herself is shunned from existence. It would not seem possible, from the perspective of either the actual world or another world, to survey the wealth, or lack thereof, of nonexistent entities, whose bank accounts and pocketbooks are most likely as nonexistent as they are. Indeed, at an extreme, it could be argued that since the residents of other worlds are nonexistent, it is not possible for them to possess any form of real wealth, meaning that all non-actual individuals are necessarily poor. Such a position would drastically reduce the expressive power of the proposition ‘I could have been wealthier than I actually am’, as it reduces the proposition to a mere triviality, which is false merely in virtue of the fact that the counterpart of the actual individual who instantiates the proposition is himself or herself non-actual, and therefore necessarily poor. Essentially, the restriction of attributing existence solely to actual objects, namely the actual world and its constituents, is problematic for coherently analyzing propositions that involve cross-world predication, and hence the Actual Concrete Interpretation of existence is not ideal for such purposes.

Alternatively, contrasting drastically with the Actual Concrete Interpretation, the All-Inclusive Interpretation of existence is extraordinarily generous with regards to its ontological commitments, attributing existence to all objects that are conceivable to human beings, as well as to objects that exceed human imagination altogether. Diverging greatly from the standard Quinean ontological theory, the All-Inclusive Interpretation grants existence to all objects, including other worlds and the entities that are contained within them. Additionally, contrary to the ontological theory encapsulated within the modal realism advocated for by Lewis, the All-Inclusive Interpretation attributes existence to both impossible entities and impossible worlds, fully acknowledging and accepting the inherent logical inconsistencies that manifest within such impossible objects.

Since impossible objects are conceivable, or at least describable, by human beings, the property of existing, either as thoughts within the mind of a particular human being or as linguistic expressions, may be attributed to such objects, from the perspective of other worlds or when evaluated at the actual world, in accordance with the All-Inclusive Interpretation of existence. For example, a torus with two holes is an impossible object that inherently contradicts itself, as all toruses have merely one hole, by definition. Nevertheless, the property of existence can truthfully be attributed to a torus with two holes when evaluated at the actual world, or at any other world, in accordance with the All-Inclusive Interpretation of existence. At an absolute minimum, a torus with two holes exists as a piece of language, which is evidenced by the fact that the expression ‘torus with two holes’ appears upon the page. Although a torus with two holes may be beyond the scope of human imagination, as it is logically inconsistent and definitionally impossible, it nevertheless exists as a linguistic expression that can be instantiated, and which is instantiated, within the actual world. As another example, it may be the case that a particular individual within the actual world imagines an ineffable object that may initially seem to be logically possible, though unbeknownst to the particular individual, the imagined object is truly logically inconsistent, albeit in a subtle way. Despite the fact that the imagined object is logically inconsistent and eludes linguistic description, the property of existing can be accurately attributed to the object as a form of cognitive processing

that occurs within the mind of the particular individual, in accordance with the All-Inclusive Interpretation of existence.

Whilst advantageous for certain applications, the ontological liberality of the All-Inclusive Interpretation is perhaps more robust than is desirable for the purposes of analysis of propositions involving cross-world predication, and hence, similarly as to the Actual Concrete Interpretation, the All-Inclusive Interpretation of existence is not ideal for the purposes of evaluating claims concerning cross-world predication.

By the process of elimination, the General Concrete Interpretation is the best interpretation of the notion of existence for the purposes of analyzing propositions concerning cross-world predication. The General Concrete Interpretation of existence serves as a reasonable “middle ground” position between the Actual Concrete Interpretation of existence and the All-Inclusive Interpretation of existence. More ontologically generous than the Actual Concrete Interpretation, the General Concrete Interpretation attributes existence to the non-actual objects that are located within other worlds, enabling philosophically interesting analyses of and substantive comparisons between objects of different worlds. Less expansive in its ontological commitments than the All-Inclusive Interpretation, the General Concrete Interpretation does not attribute existence to objects merely in virtue of the fact that they are cognitively conceivable or linguistically describable, restricting the constituents of reality to ones that are perhaps “more tangible” than mere thoughts or petty words or other more obscure forms of representation of certain metaphysically abstract entities.

### **Deciding upon a Single Formalism**

Perhaps unsurprisingly, in addition to selecting a specific interpretation of existence, it is vital to decide upon a particular logical formalism for representing cross-world predication itself in order to successfully engage in linguistic analyses of propositions, or propositional concepts, that involve cross-world predication. Whilst all of the eight potential formal translations of the proposition ‘I could have been wealthier than I actually am’ have their distinctive advantages and unique attributes, identifying a single translation as the exemplary instance of the logical formalization of cross-world predication, and then generalizing that particular logical formalization in such a manner that it may be applied to other propositions involving cross-world predication, is a prudent decision for furthering research that is of relevance to modal metaphysics.

Although perhaps not entirely perfect, the Weak Rigid Identification Meinongian Interpretation of cross-world predication is the most desirable for the purposes of formally representing intricate systems of modal metaphysics, in particular when comparisons between different worlds are to be performed. Accepting weak rigid identification, rather than strong rigid identification, enables a more accurate analysis of the situations that may persist within other worlds. By intentionally refraining from presupposing such an objective conception of truth as would be implied by strong rigid identification, the meanings of predicates can vary from one world to another, capturing the notion that certain terms, including, though not limited to, vague terms and indexical terms, can have different meanings in different contexts. Additionally, by selecting an interpretation of cross-world predication that incorporates Meinongianism, it is possible to analyze works of fiction by regarding fictional locations as merely possible worlds and fictional scenarios as events that transpire within such worlds. Similarly, fictional characters and fictional objects may be understood as

entities that reside within the merely possible world of a particular fictional location, all of which can be expressed nicely within the formalism of Ty2.

Although requiring that the existence of particular worlds and particular entities must be explicitly stated, as is the case within a formal system that incorporates Meinongianism, may seem redundant or extraneous, such a requirement is particularly useful for monitoring and documenting the status of worlds and entities within complex systems, serving as a form of “metaphysical bookkeeping”. For example, when a particular character is erased from reality within a science fiction novel, it would be desirable to have the means by which to express the idea that the particular character did exist within a particular world prior to a certain event, and then did not exist within the particular world after the specified event. When attempting to formally represent such a scenario, it is perhaps beneficial to be required to explicitly state that a particular entity within a particular world either exists or does not exist, and Meinongianism would require such explicitness.

In fact, the process of explicitly asserting that particular entities exist within particular possible worlds at particular instants within time is particularly relevant to the notion of cross-world travel, as articulated within Chapter 5. For example, suppose that  $x$  is an entity and that the elements of the set  $\{w_1, w_2\}$  are distinct possible worlds and that the elements of the set  $\{t_1, t_2\}$  are distinct instants within time and that  $x$  travels from  $w_1$  to  $w_2$ . Since  $x$  travels from  $w_1$  to  $w_2$ , it may seem appropriate to assert that  $x$  exists within  $w_1$  at a particular instant within time and that  $x$  exists within  $w_2$  at a different instant within time. Within the Ty2 system, the formalism  $\varepsilon_{w_1}(t_1)(x)$  could potentially represent the expression ‘ $x$  exists at time  $t_1$ ’ evaluated at  $w_1$  and  $\varepsilon_{w_2}(t_2)(x)$  could potentially represent the expression ‘ $x$  exists at time  $t_2$ ’ evaluated at  $w_2$ , which explicitly accounts for the process of attributing the property of existing to  $x$  within different possible worlds at different times. Furthermore, prior to the arrival of  $x$  within  $w_2$ , it seems appropriate to claim that  $x$  does not exist by the “standards of interpretation” of  $w_2$ . Similarly, after the departure of  $x$  from  $w_1$ , it seems appropriate to claim that  $x$  does not exist by the “standards of interpretation” of  $w_1$ . Both of the aforementioned rejections of the attribution of the property of existing to  $x$  can be formally represented within the Ty2 system as  $\neg\varepsilon_{w_2}(t_1)(x)$  and  $\neg\varepsilon_{w_1}(t_2)(x)$ , respectively.

Through Meinongianism, it is possible to attribute the property of existence to worlds themselves, which is beneficial for representing the idea that all other possible worlds are concrete particulars that are as real, and as existent, as the actual world. Interestingly, Lewis himself observes that his interpretation of quantification as having the capacity to span all possible objects, including non-actual entities and non-actual worlds, is attributed as being particularly “Meinongian” in nature by William Lycan (Lewis, 1986, page 98). Although such a Meinongian approach to modal metaphysics may be distasteful to the most ardent defenders of the standard Quinean ontological theory, it is exceedingly useful within the analysis of entities that may not exist within the actual world, though which nevertheless provide significant insight into the happenings that do transpire within the actual world, or alternatively, insight into the counterfactual scenarios that are epistemically possible within the actual world, and their subsequent consequences.

As an additional consideration, it is perhaps worth explicitly acknowledging that the formalism of Ty2 is capable of representing propositions involving cross-world quantification as well as propositions involving cross-world predication. Cross-world predication is the process of identifying

a relation between entities contained within distinct possible worlds, such as within the proposition ‘I could have been wealthier than I actually am’. Cross-world quantification is the process of quantifying over multiple distinct possible worlds simultaneously, such as within the proposition ‘The rich could have all been poor’. To demonstrate the capacity of the Ty2 system to formally represent propositions involving cross-world quantification, eight potential formal translations of the proposition ‘The rich could have all been poor’ are provided within Appendix C.

## **A Succinct Culmination of Chapter 2**

Ultimately, for the present purposes of logical analysis of cross-world predication, the philosophical ideologies and the metaphysical claims that are of the utmost importance may be summarized by a concise collection of fundamental principles. All of the most important philosophical principles for the present research initiative are compiled within Appendix A.

- Entities, which are all of type  $e$ , must be located within a particular world
- Entities cannot be simultaneously located within more than one world, meaning that there does not exist cross-world identity between entities
- The world that a particular existent entity is located within must itself exist
- Quantification over the constant  $v$ , which is the actual world, is prohibited
- Concreteness is defined as the state of being extended within both space and time
- Abstractness is defined as the state of not being extended within both space and time
- The ontological status of existence as an existent entity in and of itself is rejected
- Relations, such as the identity relation, are not entities, though rather predicates, meaning that they are not of type  $e$
- The General Concrete Interpretation is selected as the preferred interpretation of existence
- The Weak Rigid Identification Meinongian Interpretation is selected as the preferred interpretation of cross-world predication
- Weak rigid identification utilizes the two-dimensional notion of semantic meaning

## **Chapter 3**

### **Cross-World Causation**

#### **Modal Realism and Causation**

Within his masterpiece *On the Plurality of Worlds*, Lewis articulates his counterfactual analysis of causation as it pertains to his theory of modal realism. Initially, Lewis provides a relatively simple account of causation, in which he states that there exists a causal relation between two distinct events, namely a cause  $C$  and an effect  $E$ , when it is true that the lack of occurrence of  $C$  implies the lack of occurrence of  $E$  (Lewis, 1986, page 78). For the present purposes of analysis, an event may be understood simply as the instantiation of a property either at a particular instant of time or throughout a particular interval of time. It is perhaps worth explicitly acknowledging that the aforementioned definition of an event is not the sole definition that has been proposed. One alternative way of defining an event, which is especially prevalent within probability theory, is simply as a set of possible outcomes (Ross, 2014, page 22). Regardless of any other definitions of the term ‘event’ that may be available, an event is defined, for the purposes of the present research initiative, as the instantiation of a property either at a particular instant of time or throughout a particular interval of time.

Relating his theory of causation to his theory of modal realism, Lewis explains that causal relations within the actual world can be identified by imagining a counterfactual scenario in which a specified cause did not occur, and consequently, a specified effect did not occur. The counterfactual scenario transpires within the closest merely possible world at which the specified cause did not occur. One important detail is that the laws governing the merely possible world at which the specified cause did not occur must be similar, or at least similar in the relevant regards, to the laws that govern the actual world for the counterfactual analysis to be insightful. If the laws governing the merely possible world at which the specified cause did not occur are not relevantly similar to the laws of the actual world, then it is possible that the specified effect could occur without the specified cause. The laws of nature that govern closest worlds need not be exactly identical, though, as other considerations can influence the proximity of distinct worlds to one another (Lewis, 1973a, page 560). Presupposing that the laws governing the merely possible world at which the specified cause did not occur are relevantly similar to the laws of the actual world, the specified effect shall not occur, as a result of the fact that the specified cause did not occur. Thus, through the existence of merely possible worlds, it is possible to generate a theory of causation within the actual world through instantiating the notion of counterfactual scenarios.

It is perhaps beneficial to distinguish between the distinct notions of causation and truth-making as they pertain to the Lewisian conception of modal realism. Indeed, there may exist a misguided form of equivocation associated with the notion of causation that must be addressed to achieve a clear understanding of modal realism. It is apparent that, in general, causation is an incredibly sophisticated and complex subject. Therefore, it may be most advantageous to contemplate causation through an extensive illustrative example of its instantiation.

Suppose that Billiard Ball A is rolling across a table and that Billiard Ball A suddenly strikes Billiard Ball B. Through the process of the collision, Billiard Ball B, which was initially at rest relative to the table, begins to roll across the table with a similar path of trajectory as Billiard Ball A, whilst Billiard Ball A continues in its journey across the table, though at a significantly reduced rate of speed. Within such a scenario, it is apparent that an interaction, namely a collision, has occurred between two metaphysically concrete entities, in which change transpired within the collective system as a result of such an interaction. In fact, it may be observed that there exist multiple forms of change within the aforementioned scenario. Firstly, the status of Billiard Ball B as being “at rest relative to the table” has been eliminated as a result of its exchange with Billiard Ball A, meaning that Billiard Ball B is not “at rest relative to the table” by the conclusion of the collision, such that it may be stated that Billiard Ball A caused Billiard Ball B to fail to be “at rest relative to the table”. Secondly, the respective velocities of both Billiard Ball A and Billiard Ball B have been altered, which remains valid, interestingly, in all inertial frames of reference, such that it may be stated that Billiard Ball A caused a change in the velocity of Billiard Ball B and that Billiard Ball B caused a change in the velocity of Billiard Ball A. Thirdly, as is evidenced by the changes in the respective velocities of the two billiard balls, the kinetic energy of Billiard Ball A has decreased and the kinetic energy of Billiard Ball B has increased, such that it may be stated that Billiard Ball A caused the kinetic energy of Billiard Ball B to increase and that Billiard Ball B caused the kinetic energy of Billiard Ball A to decrease. Whilst certainly not an exhaustive listing of the various different causes that are present within the collision between Billiard Ball A and Billiard Ball B, it ought to be clear that there exists a plethora of distinct causes that can be attributed to the constituents of such a system.

Although it may seem obvious, it is perhaps nevertheless worth explicitly stating that there exist other forms of causation within the aforementioned scenario that, whilst typically ignored, remain prevalent, such as the friction that exists between the two billiard balls and the table that causes a progressive deterioration in the respective velocities of the billiard balls and the friction that exists between the two billiard balls when Billiard Ball A strikes Billiard Ball B that causes a minute increase in the thermal energy of the two billiard balls. Furthermore, it can be argued that causation is transitive, meaning that a particular entity may cause change within another entity, albeit in an indirect way, through an intermediary. For example, when Billiard Ball A rolls across a table and strikes Billiard Ball B, causing Billiard Ball B to roll across the table and eventually strike Billiard Ball C, causing Billiard Ball C, which was initially at rest relative to the table, to begin to roll across the surface of the table, it can reasonably be argued that Billiard Ball A indirectly caused Billiard Ball C to be set into motion. Similar, although perhaps less apparent, forms of indirect causation may be observed within such a system, such as when the friction between Billiard Ball A and Billiard Ball B causes an increase in the thermal energy of Billiard Ball B, which itself causes an extraordinarily minuscule increase in the mass of Billiard Ball B, in accordance with the theory of General Relativity.

Although it may violate certain pragmatic maxims of utterability to assert that there exists a causal relation between two particular distinct events when there exists a significant quantity of other events through which transitivity must persist for a causal link between the two particular distinct events to be established, or to assert that there exists a causal influence between two distinct events when the impact of one event upon another is so extraordinarily minuscule that it is seemingly neg-



ligible, it is certainly worth explicitly acknowledging that a causal relation, or a causal influence, exists between the two distinct events nonetheless. For example, it may appear strange to assert that there exists a causal relation between Event A and Event Z when it is necessary to traverse the entirety of transitive causality from Event A to Event B, from Event B to Event C, from Event C to Event D, et cetera, to eventually establish a causal relation between Event Y and Event Z, thus completing the explanatory process of relating Event A to Event Z. The causal distance between two particular distinct events, with regards to the quantity of intermediary events that must transpire for there to exist a causal relation between the two particular distinct events, is ultimately irrelevant to the fact that it is technically correct to assert that there does exist a genuine causal relation between the two particular distinct events. For certain practical intents and purposes, it may seem inappropriate to state that there exists a causal relation between two causally-distant events, though the causal relation truly exists nevertheless.

### Causation and Causal Influences

The causal influences that may exist between two distinct events can often appear to be sufficiently minute as to be deemed negligible, though it is technically not correct to dismiss them entirely. For example, suppose that the elements of the set  $\{a, b, c\}$  are distinct events and that  $a$  has a one percent causal influence upon  $b$  and that  $b$  has a one percent causal influence upon  $c$ . Without obsessing over precisely what the phrase “one percent causal influence” means, it ought to be apparent that it is possible to perform some basic analysis upon the extent to which  $a$  is causally influential upon  $c$ . Intuitively, and in the absence of any other ulterior considerations that may be of relevance, it is reasonable to presume that there exists a form of “causal filtration” between  $a$  and  $c$ , such that to determine the caliber of causal influence of  $a$  upon  $c$ , it is sufficient to simply calculate the product of the extent of causal influence of  $a$  upon  $b$  and the extent of causal influence of  $b$  upon  $c$ . Since  $a$  has a one percent causal influence upon  $b$  and  $b$  has a one percent causal influence upon  $c$ , it is reasonable to speculate that  $a$  has a 0.01 percent causal influence upon  $c$ . Within such a scenario, the one percent causal influence of  $a$  upon  $b$  is effectively “filtered through” the one percent causal influence of  $b$  upon  $c$  to generate the resultant 0.01 percent causal influence of  $a$  upon  $c$ . In fact, despite the incredibly tiny caliber of causal influence of  $a$  upon  $c$ , it may be the case that  $c$  would not have occurred at all if  $a$  had not occurred, meaning that the influence of  $a$  upon  $c$ , though minute, is nevertheless extremely significant.

Ultimately, regardless of any other considerations, both causation and causal influence are, technically, transitive relations. Indeed, Lewis himself repeatedly asserts that causation is indeed a transitive relation (Lewis, 2000, page 194; Lewis, 1973a, page 563). Alternatively, Lewis claims that causal influence is not transitive as a result of the fact that there can exist discrepancies between the patterns of causal influence between three or more distinct events within a sequence of occurrence (Lewis, 2000, page 192). Thus, Lewis advocates for a significant metaphysical distinction between causation and causal influence on the basis of transitivity. It is certainly appropriate to distinguish between scenarios in which an effect would indubitably transpire when a particular causal factor was present and scenarios in which multiple distinct causal influences are all potentially attributable to the eventual occurrence of an effect, corresponding to causation and causal influence, respectively. Nevertheless, whether it is a single event that causes a particular outcome or multiple distinct events that are all causally contributing towards a particular outcome, transitivity

ought to persist when other subsequent events are appended to the sequence. In an effort to remain as consistent as reasonably possible with *On the Plurality of Worlds*, the exposition concerning causality within the present research initiative shall be oriented primarily towards addressing causation, rather than causal influence. Contemplating which one of the two distinct ideas of causation and causal influence is the superior notion for describing causal relations between distinct events, or within what contexts which of the two is preferable, is a worthwhile endeavor, though for the present purposes of analysis, it shall suffice to maintain a certain caliber of agnosticism on the subject.

A complete account of all of the details and all of the implications of causation is beyond the scope of the present research initiative, as it shall suffice simply to have articulated such a relatively rudimentary account of causation, at least as it pertains to causation that is restricted to the boundaries of a single world. Perhaps the single most important quality of the Lewisian conception of causation, particularly as it pertains to distinguishing causation from truth-making within a theory of modal realism, is that causation between entities occurs exclusively within the confines of a specified world. Throughout *On the Plurality of Worlds*, Lewis consistently maintains that all of the possible worlds are spatiotemporally isolated from one another, and that cross-world causation is not possible (Lewis, 1986, page 2, page 78, page 84). In fact, the lack of persistence across possible worlds is perhaps the feature that most clearly distinguishes causation from truth-making within Lewisian modal realism.

### **Causation and Truth-Making**

Within the theory of modal realism originally advocated for by Lewis, the implications of causation are restricted to the boundaries of a particular possible world, whereas the ontological power of truth-makers can extend to all of the possible worlds. For the purposes of the present research initiative, it may be most beneficial to simply define a truth-maker as a state of affairs that ultimately renders propositions, or propositional concepts, true. States of affairs render propositions, or propositional concepts, true by providing the metaphysically concrete realizations of ways of being that are necessary for specified propositions, or propositional concepts, to be true.

States of affairs are context-sensitive, meaning that the precise scope of a particular state of affairs may differ drastically from the scope of a distinct state of affairs. Within one context, the scope of a state of affairs may be as restrictive as including merely a few entities, whilst within another context, the scope of a state of affairs may include an entire possible world, or possibly a collection of several possible worlds. For example, the truth-maker for the proposition ‘The mug is full of coffee’ is simply the state of affairs of the relevant mug having the maximum capacity of coffee that it is capable of containing within itself. It is possible that the states of affairs that serve as the truth-makers for certain propositions may, in fact, be sufficiently expansive as to include a possible world in its entirety, which Kris McDaniel appears to believe is particularly relevant to propositions involving negative existential claims, such as ‘Fire-breathing dragons do not exist’, in which case the truth-makers for such propositions are possible worlds that lack the entities whose existence is being denied (McDaniel, 2004, page 141). Similarly, the truth-maker for the proposition ‘I was not fatally electrocuted’ is the state of affairs that is a possible world within which the referent of the indexical ‘I’ is not killed by electricity. The most inclusive state of affairs would be

the totality of all possible worlds, which is the truth-maker for propositions involving metaphysical or logical necessities, such as the proposition ‘The sum of two and two is necessarily four’. Ultimately, in accordance with their context-sensitivity, a state of affairs may involve a few simple entities that are related to one another in a particular way, or a state of affairs may be as expansive in its scope as to include a possible world, in its entirety, or possibly a collection of several distinct possible worlds.

Defining a truth-maker as a state of affairs has its desirable qualities within the present research initiative. Nevertheless, it is worth explicitly acknowledging that, as observed and documented by M.J. Mozersky, certain philosophers would perhaps prefer to associate truth-makers with notions other than states of affairs, such as John Bigelow, who defines truth-makers as being properties, rather than entities (Mozersky, 2011, page 131). Alternatively, Marian David attributes Lewis himself as presuming an association between truth-makers and Tractarian facts (David, 2004, page 47). In an effort to circumvent an extensive articulation of the respective merits of defining truth-makers either as states of affairs or otherwise, it is perhaps best to simply stipulate that, for the present research initiative, truth-makers are states of affairs. If concerns of genuine philosophical significance persist regarding certain statements, then reformulate the statements appropriately as is needed to accommodate the desired alternative notion of truth-makers. For example, suppose that  $X$  is a proposition and that  $S$  is the state of affairs that makes  $X$  true. The statement ‘ $S$  is the truth-maker of  $X$ ’ can be readily reformulated, when necessary to appease disgruntled philosophers, as ‘The property of being  $S$  is the truth-maker of  $X$ ’, or perhaps as ‘The set of properties attributable to  $S$  is the truth-maker of  $X$ ’. Regardless of any other considerations, for the purposes of the present research initiative, truth-makers are defined as states of affairs, and are referred to as such throughout.

Presumably, when a particular proposition involving cross-world predication is instantiated within a particular world, the particular proposition refers to a constituent of another world, or potentially to the constituents of multiple different worlds. The referents of such propositions are the entities that are contained within other possible worlds, meaning that propositions involving cross-world predication must be capable of identifying entities that are not present within the particular world in which they themselves are instantiated. For example, one way in which to reasonably represent the proposition ‘The Alice of the actual world is taller than her respective counterpart within the world of Gotham City’ evaluated at the actual world within the formalism of Ty2 is as  $T_v(c)(a)$  where  $T_v$  is the “taller than” relation evaluated at the actual world and  $c$  is the respective counterpart to Alice within the world of Gotham City and  $a$  is the relevant person named Alice within the actual world. As such, within the formal expression  $T_v(c)(a)$ ,  $c$  is an entity that is contained within the world of Gotham City, rather than within the actual world. Whilst it may be sufficient to remain within the boundaries of the actual world for the purposes of successfully referring to  $a$ , as Alice is an actual person, as well as to the “taller than” relation represented by  $T_v$ , as the “taller than” relation is evaluated at the actual world, it is an exercise in futility to search for the referent of  $c$  within the actual world, as the respective counterpart to Alice within the world of Gotham City cannot be simultaneously located within more than one world. Consequently, the formal expression  $T_v(c)(a)$  must have a referential prowess that persists across worlds to be in any way meaningful. And to preemptively address one potential objection that can be readily anticipated, it would certainly seem unjustified to claim that propositions involving cross-world predication,

such as the one represented by  $T_v(c)(a)$ , are not meaningful solely upon the basis that they require reference to extend beyond the actual world. To deny reference to non-actual entities is to deny the ideology of cross-world predication altogether.

As it pertains to truth-making, it can be observed that propositions involving cross-world predication must have the expressive power to refer to the constituents of distinct worlds, including distinct non-actual worlds, to be true. For example, the proposition ‘The Joker could have had a daughter, despite the fact that he did not’ evaluated at the world of Gotham City implicitly incorporates a reference to a world other than the world of Gotham City, perhaps named Gothamopolis. Located within Gothamopolis is a young girl, perhaps named Harleen Giggles, whose father, perhaps named the Comedian, is the respective counterpart of the Joker. To be clear, the world of Gothamopolis contains both Harleen Giggles and the Comedian, whereas the Joker is located within the world of Gotham City. Importantly, although it has been relatively arbitrarily labeled as ‘Gothamopolis’ for the purposes of ease of reference, the precise world in which Harleen Giggles resides need not be specified, as it suffices merely for such a world to exist. What is of the utmost relevance is the fact that Harleen Giggles is the daughter of the closest counterpart of the Joker within a particular world. When such a condition is satisfied, the proposition ‘The Joker could have had a daughter, despite the fact that he did not’ evaluated at the world of Gotham City is made true, namely by the state of affairs of Harleen Giggles existing and being in an appropriate relation to the closest counterpart of the Joker within a possible world other than Gotham City. Thus, the state of affairs of Harleen Giggles being the daughter of the Comedian is the truth-maker for the proposition ‘The Joker could have had a daughter, despite the fact that he did not’ evaluated at the world of Gotham City. In general, it can be argued that within the theory of modal realism advocated for by Lewis, the states of affairs that are contained within merely possible worlds are often the truth-makers of the propositions involving cross-world predication that are instantiated within the confines of the actual world. Similarly, the states of affairs that are contained within the actual world are the truth-makers of some of the propositions involving cross-world predication that are instantiated within the confines of merely possible worlds.

For a proper comprehension of the ontological theory initially proposed by Lewis, it is imperative to appreciate the differences in the metaphysical implications of both causation and truth-making. One aspect of the Lewisian conception of modal realism that may occasionally obscure the distinction between causation and truth-making is that Lewis argues that the merely possible worlds are the metaphysically concrete realizations of all of the counterfactual scenarios that could have transpired within the actual world, despite the fact that they did not. Furthermore, for a particular way in which the world could have been, there exists a single unique world that corresponds to that specified particular, meaning that there exists an injection between possible ways in which the world could have been and possible worlds. As such, all possible worlds are distinct from one another, meaning that duplicates of worlds do not exist. Interestingly, Neil Sinhababu observes that Lewis admits that such a prohibition upon the redundancy of possible worlds is mere speculation, as is illustrated within the commentary that, “Lewis himself held that each possibility was instantiated by exactly one world, though he allowed that this might not be the case” (Sinhababu, 2008, page 257). As such, within a Lewisian theory of modal realism, it is asserted that all possible worlds are unique, though such an assertion is mere speculation that is without definitive proof.

As a consequence of the fact that all of the individual counterfactual ways in which the world could have been are realized within unique possible worlds, it may be argued that when a particular person initiates a certain action within the actual world, it shall inescapably be the case that his or her respective counterpart within at least one merely possible world shall refrain from engaging in such an action. For example, suppose that whilst Alice is a dedicated student who wakes in the morning and dutifully prepares to commute to class so as to maintain a punctual record within the actual world, her respective counterpart within another possible world, named Belle, remains in bed for an extended duration of time, believing that her tardiness on one day of class shall be excused by her otherwise perfect history of punctuality. In fact, in addition to Belle, there exists another counterpart within a different merely possible world, named Claire, who never manages to arrive at class prior to its designated starting time. Within such a scenario, whilst it is the case that the state of affairs of the collection of the punctuality of Alice and the tardiness of Belle is a truth-maker of the proposition 'Alice is more punctual than Belle' and that the state of affairs of the collection of the punctuality of Alice and the tardiness of Claire is a truth-maker of the proposition 'Alice is more punctual than Claire', it is not the case that the failure to maintain a perfect record of punctuality by either Belle or Claire causes Alice to be more punctual than them. Indeed, when causation is restricted to the metaphysically concrete constituents of a particular world, it would not be possible for either Belle or Claire to cause events to occur within the world inhabited by Alice, or for Alice to cause events to occur within either of the worlds inhabited by Belle or Claire. Rather, it would be more appropriate to assert that the punctuality of Alice within the actual world guarantees that there exists at least one other world in which her respective counterpart is not as punctual. More generally, within the Lewisian theory of modal realism, it is possible for facts to be non-causally realized, simply in virtue of the modal metaphysics that Lewis advocates for (Sinhbabu, 2008, page 257).

Ultimately, for the purposes of comprehending the ontological theory initially proposed by Lewis, it may be beneficial to conceive of causation as a form of interaction that relates metaphysically concrete entities to other metaphysically concrete entities, which occurs within a single world, and to conceive of truth-making as a form of interaction that relates metaphysically concrete states of affairs to either propositions or propositional concepts, which may span multiple worlds. The primary purpose for including exposition concerning truth-makers is simply to provide a comparison between truth-makers and causation, with the intention of illustrating how the two differ within Lewisian modal realism. Within the original theory of modal realism introduced by Lewis himself, the ontological power of truth-making persists through the boundaries between distinct possible worlds, whereas causation does not.

### **A Departure from Lewisian Modal Realism**

Within his articulation of his theory of modal realism, Lewis consistently maintains that distinct possible worlds are causally isolated from one another, such that the entities that are contained within a particular possible world influence neither the behavior of the entities that are contained within any of the other possible worlds nor the events that transpire within the other such worlds (Lewis, 1986, page 2, page 78, page 84). Whilst the Lewisian ontological theory may provide a convenient means by which to conceptualize alternative ways in which the world could have been, its metaphysical restrictions upon the accessibility relations that exist between distinct possible worlds hinders its capacity to account for certain scenarios that may be of interest. Contrary

to Lewis, it can be beneficial to permit for causation to permeate across possible worlds, whilst maintaining that possible worlds are spatiotemporally isolated from one another, thus enabling interaction between worlds that do not intersect in either space or time. Such a departure from the Lewisian theory of modal realism, as well as from the standard Quinean ontological theory, perhaps requires a certain caliber of motivation.

Interestingly, despite his persistence in advocating for modal realism, as well as the “ontological legitimacy” of merely possible worlds that it implies, Lewis argues against the notion of cross-world causation, in which the entities contained within one possible world causally interact with the entities that are contained within a different possible world. It appears as though the motivation that Lewis has for rejecting the idea of causal relations between the entities of distinct worlds is predominantly a result of his counterfactual analysis of causation. More specifically, the primary concern that Lewis expresses with the notion of cross-world causation is that, when multiple worlds are involved, it is not clear at which world the counterfactual statement associated with the causal relation ought to be evaluated, as is evidenced by his inquiry that, “This [cross-world causation] counterfactual is supposed to hold – where?” (Lewis, 1986, page 78). As a result of the structure of the formalism of the Ty2 system, one response is readily available for reasonably and coherently addressing the preceding question. A particular counterfactual statement associated with a causal relation between the entities of distinct worlds ought to be evaluated at the world of evaluation of the predicate that formally represents the counterfactual statement.

Within the Ty2 system, evaluation of predication occurs at a specified world, which, for the present purposes of analysis, is represented by the world identified within the subscript associated with a particular predicate. For example, within the formalism  $X_y(z)$ ,  $y$  represents the world at which the predicate represented by  $X$  is to be evaluated. Suppose that  $X$  represents the predicate ‘sleeps’ and that  $z$  represents the entity ‘Batman’. With  $X$  representing the predicate ‘sleeps’ and  $z$  representing the entity ‘Batman’, the formalism  $X_y(z)$  represents the expression ‘Batman sleeps’ evaluated at the world represented by  $y$ . If it happens to be the case that  $y = v$ , then the world at which the predicate ‘sleeps’ is to be evaluated is the actual world. Otherwise, the world at which the predicate ‘sleeps’ is to be evaluated is a merely possible world, such as Gotham City.

By referencing both an entity that is contained within one possible world and a distinct entity that is contained within a different possible world within the input-values of a particular predicate, it is possible to generate predication statements that span multiple worlds. As such, extending the notion of predication, as well as the notion of causation, beyond the confines of a single world is exceedingly simple within the system of Ty2. For example, suppose that Batman is located within the world of Gotham City and that Rex is a dinosaur located within the actual world and that the formalism  $D_y(r)(b)$  represents the expression ‘Batman causes the death of Rex’ evaluated at the world represented by  $y$ . Within such a scenario, the formalism  $D_y(r)(b)$  represents a form of cross-world causation, as Batman, who is not located within the actual world, causes the death of a dinosaur within the actual world. Additionally, it is certainly worth observing that although the world of evaluation represented by  $y$  within the formalism  $D_y(r)(b)$  could be the world of Gotham City or the actual world, it need not be either, as the world represented by  $y$  can, in fact, be any possible world. Consequently, it is possible to evaluate counterfactual statements involving cross-world causation either from the “standards of evaluation” of one of the worlds within which the

entities referenced is located or from the “standards of evaluation” of a world that is not involved at all in the causal relation. Thus, the Ty2 system provides an eloquent means by which to address the seemingly arcane nature of evaluation of counterfactual statements involving cross-world causation that Lewis is concerned with.

Throughout his explanation of his theory that all possible worlds are both spatiotemporally and causally isolated from one another, Lewis himself contemplates potential solutions to the metaphysical challenges associated with cross-world causation. Emphasizing the importance of identifying precisely where counterfactual statements involving cross-world causation ought to hold true, one idea that Lewis proposes is that counterfactual statements that involve causal interaction between the constituents of two distinct possible worlds must be true at both of the relevant worlds (Lewis, 1986, page 78). Operating with such a mentality, Lewis considers several different variations of counterfactual accounts of cross-world causation, and ultimately concludes that none of them are satisfactory. Although he eventually dispenses with it, the version of cross-world causation that Lewis appears to believe has the most potential for success is one that effectively substitutes world-pairs for single worlds, as is articulated within the definition that, “[A]t the closest world-pairs to the pair  $\langle W_C, W_E \rangle$  such that  $C$  does not occur at the first world of the pair,  $E$  does not occur at the second world of the pair” (Lewis, 1986, page 79). Within the preceding definition,  $W_C$  represents the world at which a particular cause occurs,  $W_E$  represents the world at which the effect generated by the particular cause occurs, and the bracketed expression  $\langle W_C, W_E \rangle$  represents the world-pair that consists of both  $W_C$  and  $W_E$ . Whilst such an account of cross-world causation based upon counterfactual analyses of pairings of worlds may initially seem reasonable, Lewis observes that it is flawed, and expediently rejects it (Lewis, 1986, page 79). Nonetheless, it can be argued that with a few critical modifications, the aforementioned theory that references multitudes of worlds, rather than single worlds, may be ideal for the purposes of producing a coherent account of cross-world causation.

## **A Counterfactual Account of Cross-World Causation**

In the process of creating a revised theory of cross-world causation, it may be beneficial to explicitly define several symbolic representations.

$C$  = a particular cause

$E$  = a particular effect generated by  $C$

$W_C$  = the world within which  $C$  occurs

$W_E$  = the world within which  $E$  occurs

$W_{\neg C}$  = the closest world to  $W_C$  within which  $C$  does not occur

$W_{\neg E}$  = the closest world to  $W_E$  within which  $E$  does not occur

$\langle W_C, W_E \rangle$  = the world-pair consisting of  $W_C$  and  $W_E$

$\langle W_{\neg C}, W_{\neg E} \rangle$  = the world-pair consisting of  $W_{\neg C}$  and  $W_{\neg E}$

Additionally, in an effort to amend the counterfactual account of cross-world causation based upon pairings of worlds initially proposed by Lewis, it is prudent to stipulate two additional principles that must be adhered to, namely the Sole Self-Identity Principle and the Appropriate Symmetry Principle.

### Sole Self-Identity Principle:

Perhaps the most immediately obvious amendment to the proposal by Lewis for a theory of cross-world causation that involves counterfactual analyses between world-pairs is to stipulate that no possible world is identical to any other possible world, and that all possible worlds are necessarily self-identical. Conveniently, the identity relations, or lack thereof, between worlds can be visually represented exceedingly nicely by an identity matrix, within which the value 1 represents identity between the corresponding possible worlds and the value 0 represents a lack of identity between the corresponding possible worlds.

	$W_C$	$W_E$	$W_{\neg C}$	$W_{\neg E}$
$W_C$	1	0	0	0
$W_E$	0	1	0	0
$W_{\neg C}$	0	0	1	0
$W_{\neg E}$	0	0	0	1

### Appropriate Symmetry Principle:

Another crucial detail that ought to be specified is that the particular causal relation that exists between the entities of  $\langle W_{\neg C}, W_{\neg E} \rangle$  must be appropriately symmetrical to the causal relation that exists between the entities of  $\langle W_C, W_E \rangle$ . The preceding requirement ensures that it will be possible to infer a comparison that is both reasonable and relevant between the causal relations that exist between the elements of distinct world-pairs.

Perhaps the most effective means by which to articulate the Appropriate Symmetry Principle is through an illustrative example. Suppose that  $\langle \alpha, \beta \rangle$  is a world-pair. Perhaps it is the case that, for a strange reason, whenever a seahorse dies within  $\alpha$ , the death of the seahorse causes the death of a starfish within  $\beta$ . The death of seahorses within  $\alpha$  and the death of starfish within  $\beta$  are not attributable to a common external influence. It is not the case that the relation between the death of seahorses within  $\alpha$  and the death of starfish within  $\beta$  is a mere correlation of events. Rather, there exists a genuine causal relation between the death of seahorses within  $\alpha$  and the death of starfish within  $\beta$ , such that a particular starfish within  $\beta$  would not have died if a particular seahorse within  $\alpha$  had not died. The closest world to  $\alpha$  within which a particular seahorse does not die may be represented symbolically as  $\dot{\alpha}$  and the closest world to  $\beta$  within which a particular starfish does not die may be represented symbolically as  $\dot{\beta}$ . As such, the world-pair  $\langle \dot{\alpha}, \dot{\beta} \rangle$  represents the closest world-pair to  $\langle \alpha, \beta \rangle$  where a particular seahorse within  $\dot{\alpha}$  does not die and a particular starfish within  $\dot{\beta}$  does not die. If it had been the case that a particular seahorse within  $\dot{\alpha}$  had died, then it would have been the case that a particular starfish within  $\dot{\beta}$  would have died. Thus, the causal relation that exists between the entities of  $\langle \dot{\alpha}, \dot{\beta} \rangle$  is appropriately symmetrical to the causal relation that exists between the entities of  $\langle \alpha, \beta \rangle$ . Interestingly, within his journal article “Trans-World Causation?”, Eduardo García-Ramírez describes a similar scenario of cross-world causation in which the event of a human being sneezing within the actual world causes the death of a talking donkey within a merely possible world (García-Ramírez, 2012, page 77). Importantly, details that are not relevant to a particular causal relation between the entities of distinct worlds are not to be taken into consideration.



Although it does not appear as though he explicitly identifies a condition of appropriate symmetry between the causal structure of worlds within his counterfactual account of causation within a single world, Lewis may be guaranteed the prevalence of such symmetry as a result of his ontological theory. In accordance with his counterfactual account of causation, Lewis claims that to establish a causal relation between two distinct events, namely a cause and its corresponding effect, within a particular possible world, it is imperative to analyze a different possible world, namely the possible world that is closest to the particular possible world, though within which the specified cause does not occur. Presumably, there may exist a plethora of distinct possible worlds, within which a specified cause does not occur, that are of equal proximity to the possible world under consideration, within which the specified cause does occur. Although such a consideration may initially seem problematic, it is ultimately a benign truth, as it is sufficient, for the purposes of endeavoring to establish a causal relation, to simply select one of the closest possible worlds within which the specified cause does not occur for evaluation.

Another potential complication is that the standards by which worlds are deemed “close” to one another may vary within different contexts, meaning that certain worlds may be deemed “close” to one another within one context and “distant” from one another within a different context. The preceding consideration may initially appear to pose a dilemma to the counterfactual account of causation proposed by Lewis, for it may seem as though certain standards of “closeness” between distinct possible worlds may occasionally require designating two possible worlds with distinct laws of nature as being “close” to one another, in which case the causal structure of the two worlds may differ from one another. In fact, Lewis himself considers the potential for worlds to differ in their causal structure, including the possibility for a world to lack causation altogether, as is exemplified well within his commentary that, “A chaotic and lawless world might have no causation” (Lewis, 1986, page 84). When the causal structure of two worlds differ from one another, the causal relations between the entities contained within one of the two worlds may differ from the causal relations between the entities contained within the other of the two worlds. Within such a scenario, it may not be appropriate to perform a counterfactual analysis of causation between two distinct worlds, for it may be the case that a specified event would cause a specified resultant event to occur within one of the two worlds, whereas the specified event would not cause the specified resultant event to occur within the other of the two worlds, as a result of the distinct causal structure of the two distinct worlds. Whilst such a consideration may seem detrimental to the counterfactual account of causation initially proposed by Lewis, the magnitude of its severity is fairly minuscule. For all practical intents and purposes, it would be unreasonable to select a standard of “closeness” of possible worlds that involved drastically altering the laws of nature. It is profoundly improbable that two possible worlds that are within close proximity to one another would exhibit sufficiently dissimilar laws of nature so as to have different causal structures.

As a result of the fact that the vast infinitude of possible worlds within the theory of modal realism advocated for by Lewis successfully spans the totality of logical possibilities, it is seemingly impossible for the condition of appropriate symmetry associated with the causal relations between the entities of distinct worlds not to be satisfied under reasonable standards of “closeness”. Perhaps that idea, in and of itself, is further evidence for the plausibility of the theory of modal realism that Lewis so persistently advocates for.

It is perhaps appropriate to explicitly acknowledge a particular concern that is associated with the counterfactual conceptualization of causation proposed by Lewis, which is pertinent to causation within individual worlds, as well as to causation between the entities of the distinct worlds that constitute a world-pair. A critical observer may realize that there exists an insidious form of circularity between the counterfactual account of causation that Lewis advocates for and the “standards of closeness” of distinct possible worlds that it is founded upon.

Suppose that  $w_1$  is an arbitrary possible world and that  $a$  is a particular event contained within  $w_1$  and that  $b$  is a distinct event from  $a$  contained within  $w_1$  and that  $w_2$  is the closest counterpart to  $w_1$  within which  $a$  does not occur. To establish the existence of a certain causal relation between  $a$  and  $b$  within  $w_1$ , it is necessary to inspect  $w_2$ . If  $b$  occurs within  $w_2$ , then there does not exist a causal relation between  $a$  and  $b$ . If  $b$  does not occur within  $w_2$ , then there exists a causal relation between  $a$  and  $b$ . Consequently, the existence, or lack thereof, of a causal relation between distinct events within  $w_1$  is explained by the contents of  $w_2$ . Such an account of causation is intuitively plausible, though it subtly conceals a presupposition that seemingly guarantees its success, and which is ultimately the source of the aforementioned circularity. To determine that  $w_2$  is the closest counterpart to  $w_1$  within which  $a$  does not occur, it is necessary to inspect  $w_1$ . For  $w_2$  to be the closest counterpart to  $w_1$  within which  $a$  does not occur,  $w_2$  must be governed by laws of nature that are relevantly similar to the laws of nature that govern  $w_1$ , lest it may be possible that the causal structure of  $w_2$  differs from the causal structure of  $w_1$ , thus rendering a counterfactual analysis of causation impractical. As such, the status of  $w_2$  as being the closest counterpart to  $w_1$  within which  $a$  does not occur is explained by the contents of  $w_1$ . Collectively, the causal relations between distinct events within  $w_1$  is explained by the contents of  $w_2$  and the status of closest “counterpartness” of  $w_2$  is explained by the contents of  $w_1$ . Thus, there exists a form of circularity that is attributable to the counterfactual account of causation that Lewis articulates.

The notion of causation relies upon the notion of “counterpartness” to determine which possible worlds are closest to one another and the notion of “counterpartness” relies upon the notion of causation to determine which possible worlds have relevantly similar laws of nature with correspondingly relevantly similar causal structures. The aforementioned circularity associated with the Lewisian theory of causation pertains to causation that is restricted to the confines of a single possible world.

Perhaps unsurprisingly, attempts to rectify the one account of cross-world causation based upon counterfactual pairings of worlds that Lewis appears to favor most will inescapably exhibit an analogous form of circularity. Suppose that  $\langle \alpha_1, \beta_1 \rangle$  is an arbitrary possible world-pair and that  $a$  is a particular event contained within  $\alpha_1$  and that  $b$  is a particular event contained within  $\beta_1$  and that  $\alpha_2$  is the closest counterpart to  $\alpha_1$  within which  $a$  does not occur and that  $\langle \alpha_2, \beta_2 \rangle$  is the closest counterpart to  $\langle \alpha_1, \beta_1 \rangle$ . Importantly, for a counterfactual account of cross-world causation to be in any way meaningful, both the Sole Self-Identity Principle and the Appropriate Symmetry Principle must be adhered to. As such, in accordance with the Sole Self-Identity Principle,  $\alpha_1, \beta_1, \alpha_2,$  and  $\beta_2$  must all be distinct from one another. Additionally, in accordance with the Appropriate Symmetry Principle, the causal relation that exists between the entities of  $\langle \alpha_1, \beta_1 \rangle$  must be appropriately symmetrical to the causal relation that exists between the entities of  $\langle \alpha_2, \beta_2 \rangle$ . To establish the existence of a certain cross-world causal relation between  $a$  within  $\alpha_1$  and  $b$  within  $\beta_1$ , it is

necessary to inspect  $\langle \alpha_2, \beta_2 \rangle$ . If  $b$  occurs within  $\beta_2$ , then there does not exist a causal relation between  $a$  and  $b$ . If  $b$  does not occur within  $\beta_2$ , then there exists a causal relation between  $a$  and  $b$ . Consequently, the existence, or lack thereof, of a cross-world causal relation between the events of the distinct worlds of the world-pair  $\langle \alpha_1, \beta_1 \rangle$  is explained by the contents of  $\langle \alpha_2, \beta_2 \rangle$ . Similarly as to within the case of causation that is contained within a single possible world, an account of cross-world causation that remains as truthful as reasonably possible to the theory of causation advocated for by Lewis depends upon a presupposition that seemingly automatically guarantees its success. To determine that  $\alpha_2$  is the closest counterpart to  $\alpha_1$  within which  $a$  does not occur, it is necessary to inspect  $\alpha_1$ . For  $\alpha_2$  to be the closest counterpart to  $\alpha_1$  within which  $a$  does not occur,  $\alpha_2$  must be governed by laws of nature that are relevantly similar to the laws of nature that govern  $\alpha_1$ , lest it may be possible that the causal structure of  $\alpha_2$  differs from the causal structure of  $\alpha_1$ , thus rendering a counterfactual analysis of causation impractical. As such, the status of  $\alpha_2$  as being the closest counterpart to  $\alpha_1$  within which  $a$  does not occur is explained by the contents of  $\alpha_1$ . Furthermore, the status of  $\langle \alpha_2, \beta_2 \rangle$  as being the closest counterpart to  $\langle \alpha_1, \beta_1 \rangle$  is explained by the contents of  $\langle \alpha_1, \beta_1 \rangle$ . Collectively, the cross-world causal relations between the events of the distinct worlds of the world-pair  $\langle \alpha_1, \beta_1 \rangle$  is explained by the contents of  $\langle \alpha_2, \beta_2 \rangle$  and the status of closest “counterpartness” of  $\langle \alpha_2, \beta_2 \rangle$  is explained by the contents of  $\langle \alpha_1, \beta_1 \rangle$ .

The notion of causation relies upon the notion of “counterpartness” to determine which possible world-pairs are closest to one another and the notion of “counterpartness” relies upon the notion of causation to determine which possible world-pairs have relevantly similar laws of nature with correspondingly relevantly similar causal structures. It is beyond the scope of the present analysis of logic applied to formal representations of propositions to resolve the explanatory circularity associated with a counterfactual account of causation. Perhaps it is invariably impossible to formulate a counterfactual account of causation that is entirely without circularity. In fact, Lewis himself claims that inherent circularity within a theory does not necessarily disqualify its viability, and may, on the contrary, serve as supportive evidence for accepting such a theory as primitive (Lewis, 1986, page 63). Ultimately, it is possible to generate a theory of cross-world causation based upon counterfactual scenarios that is satisfactory to the standards set by Lewis.

It is reasonable to believe that, with the aforementioned critical modifications and general considerations, the theory of modal realism advocated for by Lewis is capable of accounting for the potential of cross-world causation. Indeed, García-Ramírez concurs that the notion of cross-world causation is compatible with the Lewisian conceptualization of modal realism, as is exemplified within the commentary that, “Yet if we accept counterpart theory, assume a standard possible-worlds semantics for the relevant counterfactuals, and Lewis’ proposed modal realism, we will have to accept that there is trans-world causation” (García-Ramírez, 2012, page 82). It is perhaps worth explicitly acknowledging that one author in particular, named Axel Arturo Barceló Aspeitia, directly opposes García-Ramírez, asserting that the counterfactual account of causation developed by Lewis is inherently incompatible with the notion of cross-world causation (Aspeitia, 2014, page 40). Alternatively, Alessandro Torza believes that, with a strategically-modified version of the best theory account of natural laws, cross-world causation is logically consistent with the system of modal metaphysics advocated for by Lewis (Torza, 2014, page 202, page 207). Detailed summaries of the respective arguments of Aspeitia, García-Ramírez, and Torza may be reviewed within Appendix E. Ultimately, despite the dismissal of cross-world causation by Lewis himself,

it is possible to generate a viable theory of causal relations between the entities that are contained within distinct possible worlds when modal realism is presupposed, as it is throughout the present research initiative.

### **Nine Different Forms of Cross-World Causation**

Whilst both the Sole Self-Identity Principle and the Appropriate Symmetry Principle improve upon the theory of cross-world causation based upon comparisons between distinct world-pairs proposed by Lewis, there exist other considerations that are not addressed by either of the two aforementioned principles which must be accounted for if a counterfactual account of cross-world causation is to be complete. As Lewis rejects the notion of cross-world causation, he does not bother to deliberate the intricate complexity of causal relations that may exist between multitudes of distinct worlds. Indeed, it may be the case that certain cross-world causal relations involve the interactions between more than two distinct worlds, thus requiring more than a mere pair of worlds within a counterfactual account of cross-world causation. In fact, although it may not be immediately obvious, the sophisticated causal relations that can exist between multitudes of distinct possible worlds are highly analogous to many of the causal relations that exist between the entities contained within the actual world. Such causal relations, which can be observed within the confines of the actual world, include, though are not limited to, scenarios in which a plethora of distinct causes converge upon a single effect and scenarios in which a single event causes a plenitude of distinct effects. For the sake of clarity in elucidating the several different ways in which distinct worlds can have causal relations between one another, it may be beneficial to distinguish between possible worlds within which causes are contained, denoted henceforth as cause-worlds, and possible worlds within which the effects associated with specified causes are contained, denoted henceforth as effect-worlds.

In total, there exist nine distinct forms of cross-world causal relations, four of which involve three or more distinct possible worlds. It would seem remiss to fail to explicitly identify all of the nine different cases of cross-world causation, which would thus mitigate the potential for confusion between them.

## Fundamental Cases of Cross-World Causation

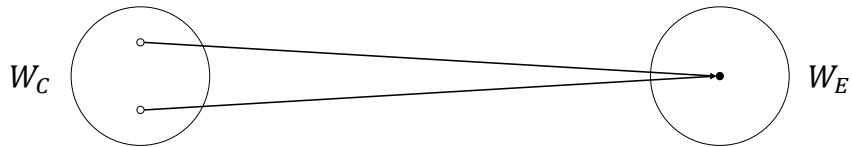
1. A single cause contained within a single cause-world generates a single effect contained within a single effect-world

### Case 1



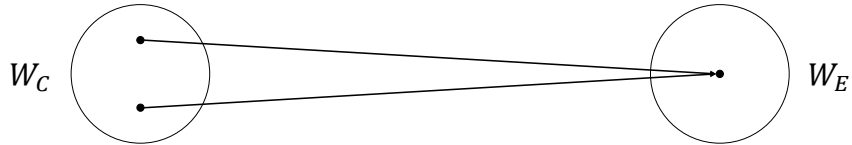
2. Two or more distinct causes contained within a single cause-world are independently sufficient to generate a single effect contained within a single effect-world

### Case 2



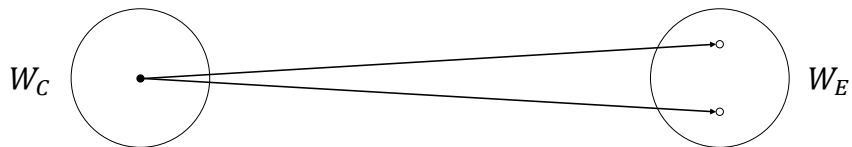
3. Two or more distinct causes contained within a single cause-world are collectively necessary to generate a single effect contained within a single effect-world

### Case 3



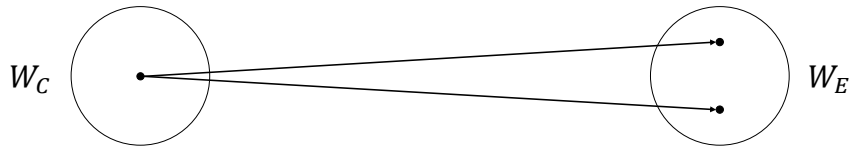
4. A single cause contained within a single cause-world generates only one of two or more possible effects contained within a single effect-world

### Case 4



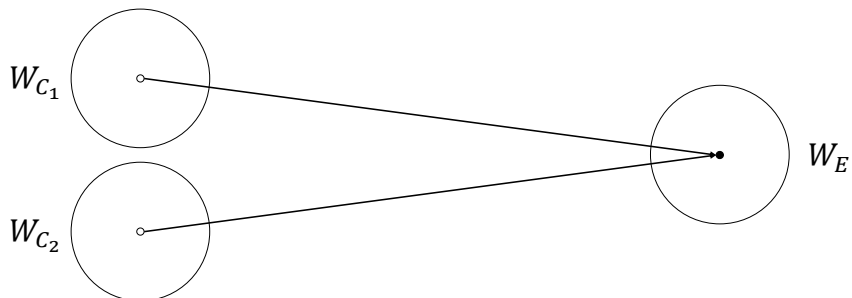
5. A single cause contained within a single cause-world generates all of two or more possible effects contained within a single effect-world

### Case 5



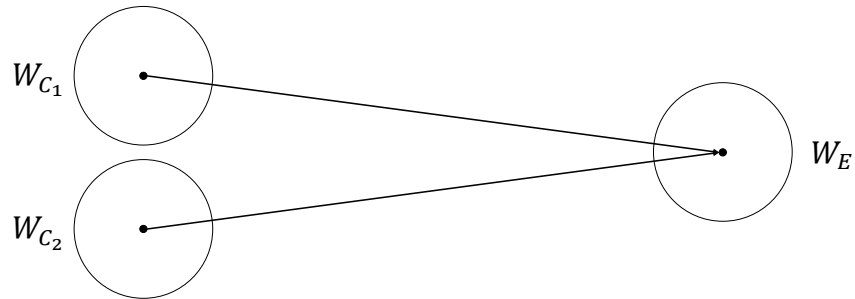
6. Two or more distinct cause-worlds individually contain a single cause within themselves, any one of which is independently sufficient to generate a single effect contained within a single effect-world

### Case 6



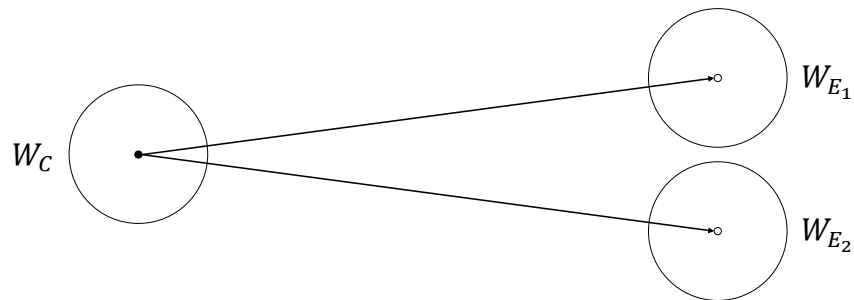
7. Two or more distinct cause-worlds individually contain a single cause within themselves, all of which are collectively necessary to generate a single effect contained within a single effect-world

### Case 7



8. A single cause contained within a single cause-world generates only one of two or more possible effects, which are individually contained within distinct effect-worlds

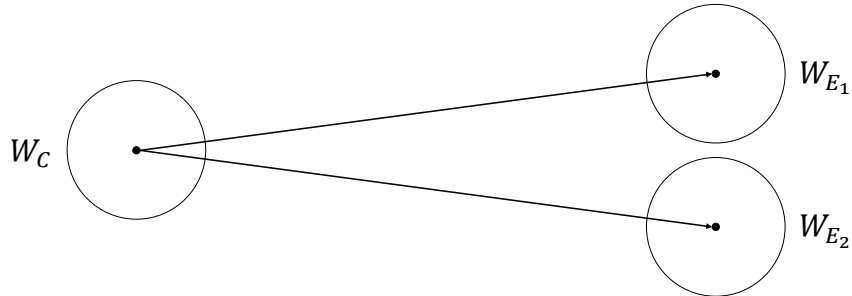
### Case 8





9. A single cause contained within a single cause-world generates all of two or more possible effects, which are individually contained within distinct effect-worlds

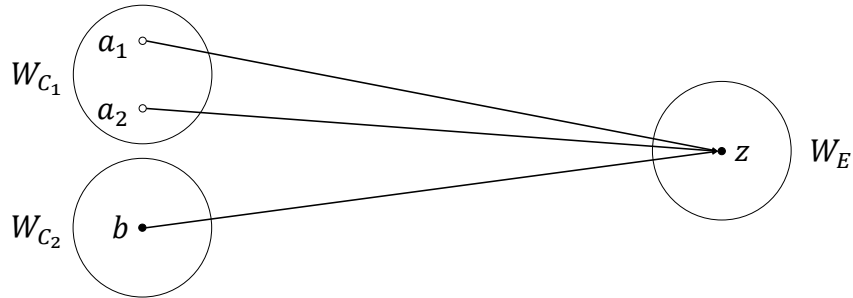
### Case 9



The diagrams representing visual illustrations of the nine fundamental cases of cross-world causation may be reviewed within Appendix D.

All other forms of cross-world causation can be construed as combinations of the nine fundamental cases. For example, suppose that  $W_{C_1}$  is a cause-world and that  $a_1$  is a particular event contained within  $W_{C_1}$  and that  $a_2$  is a particular event distinct from  $a_1$  contained within  $W_{C_1}$  and that  $W_{C_2}$  is a cause-world distinct from  $W_{C_1}$  and that  $b$  is a particular event contained within  $W_{C_2}$  and that  $W_E$  is an effect-world and that  $z$  is a particular effect contained within  $W_E$ . It may be the case that for  $z$  to occur,  $b$  must occur and at least one element of the set of events of  $\{a_1, a_2\}$  must occur. If both  $a_1$  and  $b$  occur, then  $z$  occurs. If both  $a_2$  and  $b$  occur, then  $z$  occurs. If all three of  $a_1$  and  $a_2$  and  $b$  occur, then  $z$  occurs. In all other possible scenarios,  $z$  does not occur. Although such a scenario is certainly not one of the nine fundamental cases of cross-world causation, it can be understood as a combination of two of the nine cases. More specifically, such a scenario may be formulated as a combination of Case 2 and Case 7.

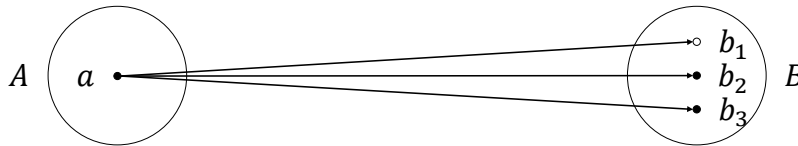
### Example 1



The diagram labeled “Example 1” may be reviewed within Appendix D as well.

As another example, suppose that  $A$  is a cause-world and that  $a$  is a particular event contained within  $A$  and that  $B$  is an effect-world and that the elements of the set  $\{b_1, b_2, b_3\}$  are distinct events contained within  $B$ . It may be the case that for  $b_1$  to occur or for both of the elements of the set  $\{b_2, b_3\}$  to occur,  $a$  must occur. In the event that  $a$  occurs,  $b_1$  shall occur or both of the elements of the set  $\{b_2, b_3\}$  shall occur or all three effects shall occur. An alternative, though equivalent, means of expressing the preceding causal relation is to assert that the occurrence of  $a$  causally implies the occurrence of  $b_1 \vee (b_2 \wedge b_3)$ . Such a scenario may be formulated as a combination of two of the nine fundamental cases of cross-world causation, namely Case 4 and Case 5.

## Example 2



The diagram labeled “Example 2” may be reviewed within Appendix D as well.

Ultimately, all causal relations that exist between the entities of distinct possible worlds, regardless of how intricate or intertwined they may be, can be accurately represented by an appropriate combination of the nine aforementioned cases of cross-world causation. For the sake of brevity, it may be beneficial to limit exposition merely to descriptive accounts of the most complex forms of cross-world causation, namely the four forms that involve causal relations between the entities of three or more distinct possible worlds, whilst presuming that the other forms of cross-world causation are relatively simple to understand, by comparison.

## Cross-World Causation between Three or More Possible Worlds

### Tokens of Case 6

The first fundamental case of cross-world causation that involves three or more distinct possible worlds is when multiple distinct cause-worlds contain events that are independently sufficient to generate a particular effect within an effect-world, which is distinct from all of the cause-worlds, corresponding to Case 6.

Within tokens of Case 6, the occurrence of any one of the causes contained within the distinct cause-worlds would entail that a particular effect would occur within the confines of the possible world within which it is located. For example, it may be the case that the event of Batman siring a child within the possible world of Gotham City and the event of the closest counterpart of Batman siring a child within a possible world that is distinct from the possible world of Gotham City are both sufficient to cause a state of frenzied fear within a possible world that is predominantly populated by villains, and which is distinct from both of the aforementioned possible worlds. Suppose that  $g$  is the world of Gotham City and that  $h$  is a world distinct from Gotham City and that  $j$  is a world predominantly populated by villains and that  $g \neq h$  and that  $g \neq j$  and that  $h \neq j$ . It is apparent that the distinct events of the siring of a child by Batman within  $g$  and the siring of child by the closest counterpart to Batman within  $h$  are both independently capable of causing a state of frenzied fear amongst the villains within  $j$ .

In general, a causal relation between the entities of distinct possible worlds that features a structure such as that of Case 6 is perhaps reminiscent of what Lewis refers to as “redundant causation” (Lewis, 2000, page 182). More specifically, it may be most appropriate to identify particular tokens of Case 6 of the fundamental cases of cross-world causation as either forms of preemption or forms of causal overdetermination.

Typically, when a particular causal relation is restricted to the confines of a single possible world, the distinction between preemption and overdetermination is defined with regards to time. Preemption, in which one potential cause is temporally prior to an alternative potential cause, is discernible from overdetermination, in which multiple distinct potential causes are either precisely temporally simultaneous or sufficiently temporally proximate to be deemed temporally simultaneous for all practical intents and purposes, as a result of the differences in the temporal structure between the two. As it pertains to preemption, Lewis himself identifies the potential cause that is temporally prior, and which is therefore the event that is ultimately causally responsible for the occurrence of a particular effect, as being the preempting cause, whereas the potential cause that is temporally posterior, and which is therefore not the cause of a particular effect, as being the preempted alternative cause (Lewis, 2000, page 182). In scenarios where preemption is present, although the occurrence of either one of the preempting cause or the preempted alternative cause would be sufficient to generate a specified effect, the preempting cause is the event that is attributable as being the cause of the specified effect. In a sense, the preempted alternative cause is not the cause of a specified effect because the preempting cause “beats it to the punchline”. The preceding characteristic distinguishes preemption from overdetermination, in which the multiple distinct temporally simultaneous potential causes are all equally attributable as being causes of a specified effect. Differentiating between preemption and overdetermination with regards to temporal

standards is adequate when causation is confined within the boundaries of a single possible world, though it is not feasible to utilize time as the entity that distinguishes the two when causal relations span between the constituents of distinct possible worlds.

In accordance with the theory of modal realism advocated for by Lewis, distinct possible worlds are spatiotemporally isolated from one another, and as such they do not have temporal proximity to one another. Furthermore, it is certainly not reasonable to presuppose that distinct possible worlds are in any way temporally synchronized with one another. Indeed, time is in fact relativized to individual possible worlds. As such, time cannot serve as the entity that distinguishes between preemption and overdetermination within scenarios that involve cross-world causation. Rather, when the occurrence of any one of the potential causes contained within multiple distinct cause-worlds would be sufficient to generate a particular effect within the confines of a particular effect-world, it is necessary to refer to a state of causal priority, or the lack thereof, between the several cause-worlds and the single effect-world to determine whether a particular scenario is either a form of preemption or a form of overdetermination.

A state of causal priority exists between the elements of a set of multiple distinct cause-worlds and a single effect-world when the specified effect-world exhibits a preference of the events that transpire within certain cause-worlds to the events that transpire within other cause-worlds. For example, suppose that the elements of the set  $\{W_{C_1}, W_{C_2}, W_{C_3}\}$  are distinct cause-worlds and that the elements of the set  $\{c_1, c_2, c_3\}$  are events respectively contained within the elements of the set  $\{W_{C_1}, W_{C_2}, W_{C_3}\}$  and that  $W_E$  is an effect-world and that  $z$  is a particular effect contained within  $W_E$ . It is possible that for  $z$  to occur,  $W_E$  relies primarily upon the occurrence of  $c_1$  within  $W_{C_1}$ , secondarily upon the occurrence of  $c_2$  within  $W_{C_2}$ , and as a tertiary option upon the occurrence of  $c_3$  within  $W_{C_3}$ . Within such a scenario, it is apparent that  $W_E$  exhibits a preference of  $c_1$  to  $c_2$ , as well as a preference of  $c_2$  to  $c_3$ , thus qualifying as a form of preemption. More specifically,  $c_1$  is the preempting cause of  $z$ ,  $c_2$  serves as a preempted alternative to  $c_1$ , and  $c_3$  serves as a preempted alternative to  $c_2$ . If there did not exist any ordering of the priority of potential causes, then such a scenario would simply be a form of overdetermination.

Perhaps a worthwhile reiteration, the distinction between preemption and overdetermination, as it pertains to cross-world causation, is not one of temporal standards, though rather one of causal structure that is determined by either the presence or the absence of a state of causal priority between the plethora of distinct cause-worlds and the single effect-world under consideration. Regardless of whether a particular token of Case 6 features a form of preemption or a form of overdetermination, it is possible to formally represent scenarios within which multiple distinct cause-worlds contain events that are independently sufficient to generate a particular effect within an effect-world, which is distinct from all of the cause-worlds.

$$\left( \bigvee_{k=1}^N (a_k) \right) \rightarrow b$$

where  $N$  is the quantity of cause-worlds,  $a_k$  are the distinct causes, and  $b$  is the effect

### Tokens of Case 7

The second fundamental case of cross-world causation that involves three or more distinct possible worlds is when multiple distinct cause-worlds contain events that are all collectively necessary to generate a particular effect within an effect-world, which is distinct from all of the cause-worlds, corresponding to Case 7.

Within tokens of Case 7, the mere occurrence of a single one of the causes contained within the distinct cause-worlds is not sufficient to generate the particular effect contained within the effect-world. Rather, all of the individual causes must occur within the confines of their respective distinct cause-worlds to ensure that the effect shall occur within the effect-world. If so much as a single cause does not occur within the cause-world within which it is located, then there shall not exist a guarantee that the effect shall occur within the effect-world within which it is located. For example, it may be the case that the event of Batman siring a child within the possible world of Gotham City and the event of the closest counterpart of Batman siring a child within a possible world that is distinct from the possible world of Gotham City are both necessary to cause a state of frenzied fear within a possible world that is predominantly populated by villains, and which is distinct from both of the aforementioned worlds. Suppose that  $g$  is the world of Gotham City and that  $h$  is a world distinct from Gotham City and that  $j$  is a world predominantly populated by villains and that  $g \neq h$  and that  $g \neq j$  and that  $h \neq j$ . It is apparent that the distinct events of a siring of a child by Batman within  $g$  and the siring of a child by the closest counterpart to Batman within  $h$  are both required to cause a state of frenzied fear amongst the villains within  $j$ .

Ultimately, the distinguishing characteristic between Case 6 and Case 7 is the difference between disjunction and conjunction, respectively. As such, similarly as to scenarios within which multiple distinct cause-worlds contain events that are independently sufficient to generate a particular effect within an effect-world, which is distinct from all of the cause-worlds, it is possible to formally represent scenarios within which multiple distinct cause-worlds contain events that are all collectively necessary to generate a particular effect within an effect-world, which is distinct from all of the cause-worlds, which shall feature a conjunction of causes, rather than a disjunction of causes.

$$\left( \bigwedge_{k=1}^N (a_k) \right) \rightarrow b$$

where  $N$  is the quantity of cause-worlds,  $a_k$  are the distinct causes, and  $b$  is the effect

### Tokens of Case 8

The third fundamental case of cross-world causation that involves three or more distinct possible worlds is when a single cause-world contains a particular event that generates only one of multiple distinct potential effects, which are individually contained within distinct effect-worlds, corresponding to Case 8.

Within tokens of Case 8, the occurrence of the particular cause contained within the single cause-world entails that a single effect contained within a single effect-world shall occur, although several other distinct effects contained within other effect-worlds could have been generated by the particular cause. For example, it may be the case that the event of Batman siring a child within the

possible world of Gotham City shall cause a state of frenzied fear within exactly one of either a possible world lacking a close resemblant of Batman where the closest counterpart of the Joker reigns as the solitary uncontested sovereign or a possible world lacking a close resemblant of Batman where the closest counterpart of the Riddler reigns as the solitary uncontested sovereign. Suppose that  $g$  is the world of Gotham City and that  $j$  is a possible world lacking a close resemblant of Batman where the closest counterpart of the Joker reigns as the solitary uncontested sovereign and that  $r$  is a possible world lacking a close resemblant of Batman where the closest counterpart of the Riddler reigns as the solitary uncontested sovereign and that  $g \neq j$  and that  $g \neq r$  and that  $j \neq r$ . It is apparent that the single event of the siring of a child by Batman within  $g$  is capable of causing a state of frenzied fear amongst the inhabitants of  $j$  or  $r$ , though not both. The individuals residing within the boundaries of  $j$  shall be provoked into a state of frenzied fear or the individuals residing within the boundaries of  $r$  shall be provoked into a state of frenzied fear as a result of the siring of a child by Batman within  $g$ , though that particular event alone is not sufficient to cause a state of frenzied fear within both  $j$  and  $r$ .

In a sense, tokens of Case 8 may be regarded as forms of “reverse preemption”, in which one potential effect, which does not ultimately occur, serves as an alternative to the one effect that does occur. Whereas preemption involves the convergence of two or more distinct potential causes upon a single effect, in which one of the potential causes is attributable as being the cause of the specified effect, the reverse process involves a single cause diverging into two or more distinct potential effects, in which the specified cause generates merely one of the multiple distinct potential effects. Importantly, whilst the form of cross-world causation represented by Case 8 may be reminiscent of a probabilistic division between possible worlds, it is imperative to abstain from conflating certain similar, though nevertheless distinct, concepts. The potential effects contained within the distinct effect-worlds are dependent upon the single cause contained within the single cause-world, otherwise the notion of a causal relation between the constituents of the cause-world and the constituents of the effect-worlds would be meaningless.

Although the potential effects contained within the distinct effect-worlds are independent of one another, they are not necessarily disjoint events, which are occasionally referred to as mutually exclusive events. It may be the case that a particular event contained within a particular effect-world could have been, though ultimately was not, caused by the occurrence of a specified event contained within a particular cause-world, though the particular event contained within the particular effect-world was caused by another event altogether. For example, suppose that  $W_C$  is a cause-world and that  $c$  is a particular cause contained within  $W_C$  and that  $W_{E_1}$  is an effect-world and that  $e_1$  is a particular effect contained within  $W_{E_1}$  and that  $W_{E_2}$  is an effect-world distinct from  $W_{E_1}$  and that  $e_2$  is a particular effect contained within  $W_{E_2}$ . It may be the case that  $c$  can cause  $e_1$  to occur or  $e_2$  to occur, though not both. Perhaps  $c$  ultimately causes  $e_2$  to occur, and is consequently in no way causally influential upon the occurrence of  $e_1$ . Despite the fact that  $c$  does not cause  $e_1$  to occur, it is possible for  $e_1$  to occur nonetheless. It may be that an event distinct from  $c$  contained within  $W_C$  causes  $e_1$  to occur, that an event distinct from  $e_2$  contained within  $W_{E_2}$  causes  $e_1$  to occur, that an event contained within a hitherto unmentioned possible world causes  $e_1$  to occur, or that an event distinct from  $e_1$  contained within  $W_{E_1}$  itself causes  $e_1$  to occur. There exists a plethora of ways in which  $e_1$  could occur without the causal contribution of  $c$ . Furthermore, it is not appropriate to presuppose that  $e_1$  shall not occur simply due to the fact that  $e_2$  occurs. In

general, it is possible to distinguish between independence and disjointness of events through the formalism of probability theory.

**Independence:**

an event  $A$  is independent of an event  $B$  if and only if  $P(A) = P(A|B)$   
(Ross, 2014, page 75)

**Disjointness:**

an event  $A$  and an event  $B$  are disjoint if and only if  $A \neq B$  and  $AB = \emptyset$   
(Ross, 2014, page 26)

Crucially, although the distinction between independence and disjointness of events may be understood in regards to probability theory, such a consideration does not automatically imply that the causal relations that exist between the events transpiring within distinct worlds are probabilistic in nature. It may be that some, or all, forms of cross-world causal relations operate in accordance with deterministic laws, and that the representation of such relations through probabilistic means is merely a consequence of human ignorance. Whilst much philosophical contemplation could be articulated concerning the conflicting ideas that the laws of nature are truly metaphysically probabilistic in nature and that probability theory merely represents a certain caliber of epistemic uncertainty as to what the deterministic laws of nature entail, such considerations are largely irrelevant to the present investigation. It is sufficient, for the present purposes of analysis, to acknowledge that the laws of nature may differ from one possible world to another. In fact, in accordance with the theory of modal realism that Lewis advocates for, in which all logical possibilities must be accounted for, it is entirely reasonable to presume that certain possible worlds are governed by deterministic laws of nature and that other possible worlds are governed by probabilistic laws of nature. Determining whether the laws governing the actual world are deterministic or probabilistic in nature, whilst an admirable ambition, is beyond the scope of the present investigation. Regardless of whether a particular token of Case 8 features a deterministic cross-world causal relation or a probabilistic cross-world causal relation, it is possible for formally represent scenarios within which a single cause-world contains a particular event that generates only one of multiple distinct potential effects, which are individually contained within distinct effect-worlds.

$$a \rightarrow \left( \bigvee_{k=1}^N (b_k) \right)$$

where  $N$  is the quantity of cause-worlds,  $a$  is the cause, and  $b_k$  are the distinct effects

**Tokens of Case 9**

The fourth fundamental case of cross-world causation that involves three or more distinct possible worlds is when a single cause-world contains a particular event that generates multiple distinct effects, which are individually contained within distinct effect-worlds, corresponding to Case 9.

Within tokens of Case 9, the occurrence of the particular cause contained within the single cause-world entails that all of several different effects that are confined to the boundaries of distinct possible worlds shall occur. For example, it may be the case that the event of Batman siring a child



within the possible world of Gotham City shall cause a state of frenzied fear within both a possible world lacking a close resemblant of Batman where the closest counterpart of the Joker reigns as the solitary uncontested sovereign or a possible world lacking a close resemblant of Batman where that closest counterpart of the Riddler reigns as the solitary uncontested sovereign. Suppose that  $g$  is the world of Gotham City and that  $j$  is a possible world lacking a close resemblant of Batman where the closest counterpart of the Joker reigns as the solitary uncontested sovereign and that  $r$  is a possible world lacking a close resemblant of Batman where the closest counterpart of the Riddler reigns as the solitary uncontested sovereign and that  $g \neq j$  and that  $g \neq r$  and that  $j \neq r$ . It is apparent that the single event of the siring of a child by Batman within  $g$  is capable of causing a state of frenzied fear amongst the inhabitants of both  $j$  and  $r$ . Indeed, the sole event of the siring of a child by Batman is sufficient to cause both the individuals residing within the boundaries of  $j$  to be provoked into a state of frenzied fear and the individuals residing within the boundaries of  $r$  to be provoked into a state of frenzied fear.

Ultimately, the distinguishing characteristic between Case 8 and Case 9 is the difference between disjunction and conjunction, respectively. As such, it is possible to formally represent scenarios within which a single cause-world contains a particular event that generates multiple distinct effects, which are individually contained within distinct effect-worlds, through the utilization of a correspondingly appropriate quantity of conjuncts.

$$a \rightarrow \left( \bigwedge_{k=1}^N (b_k) \right)$$

where  $N$  is the quantity of cause-worlds,  $a$  is the cause, and  $b_k$  are the distinct effects

## **A World to End All Accessible Worlds**

Perhaps the most interesting causal relations that can exist between the entities of distinct possible worlds, the prevalence of certain tokens of Case 9 would involve a particularly ominous form of cross-world causation, one which may require a reevaluation of the underlying metaphysics of modal realism. If all of the different logically possible ways that the world could be are instantiated within distinct concrete particulars that are ontologically comparable to the actual world, then there exists a possible world where the inhabitants who reside within that world have developed a weapon that is sufficiently powerful to end both the world within which the weapon is activated and all other possible worlds that are accessible from the world within which the weapon is activated. Since it is logically possible that such a weapon has been activated within such a world, the possibility has been realized amongst the vast plenitude of possible worlds, in accordance with the conceptualization of modal realism that Lewis proposes. To be clear, ending a possible world may be understood as the process of eradicating the state of existing of the world entirely. An equivalent formulation would be to assert that when a possible world ends, it is transferred from a state of existing to a state of not existing. A possible world within which a weapon capable of ending all accessible possible worlds is both constructed and activated may be appropriately labeled as a World to End All Accessible Worlds, denoted henceforth as a WTEAAW. As psychologically disturbing as the thought of a WTEAAW may be, it is possible to achieve a certain caliber of solace from the imminent catastrophe of the destruction of possible worlds. In fact, the simple truth that the actual world has not ended provides substantial reassurance that there exist limitations upon

the possibilities afforded by modal realism. Thus, it is possible to refute the idea of an “anarchy of possibility where anything goes” within modal realism, as is demonstrable through a few different philosophical arguments, explicitly within standard normal form.

### **Argument 1**

1. It is logically possible for there to exist a WTEAAW if and only if it is possible to end all accessible worlds.
  2. The actual world exists.
  3. The actual world has not ended.
  4. It is not possible to end all accessible worlds.
- 
- C. It is not logically possible for there to exist a WTEAAW.

### **Argument 2**

1. It is metaphysically possible for there to exist a WTEAAW if and only if it is possible to end all accessible worlds.
  2. The actual world exists.
  3. The actual world has not ended.
  4. It is not possible to end all accessible worlds.
- 
- C. It is not metaphysically possible for there to exist a WTEAAW.

### **Argument 3**

1. It is physically possible for there to exist a WTEAAW if and only if it is possible to end all accessible worlds.
  2. The actual world exists.
  3. The actual world has not ended.
  4. It is not possible to end all accessible worlds.
- 
- C. It is not physically possible for there to exist a WTEAAW.

It is perhaps worth explicitly acknowledging that Argument 1, Argument 2, and Argument 3 all implicitly presuppose maximal accessibility between possible worlds. Although the preceding presupposition may initially seem reasonable, it may be possible to more satisfactorily address the concerns associated with a WTEAAW, without being obligated to accept a metaphysical claim that is so lacking in ontological parsimony.

### **Argument 4**

1. If there exists a world that is not accessible from another world, then there does not exist maximal accessibility between worlds.
  2. If the actual world is accessible from a WTEAAW, then the actual world has ended.
  3. The actual world exists.
  4. The actual world has not ended.
  5. The actual world is not accessible from a WTEAAW.
  6. There exists a world that is not accessible from another world.
- 
- C. There does not exist maximal accessibility between worlds.

Since all of the four aforementioned arguments have their unique advantages and disadvantages, it is a worthwhile endeavor to comparatively analyze them.

With a mere four premises, Argument 1 is immediately appealing on the basis of parsimony, or perhaps through an adherence to Occam's Razor. Furthermore, all of the premises of Argument 1 are highly intuitive, with Premise 2 readily implying Premise 3, Premise 3 readily implying Premise 4, and the conclusion being a direct logical consequence of the negation of one of the two components of the bi-conditional statement of Premise 1 by Premise 4. Despite the preceding considerations, though, the conclusion of Argument 1 remains a bit counterintuitive, as it does not seem to be the case that the potential existence of a WTEAAW is precluded by logic. Indeed, it is not difficult to imagine a world that exudes a destructive force outwards towards other worlds, eliminating both itself and the other worlds in the process. Such a possibility may be frightening to contemplate, though it certainly does not appear to be immediately absurd as a philosophical idea. The mere fact that a WTEAAW is seemingly epistemically possible is suggestive of the fact that it is logically possible as well. Debatably, for all of its appeal to simplicity, Argument 1 conflicts so severely with natural intuition that it may not ultimately persist through the protocols of reflective equilibrium.

Modifying Argument 1, such as by emphasizing metaphysical possibility, rather than logical possibility, as is observable within Argument 2, provides a means by which to maintain the general logical structure of Argument 1, whilst nevertheless generating a slightly different conclusion. More specifically, the alteration of the initial premise of Argument 1 to directly address the subject of metaphysical possibility within Argument 2 enables a critical variation upon the conclusion of Argument 1 to be instantiated, namely refuting the metaphysical possibility for there to exist a WTEAAW, rather than the logical possibility thereof. It can be argued that metaphysical possibility materially implies logical possibility, which, for philosophers who are willing to acknowledge the philosophical importance of metaphysics, is a claim that is seemingly reasonable to believe. As such, the conclusion of Argument 2 rejects the metaphysical possibility for there to exist a WTEAAW, without jeopardizing the logical possibility for such a world to exist. Importantly, whilst it may be the case that metaphysical possibility materially implies logical possibility, the converse is probably not true. Therefore, Argument 2 successfully dismisses the potential for there to exist a WTEAAW on a metaphysical basis, whilst preserving the intuitive notion that a WTEAAW is logically possible, and thus circumventing the most obvious objections that may be leveraged against Argument 1.

Similarly as to Argument 2, Argument 3 merely changes the emphasis of the initial premise of Argument 1 to generate a distinct conclusion. Whereas Argument 2 amends the initial premise of Argument 1 to emphasize metaphysical possibility, Argument 3 alters the initial premise of Argument 1 to emphasize physical possibility. The claim that it is not physically possible for there to exist a WTEAAW, though, is far less persuasive than the claim that it is not metaphysically possible for there to exist a WTEAAW. One potential theory as to precisely why Argument 3 is less intuitively appealing than Argument 2 is that Argument 2 has explanatory priority over Argument 3. It can certainly be argued that something is physically possible only if it is metaphysically possible. Therefore, by contraposition, something is not physically possible if it is not metaphysically possible. As such, the conclusion of Argument 2 implies the conclusion of Argument 3. Since

Argument 2 is reasonably convincing and arrives at a more general conclusion than Argument 3, it may be asserted that Argument 2 has explanatory priority over Argument 3.

An astute individual may observe that, similarly as to the implication relation that exists between Argument 2 and Argument 3, there exists an implication relation between Argument 1 and Argument 2. It can certainly be argued that something is metaphysically possible only if it is logically possible. Therefore, by contraposition, something is not metaphysically possible if it is not logically possible. As such, the conclusion of Argument 1 implies the conclusion of Argument 2. If Argument 2 has explanatory priority over Argument 3, then perhaps Argument 1 has explanatory priority over Argument 2. It may be questionable, then, as to precisely why Argument 2 is regarded as favorable to Argument 1, especially given the fact that the conclusion of Argument 1 is more general than the conclusion of Argument 2. Perhaps the most obvious response to such an inquiry is that although it may materially imply the conclusion of Argument 2, the conclusion of Argument 1 conflicts so severely and immediately with intuition that it is ultimately less desirable than the conclusion of Argument 2, which is much more appealing on the basis of intuition. It is seemingly a consequence of intuition that the conclusion of Argument 2 ought to be deemed preferable to the conclusion of Argument 1. And as a result of the priority of caliber of preference of their respective conclusions, Argument 2 ought to be deemed preferable to Argument 1, in general.

Differing from all of the other three arguments in both its logical structure and its emphasis, Argument 4 addresses accessibility, rather than possibility. By explicitly asserting that the actual world is not accessible from a WTEAAW within Premise 5, Argument 4 simultaneously provides a plausible explanation as to why the actual world has not been ominously eliminated by a WTEAAW and refutes the idea of maximal accessibility between possible worlds. As it pertains to the other claims contained within Argument 4, all of the premises preceding Premise 5 are highly intuitive, Premise 6 is merely an existential statement that simply “weakens” the specificity of Premise 5, and the conclusion is a direct logical consequence of Premise 6 and the material implication statement contained within Premise 1. As an additional advantage, by dismissing the potential for the maximal accessibility of possible worlds, rather than the potential for a WTEAAW to exist, Argument 4 remains more truthful to the Lewisian theory that all possible worlds exist than does Argument 1, Argument 2, or Argument 3.

With all of the aforementioned considerations, it is perhaps possible to generate a hierarchy representing the philosophical plausibility and general caliber of preference between Argument 1, Argument 2, Argument 3, and Argument 4. Conflicting so heinously with immediate intuition, Argument 1 is severely deficient in its persuasive prowess, and as such, is seemingly the least plausible of the four. Improving upon Argument 1 slightly, it nevertheless appears impractical to believe in Argument 3, meaning that it is merely marginally better than Argument 1. With explanatory priority over and above Argument 3, Argument 2 features a similar general logical structure as both Argument 1 and Argument 3, though generates a conclusion that is far more viable than either of the two, meaning that Argument 2 is significantly better than Argument 3. Accounting for the fact that the actual world has not ended without rejecting the possibility for there to exist a WTEAAW on any basis, Argument 4 is ultimately the best argument available. Indeed, Argument 4 may be especially tantalizing to a person who advocates for the expunging of metaphysics altogether, such as by attempting to reduce metaphysical possibility to a special form of logical

possibility, or by endeavoring to dispense with metaphysics through a process of “absorbing” it into the philosophy of language. Thus, the hierarchy of preference, in order from worst to best, is Argument 1, Argument 3, Argument 2, and Argument 4.

### **The Hierarchy of Arguments**

Argument 4	Best
Argument 2	
Argument 3	
Argument 1	Worst

### **A Succinct Culmination of Chapter 3**

In addition to the collection of ontological principles associated with cross-world predication, it may be beneficial to elucidate a few more succinct metaphysical claim of importance, so as to account for the philosophical possibility of cross-world causation.

- An event is the instantiation of a property either at a particular instant of time or throughout a particular interval of time
- Causal relations between the entities contained within distinct possible worlds can exist

## **Chapter 4**

### **Cross-World Interaction**

#### **The Influence of Actual Entities upon Merely Possible Entities**

For the purposes of analyzing propositions, or propositional concepts, that involve cross-world predication, it can be beneficial to adhere to a conception of modal realism. The troublesome task of satisfactorily articulating the semantics of propositions that rely upon the apparent existence of non-actual entities can be readily addressed by appealing to a strategically selected form of modal metaphysics where comparisons between the inhabitants of distinct worlds is possible. In fact, the challenge of providing an adequate account of counterfactual scenarios served as one of the primary sources of inspiration for Lewis in his development of his particular ontological theory. Seeking a means by which to capture the ideologies contained within such linguistic expressions as the proposition ‘I could have been wealthier than I actually am’ or the proposition ‘The rich could have all been poor’, which refer to non-actual, though nevertheless intuitively possible, states of affairs, Lewis contemplated as to what theory of semantic meaning would be most appropriate for such purposes. Eventually, Lewis concluded that by conceiving of other worlds as concrete particulars, rather than as such abstract objects as maximally consistent sets of propositions or maximally consistent states of affairs, as has alternatively been proposed within the philosophical literature, he would thus be able to provide a plausible description of both counterfactual scenarios and counterfactual entities that could be represented well within the formalisms of a powerful and expressive logical system, without sacrificing such desirable notions as the individuation that can occur between the constituents of distinct worlds or the preservation of self-identity of a particular entity within a particular world with itself.

Another appealing quality of the Lewisian ontological theory is that it maintains that all merely possible worlds are as real as the actual world, which supplies a certain caliber of “metaphysical authenticity” to the non-actual worlds, as well as to the counterfactual happenings that transpire within them. Indeed, the thought that all attempts to describe counterfactual scenarios are mere speculations about nonexistent events that are never realized is highly discouraging. It can reasonably be argued that by stipulating possible worlds as metaphysically concrete particulars, Lewis legitimizes the significance of counterfactual scenarios, and directly illustrates their indispensability within the understanding of both metaphysical possibility and contingency itself. Furthermore, by granting reality to merely possible entities, Lewis enhances the genuineness of the relations between the constituents of the actual world and the non-actual entities that they are comparable to. In a sense, the entities that are contained within other worlds contribute towards the states of affairs that are the truth-makers of propositions involving cross-world predication. If the existence of non-actual entities is denied entirely, then it is arcane as to precisely what it is that makes statements concerning alternative ways in which the world intuitively could have been to be true.

An especially interesting consequence of the sincerity of the relations that exist between actual entities and non-actual entities is that it enables full-fledged cross-world relationships, such as romantic relationships, to exist between the inhabitants of distinct worlds, as is articulated well by Sinhababu within his outstanding journal article “Possible Girls” (Sinhababu, 2008, page 254).

By accepting the theory of modal realism defended by Lewis, it is possible to partake in other-worldly relationships with the inhabitants of non-actual possible worlds, rather than merely fantasizing about a fulfilling relationship within the actual world. And it is precisely the modal realism advocated for by Lewis that establishes cross-world relationships as being so sincere, perhaps reminiscent of the common expression “What we have is real”, which implies that the particular relationship is an authentic one.

Although the idea that the inhabitants of distinct possible worlds are capable of interacting with one another, despite being both temporally and spatially separated, may seem profoundly strange, such forms of interaction with other-worldly beings is perhaps far more commonplace than may be immediately apparent. Indeed, one source of inspiration for supplying appropriate provisions for cross-world interaction within an ontological theory is its subtle ubiquitousness within the daily exchanges of the actual world. For a moment, consider the experience of playing an “open world” video game, in which the game is structured such that the user is free to explore the world in which the game is set. Whilst “open world” games may feature a “primary storyline” that is available for users to engage with, the people who play such games are nevertheless often at liberty to deviate from the activities of the “primary storyline” at their discretion, perhaps to pursue alternative objectives, to complete “side missions” that may be available within the game, or to simply wander about.

Within “open world” games, different users may complete different tasks in different sequential orderings, such that different users may have radically different gaming experiences. It may be beneficial to investigate the influence of actual individuals upon the possible worlds of video games through an extensive illustrative example of a hypothetical game-play scenario.

Suppose that within a hypothetical “open world” video game, it is possible to deviate from the “primary storyline” of journeying to the Castle of Achievement, where the user shall be expected to vanquish Bob the Fearsome Dragon, to pursue an alternative “side mission”, in which the user shall voyage to Absurdity Valley, far to the East of the Castle of Achievement, to combat the legions of zombified fairies that are initiating a relentless assault on the local prospectors. Whilst it may not be a compulsory requirement to travel to Absurdity Valley to successfully complete the “primary storyline” of the game, and doing so may significantly prolong the duration of time that the user must commit to the game prior to completing the “primary storyline”, the option to depart from the “primary storyline” is readily available. In fact, partaking in the arduous task of combating the zombified fairies within Absurdity Valley may be an attractive offer to certain users. Suppose that after successfully defeating the zombified fairies, the local prospectors present the character controlled by the user with an incredibly powerful longbow, ideal for long-range strikes against enemies, as a token of their appreciation for the protection that the user has provided them with. Within such a scenario, volunteering to undertake the “side mission” within Absurdity Valley may prove to be an immensely advantageous decision. With the powerful longbow in hand, it may be considerably less difficult to subdue Bob the Fearsome Dragon upon returning to the “primary storyline” of the game. In addition to the valuable experience accrued whilst engaging the zombified fairies within Absurdity Valley, the powerful longbow may enable a user to slay Bob the Fearsome Dragon with ease, launching a stealthy assault from a distance that Bob the Fearsome Dragon will struggle to defend against, whereas another user who did not see fit to travel to Absur-

dity Valley may be required to challenge Bob the Fearsome Dragon with a meager sword. Thus, a user who ventures to Absurdity Valley shall have a remarkably different game-playing experience than a user who strictly adheres to the “primary storyline” of the video game.

When the setting of the video game is understood as a possible world, it is observable that the user ultimately selects between distinct possible worlds when deciding either to voyage to Absurdity Valley or to charge directly towards the Castle of Achievement. Inevitably, the actions of the user shall have an impact upon the historical development of the possible world that is the setting of the video game. If the user decides to aid the prospectors under assault within Absurdity Valley, then the history of the possible world of the video game shall include the defeat of the zombified fairies within Absurdity Valley. If the user decides to ignore the plight of the prospectors within Absurdity Valley, then the history of the possible world of the video game shall not include the defeat of the zombified fairies within Absurdity Valley. As the history of the world in which the user travels to Absurdity Valley is different from the history of the world in which the user does not travel to Absurdity Valley, the two worlds are distinguishable from one another, and are therefore two distinct worlds. As such, the decision of the user to either undertake the “side mission” within Absurdity Valley or to maintain the current progression through the “primary storyline” of the video game is effectively a decision between two distinct possible worlds.

More generally, certain video games may feature a vast array of different “side missions” that the user may participate in, therefore implying a plethora of different possible worlds that the user shall ultimately select between. One particularly exemplary instance of such a scenario is the video game *Batman: Arkham Knight*, which features an “open world” environment containing over a half of a dozen different “side missions” that users can unlock as they progress through the “primary storyline”, providing for hundreds of different variations of game play. The power of the user to select between distinct possible worlds is perhaps most obvious within video games that feature branching storylines, which may or may not be of an “open world” format, where the user is often presented with in-game menus that explicitly request a selection between different options, all of which result in different consequences.

For the sake of completeness, and in an effort to remain truthful to the maximal realization of possibilities advocated for by Lewis, it may be required to assert that there exist infinitely many different worlds that the user selects between when playing a video game, albeit perhaps not entirely conscientiously, for the slightest discrepancy in game play from one user to another, such as dodging left at a particular moment, rather than dodging right, shall ultimately qualify as a distinction between two different possible worlds. With or without requiring such a detailed specification of the different ways in which a particular game may be played, it is nevertheless apparent that the decisions of the user have a significant impact upon the realization of distinct possible worlds contained within a video game. It can further be observed that the actual world, which is presumably where the user is located, is spatiotemporally isolated from the world of a video game, as the world of a particular video game will contain a distinct conception of both space and time. By controlling his or her character within a video game, the user influences the events that transpire within the possible world of the video game, thus qualifying as a causal form of cross-world interaction between spatiotemporally isolated possible worlds. In fact, video games are a particularly excellent example of cross-world interaction, as video games are intentionally designed to be interactive.



## **The Influence of Merely Possible Entities upon Actual Entities**

In addition to the ways in which the inhabitants of the actual world impact the happenings that transpire within other possible worlds, such as within the worlds of works of fiction, the entities that are contained within merely possible worlds can have a significant causal influence upon the actual world. In fact, the magnitude of the influence of merely possible entities upon actual entities may be far greater than it would initially seem. Interestingly, the many interacting worlds approach to understanding quantum physics states that all quantum phenomena pertaining to particles within the actual world are caused by interactions with the constituents of other worlds, as is demonstrated within the bold assertion that, “All quantum effects arise from, and only from, the interaction between worlds” (Hall and Deckert and Wiseman, 2014, page 2). Similar scientific justification for believing that merely possible worlds have a significant impact upon the actual world are articulated by Source 10, Source 11, and Source 12 within Appendix E.

Merely possible entities, as well as merely possible events, can dramatically alter the state of affairs within the actual world, causing substantial changes within the actual world. For example, the mere existence of possible worlds other than the actual world can have a dramatic impact upon the spending patterns of actual consumers, such as through their investments in insurance policies. When a particular individual within the actual world invests in an insurance policy for his or her house, he or she typically does so for the purpose of protecting himself or herself from the potentially devastating financial expenses associated with all of the improbable, though certainly possible, damages that his or her property may sustain. It is not knowledge of unfortunate tidings that shall transpire within the actual world that inspires investment in insurance policies, though rather, it is the acknowledgment of the existence of at least one possible world, which may or may not be the actual world, in which disaster strikes that provokes investment in insurance policies. Indeed, the insurance industry thrives off of epistemic ignorance, in which people are unaware of which possible world it is that they are located within. And the immense magnitude of the impact of the insurance industry upon both national legislative policies and the global economy within the actual world is undeniable. Thus, the mere presence of other possible worlds can drastically alter the course of events within the actual world.

Through their interactions with other possible worlds, people within the actual world are often persuaded to pursue a different career than they otherwise would have, or are compelled to comport themselves in a certain way. Through their interactions with other possible worlds, people within the actual world have the ability to learn from the mistakes of non-actual individuals, such that they are empowered to avoid the ramifications of irresponsible actions that they would have initiated, had it not been for the knowledge that they acquired through their observations of the calamity that is associated with such actions within another possible world. Through their interactions with other possible worlds, people within the actual world are encouraged to explore opportunities that they did not previously realize were genuine possibilities, from which they may achieve wondrous successes that they could not have secured without the aid provided to them through other possible worlds.

The influence of both non-actual entities and non-actual events upon the actual world does not pertain solely to individual human beings within the actual world, as it can extend further to alter the decisions and the rulings of interpersonal organizations and governmental institutions, for which there exists historical evidence. After the initial publication of the book *Frankenstein* within the nineteenth century, certain governing bodies within Europe began to modify their legislative policies concerning grave robbing. For example, Tim Marshall asserts that the instantiation of the Anatomy Act of 1832 within the United Kingdom was influenced by the publication of *Frankenstein* years prior, as is articulated within the claim that, “Using the perspective offered by the 1820s, I shall argue that *Frankenstein* and the Anatomy Act can be seen as identical twins – one in the world of imagination, the other in the realms of legislation” (Marshall, 1995, page 2). Fearing that a reckless individual may attempt to reanimate the bodies of exhumed corpses, such as Victor Frankenstein did, such legislation was passed in an effort to deter thieves from unearthing the dead entirely. The thought, inspired by the events that transpired within the possible world of *Frankenstein*, of an imprudent scientist resurrecting a cadaver was adequately terrifying to prompt certain European legislators to enhance the penalties that would be imposed upon people who were found to be robbing graves. Undoubtedly not an isolated incident, the effect of *Frankenstein* upon legislation within the actual world is but one of many such instances of groups of people within the actual world responding to the interactions that they have experienced with the entities of other possible worlds.

It can be argued that certain features of certain merely possible worlds are designed with the explicit intention of provoking certain actions within the actual world. For example, works of fiction occasionally contain content that is seemingly present for the sole purpose of promoting consumerism within the actual world. When a malicious villain creates a powerful monster within the world of a television series, it can be argued that one of the sources of motivation for the creation of such a hitherto nonexistent character is to generate opportunities to sell more merchandise to consumers, such as action figures and Halloween costumes. Whilst a critical observer may claim that such an introduction of a character within a television series is merely the doings of the producers and the directors of the show, rather than the conscious efforts of the individuals who reside within the world of the fictional story, such an objection does not diminish the validity of the assertion that there exists a merely possible world, represented by the television series within the actual world, that is capable of causally interacting with actual individuals in the form of influencing their behaviors. Through the process of formulating a character within a work of fiction, the creator of the character engages in a form of cross-world interaction in which he or she alters the merely possible world of the work of fiction, though the created character within the merely possible world of the work of fiction is similarly capable of engaging in a form of cross-world interaction in which he or she alters the actual world and its inhabitants.

### **Breaking the Fourth Wall**

Interestingly, there exists a particularly blunt form of cross-world interaction in which the individuals contained within the merely possible worlds of works of fiction directly address the actual people engaging with the works of fiction through a process known as breaking the fourth wall. Although characters of works of fiction can break the fourth wall in a variety of different ways, perhaps the most common way is to simply stare directly out at the audience within the actual

world and to initiate a conversation, albeit perhaps a one-sided one, with the audience. When a particular character within a work of fiction breaks the fourth wall, he or she is demonstrating that he or she is consciously aware of the fact that there exists another world, a world other than the one that he or she inhabits, that he or she is capable of interacting with. Importantly, the conscious awareness of the existence of another possible world by a specific character within a particular work of fiction does not imply that any of the other characters within the particular work of fiction have achieved a similar state of awareness. As such, the associates of an individual who breaks the fourth wall may fail to comprehend the peculiar behavior of their compatriot, for as they are ignorant of the existence of the actual world, it appears to them as though the character that is breaking the fourth wall is merely speaking to empty space. Other forms of breaking the fourth wall are often more subtle than direct communication with the constituents of the actual world, and can include such actions as a particular character commenting on his or her indispensable value to the corporate franchise within the actual world or ridiculing the excessive abundance of costly pyrotechnic effects within a movie.

Certain individuals who are capable of breaking the fourth wall can apparently actively control the merely possible world in which they reside on a multitude of different levels, seemingly as a result of the fact that they are consciously aware of the existence of another possible world, namely the actual world. For example, within the video game *Doki Doki Literature Club!*, Monika is a character who is able to break the fourth wall, as is evidenced by the fact that she explicitly confesses that she initially deferred direct communication with the user due to her desire to avoid breaking the fourth wall. After having broken the fourth wall, though, Monika begins to articulate the ways in which she has been attempting to manipulate the outcome of the game from the start, including an exposition of her efforts to program the other characters within the game to behave in a certain manner. Demonstrating an impressively detailed comprehension of the functionality of the actual world, Monika can describe the process by which she is able to delete character files off of the hard drive of the computer of the user within the actual world. And when Monika deletes the file associated with a particular character off of the hard drive within the actual world, the particular character is eradicated within the merely possible world that she inhabits. Thus, through her knowledge of the existence of another possible world, namely the actual world, Monika is capable of both explicitly addressing the user within the actual world and distorting the nature of her merely possible world at will. Consequently, it can be argued that the interactions that exist between the entities of distinct worlds can be simultaneous and dynamic, providing for an intricate and complex modal metaphysics.

### **Cross-World Predication and Cross-World Interaction**

A critical observation of the utmost importance, it is certainly worth explicitly acknowledging that a formal language with an expressive power sufficient to represent propositions involving cross-world predication, such as Ty2, is simultaneously sufficiently powerful to represent propositions involving cross-world interaction.

Without modifying either the structure or the formalism of Ty2, it is possible to satisfactorily represent propositions involving cross-world interaction. For example, within the Ty2 system, the formalism  $S_v(y)(x)$  could potentially represent the expression ‘ $x$  signals  $y$ ’ evaluated at the actual

world. Within the confines of the actual world, such a form of signaling could be as commonplace as the act of  $x$  waving to  $y$ , though within other contexts, the expression ‘ $x$  signals  $y$ ’ could represent far more elaborate forms of communication, such as the act of  $x$ , contained within the actual world, sending an electronic signal to  $y$ , contained within a merely possible world. The evaluation of  $S_v(y)(x)$  occurs at a single world, namely the actual world, though the proposition represented by  $S_v(y)(x)$  may span a multiplicity of worlds, depending upon within which worlds  $x$  and  $y$  are located. As another example, within the Ty2 system, the formalism  $I_v(y)(x)$  could potentially represent the expression ‘ $x$  inspires  $y$ ’ evaluated at the actual world. Whilst there exists a plethora of scenarios in which  $x$  and  $y$  are actual entities, there simultaneously exists a plethora of scenarios in which  $x$  inspires  $y$  from within the confines of a world other than the world inhabited by  $y$ . It could be the case that  $x$  is a fictional character who inspires an actual person, represented by  $y$ , to be more adventurous within his or her life. Perhaps  $x$  is Batman, who, through his noble determination to protect the merely possible world of Gotham City from the relentless persistence of its criminal element, inspires James, a person within the actual world represented by  $y$ , to pursue a career in law enforcement. Within such a scenario, it can certainly be argued that a merely possible entity, namely Batman, has a causal influence upon both the decisions and the actions of an actual entity, namely James, therefore constituting a form of cross-world interaction between the merely possible world of Gotham City and the actual world. Clearly, cross-world interaction can include such events as an entity signaling an entity contained within another possible world or Batman inspiring individuals within the actual world to pursue careers in law enforcement through his brave and heroic acts.

The preceding elucidation of cross-world interaction is certainly not exhaustive, though, as there exists a vast plethora of different forms of cross-world interaction, all of which are representable within the formalism of Ty2. Since the Ty2 system is capable of formally representing propositions involving cross-world predication, it is capable of formally representing propositions involving cross-world interaction. Thus, the ability to formally represent propositions involving cross-world predication implies the ability to formally represent propositions involving cross-world interaction.

### **A Succinct Culmination of Chapter 4**

Ultimately, with all of the illustrations of the manners in which the actual world influences the development of merely possible worlds, as well as the corresponding ways in which merely possible worlds can impact the evolution of events within the actual world, it can be argued that there exists justifiable philosophical value to considering the potential for cross-world interaction through cross-world causation, despite the stipulation of Lewis that causation ought to be restricted to the confines of a particular world. As such, in addition to the collection of fundamental principles associated with cross-world predication, it may be beneficial to tersely articulate more metaphysical claims of importance, so as to produce a plausible account of cross-world interaction for philosophical purposes.

- The entities contained within the actual world can causally interact with the entities contained within other worlds
- The entities contained within other worlds can causally interact with the entities contained within the actual world

## Chapter 5 **Cross-World Travel**

### **The Enigma of Cross-World Travel**

Having satisfactorily established the legitimacy of the potential for cross-world causation within an appropriately modified version of Lewisian modal metaphysics, as well as the capacity of the Ty2 system to represent such a phenomenon as cross-world interaction, it is possible to extend the novelty of such ideas further to include a similar, though distinct, notion, namely that of cross-world travel. In fact, García-Ramírez asserts that a successful explanation of how to understand causation through counterfactual scenarios is suggestive of a plethora of grand possibilities, including cross-world travel, as is illustrated within the observation that, “If this [counterfactual account of cross-world causation] is correct, we now have reasons to accept that there can be trans-world telescopes, logical-space ships, and, hopefully, inter-world travel” (García-Ramírez, 2012, page 82). For the sake of brevity, the exposition concerning cross-world travel shall remain terse.

The process of cross-world interaction simply involves two distinct entities, contained within two distinct possible worlds, engaging with one another in some form or another, such that there exists some form of causal relation between the two distinct entities. Alternatively, cross-world travel involves a process in which an entity that is contained within one possible world literally relocates to another possible world. The metaphysical means by which an entity voyages from one world to another may seem arcane to the inhabitants of the actual world, as the technology that would enable such travel does not, as of yet, exist within the actual world. Indeed, on the basis of their personal experiences, actual entities may be perplexed as to precisely how the constituents of other possible worlds occasionally manage to traverse the boundaries between distinct worlds. Mysterious though it may be to actual people, cross-world travel is undoubtedly an interesting metaphysical possibility. In fact, the notion of cross-world travel is perhaps so interesting precisely as a result of its obscurity.

Regardless of its capacity to inspire intrigue, cross-world travel is a legitimate metaphysical possibility, and the mere fact that scientific research within the actual world has not yet produced a functioning prototype of a device that enables cross-world travel does not serve as evidence for the claim that cross-world travel is not possible. Another way of understanding the preceding idea is that regardless of the engineering limitations that presently persist within the actual world, it is not epistemically justifiable to reject the notion of cross-world travel on an a posteriori basis. Similarly, it does not seem reasonable to deny the possibility of cross-world travel on an a priori basis. Within his book *On the Plurality of Worlds*, Lewis identifies a correlation between cross-world causation and cross-world travel, claiming that a lack of cross-world causation would entail a lack of cross-world travel, as is demonstrated within his statement that, “Likewise, if there is no trans-world causation, there is no trans-world travel” (Lewis, 1986, page 80). Presumably, resolving the most severe concerns with the notion of cross-world causation would significantly reduce the caliber of resistance to the idea of cross-world travel within the philosophical community.

The theory of cross-world causation elucidated within Chapter 3 provides a reasonable account of causation that remains truthful to the Lewisian approach of understanding causation through comparisons between counterfactual scenarios, whilst being able to account for the prevalence of causal relations between the entities contained within distinct possible worlds, which Lewis was not able to do. As such, it is possible to generate a viable theory of cross-world causation that is compatible with the system of modal realism advocated for by Lewis, meaning that there exists an a priori basis for believing that cross-world causation is, at least conceptually, possible. Having thusly addressed the most immediate concerns with the idea of cross-world causation, it is not difficult to expand such a notion to include the possibility of cross-world travel. If causal interaction can persist through the boundaries between distinct possible worlds, then perhaps traveling entities can as well. Whilst it may be uncommon for entities to voyage from one world to another, it does not seem rational to believe that modal realism precludes such a possibility.

### **Restrictions upon Cross-World Travel**

Although traveling from one world to another may be possible, such a consideration does not necessarily imply that all entities from all possible worlds are capable of engaging in cross-world travel. In accordance with the Lewisian theory of modal realism, all logical possibilities are realized within the expanse of possible worlds. As such, in accordance with the Lewisian theory of modal realism, there exist entities that are incorrigibly incapable of departing from the world within which they are contained. Similarly, there exist possible worlds that it is possible to travel to, though from which it is impossible for any entity to escape, perhaps a bit reminiscent of the way that black holes are typically described. There exist possible worlds that simply “redirect” or “reroute” incoming traffic to other possible worlds, and there exist entities that are “restricted” or “banned” from traveling to certain possible worlds. Enigmatic as the existence of such entities and such worlds may be, they are all logically possible, and therefore existent within a Lewisian conceptualization of modal realism.

It is not reasonable to suspect that a particular entity, selected at random from a uniform distribution, shall be capable of traveling to a particular possible world, selected at random from a uniform distribution. In fact, presupposing a uniform distribution for the selection of both entities and possible worlds, the probability that a randomly selected entity would be capable of traveling to a randomly selected possible world is 0.5, or, equivalently, 50 percent. There exist uncountably infinitely many ways in which an entity may be capable of traveling to a possible world and uncountably infinitely many ways in which an entity may be incapable of traveling to a possible world, and there does not exist any immediately obvious compelling reason to believe that the respective cardinalities of the two are different. The process of randomly selecting an entity that is capable of traveling to a particular possible world is mathematically analogous to the event of randomly selecting a real number that is less than or equal to  $\frac{1}{2}$  from a uniform distribution over the interval  $[0, 1]$ . Within such a scenario, integral calculus illustrates that the probability of a success is equal to the probability of a failure.

$$P(A) = P\left(X \leq \frac{1}{2}\right) = \int_0^{\frac{1}{2}} ((1) dx) = \int_{\frac{1}{2}}^1 ((1) dx) = P\left(X > \frac{1}{2}\right) = P(A^C)$$

Therefore, the probability that an entity selected at random from a uniform distribution would be capable of traveling to a randomly selected possible world is truly 0.5, and as there exist exactly

two possible outcomes within such a scenario, namely either a success or a failure, individual instances of selecting an entity at random may be regarded as a Bernoulli experiments.

With particular emphasis upon the actual world, it is apparent that certain entities are incapable of traveling from the respective possible worlds in which they are located to the actual world. If travel from any merely possible world to the actual world were possible, then a plethora of entities from merely possible worlds would be arriving within the actual world. Indeed, exotic entities and strange beings that are significantly different from the inhabitants of the actual world would probably be appearing frequently within the actual world if they had the opportunity to enter into its confines. In fact, it can be argued that the safety and the security of the actual world, as well as its constituents, is perhaps greatly benefited by the limitations upon travel to the actual world that exist. For example, in the event that any and all merely possible entities were capable of traveling to the actual world, it would be possible for invincible sadistic serial killer clowns to enter into the actual world. Such clowns would be motivated by their depraved mentalities to seek opportunities to torment and murder the inhabitants of the actual world, and, given their invincibility, it would not be reasonable to anticipate that the individuals residing within the actual world would be capable of defending themselves from the nightmarish invasion of clowns. Reminiscent of a viscerally grotesque horror movie, the inhabitants of the actual world would be subjected to gruesome bloodshed and unrelenting fear. As such, it certainly seems all for the better that invincible sadistic serial killer clowns are not capable of traveling to the actual world, which is evidenced by the fact that invincible sadistic serial killer clowns have never, to the best of contemporary knowledge, arrived within the actual world. Perhaps it is the case that invincible sadistic serial killer clowns have traveled to the actual world within the past, and are simply biding their time, hiding within a distant galaxy, as they prepare to launch a massive assault upon the civilizations of Planet Earth. Perhaps an infantry of invincible sadistic serial killer clowns have yet to arrive within the actual world, though at some specific point in time within the future, they shall abruptly enter into the actual world and end all life within it. Although such scenarios are logically possible, abductive reasoning, as well as contemporary theories of science, would presumably disqualify such ideas from serious consideration.

Presupposing that it is not possible for invincible sadistic serial killer clowns to travel from a merely possible world to the actual world, it is apparent that the actual world is not maximally accessible from all other possible worlds. Such a consideration perhaps serves as further evidence for the rejection of the idea of maximal accessibility between possible worlds, as proposed by Argument 4 within Chapter 3.

## **Two-Dimensional Semantics and Cross-World Travel**

It may be beneficial to demonstrate the practical utility of weak rigid identification, as it pertains to a two-dimensional notion of semantics, within the context of cross-world travel. In accordance with weak rigid identification, entities, which are of type  $e$ , are rigidly identified between distinct possible worlds, though properties, which are not of type  $e$ , are not. Importantly, there exists a substantial distinction between the entity ‘Batman’ and the property ‘being Batman’, and the two ought not be conflated, which can be demonstrated through an illustrative example that references the movie *Justice League: The Flashpoint Paradox*. Suppose, for the sake of ease of reference,

that the possible world that the Flash travels to within *Justice League: The Flashpoint Paradox* may be labeled as the Flashpoint World. Additionally, it may be advantageous, for the present purposes of analysis, to presuppose that Gotham City, as it is typically portrayed within the DC Extended Universe, is a merely possible world that is distinct from the Flashpoint World. Within Gotham City, Bruce Wayne is Batman, and it may be beneficial to stipulate that Bruce Wayne is the one “true” Batman, such that the name ‘Batman’ rigidly identifies Bruce Wayne throughout all possible worlds.

For the sake of clarity, it may be prudent to establish some terminological conventions for distinguishing between the inhabitants of distinct possible worlds. As is perhaps apparent, the individuals Bruce Wayne and his father, Thomas Wayne, reside within the world of Gotham City. Correspondingly, within the Flashpoint World, there exist both a closest counterpart of Bruce Wayne and a closest counterpart of Thomas Wayne, which may, for the purposes of ease of reference, be labeled as Flashpoint Bruce Wayne and Flashpoint Thomas Wayne, respectively. For the sake of completeness in attention to detail, it is perhaps worth explicitly acknowledging that, within the Flashpoint World, the closest counterpart of Bruce Wayne and the closest counterpart of Thomas Wayne are distinct from one another, meaning that Flashpoint Bruce Wayne and Flashpoint Thomas Wayne are distinct entities.

Within the Flashpoint World, events differ from within the world of Gotham City, including the fact that Flashpoint Bruce Wayne was murdered as a young child. Having died at such a young age, Flashpoint Bruce Wayne was obviously unable to be a vigilante crime-fighter as an adult, and his father, Flashpoint Thomas Wayne, ultimately bore the persona of the closest counterpart of Batman by serving as the “Batman” of the Flashpoint World. It is perhaps worth explicitly reiterating that, by stipulation, the name ‘Batman’ rigidly identifies Bruce Wayne, and hence the utilization of encapsulating quotation marks when referring to Flashpoint Thomas Wayne as the “Batman” of the Flashpoint World. Since the name ‘Batman’ rigidly identifies Bruce Wayne and Flashpoint Thomas Wayne is distinct from Bruce Wayne, Flashpoint Thomas Wayne is not truly Batman. For a moment, suppose that Batman were to travel from Gotham City to the Flashpoint World. Since the name ‘Batman’ rigidly identifies Bruce Wayne, it ought to be apparent that the act of Batman traveling from Gotham City to the Flashpoint World implies that Bruce Wayne traveled from Gotham City to the Flashpoint World. As such, Bruce Wayne, the one “true” Batman, would then be located within the Flashpoint World. By rigidly identifying entities, weak rigid identification has the advantage of being able to coherently describe such a scenario.

Without rigid identification of entities, it would perhaps be unclear as to precisely who is Batman within the Flashpoint World. It could be the case that upon his arrival within the Flashpoint World, both Bruce Wayne and Flashpoint Thomas Wayne would have equal claim to be the referent of the name ‘Batman’, such that it would be indeterminate as to precisely which entity the name ‘Batman’ refers to. Such an awkward confrontation would diminish the expressive power of the name ‘Batman’, which is obviously an undesirable outcome. As an additional concern, it is possible that, in the process of voyaging from Gotham City to the Flashpoint World, the identity of “Bruce Wayne as Batman” would be lost, such that Bruce Wayne would not be regarded as Batman within the Flashpoint World, and the “Bruce Wayne as Batman” identity would therefore perhaps seem to have been eradicated entirely. Without rigid identification of entities, when Bruce Wayne



departs from the world of Gotham City, it would not necessarily be appropriate to continue to refer to him as Batman, such that it is consequently nonsensical to claim that Batman arrives within the Flashpoint World. To illustrate the preceding idea, it is possible to evaluate a few reasonable equivalences of linguistic expressions.

$$\begin{aligned}
 & \text{‘Batman departs from Gotham City and arrives within the Flashpoint World’} \\
 & \quad \equiv \\
 & \text{‘Batman departs from Gotham City and he arrives within the Flashpoint World’} \\
 & \quad \equiv \\
 & \text{‘Batman departs from Gotham City and Batman arrives within the Flashpoint World’} \\
 & \quad \equiv \\
 & D_g(g)(b) \wedge A_f(f)(b)
 \end{aligned}$$

If the name ‘Batman’ is not a rigid identifier, then it is not apparent that the second conjunct is true. Since it can reasonably be argued that the four aforementioned statements are semantically equivalent, the falsity of  $D_g(g)(b) \wedge A_f(f)(b)$  implies the falsity of the proposition ‘Batman departs from Gotham City and arrives within the Flashpoint World’.

Whilst maintaining rigid identification of entities is important, it is nevertheless advantageous to abstain from requiring that rigid identification apply to expressions that are not of type  $e$ , such as properties. By permitting the semantic meaning of properties to vary between distinct possible worlds, it is possible to account for the idea that certain terms and linguistic expressions may be utilized differently by the inhabitants of different worlds. For example, for the individuals who reside within the confines of the Flashpoint World, the property ‘being Batman’ is synonymous with ‘being Flashpoint Thomas Wayne’, although, as a pragmatic consideration, such a synonymy may be largely unbeknownst to the inhabitants of the Flashpoint World, as the secret identity of their “Batman” is, indeed, a secret. An alternative way of understanding the preceding idea is that by the “standards of interpretation” of the Flashpoint World, the property ‘being Batman’ is identical to the property ‘being Flashpoint Thomas Wayne’, meaning that a particular entity will instantiate the property ‘being Batman’ if and only if the particular entity instantiates the property ‘being Flashpoint Thomas Wayne’. As Flashpoint Thomas Wayne is presumably the only entity that would instantiate the property ‘being Flashpoint Thomas Wayne’ by the “standards of interpretation” of the Flashpoint World, he is therefore the sole entity that would instantiate the property ‘being Batman’. Therefore, it is possible to account for the fact that Bruce Wayne would not be regarded as Batman by the inhabitants of the Flashpoint World. Rather, the individuals who reside within the boundaries of the Flashpoint World would most probably recognize Flashpoint Thomas Wayne as being Batman, whereas they would regard Bruce Wayne as being an impostor, which intuitively seems to be what intuitively ought to occur within the Flashpoint World.

Although Batman did not truly travel from Gotham City to the Flashpoint World within *Justice League: The Flashpoint Paradox*, such a hypothetical scenario serves as an excellent illustration of the challenges that are associated with endeavoring to properly account for the notion of cross-world travel, which can be rendered simpler through weak rigid identification. Requiring that entities are rigidly identified between distinct possible worlds is beneficial for the sake of monitoring the movements of entities from one possible world to another, which is a practical source of motivation for stipulating that rigid identification ought to apply to entities. Simultaneously, by

enabling expressions that are not of type  $e$ , such as properties, to vary in their semantic meaning from one world to another, it is possible to account for the fact that the societies of distinct worlds will often have different ways of utilizing linguistic expressions.

As a final technical consideration, it is perhaps worth explicitly acknowledging that within *Justice League: The Flashpoint Paradox*, the Flashpoint World that the Flash travels to is the world that was the resultant effect of his efforts to alter the past. Whilst it is perhaps debatable if time travel qualifies as a form of cross-world travel, that metaphysical dilemma is not particularly relevant to the present exposition. The primary purpose of referencing *Justice League: The Flashpoint Paradox* was to provide a specific instance within which an individual other than Bruce Wayne had a seemingly legitimate claim to be Batman, and to subsequently analyze how a cross-world exchange, such as Bruce Wayne traveling from Gotham City to the Flashpoint World, would be impacted. If concerns with the time travel aspect of the scenario are particularly troublesome, then it is sufficient to simply assert that the world of Gotham City and the Flashpoint World are distinct possible worlds whilst blatantly disregarding the idea of time travel for the present purposes of analysis.

## **Cross-World Predication and Cross-World Travel**

As it pertains to the primary hypothesis of the present research initiative, propositions involving cross-world travel can be adequately represented within a formal language that has the capacity to account for cross-world predication. Indeed, a formal language with an expressive power that is sufficient to represent propositions involving cross-world predication, such as Ty2, is simultaneously sufficiently powerful to represent propositions involving cross-world travel. As such, the ability to formally represent propositions involving cross-world predication implies the ability to formally represent propositions involving cross-world travel.

Interestingly, there exist two distinct prevalent ways in which a formal language, such as the system of Ty2, can account for cross-world travel. Both techniques depend upon predication to succeed, though the manner in which they do so is different.

The first prevalent way in which a formal language can represent the idea of a particular entity voyaging from one possible world to another is through direct property attribution. Such an approach would directly attribute a specified entity as having the property of traveling from one possible world to another. For example, within the Ty2 system, the formalism  $(a \neq b) \wedge (T_v(a)(b)(x))$  could potentially represent the expression ‘ $x$  travels from  $a$  to  $b$ ’ evaluated at the actual world. The specification  $a \neq b$  is necessary, as it ensures that  $a$  and  $b$  are distinct from one another. Without explicitly asserting that  $a$  and  $b$  are distinct possible worlds, it could be possible that  $a = b$ , in which case  $T_v(a)(b)(x)$  would not represent an instance of cross-world travel, and would be highly trivial. Similarly as to with cross-world interaction, the evaluation of  $T_v(a)(b)(x)$  occurs at a single world, namely the actual world, though the proposition represented by  $T_v(a)(b)(x)$  spans multiple distinct possible worlds, as is apparent from the explicit reference to both  $a$  and  $b$ . Utilizing predication itself to directly attribute a specified entity as having the property of traveling from one possible world to another is perhaps the most obvious way in which cross-world travel can be represented through cross-world predication.

The second prevalent way in which a formal language can represent the idea of a particular entity voyaging from one possible world to another is through a conjunction of location attributions. Such an approach would specify that a particular entity is initially located within a particular world at a particular instant within time, and is then located within a different world at a different instant within time. For example, within the Ty2 system, the formalism  $(a \neq b) \wedge (m \neq n) \wedge (L_v(a)(m)(x) \wedge L_v(b)(n)(x))$  could potentially represent the expression ‘ $x$  is located within  $a$  at time  $m$  and  $x$  is located within  $b$  at time  $n$ ’ evaluated at the actual world. An alternative means by which to formally represent the journey from  $a$  to  $b$  experienced by  $x$  that accounts for the Meinongianism associated with cross-world travel, as articulated within Chapter 2, would be through the formalism  $(a \neq b) \wedge (m \neq n) \wedge ((\varepsilon_{w_1}(m)(x) \wedge \neg\varepsilon_{w_2}(m)(x) \wedge L_v(a)(m)(x)) \wedge (\neg\varepsilon_{w_1}(n)(x) \wedge \varepsilon_{w_2}(n)(x) \wedge L_v(b)(n)(x)))$ . Similarly as to how  $a \neq b$  specifies that  $a$  and  $b$  are distinct possible worlds,  $m \neq n$  specifies that  $m$  and  $n$  are distinct instants within time. Without explicitly asserting that  $m$  and  $n$  are distinct instants within time, it could be possible that  $m = n$ , in which case the entity  $x$  would be located within two distinct possible worlds simultaneously, thus violating the restriction upon cross-world identity advocated for by Lewis, and accordingly adhered to throughout the present research initiative. Importantly, the instants of time represented by  $m$  and  $n$  can be relativized to the individualized temporal history of  $x$ , therefore circumventing concerns associated with the lack of synchronization of time between distinct possible worlds. Furthermore,  $m$  and  $n$  need not necessarily be instants of time, as it is conceptually possible to generalize the formal representation of time to include intervals of time as well, though perhaps with the additional stipulation that there must exist no “intersection” or “overlap” between  $m$  and  $n$ . As is perhaps apparent, both evaluations of the location property occur at the actual world, though the conjunction of the two involves reference to two distinct worlds, which may or may not be the actual world. Consequently, albeit perhaps in an indirect manner, a conjunction of location attributions utilizes predication to account for the fact that an entity has traversed the boundaries between distinct possible worlds, thus illustrating that cross-world travel can be represented through cross-world predication.

## A Succinct Culmination of Chapter 5

Expanding upon the collection of principles that are of fundamental importance to the present research initiative, one more ontological claim ought to be included, in addition to the principles that are of relevance to cross-world predication and cross-world causation, so as to account for the genuine possibility of cross-world travel.

- Travel between distinct possible worlds can exist, for certain entities

## **Chapter 6**

### **Case Study: The DC Extended Universe**

#### **An Application to Fiction**

Understandably, many of the ideas addressed within the present research initiative may seem extraordinarily abstract, as such notions as cross-world causation, cross-world interaction, and cross-world travel may be a bit bizarre to contemplate, particularly as they do not comply well with the standard Quinean ontological theory. Perhaps it would be beneficial to succinctly demonstrate the substantial philosophical utility of the primary hypothesis of the present research initiative, as well as the metaphysical considerations associated with cross-world predication, cross-world causation, cross-world interaction, and cross-world travel. To such an end, it is advantageous to analyze a case study of a particularly complex system of modal metaphysics, such as that of the DC Extended Universe. In fact, within some of its associated works of fiction, the descriptions of the modal metaphysics and the ontology of the DC Extended Universe are impressively similar to the ideologies expressed by Lewis himself within his book *On the Plurality of Worlds*. Although there may exist a certain caliber of debate as to the exact terminology that ought to be utilized, the phrase “DC Extended Universe” shall be utilized throughout the present analysis, rather than simply “DC Universe”, in an effort to emphasize that the modal metaphysics under consideration is far more extensive than that of a single universe. Additionally, it is observable that different terms are utilized to describe the modality of the DC Extended Universe throughout the plethora of comic books, movies, and video games that portray it. For the present purposes of analysis, it is presupposed that such terms as “dimensions” and “Earths”, as they pertain to and are utilized by characters within the DC Extended Universe, are synonymous with the Lewisian conceptualization of possible worlds.

Whilst an exhaustive analysis of all of the works of fiction that portray the DC Extended Universe is perhaps a worthwhile research project in and of itself, it is well beyond the scope of the present research initiative. As such, for the present purposes, analysis is limited to merely a few specific works of fiction that provide especially relevant descriptions of the modal metaphysics of the DC Extended Universe. Whilst it may initially be tempting to scoff at the idea of referencing works of fiction for the purposes of serious philosophical contemplation, such a disgruntled attitude is not sufficient justification for dismissing the genuine merits of fiction. In fact, Lewis himself concurs that quality works of fiction, especially science fiction, can have philosophical value, as is exemplified within his bold declaration that, “I would be the last to denounce decent science fiction as philosophically unsound” (Lewis, 1986, page 81). Despite what ardent skeptics may insist upon, it can be beneficial to study and to analyze works of fiction within philosophy. For the sake of clarity, it may be wise to explicitly state that the DC Extended Universe is the superhero franchise that includes such characters as Batman, Superman, Wonder Woman, the Flash, and the Teen Titans. The DC Extended Universe is distinct from the Marvel Cinematic Universe, which is constituted of such characters as Iron Man, Captain America, Thor, the Hulk, and Spiderman.

## Cross-World Travel within the DC Extended Universe

It seems apparent that there exist infinitely many possible worlds within the DC Extended Universe, which is highly reminiscent of the theory of modal realism advocated for by Lewis. One particularly excellent articulation of the plenitude of worlds within the DC Extended Universe is tersely described by the Master of Games, as is illustrated within his statement that, “But there are actually Infinite Earths . . . and each one is different!” (*Teen Titans GO! vs. Teen Titans*, 2019, 14 minutes: 25 seconds). Presuming that the Master of Games is correct, all of the possible worlds that constitute the DC Extended Universe are distinct from one another, which is analogous to the speculation by Lewis that duplicates of possible worlds do not exist. Furthermore, the Master of Games wields an effulgent orb, known as a Worlogog, which enables him to travel to different worlds all throughout the DC Extended Universe. As such, invoking the power of the Worlogog is a literal means by which to partake in cross-world travel. And through his utilization of the Worlogog, the Master of Games ultimately arranges a meeting between the Teen Titans of one world, who are simply called the “Teen Titans”, and their respective closest counterparts from another world, who are perhaps most appropriately called the “Teen Titans GO!”, for the purposes of provoking the two teams to compete against one another within a battle tournament, hence why the movie is entitled *Teen Titans GO! vs. Teen Titans*.

Eventually, the two distinct teams of Teen Titans develop an alliance, and through their collective efforts, they succeed in acquiring the closest counterpart of the Worlogog from the world within which they are trapped, thus providing them with the opportunity to then travel throughout the DC Extended Universe. Capitalizing upon the power afforded to them by their recently-acquired tool, the two teams of Teen Titans create what is perhaps best described as a portal, through which they are able to voyage to other possible worlds. Upon entering the portal, the members of both the Teen Titans and the Teen Titans GO! are transported to a tunnel-shaped realm with hundreds of portals adorning its “walls”, in which a particular portal connects to a particular world, and all of the worlds that are connected to the tunnel-shaped realm are distinct from one another. The presence of such a realm is perhaps suggestive of the fact that there exists a “special world” within the DC Extended Universe, which exists solely for the purpose of connecting to all other worlds, and which shall be labeled, for ease of reference, as the Portal Tunnel World henceforth. Perhaps serving as an intermediary between distinct possible worlds, it is seemingly necessary to traverse through the Portal Tunnel World when voyaging between distinct possible worlds, at least when partaking in cross-world travel through the powers of a Worlogog.

As the Portal Tunnel World is presumably both accessible from all other possible worlds and able to access all other possible worlds, it is a “centralized hub” through which travel from any world to any other world is possible. Since the Portal Tunnel World is a “centralized hub” through which travel from any world to any other world is possible, it seems reasonable to conclude that the Portal Tunnel World is itself maximally connected to all other worlds. Presupposing that a critical stipulation that all entities traveling between distinct possible worlds must traverse through the Portal Tunnel World is accounted for, it can further be deduced that cross-world travel is transitive within the DC Extended Universe. If cross-world travel throughout the DC Extended Universe by means of a Worlogog were to be modeled in a graph-theoretic way, then it would perhaps be most appropriate to represent the cross-world travel enabled by a Worlogog as a “ring” of nodes

centered about a single node. Within such a graph, the central node would have directed edges directed towards, and directed at it from, all of the individual nodes constituting the ambient “ring”, therefore accounting for the symmetry of the accessibility relations that exist between the Portal Tunnel World and all of the other possible worlds. It is perhaps worth explicitly acknowledging that there exist a distinction between connectivity and accessibility with such a graph. Although the Portal Tunnel World is the sole world that is maximally connected, there nevertheless exists maximal accessibility between the infinite possible worlds that constitute the DC Extended Universe, as it is ultimately possible to access any particular world from any other world.

One final observation concerning travel by means of the Worlogog is that it does not appear as though the Worlogog has any limitation upon its routing capacity, as the two teams of Teen Titans are eventually able to simultaneously direct the teams of Teen Titans from infinitely many worlds into a single world to aid in battle, from which it is tempting to conclude that there may not exist a limit upon the quantity of entities that may be simultaneously undergoing a process of cross-world travel within the DC Extended Universe.

Although perhaps the most readily convenient mechanism for traveling throughout the DC Extended Universe, the Worlogog is not the sole means by which to permeate through the boundaries that exist between distinct worlds, as there exist other forms of cross-world travel within the DC Extended Universe. For example, whilst within the possible world of Azarath, Raven summons her father, Trigon, from his world to her location through a magical ritual within the movie *Justice League vs. Teen Titans*. Indeed, there may exist a plethora of distinct techniques for traveling between distinct possible worlds within the DC Extended Universe. For the purposes of the present research initiative, though, it is sufficient to merely demonstrate that cross-world travel is possible within the DC Extended Universe, thus justifying the need for a viable theory of cross-world travel.

### **Cross-World Causation and Cross-World Interaction within the DC Extended Universe**

Whilst cross-world travel is perhaps the most impressive form of cross-world behavior, there certainly exist other forms of exchanges between distinct possible worlds within the DC Extended Universe. For example, within the movie *Suicide Squad: Hell to Pay*, whilst his body seemingly remains within the confines of one particular world, Zoom interacts with the characters contained within another world. In fact, it can be argued that although perhaps not properly physically located within the relevant world, Zoom nevertheless serves as one of the primary antagonists of the plot, conspiring to obtain what he desires within the world within which he is not located to serve his interests within the world within which he is located. As such, it is apparent that Zoom is involved in an especially sophisticated form of cross-world interaction. Importantly, as it does not seem obvious that Zoom properly travels from one possible world to another, it would perhaps be more appropriate to classify his behavior as an instance of cross-world interaction, rather than cross-world travel, thus nicely illustrating the significant distinction between the two.

Expanding upon such analysis, the inter-worldly actions of Zoom were a direct result of an external factor, namely an attempt to assassinate Zoom within the world within which he is located. Interestingly, when reviewing both *Justice League: The Flashpoint Paradox* and *Suicide Squad:*

*Hell to Pay*, it seems apparent that the two movies collectively imply that the attempt to assassinate Zoom was initiated by Flashpoint Thomas Wayne, as described within Chapter 5. Consequently, the event of Flashpoint Thomas Wayne attempting to assassinate Zoom within one possible world caused Zoom to participate in the events transpiring within another possible world, meaning that Flashpoint Thomas Wayne himself is involved in a form of cross-world causation, albeit perhaps an indirect one that persists through another person. Additionally, the manner in which Zoom artificially extends his lifespan illustrates how the passing of time differs between distinct possible worlds. Whilst a mere fraction of a second passes within the world that Zoom is physically located within, numerous days pass within the world that Zoom is interacting with, as is elucidated within his assertion that, “And literally by time, I’d expanded my moment of dying into days, maybe weeks” (*Suicide Squad: Hell to Pay*, 2018, 1 hour: 10 minutes: 34 seconds). The preceding idea clearly demonstrates the fact that time is relativized to individual worlds within the DC Extended Universe, and that synchronization of time between distinct worlds is not to be anticipated.

As a final illustration of cross-world behavior within the DC Extended Universe, it is perhaps worth explicitly acknowledging that there apparently exists a WTEAAW within the DC Extended Universe, as described within Chapter 3. Within the movie *Justice League: Crisis on Two Earths*, the evil Owlman devises a plan to annihilate all possible worlds by eradicating the one possible world from which all other possible worlds are “created”. It seems as though all of the other possible worlds rely upon the one possible world from whence they were “created”, which Owlman names Earth Prime, for their continued survival. If Earth Prime is destroyed in its entirety, then the destruction of Earth Prime shall initiate a “domino effect” of destruction that shall eliminate all of the other possible worlds within the DC Extended Universe. With such a metaphysical status, it would appear as though, similarly as to the Portal Tunnel World, Earth Prime is maximally connected to all other worlds. Furthermore, as Earth Prime is capable of ending all of the possible worlds within the DC Extended Universe, it is clear that Earth Prime is, indeed, a WTEAAW.

The DC Extended Universe truly does feature an incredibly sophisticated system of modal metaphysics. The transpiring of events within the DC Extended Universe, and the exchanges between the entities contained within its infinitely many distinct possible worlds, are highly intertwined and exceedingly complex, as the occurrences of the DC Extended Universe include all three of cross-world causation, cross-world interaction, and cross-world travel. Thus, the DC Extended Universe serves as an exemplary illustration of both the philosophical utility and the practical application of such notions.

## **Chapter 7**

### **Conclusion**

Perhaps a worthwhile reiteration, the primary hypothesis of the current research initiative may be tersely summarized as the theory that a formal language with an expressive power sufficient to adequately represent propositions involving cross-world predication is simultaneously capable of representing both propositions involving cross-world interaction and propositions involving cross-world travel. For the purpose of providing a reasonable ontological component to the semantics associated with interpreting propositions involving cross-world predication, the conceptualization of modal realism advocated for by Lewis is presupposed. Furthermore, in addition to articulating the linguistic connections between the various different forms of cross-world behaviors that are apparent through the application of the formalism of Ty2, the present research initiative provides an elucidation of the logical coherency of such notions as cross-world interaction and cross-world travel. Endeavoring to provide a reasonable means by which to describe both cross-world interaction and cross-world travel, the present research initiative strategically modifies the original Lewisian theory of modal realism to account for cross-world causation. The present research initiative demonstrates the usefulness of both cross-world interaction and cross-world travel for philosophical theorizing through a practical application of a case study of the sophisticated system of modal metaphysics of the DC Extended Universe.

Whilst the present research initiative does provide extensive metaphysical and philosophical exposition concerning such subjects as cross-world interaction and cross-world travel, it does not provide a detailed description as to precisely how such notions could be physically realized within the actual world. Future research that is of relevance to the subjects addressed within the present research initiative could include scientific investigations into precisely how to engineer a physical machine that is capable of generating a literal bridge between distinct possible worlds. The ramifications of the invention of such a machine would be substantial, and would afford incredible opportunities for scientific discovery. Additionally, as a pragmatic consideration, another compelling reason for developing such a machine is that the manufacturing of the technology associated with cross-world travel could potentially be highly profitable. Although it is certainly not obvious what the relationship between the two would be, it is possible that time travel technology could potentially be reverse engineered from cross-world travel technology, or, alternatively, that cross-world travel technology could potentially be reverse engineered from time travel technology. The preceding assertion is purely speculative, though, and is certainly not a claim that is definitively certain.



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## Appendix A

All of the most quintessential philosophical and ontological claims that are of relevance through the present research initiative have been compiled for ease of reference.

- Entities, which are all of type  $e$ , must be located within a particular world
- Entities cannot be simultaneously located within more than one world, meaning that there does not exist cross-world identity between entities
- The world that a particular existent entity is located within must itself exist
- Quantification over the constant  $v$ , which is the actual world, is prohibited
- Concreteness is defined as the state of being extended within both space and time
- Abstractness is defined as the state of not being extended within both space and time
- The ontological status of existence as an existent entity in and of itself is rejected
- Relations, such as the identity relation, are not entities, though rather predicates, meaning that they are not of type  $e$
- The General Concrete Interpretation is selected as the preferred interpretation of existence
- The Weak Rigid Identification Meinongian Interpretation is selected as the preferred interpretation of cross-world predication
- Weak rigid identification utilizes the two-dimensional notion of semantic meaning
- An event is the instantiation of a property either at a particular instant of time or throughout a particular interval of time
- Causal relations between the entities contained within distinct possible worlds can exist
- The entities contained within the actual world can causally interact with the entities contained within other worlds
- The entities contained within other worlds can causally interact with the entities contained within the actual world
- Travel between distinct possible worlds can exist, for certain entities

## Appendix B

Contained herein are the eight distinct formal translations of the proposition ‘I could have been wealthier than I actually am’, as articulated within Chapter 2.

### Strong Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \exists!x(L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_v(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’

### Generalized Strong Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \exists!x(L_{\omega_1}(v)(\mathbb{I}) \wedge L_{\omega_2}(w)(x) \wedge C_{\omega_3}(\mathbb{I})(x) \wedge W_{\omega_4}(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4\}$  represent arbitrary worlds of evaluation

### Weak Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \exists!x(L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_w(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’

### Generalized Weak Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \exists!x(L_{\omega_1}(v)(\mathbb{I}) \wedge L_{\omega_2}(w)(x) \wedge C_{\omega_3}(\mathbb{I})(x) \wedge W_{\omega_4}(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4\}$  represent arbitrary worlds of evaluation

### Strong Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_v(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_v(\mathbb{I}) \wedge \varepsilon_v(x) \wedge L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_v(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’

### Generalized Strong Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_{\omega_3}(\mathbb{I}) \wedge \varepsilon_{\omega_4}(x) \wedge L_{\omega_5}(v)(\mathbb{I}) \wedge L_{\omega_6}(w)(x) \wedge C_{\omega_7}(\mathbb{I})(x) \wedge W_{\omega_8}(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8\}$  represent arbitrary worlds of evaluation

### Weak Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_w(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_v(\mathbb{I}) \wedge \varepsilon_w(x) \wedge L_v(v)(\mathbb{I}) \wedge L_v(w)(x) \wedge C_v(\mathbb{I})(x) \wedge W_w(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’

### Generalized Weak Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Sigma!x(\varepsilon_{\omega_3}(\mathbb{I}) \wedge \varepsilon_{\omega_4}(x) \wedge L_{\omega_5}(v)(\mathbb{I}) \wedge L_{\omega_6}(w)(x) \wedge C_{\omega_7}(\mathbb{I})(x) \wedge W_{\omega_8}(\mathbb{I})(x)))$$

where  $\mathbb{I}$  represents the referent of the indexical ‘I’ and the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8\}$  represent arbitrary worlds of evaluation

## Appendix C

Contained herein are the eight distinct formal translations of the proposition ‘The rich could have all been poor’, as articulated within Chapter 2.

### Strong Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \forall x \exists! y(L_v(w)(y) \wedge C_v(x)(y) \wedge ((L_v(v)(x) \wedge R_v(x)) \rightarrow P_v(y))))$$

### Generalized Strong Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \forall x \exists! y(L_{\omega_1}(w)(y) \wedge C_{\omega_2}(x)(y) \wedge ((L_{\omega_3}(v)(x) \wedge R_{\omega_4}(x)) \rightarrow P_{\omega_5}(y))))$$

where the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5\}$  represent arbitrary worlds of evaluation

### Weak Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \forall x \exists! y(L_v(w)(y) \wedge C_v(x)(y) \wedge ((L_v(v)(x) \wedge R_v(x)) \rightarrow P_w(y))))$$

### Generalized Weak Rigid Identification Lewisian Interpretation

$$\exists w((v \neq w) \wedge \forall x \exists! y(L_{\omega_1}(w)(y) \wedge C_{\omega_2}(x)(y) \wedge ((L_{\omega_3}(v)(x) \wedge R_{\omega_4}(x)) \rightarrow P_{\omega_5}(y))))$$

where the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5\}$  represent arbitrary worlds of evaluation

### Strong Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_w(w) \wedge (v \neq w) \wedge \Lambda x \Sigma! y(\varepsilon_v(x) \wedge \varepsilon_v(y) \wedge L_v(w)(y) \wedge C_v(x)(y) \wedge ((L_v(v)(x) \wedge R_v(x)) \rightarrow P_v(y))))$$

### Generalized Strong Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Lambda x \Sigma! y(\varepsilon_{\omega_3}(x) \wedge \varepsilon_{\omega_4}(y) \wedge L_{\omega_5}(w)(y) \wedge C_{\omega_6}(x)(y) \wedge ((L_{\omega_7}(v)(x) \wedge R_{\omega_8}(x)) \rightarrow P_{\omega_9}(y))))$$

where the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8, \omega_9\}$  represent arbitrary worlds of evaluation

### Weak Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_v(v) \wedge \varepsilon_w(w) \wedge (v \neq w) \wedge \Lambda x \Sigma! y(\varepsilon_v(x) \wedge \varepsilon_w(y) \wedge L_v(w)(y) \wedge C_v(x)(y) \wedge ((L_v(v)(x) \wedge R_v(x)) \rightarrow P_w(y))))$$

### Generalized Weak Rigid Identification Meinongian Interpretation

$$\Sigma w(\varepsilon_{\omega_1}(v) \wedge \varepsilon_{\omega_2}(w) \wedge (v \neq w) \wedge \Lambda x \Sigma! y(\varepsilon_{\omega_3}(x) \wedge \varepsilon_{\omega_4}(y) \wedge L_{\omega_5}(w)(y) \wedge C_{\omega_6}(x)(y) \wedge ((L_{\omega_7}(v)(x) \wedge R_{\omega_8}(x)) \rightarrow P_{\omega_9}(y))))$$

where the elements of the set  $\{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8, \omega_9\}$  represent arbitrary worlds of evaluation

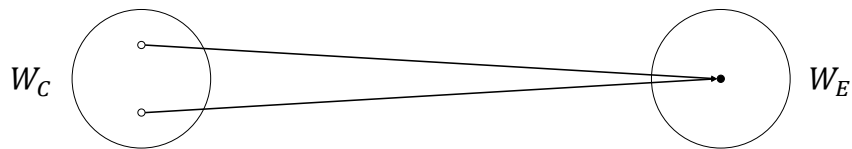
## Appendix D

Contained herein are diagrams representing visual illustrations of the nine fundamental cases of cross-world causation, as well as two examples of combinations of the fundamental cases. Within the diagrams, solid dots represent events that must occur, such as when such events are conjuncts, whereas hollow dots represent events that may or may not occur, such as when such events are disjuncts.

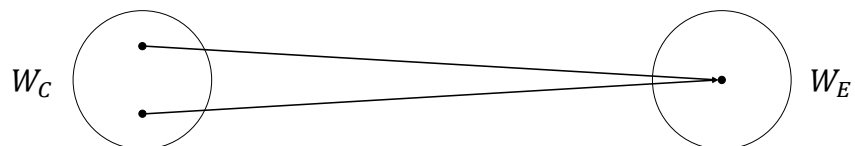
### Case 1



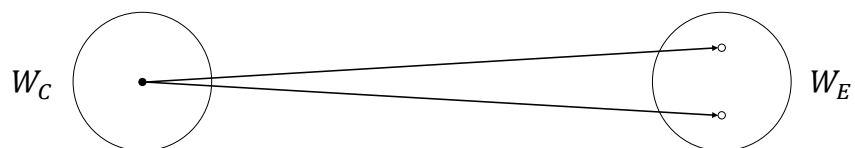
### Case 2



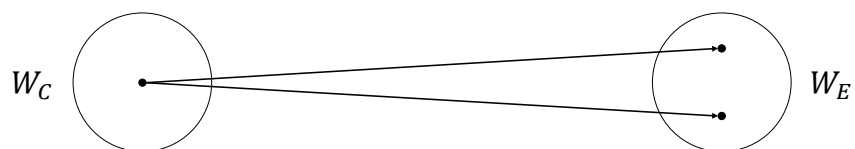
### Case 3



### Case 4

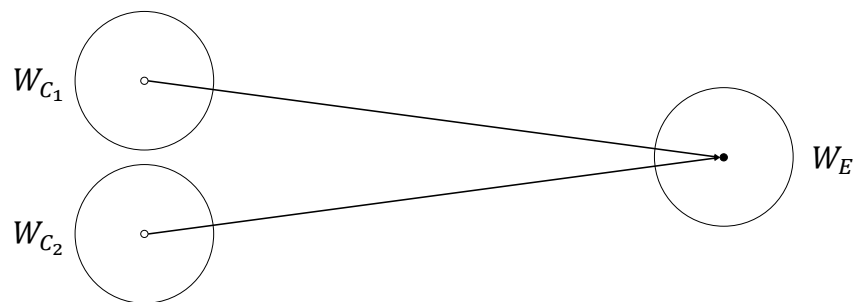


### Case 5

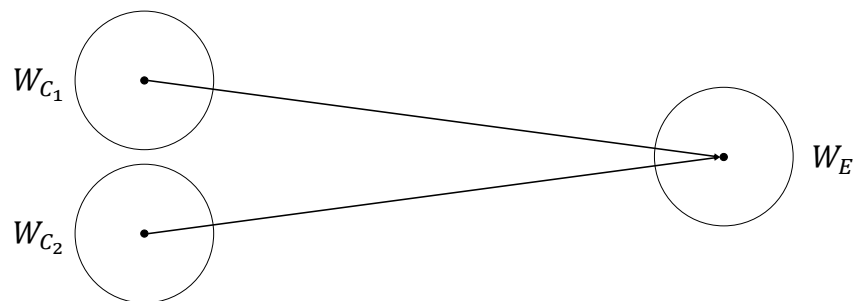




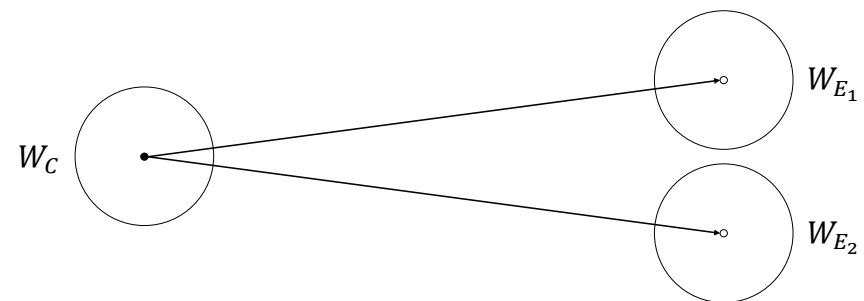
### Case 6



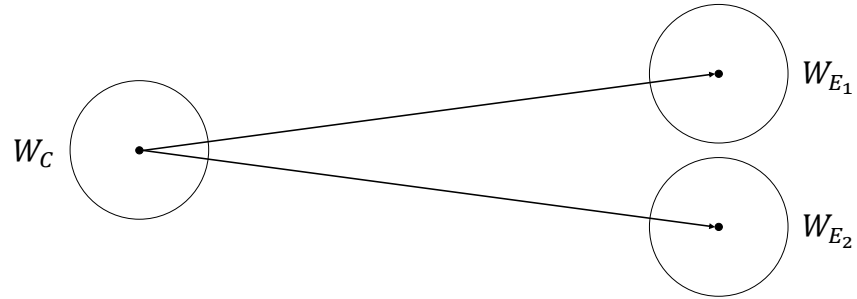
### Case 7



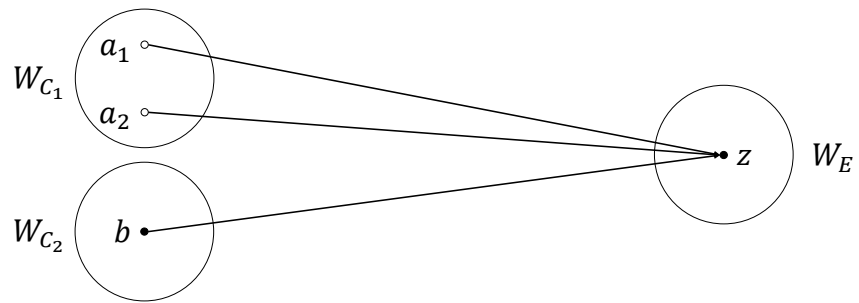
### Case 8



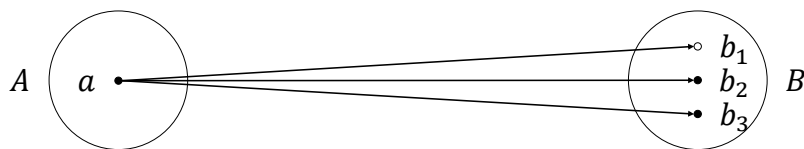
### Case 9



### Example 1



### Example 2



## Appendix E

As elucidated within Chapter 1, there does not, as of yet, exist an overwhelming abundance of academic literature addressing such notions as cross-world causation, cross-world interaction, and cross-world travel. Nevertheless, certain sources of preexisting academic literature are particularly relevant to the present research initiative. Although certainly not a comprehensive listing of all of the sources that are referenced throughout the present research initiative, the present section systematically reviews several sources, and provides relatively succinct summaries of the information contained therein. Full bibliographic citations for the sources analyzed within the present section, as well as for all of the other sources referenced throughout the present research initiative, may be reviewed within the Works Cited section of the present research initiative.

### Sources of Particular Relevance to Philosophy

#### Source 1

Title: Trans-World Causation Revisited

Author: Axel Arturo Barceló Aspeitia

Publication Year: 2014

In direct opposition to Source 2, Aspeitia argues that the counterfactual account of causation initially proposed by Lewis does not entail the possibility of cross-world causation. The quintessential error, Aspeitia claims, in attempting to satisfactorily describe cross-world causation by means of a counterfactual account is that it is not possible to expand upon the idea of “closeness” of possible worlds, which is utilized extensively by Lewis, to produce a viable way of evaluating “closeness” between world-pairs. Interestingly, Aspeitia asserts that Source 2 provides an alleged argument against the conjunction of Lewisian modal realism and the counterfactual account of causation. As the argument that is allegedly contained within Source 2 does not truly rely upon the concreteness of possible worlds, though, such an argument is, in fact, merely a rejection of the counterfactual account of causation developed by Lewis, meaning that it does not directly pertain to modal realism at all. Having thus dispensed with the requirement that possible worlds are concrete particulars, Aspeitia proceeds to object to Source 2 by claiming that it is not possible to generate a functioning theory of comparative similarity between pairs of worlds that remains truthful to the original intentions of comparative similarity applied to individual possible worlds. Reiterating Source 2, Aspeitia acknowledges that identifying which world-pairs are closer to a specified world-pair than others would involve both comparing individual members of distinct world-pairs to one another and comparing world-pairs themselves to one another. Contrary to Source 2, Aspeitia argues that it is not possible to combine the two aforementioned forms of comparison between possible worlds into a single “closeness” relation without departing from the original stipulations of Lewis concerning how possible worlds ought to be compared to one another. Similarly as to Source 5, Aspeitia observes the challenges associated with quantifying the degrees of similarity between distinct world-pairs, and continues to state that such a process as imposing relative weights upon the similarity between the individual members of distinct world-pairs and the similarity between the world-pairs themselves can be done in infinitely many different ways. Since there exist infinitely many different ways in which to assign relative weights to distinct forms of similarity, it is possible both to assign relative weights to distinct forms of similarity in such a manner as to enable cross-world causation and to assign relative weights to distinct forms of similarity in such a manner as

to prohibit cross-world causation. Since it ought not be possible to both enable cross-world causation and prohibit cross-world causation, there exists a problem with the account of cross-world causation articulated within Source 2. Furthermore, as Lewis himself did not identify a particular manner in which to assign weights to such distinct forms of similarity, attempting to do so would necessarily require introducing additional considerations to the original Lewisian method of comparing counterfactual scenarios, which would therefore seem to be ad hoc. Ultimately, Aspetia concludes that it is not possible to expand upon the “closeness” relation between individual possible worlds initially proposed by Lewis to include comparisons between pairs of possible worlds in a manner that is both not ad hoc and nontrivial, and boldly declares that Source 2 is incorrect in asserting that the counterfactual account of causation implies the possibility of cross-world causation.

## Source 2

Title: Trans-World Causation?

Author: Eduardo García-Ramírez

Publication Year: 2012

Within his journal article, García-Ramírez states that the primary concern with cross-world causation identified by Lewis is that it is not possible to generate a coherent theory of counterfactual claims involving relations between possible worlds, or the constituents of possible worlds, without immediately rendering such claims false. Furthermore, García-Ramírez argues that Lewis is incorrect in asserting that cross-world counterfactual claims cannot be non-vacuously true. The majority of the journal article is devoted to articulating a theory of cross-world counterfactual claims that are based upon relations of comparative similarity, which García-Ramírez abbreviates as RCS, between world-pairs. On page 79 of Source 3, Lewis proposes the idea of attempting to understand cross-world causal relations by modifying his original counterfactual account of causation in the form of substituting pairs of worlds for single worlds, which ultimately appears to be the theory of cross-world causation that Lewis believes to have the most potential for success. In an effort to rectify the counterfactual account of cross-world causation based upon world-pairs, which Lewis himself eventually dispenses with, García-Ramírez stipulates that it is not sufficient merely to perform a relative comparison between the individual members of world-pairs, which is precisely what Lewis seems to do. Rather, García-Ramírez claims that whilst it is necessary to compare the individual members of distinct world-pairs to one another, it is additionally necessary to compare the world-pairs themselves to one another. Suppose that the elements of the set  $\{A, B, C, D\}$  are distinct possible worlds. When considering the world-pairs  $\langle A, B \rangle$  and  $\langle C, D \rangle$ , the first form of comparison, namely comparing individual members of distinct world-pairs to one another, would involve comparing  $A$  to  $C$  and, independently, comparing  $B$  to  $D$ . Alternatively, the second form of comparison, namely comparing world-pairs themselves to one another, would involve comparing  $\langle A, B \rangle$  as a unified world-pair to  $\langle C, D \rangle$  as a unified world-pair. Within his journal article, García-Ramírez states that, collectively, the two aforementioned forms of comparisons of similarity between world-pairs provide the means by which to identify which world-pairs are closer to a specified world-pair than others. Furthermore, García-Ramírez explains that the second form of comparison relies upon the RCS between possible worlds that Lewis advocates for so fervently, and emphasizes that it generates a way in which to ensure that cross-world counterfactual statements are non-vacuously true, as is illustrated within his assertion that, “I think *comparison 2* provides us with just the kind of *significant* relations we need to make trans-world counterfactuals

true” (García-Ramírez, 2012, page 77). Expanding upon such a notion, García-Ramírez reports that as it is possible that cross-world counterfactual claims can be true, the objection to causal relations between distinct possible worlds proposed by Lewis is resolved. Consequently, cross-world causation is possible, as well as other forms of cross-world behaviors, including cross-world travel. Finally, García-Ramírez concludes by arguing that either Lewisian modal realism must be incorrect or that causation does not rely merely upon the truth of a relevant counterfactual statement that describes it.

### **Source 3**

Title: On the Plurality of Worlds

Author: David Kellogg Lewis

Publication Year: 1986

Within his book, Lewis provides an extensive elucidation of his theory of modal realism, within which he claims that possible worlds exist as concrete particulars, and that all possible worlds are equally real. In accordance with his assertion that the ontological status of the merely possible worlds is not different from that of the actual world, Lewis states that the word ‘actual’ is merely an indexical term that uniquely identifies the possible world within which he or she who utters the word is located. Synthesizing his counterfactual account of causation and his theory of modal realism, Lewis provides an explanation of causation that involves comparisons between distinct possible worlds. For example, to determine if two distinct events are causally correlated within the actual world, it is necessary to identify a merely possible world that is as similar to the actual world as possible. The standards that identify which merely possible worlds are the closest to the actual world can vary from one context to another, in accordance with the pragmatic considerations that are of the most relevance within a particular scenario. It may be the case, for a particular scenario, that the most relevant standard for calculating “closeness” of distinct possible worlds is having identical laws of nature, or, alternatively, that the most relevant standard for calculating “closeness” of distinct possible worlds is having certain contingent facts, which are unrelated to laws of nature, in common. When a closest merely possible world has been successfully identified, Lewis states that it is possible to analyze causation within the actual world through the claim that the occurrence of a first event within the actual world causes the occurrence of a second event within the actual world when the lack of occurrence of the first event implies the lack of occurrence of the second event. To determine if the lack of occurrence of one event implies the lack of occurrence of another event within the actual world, it is necessary to observe what transpires within the merely possible world that is closest to the actual world. If it is the case that the suspected cause occurs and that the suspected effect does not occur within the merely possible world that is closest to the actual world, then the suspected cause is not truly a cause of the suspected effect within the actual world. Otherwise, a suspected cause and its associated suspected effect are causally correlated with one another within the actual world. The counterfactual account of causation proposed by Lewis can, and is intended to be, generalized to all possible worlds, such that it is possible to determine if two distinct events are causally related within a specified possible world, be it actual or merely possible, by comparing it to its closest counterpart, or closest counterparts, as it may be the case that there exist several worlds that are all equally close to the specified possible worlds. Interestingly, Lewis believes that it is not possible to satisfy counterfactual statements concerning causal relations between the entities contained within distinct possible worlds, and consequently, that it is

not possible for there to exist cross-world causation. Expanding upon his rejection of cross-world causation, Lewis claims that the impossibility of cross-world causation implies the impossibility of cross-world travel.

#### **Source 4**

Title: Possible Worlds

Author: Robert Stalnaker

Publication Year: 1976

Endeavoring to provide an account of possible worlds that can serve as an alternative to the notion of possible worlds elucidated within the Lewisian conception of modal realism, Stalnaker explicitly proposes rejecting one of the major claims that effectively constitute the metaphysical ideology of modal realism. Within his journal article, Stalnaker identifies four claims that are advocated for by Lewis within his argumentation for his theory of modal realism, which Stalnaker articulates as the theories that “*Possible worlds exist*”, that “*Other possible worlds are things of the same sort as the actual world*”, that “*The indexical analysis of the adjective ‘actual’ is the correct analysis*”, and that “*Possible worlds cannot be reduced to something more basic*” (Stalnaker, 1976, page 67). Explaining that the four aforementioned claims can be individually accepted or dismissed, independently of the others, Stalnaker explicitly acknowledges the viability of both the first and the third of the four aforementioned claims, whilst arguing that the second claim, the one which effectively defines possible worlds as concrete particulars, must be dispensed with. More specifically, by equivocating the expression ‘the actual world’ with both the expression ‘reality’ and the expression ‘the totality of everything there is’, Stalnaker claims that it is unreasonable to believe that possible worlds are concrete particulars that are external from ‘the actual world’, and therefore external from ‘reality’. As for the last of the four aforementioned claims, Stalnaker appears to advocate for the notion that possible worlds are not reducible to simpler objects, and ventures to argue that propositions can be defined in terms of possible worlds. In fact, Stalnaker considers his possible worlds theory in contrast to the seemingly opposing minimal world-story theory introduced by Robert Merrihew Adams, which entails that possible worlds ought to be defined in terms of propositions, rather than defining propositions in terms of possible worlds. Interestingly, Stalnaker concludes that when an identity condition and a closure condition are imposed upon the minimal world-story theory articulated by Adams, it is ultimately equivalent to the possible worlds theory that Stalnaker has proposed, with regards to both the manner in which propositions are related to possible worlds and the structure that the two theories require the set of propositions to exhibit. Furthermore, by defining propositions as sets of basic propositions, all of the characteristics that distinguish the minimal world-story theory from the possible worlds theory are eliminated, and the two theories are then identical. As such, Stalnaker provides a compelling argument for the claim that propositions ought to be defined in terms of possible worlds, as well as for the idea that possible worlds are metaphysically irreducible, in accordance with the last of the four claims that Stalnaker believes are imperative to the Lewisian conception of modal realism. It seems apparent that Stalnaker accepts the notion of possible worlds, and acknowledges their status as more than mere notational conventions within philosophical theorizing, though he clearly prefers a notion of what Lewis labels “*ersatz modal realism*” to the description of possible worlds as concrete particulars within the Lewisian ontological theory. In fact, Lewis himself attributes Stalnaker as adhering to “*nondescript ersatzism*” with regards to possible worlds, meaning that Stalnaker remains ag-

nostic on the subject of whether possible worlds ought to be understood from the perspective of linguistic ersatzism, pictorial ersatzism, or magical ersatzism (Lewis, 1986, page 141). Ultimately, it appears as though Stalnaker attempts to advocate for a more “conservative” conceptualization of modality than Lewis, though without dispensing with the idea of possible worlds entirely.

### **Source 5**

Title: What Trans-World Causation Could and Could Not Be

Author: Alessandro Torza

Publication Year: 2014

Responding to Source 2, Torza claims that the argumentation against the counterfactual account of causation contained therein features a critical error, namely an inappropriately overpowered notion of the semantics of counterfactual statements. More specifically, the process of identifying which world-pairs are closer to a specified world-pair than others implies that the relations of comparative similarity between distinct world-pairs form an interval scale for the set of all possible worlds, which necessarily requires sacrificing at least one of the three conditions of supervenience, dominance, and no dictatorship. Supervenience requires that a difference within at least one relevant aspect of similarity between two particular objects is a necessary condition for a difference within the overall aggregate similarity between the two particular objects. Dominance requires that a greater caliber of similarity within all relevant aspects of similarity between two particular objects implies a greater caliber of overall aggregate similarity between the two particular objects. No dictatorship requires that there does not exist a single relevant aspect of similarity between two particular objects that automatically guarantees that when the two particular objects are more similar in that relevant aspect, they are equally or more similar overall. In an effort to resolve the challenges associated with having an interval scale for the set of all possible worlds, Torza proposes that the “closeness” relation between possible worlds ought to be a weak comparative similarity relation, such that connectedness is not satisfied, meaning that it is possible that a particular relation does not hold between two distinct objects, regardless of which of the objects is the first input-value and which is the second. By abstaining from requiring connectedness, a weak comparative similarity relation can successfully satisfy all of the three conditions of supervenience, dominance, and no dictatorship. As such, by appropriately amending the set of truth conditions for counterfactual statements initially proposed by Lewis, so as to not require connectedness, a weak comparative similarity relation can provide for a reasonable means of identifying which world-pairs are closer to a specified world-pair than others, thus resolving the primary problem with the account of cross-world causation articulated within Source 2. Concludingly, Torza applies the aforementioned strategy of abstaining from requiring connectedness to the best theory account of natural laws, thus alleviating additional concerns associated with the task of identifying which world-pairs are closer to a specified world-pair than others, and cautiously asserts that cross-world causation is possible, under the condition that refraining from requiring connectedness within the best theory account of natural laws is an acceptable tactic.

## Source 6

Title: Possible Worlds as Shifting Domains

Author: Takashi Yagisawa

Publication Year: 1992

Responding to Source 3, Yagisawa asserts that Lewis does reasonably well to address several of the ontological concerns associated with his conceptualization of modal realism. Nevertheless, Yagisawa claims that the particular notion of possible worlds advocated for by Lewis remains objectionable, and proposes that possible worlds ought to be understood as shifting domains of discourse, rather than as concrete particulars. Importantly, Yagisawa distinguishes two critical purposes that possible worlds are intended to serve within Lewisian modal realism. The first purpose that possible worlds serve within Lewisian modal realism is that of being truth-relativizers that identify at precisely which possible worlds interpreted closed sentences are true and, similarly, at precisely which possible worlds interpreted closed sentences are not true. The second purpose that possible worlds serve within Lewisian modal realism is that of being possibilia-localizers that identify within precisely which possible worlds specified possibilia are located. Indeed, Yagisawa concurs that the functionality of possible worlds as truth-relativizers is quintessential to all possible-worlds semantic theories, including ones which presuppose actualism, which is precisely how the functionality of possible worlds as possibilia-localizers differentiates Lewisian modal realism from actualism. Rejecting the idea that possible worlds are possibilia-localizers, Yagisawa proposes that possible worlds are, in fact, universes of discourse that vary from one pragmatic context of linguistic expression to another. As such, by shifting between distinct universes of discourse, it is possible to account for such modal notions as necessity and contingency, without committing to the ontological existence of non-actual worlds. When comprehending possible worlds as universes of discourse, in the sense of domains of entities within a Tarskian semantics that includes quantification, it is possible to dismiss the purpose that possible worlds are intended to serve as possibilia-localizers, whilst maintaining the status of possible worlds as truth-relativizers. By defining possible worlds as linguistic universes of discourse, Yagisawa introduces a theory that is seemingly best characterized as what Lewis would presumably deem a form of linguistic ersatzism, in which possible worlds are described as being mere philosophical devices for understanding language, rather than concrete particulars. Concludingly, Yagisawa objects to the idea, which Lewis advocates for, that reality can be partitioned into a plethora of different segments that are mutually disjoint on a purely a priori basis, claiming that such a partitioning as the process of distinguishing between spatiotemporally isolated concrete particulars within Lewisian modal realism is ultimately philosophically unwarranted and ontologically unnecessary.



## Sources of Particular Relevance to Physics

In addition to the aforementioned philosophical publications that are of pertinence to the present research initiative, there exist a few academic publications that address the idea of interactions between distinct possible worlds primarily from the perspective of physics. As the present research initiative is not intended to be an extensive investigation into contemporary theoretical physics, though, the exposition concerning such information shall be relatively terse.

### Source 7

Title: Are Many Worlds and the Multiverse the Same Idea?

Author: Sean Carroll

Publication Year: 2011

Freely Available Online: <https://www.discovermagazine.com/the-sciences/are-many-worlds-and-the-multiverse-the-same-idea>

The primary purpose of the article written by Carroll is to determine if there is a significant difference between the seemingly distinct notions of such objects as “distinct universes” and “distinct worlds” within contemporary physics. Through an extensive elucidation of the similarities between the two, Carroll concludes that the “multiverse” that is associated with inflationary cosmology and the “many worlds” that are associated with quantum mechanics can potentially be conflated together into a single coherent theory, in accordance with horizon complementarity and quantum vacuum decay. Alternatively, Carroll claims that it is reasonable to believe that the “parallel branes” associated with string theory are genuinely distinct from both of the aforementioned notions. Consequently, whilst string theory seemingly features a theoretical ideology that is truly unique, it may be possible to unify inflationary cosmology and quantum mechanics in a way that includes the ontological existence of merely possible worlds.

### Source 8

Title: An unwelcome consequence of the Multiverse Thesis

Author: Nikk Effingham

Publication Year: 2012

Within his journal article, Effingham contemplates the potential ontological existence of merely possible worlds. Within the exposition of his journal article, which is primarily intended to address the subject of time travel, Effingham provides an elucidation of what he labels the Multiverse Thesis, as is explicitly articulated within his definition that, “If, at time  $t'$ ,  $x$  time travels to some prior instant,  $t$ , then  $x$  arrives at  $t$  but in an alternative universe, distinct from the one  $x$  was previously in” (Effingham, 2012, page 376). As such, the Multiverse Thesis implies that time travel necessarily involves either voyaging to existent possible worlds or creating possible worlds that are generally reminiscent of the world from which a time traveler departs. Regardless of which one of the two aforementioned options is most appropriate for describing time travel that is associated with the Multiverse Thesis, it seems apparent that possible worlds must exist, as a fundamental prerequisite, for an existent entity to travel to them, meaning that the Multiverse Thesis that Effingham describes appears to necessarily imply the existence of at least some merely possible worlds, and is therefore at least partially similar to Source 3 with regards to its ontological commitments.

### **Source 9**

Title: Quantum Phenomena Modeled by Interactions between Many Classical Worlds

Authors: Michael Hall; Dirk-André Deckert; Howard Wiseman

Publication Year: 2014

Freely Available Online: <https://journals.aps.org/prx/pdf/10.1103/PhysRevX.4.041013>

Explicitly acknowledging the significance on ontologically distinct worlds within their theory, Hall, Deckert, and Wiseman distinguish their methodology for understanding quantum mechanics from that of the many-worlds interpretation created by Hugh Everett III. One interesting consideration is that whereas the many-worlds interpretation fails to determine the precise quantity of worlds that exist at a particular instant within time, the many interacting worlds approach, abbreviated as the MIW approach, includes an exact specification of the cardinality of distinct worlds involved within a particular physical system. Extremely reminiscent of the theory of modal realism articulated by Lewis within Source 3, the MIW approach claims that all worlds have equivalent ontological status. In fact, Hall, Deckert, and Wiseman claim that certain calculations succeed only if there exists an uncountably infinite quantity of worlds that are mutually interacting with one another, thus providing a certain caliber of scientific justification for the infinitude of worlds advocated for by Lewis within Source 3. Furthermore, the MIW approach asserts that all worlds are governed by deterministic laws, and that the seemingly probabilistic nature of quantum mechanics is merely the result of the epistemic ignorance of human beings, as is summarized nicely within the statement that, “Probabilities arise only because observers are ignorant of which world they actually occupy, and so assign an equal weighting to all worlds compatible with the macroscopic state of affairs they perceive” (Hall and Deckert and Wiseman, 2014, page 2). With such a substantial ontological claim, it is possible to represent all of the alleged uncertainty associated with empirical experience through the utilization of the theory of probability developed by Pierre Simon Laplace.

### **Source 10**

Title: Bohmian mechanics without pilot waves

Author: Bill Poirier

Publication Year: 2010

Boldly reversing the ideology of the “pilot wave” interpretation of quantum mechanics developed by David Bohm, Poirier proposes that the partial differential equation representing the trajectory ensemble of a particle is sufficient for the purposes of mathematically representing the phenomena that are empirically observed within scientific experiments involving quantum physics. By postulating that the trajectory ensemble of a particle is a fundamental constituent of the physical system, it is possible to dispense with the “pilot wave” that Bohm theorized was ultimately responsible for determining the behavior of particles within a quantum system. Furthermore, by structuring a theory of quantum mechanics upon a kinematic description of trajectories, the mathematical function representing the field of the trajectory ensemble is real-valued and computationally feasible to solve, both of which are highly advantageous for pragmatic purposes. Critically, the mathematical system proposed by Poirier describes the phenomena of quantum physics in a manner that is deterministic in nature, similarly as to within other many-worlds interpretations of quantum mechanics, including the systems described within Source 9, Source 11, and Source 12. When the phenomena of quantum physics are successfully represented by a deterministic system, it is possible to provide

an elucidation of quantum mechanics that does not rely upon probabilistic laws.

### **Source 11**

Title: Communication: Quantum mechanics without wavefunctions

Authors: Jeremy Schiff; Bill Poirier

Publication Year: 2012

Freely Available Online: <https://aip.scitation.org/doi/pdf/10.1063/1.3680558>

Expanding upon the results achieved within Source 10, Schiff and Poirier successfully generate a mathematical formulation of quantum mechanics within which ensembles of partial differential equations representing quantum trajectories are utilized to calculate the relevant quantum states. By describing quantum states as such, it is possible to dispense with wavefunctions entirely, which apparently has desirable implications for computational approaches to both physics and chemistry. The equations for time-dependent quantum mechanics proposed by Schiff and Poirier have the mathematical advantage of describing quantum phenomena solely in terms of real-valued quantum trajectories, rather than complex-valued ones. Contrasting with Source 12, Schiff and Poirier emphasize the importance of the interactions between trajectories, rather than the interactions between particles, as being the source of quantum behaviors that are observed within scientific experiments. Similarly as to Source 12, Schiff and Poirier state that their results imply a form of quantum mechanics involving multiple distinct worlds, though they acknowledge that their ideas differ substantially from the many-worlds interpretation of quantum physics initially proposed by Hugh Everett III. Ultimately, Schiff and Poirier decline to explicitly assert any philosophical implications that their theory may entail other than the fact that their theory implies an interpretation of quantum mechanics that is reminiscent of a many-worlds interpretation.

### **Source 12**

Title: Quantum Mechanics as Classical Physics

Author: Charles Sebens

Publication Year: 2015

Proposing a unique means of understanding the results of quantum mechanics, Sebens claims that his interpretation of quantum physics, which he calls Newtonian QM, has a distinct advantage in describing the results observed within empirical investigations of quantum phenomena. By dispensing with the notion of a wavefunction entirely, Sebens restricts his ontology to a mere collection of particles, which interact with one another through purely Newtonian forces. What most clearly distinguishes Newtonian QM from the many-worlds interpretation, also known as the Everettian interpretation, is that within Newtonian QM, the distinct worlds are postulated as having the capacity to causally influence one another. An additional way in which Newtonian QM differs from the many-worlds interpretation is that worlds are presumed to be fundamental constituents of reality, rather than emergent objects. Specifically, Sebens asserts that the ontology of his theory consists solely of particles contained within worlds, and appears to favor the notion of simply positioning such particles within the conventional conceptualization of three-dimensional space. Interestingly, the preceding idea implies that all worlds are contained within a single fundamental space, which is namely the conventional conceptualization of three-dimensional space, and that the worlds themselves contain particles. Importantly, Sebens asserts that the form of interaction

between particles contained within distinct worlds is different than the form of interaction between the distinct particles contained within a single world, as is exemplified within his observation that, “So, particles that happen to be members of the same world interact in one way, whereas particles that are members of different worlds interact another way” (Sebens, 2015, page 284). The physical theory of Newtonian QM is reminiscent of the ideas communicated within Source 9, and the dismissal of the wavefunction is discussed within both Source 10 and Source 11, all of which Sebens himself acknowledges. Although Newtonian QM does commit to the ontological existence of many distinct worlds, Sebens confines the cardinality of such worlds to being a finite number, which is a feature that conflicts with the ideology of Source 3.