A Non-Classical Solution To Vague Endurance

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A NON-CLASSICAL SOLUTION TO VAGUE PERSISTENCE

A Thesis
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by
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ABSTRACT

One common theory of persistence is that things move through time as wholly present entities, moving from time to time as a complete unit. This theory, the endurance theory, has come under challenge by various authors, and this paper will defend the view from one such objection. Katherine Hawley argues that the endurance theory fails to account for vague persistence on the grounds that endurance cannot account for vagueness semantically. I will show that this claim is based on an assumption of classical logic and that by rejecting this assumption in favor of a non-classical logic the objection is rendered mute. By revising our understanding of the identity relation to function on a continuum scale we can understand persistence as a scalar function that can be labeled as true false or any value in between. This reinterpretation of the identity relation will allow an endurance theorist to account for vague persistence semantically and thereby reject the objection from Hawley.
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CHAPTER 1

INTRODUCTION

One of the most basic assumptions that we make about the world is that there are entities that persist through time. This iPad is the same one that I bought three months ago. My pen is the same one that I bought a few years ago. Many of our laws are based on this assumption of persistence. The possession of entities, laws against theft, etc. All of these are predicated on the fact that you cannot have the entity that is mine and that the entity that is mine is in fact the same one that I purchased. How then do we account for this persistence? We cannot simply assume that this persistence is at work and move on, because there are too many borderline cases of persistence. For example, the computer that I own has been running the same operating system for about a year, and much of the same personal data is there, but I have replaced the HDD, the RAM and many other components. In fact, the computer that I had at the end of my undergraduate degree was the same case, and the same operating system but almost nothing else was the same. How do we account for the fact that so much physical material (all of the relevant physical material to be precise) had changed over those five years? Although the idea that entities persist through time seems obvious to most, there is widespread disagreement about a theory that would help to understand this apparent phenomena.

Perhaps the most common view, at the very least the most common pre-theoretic view, is that entities move through time as a whole. There is something that is my pen and it is the same here in this moment and in the moment years ago when I bought it. However, this view may have some problems, for example, endurance seems to have difficulty in describing how an entity can change over the course of time, how to account for cases like my computer
where there does not seem to be a clear answer as to whether the computer is the same or not, and endurance has difficulty capturing our intuitions with respect to counting problems after a fusion or fission case. As such, there are other theories that have been put forward to try and account for some of the problems. Most notably perdurance and stage-theory. These are both alternative solutions to endurance theory and may or may not provide solutions to some of these problem cases. The question that this paper addresses is whether or not an endurance theorist has the resources to counter one of these problematic cases. What I will show here is that the objection to endurance theory from vague persistence can in fact be countered and as such an endurance theorist has one objection fewer to contend with.

Katherine Hawley presents her argument against the endurance theory in the form of a trilemma. She argues that the three positions of endurance theory, semantic vagueness, and vague persistence (taken as a whole) are inconsistent. For Hawley, in addition to any other issues that the endurance theory has, the inconsistency of the three positions leads to the need to reject one of the positions. As endurance is the more troubled position Hawley argues that it should be rejected. I argue that her construction of this trilemma relies on an assumption of classical logic, centered around the identity relation. By rejecting this underlying theoretical assumption, for a non-classical logical position, I show that endurance theory is free from this objection.

To make this argument, I first outline the trilemma according to Hawley and how each of the three positions interacts to make the argument. Then I show that this trilemma relies on a classical — that is to say, bivalent — interpretation of the identity relation. I will then explore some motivations for rejecting this classical interpretation and show two non-classical logics that I believe are more plausible alternatives for contending with vague persistence. Ultimately I conclude that by adopting a continuum logic as the basis of the identity relation, the trilemma falls apart and that endurance theory no longer suffers from this objection.
Hawley’s trilemma appears at first to be a devastating argument against endurance theory. In brief the argument is as follows:

(1) For any theory of persistence, that theory must account for vague persistence.
(2) The best account of vagueness in persistence is semantic.
(3) Endurance theory cannot account for vagueness semantically.
(4) Therefore, Endurance theory must not be the right theory of persistence.

Each of the premises at first glance seems to be correct. If vague persistence is in fact something to be considered then any theory of persistence should be able to account for it. Vague persistence is best accounted for in a semantic fashion, and endurance theory does have some initial problems accounting for vagueness semantically.¹ To see how this argument can be refuted I will walk through each of the premises in turn.

2.0.1 Vague Persistence

Of the three premises in question vague persistence is undoubtedly the most controversial. Where vague persistence argues that there are cases of indeterminacy in between clear cases of persistence and non-persistence, our ordinary notion of persistence is that an object persists or it does not. Even though our intuitions seem to point to vague persistence being a false claim, there are cases that seem to put pressure on this intuition; Hawley gives the following examples: “Is this restaurant the same as the one that used to be here, before the refit and the change of management? Is this much-repaired bicycle the bicycle I bought

¹There is a technical reconstruction of this argument in the Appendix on page 34.
many years ago? Is this post-brain-surgery patient the person who signed the pre-operation consent form? Was I once a foetus[sic]?”\(^2\). In all of these cases there is a question as to whether the preceding thing is in fact the same as the current thing. A restaurant that changes it’s management, decor, and presumably its food may in fact be an entirely different restaurant in the same building as the previous, the bicycle that has had parts replaced over the years may be a different bike. These questions are left unsettled. There may be ways of settling these questions, but each of these cases raises questions for our intuitive notion. To better see the problem I move now to look at vagueness as many of the same concepts will also apply to vague persistence.

Hawley gives the following statement about vagueness: “[vagueness] arises because our concepts have borderline cases: we do not know where to draw the line between the red things and the orange things, between the bald men and the non-bald men, or between those things which are my parts and those which are not.”\(^3\). Examples of this type of issue are found in sorites paradoxes. Take a collection of 500 grains of rice and ask the question, “Does this collection constitute a pile?” The intuitive response is that of course 500 grains constitute a pile. Now remove a single grain from the pile. Does the resulting collection of grains count as a pile? Again this seems to be intuitively, yes. At this point one might argue that the removal of a single grain of rice from a pile will not turn that pile into a non-pile, but if that is the case then the following must be correct:

(5) A collection \(x\) consisting of 500 grains is a pile.

(6) Removing a single grain does not change the status of \(x\) from pile to non-pile.

(7) \(x - 1\) is a pile. (5, 6)

(8) \(x_{-1} - 1\) is a pile. (6, 7)

...

(9) \(x_{-498} - 1\) is a pile. (6, \(n\))


\(^3\)Hawley, *How Things Persist*, 100
Here (9)\(^4\) is just as logical a conclusion as (7), but (7) is intuitively true and (9) is intuitively false. Given this strange conclusion the first intuition is to negate the statement that led to the conclusion. So, we end up with the statement “Removing a single grain does change the status of \(x\) from pile to non-pile.” But this results in another strange conclusion:

(5) There is some collection \(x\) containing \(n\) grains, and \(x\) is a pile.

(6\’) Removing a single grain can change the status of a pile to non-pile.

(7\’) \(y\) is a collection with \(n - 1\) grains, and \(y\) is not a pile. (5, 6\’\(^5\))

In the first case, a counterintuitive position is reached by applying the intuition that removing a single grain does not change a pile to a non-pile. When we negate the problematic statement, we reach another counterintuitive position. (7\’) is just as counterintuitive as (9). It seems that at the extremes, collections of 500 and 1, there are clear cases of piles and non-piles and that in the penumbral space between these clear extremes there are cases that are not clear. In this situation there are a few possible responses, we could say that (i) there are no such things as piles, that (ii) a singular thing can be a pile, or (iii) “pile” is a concept that is vague and as such there are clear cases of piles, clear cases of non-piles, and cases in between these clear extremes that are vague. (i) and (ii) both seem problematic. It seems apparent that there are clear cases of piles, and as equally apparent that a single thing does not constitute a pile.\(^6\) Although admitting vagueness here may not be the most favorable option it is the better of our three options. As such, I now move on to look at the way that vagueness and persistence interact.

Consider the following story, The Ship of Theseus leaves the port of Athens carrying a replacement for every plank, spit, rope, and sail. As the ship travels the crew replaces each of the pieces one by one. As they sail and replace pieces another ship follows them and picks

\(^4\)The conclusion that even a single grain can be a pile can be avoided by stipulating that a pile must be more than 0 grains.


\(^6\)There are other potential responses here, but as most of them revolve around semantic precision I will hold off talking about them here and leave them to the section on semantic vagueness.
up the discarded pieces. The following crew assembles all of the discarded pieces to make a perfect copy of the Ship of Theseus. When the first ship returns to the port of Athens, which is the original ship? Is one the Ship of Theseus and the other an imposter? Has the Ship gone out of existence and in its place are two similar but not identical ships? Again the questions of vagueness arise again as they did in the sorites paradox. Using the same reasoning as before we can ask whether the removal of a single plank changes the identity of the ship or if it does not. Again we end up in the same strange position. In the most extreme case if a single plank of the ship is retained and all the other parts are burned all the other pieces could be replaced and the ship would be the same. In an even more extreme example, the plank could be whittled into a shovel and the shovel would also be the Ship of Theseus. Here it may also help to recall Hawley’s other examples, a restaurant, a bicycle, a brain surgery patient, and a fetus. In all of these cases the question remains open as to whether the entity at the start is the same as the entity after a significant change.

Here one might respond that there is no vagueness here as the identity conditions of the ship are more than just the planks that make it up. One potential response is that there is something non-physical that the planks give rise to.\(^7\) One possibility is that the concept of the ship that is in the minds of the crew may contribute to the identity conditions, however this seems to be as equally problematic. If the planks arranged Ship-of-Theseus-wise give rise to a mental concept “Ship of Theseus” in the minds of the crew, then the reassembled parts that were discarded would also give rise to the same mental concept.

There are a number of interrelated issues here that are all difficult to contend with. For this paper though, I believe that vague persistence is at the very least a plausible concept that a theory of persistence should be able to contend with in some way. As such, I will now move on to the second premise of the trilemma, semantic vagueness.

\(^7\)In part I am relying on notions of personal identity and ideas of either a soul or some other intangible element that is suggested in addition to the body.
2.0.2 Semantic Vagueness

Given that vague persistence is something to be accounted for by any theory of persistence, I move now to the second premise of Hawley’s argument: the correct way of handling vagueness is semantically. To do this, I move through the three positions on vagueness as presented by Timothy Williamson in his book *Vagueness*. These views, in decreasing order of strength are, ontic, semantic, and epistemic vagueness. Hawley contends that the correct vision of vagueness is semantic and that the endurance theorist is not able to avail themselves of it, rather they are relegated to appealing only to epistemic vagueness. I will now work through each of these views, paying particular attention to how Hawley argues that endurance can only appeal to epistemic vagueness.

Epistemic vagueness is the view that vagueness is simply a matter of limited knowledge. Either we lack knowledge about how a term is precisely defined, or we lack the knowledge about the world to see if that term applies. More specifically, either (*i*) we know the definition of a predicate exactly and do not know whether that precise definition has been met, or (*ii*) we know the exact conditions of the world, but do not know the exact definition of the predicate in question. One example of this is again the case of the pile. On the one hand, we could have an exact definition of a pile, e.g., “a pile consists of any collection of grains greater than or equal to 80,” but not know the exact number of grains in the collection in front of us. On the other hand, we might know that we have exactly 79 grains, but be ignorant of the definition of the term. On this picture the question of vagueness is perhaps the simplest, whether $x_{t_1}$ is identical to $x_{t_2}$ will be definitively true or false, but our knowledge of the facts will be lacking. We will not be able to say that they are identical, but only on the basis of our limited knowledge.

Although this view is plausible, Hawley argues, and I agree, that epistemic vagueness is too weak to be able to truly capture our intuitions about vagueness. If it is the case that

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8As ontic vagueness does not figure into this paper, I briefly discuss it here. Ontic vagueness is the concept that the conditions of the world are inherently vague. A term like “pile” is difficult to nail down precisely because it refers to something that is not precise in the world.
vagueness is entirely epistemic, it would also seem to be the case that one could remove the
evagueness by more thoroughly examining the details. However, this does not seem to be the
case with something like “pile” or the Ship of Theseus. For example, the vagueness in
regards to the pile could be cleared up if we knew more. Taking the above examples, the
specific definition of a pile is 80 or more grains, and the collection we have has 79 grains,
therefore it is not a pile. On the other hand, if vagueness is in principle unknowable it seems
that there is something more going on than just our knowledge. Perhaps the ontological
conditions are themselves vague, or the reference of the term is indeterminate. Given this,
epistemic vagueness does not seem to be able to capture our intuitions correctly and as such
should be the last resort in explaining vague persistence.

The second view of vagueness that I explore is that of semantic vagueness. Semantic
vagueness is the view that vagueness derives from imprecision in the terms and predicates
that we are using. That is to say that when we assert that “x is a pile” there is a level of
imprecision inherent in the term “pile”. In cases like this we might say, “I know it when I see
it.” In these situations there are cases where the term will definitely apply, a collection of
500 grains, and cases where the term definitely won’t apply, a single grain, and those cases
where it is unclear whether the term applies or not.

Semantic vagueness allows us to explain vague persistence by making appeal to the
terms of our statements. For example, at $t_1$ the term definitely applies, at $t_3$ the term
does not apply, and at $t_2$ it is unclear whether the term applies or not. We will return
to this notion later when looking at Hawley’s argument against the endurance theory from
determinate reference.

An additional point in favor of semantic vagueness is that it is compatible with both
ontic and epistemic vagueness. If the term “pile” is such that it has rigid ontology but
our term is vague we have a case of vagueness, but additionally our term could be vague
because the ontology is vague. The same goes for epistemic vagueness, we could have perfect
knowledge of the situation and still have vagueness in the terms, or we could have precise
terms but imprecise knowledge.

Semantic vagueness is the best theory of vagueness because it not only captures our intuitions about vagueness but also is able to account for the possibility of vagueness in either of the other theories. Our two first premises are established as correct. If there is an error to be found in Hawley’s trilemma then it must be in the final premise, that endurance cannot account for vagueness semantically. I move now to look at the endurance theory and how Hawley argues that it cannot contend with semantic vagueness.

2.0.3 Endurance Theory

An entity’s persistence through time seems to be a given. I put my iPad down to get a drink, come back in a few minutes and the iPad is still right where I left it. I went for a walk about an hour ago and now I am typing. It seems intuitive that the person walking an hour ago and the person now typing is the same person. What then is the best theory to explain this phenomenon? The common sense theory is that there is a single entity, called “Seth”, that was walking an hour ago, is now typing, and that these are the same entity. More specifically that entity is able to walk at one time and type at a later time by moving through time as a single whole present at each intervening moment. This theory, the endurance theory, is perhaps the oldest and most common theory, and it prima facie, the most plausible theory. That said, there are other proposed theories of persistence namely the perdurance theory and the stage-theory. I will look at each of these in turn.

When I think of myself spatially, I can think of the total space that I take up, or I can subdivide that space into smaller parts. There is the part up here that my head fills, and there are the parts down there that my feet fill. These are all parts of the same space, that which I occupy, but they can be conceptually subdivided into smaller parts. The perdurance theory states that a temporal entity is similar to this spatial concept. That is to say that there is an entity that is the totality of “Seth” that stretches throughout the whole of times at which “Seth” exists. This entity is then conceptually subdivided into moments in time.
Stage-theory states that an entity is wholly present at each moment in time at which it exists, similar to the endurance view. However, this entity does not move through time; rather there are many momentary entities, strictly speaking, that relate to each other in such a way that it gives rise to the idea that there is temporal movement.

There is a lot of debate over which of these theories is correct. Many of the arguments are interesting and deserve the attention that they have received but I will here only look to motivate endurance theory. To that end, the first point in endurance’s favor is that it is the more intuitive view. In contrast, both perdurance and stage-theory seem to lead to some rather counter-intuitive conclusions. As Thomas Hofweber and J. David Velleman put it, the perdurance theory seems to imply that “[a]ll that exists at a moment in time is a temporal part of oneself, analogous to the tip of one’s nose or the centre of one’s navel. One certainly feels more complete than a nose or a navel, even at a single moment in time.” If the perdurance theory is correct then at this moment in time I am not wholly here. (On the stage-theory, I am wholly present, but only momentarily.) There are parts of me that are strung out all along my timeline receding into the past. This seems counterintuitive. It seems more plausible that I am wholly present rather than momentarily or partially present.

Another point in favor of endurance is that perdurance and stage-theory seem to imply that objects do not change, at least not in the way that we ordinarily think of change. It seems intuitive that one should be able to say that I have longer hair than I did two years ago. (By looking at pictures of me then and now this should be apparent.) However, if the perdurance picture — or stage-theory picture — is correct, then it seems not to be the case that I possess the property of “being longhaired” simpliciter now and “being shorthaired” simpliciter then.

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9 For more on these theories and other arguments for and against the various theories both Hawley (2001) and Sider (2001) offer excellent treatments of all of these theories.


11 There are some that would also argue that this also implies that there are temporal parts that are proceeding into the future.

12 There are many potential arguments here, but I will set them aside to continue with the central focus of the paper.
On the perdurance picture, I possess both the property of “being longhaired” and “being shorthaired” in virtue of having an earlier part that is shorthaired and a present part that is longhaired. (Or that one stage possesses the one and another stage possesses the other.) So when looked at atemporally, it seems that I, as a whole, do not change, but only appear to change, in virtue of differences in the properties that my various parts (or temporal counterparts) have.

Endurance theory is the view that best reflects our initial intuitions about persistence. It also has the least obscure consequences regarding ontology. I contend that unless endurance theory can be shown to fail to account for persistence, then it ought to be retained as the antecedently most plausible view.

2.0.4 The Structure of the Trilemma

Throughout the previous sections, I have argued that Hawley’s first and second premises are *prima facie* true. If so any theory of persistence must be able to account for vague persistence, and the best way to account for vagueness is semantically. I also began to look at premise (3), that endurance theory cannot account for semantic vagueness. In this section, I look more specifically at premise (3) and see exactly how it is that Hawley argues that endurance theory is incompatible with semantically accounted vague persistence.

To make her argument against endurance from vague persistence Hawley makes appeal to the example of the fiendish cabinet. In this example an entity, Alpha, enters the cabinet. The cabinet then scrambles the identity conditions of that entity in such a way that when Omega exits the cabinet the statement “Alpha is identical to Omega”, is indeterminate. This prompts the question, why is “Alpha is identical to Omega” indeterminate. Hawley states the following:

Can endurance theorists trace this indeterminacy to semantic indecision? There seem to be two options: either ‘is identical to’ has an underspecified meaning, or else the names in question do not have definite referents . . . The first option is unattractive: have we really failed to decide which relation is the semantic value of ‘identity’? What could the candidate relations possibly be, and how
could this idea fit with the endurance theory claim that persistence is a matter of identity? Endurance theorists are better advised to locate semantic indecision in the names ‘Alpha’ and ‘Omega’.\textsuperscript{13}

For Hawley there are two places that we can locate vagueness, either in the identity relation or in the names “Alpha” and “Omega”. I will return in a moment to whether or not indeterminacy can be located in the identity relation, but for now, I will look at Hawley’s argument that the endurance theorist cannot locate vagueness in the names.

Hawley argues that to locate the indeterminacy in the names “Alpha” and “Omega” is to claim that these terms do not have determinate reference.\textsuperscript{14} This is problematic for the endurance theorist. If the name “Alpha” does not have determinate reference then at the moment before Alpha enters the cabinet there are at minimum two entities to which “Alpha” could refer. This is due to the fact that if the name “Alpha” does not refer determinately, there must be at least two entities to which it could refer. This position that there is more than one entity that “Alpha” could refer to allows the indeterminacy to be in the names provided that one of the candidates is the same entity to which “Omega” refers. This is, however, problematic for the endurance theorist. For the endurance theorist to make this claim they must say that at the moment before entering the cabinet there are at least two wholly present entities that are picked out by the name “Alpha”, and that is contrary to the endurance theorist’s picture. And similar considerations apply to “Omega.”

In this first part of the argument, Hawley is correct. It is not possible to semantically account for “Alpha” determinately referring to a single three-dimensional object, and “Omega” determinately referring to a single three-dimensional object when the identity relation is rigidly fixed as Hawley thinks that it is. Given this, if there is nothing more to this argument, then the endurance theory would fail on the semantic account of vagueness.\textsuperscript{15}

However, Hawley moves too quickly over the identity relation. I argue that by locating vague-

\textsuperscript{13}Hawley, \textit{How Things Persist}, 131–132
\textsuperscript{14}Hawley, \textit{How Things Persist}, 132
\textsuperscript{15}Whether or not the correct position to reject is endurance theory will not be argued here. There may be reason to think that vague persistence is the better position to reject, but as I am responding to Hawley’s argument against endurance theory I will leave that argument to the side.
ness in the identity relation, the endurance theory is able to account for vague persistence semantically.
CHAPTER 3

UNDERLYING TECHNICAL ASSUMPTIONS

In this section, I show that Hawley relies on an underlying theoretical assumption of classical logic to make her case against the endurance theory. Although Hawley does not give a specific definition of the identity condition that she is working with, I believe that we can reconstruct the definition from various statements that she makes throughout the book. She states early on in the book that some of the problems that plague the endurance theory are caused by the “inflexible nature of the identity relation.”\(^1\) This inflexibility seems to stem from what she asserts later that endurance theorists suppose that the only ‘suitable relation’ which binds stages together to make objects is the relation of identity, a relation which, as Evans has shown, must be all-or-nothing.”\(^2\) This claim regarding Gareth Evans is based on the argument against ontic vagueness (as it relates to endurance theory) that she reconstructs:\(^3\)

(10) It is indeterminate whether Alpha steps out of the Cabinet (premise)
(11) Alpha is such that it is indeterminate whether she steps out of the Cabinet (from 10)
(12) It is not indeterminate whether Omega steps out of the Cabinet (premise)
(13) Omega is not such that it is indeterminate whether she steps out of the Cabinet (from 12)
(14) Alpha is not identical to Omega (from 11, 13, and Leibniz’s Law)

This argument against ontic vagueness from Evans relies on Leibniz’s Law. This argument contends that because it is indeterminate whether Alpha emerges from the cabinet, but it is

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\(^1\)Hawley, *How Things Persist*, 43
\(^2\)Hawley, *How Things Persist*, 137
\(^3\)Hawley, *How Things Persist*, 119 I have changed the numbering for the sake of consistency.
not indeterminate that Omega emerges, then it cannot be the case that Alpha and Omega are identical. A subproof in this argument can be constructed as follows: (For a more technical reconstruction see page 33.)

(15) For any \( x \) and any \( y \), if \( x \) and \( y \) are identical, then any property possessed by \( x \) will be possessed by \( y \). (Premise - Leibniz’s Law)

(16) It is not determinate that Alpha emerges from the cabinet. (Premise)

(17) It is determinately the case that Omega emerges from the cabinet. (Premise)

(18) Assume for the sake of argument that Alpha and Omega are identical. (ARAA)

(19) From (15) and (18) we can conclude that Alpha and Omega possess all the same properties. (15, 18 MP)

(20) It is determinate that Alpha emerges from the cabinet. (19)

(21) It is determinate and indeterminate that Alpha emerges from the cabinet. (16, 20)

(22) It must not be the case that Alpha is identical to Omega. (18, 21 RAA)

This subproof shows that classical logic is at work in Hawley’s construction of identity. Classical logic holds to the law of the excluded middle. (A law that is not assumed by some non-classical logics.) It is the law of excluded middle that makes the above proof work. To argue with a reductio ad absurdum there is need for a contradiction. Take \( \neg(p \land \neg p) \), this can be transposed into \( \neg p \lor \neg \neg p \), or \( \neg p \lor p \). Classical contradictions rely on the use of the law of the excluded middle.

Given that Hawley’s argument against endurance theory relies on classical logic, I now move on to show that one need not assume classical logic to argue using the identity relation. If this program succeeds then Hawley’s argument against the endurance theory will no longer work.

\footnote{One caveat here is that Leibniz’s Law states that if two things are identical, then they will have all the same properties. I am here only evaluating the one property, but for the purposes of argument we can assume that all other properties are shared.}
3.0.1 Non-Classical Logics

In this section, I explore whether or not the identity relation can be formally evaluated on a non-classical theoretical structure. I first look at Susan Haack’s arguments for the legitimacy of non-classical logics and then move on to evaluate a trivalent logic and a continuum logic.

In her book, *Deviant Logic, Fuzzy Logic: Beyond the Formalism*, Susan Haack argues for what she calls “a ‘pragmatist’ conception of logic ...”5 On this pragmatist view, “logic is a theory, a theory on par ... with other, ‘scientific’ theories; and to which choice of logic, ... is to be made on the basis of an assessment of the economy, coherence and simplicity of the overall belief set.”6 This is similar to the way that certain scientific theories will seem *prima facie* implausible, but will be accepted based on their ability to account for the data in the simplest way.

Haack argues that there are times that non-standard systems of logic are developed for (i) “purely formal interest,” but perhaps more often from (ii) “the belief that classical logic is in some way mistaken or inadequate.”7 This is not to say that one should develop a nonclassical logic for every instance of an unwanted conclusion. Rather, only when there are “unacceptable consequences” with the “conjunction of classical logic with other well-entrenched beliefs, and to the advantages, in terms of simplicity and economy, of modification of the logical rather than some other beliefs.”8 That is to say that when one has well-founded beliefs regarding certain phenomena and those beliefs seem to be in tension with a classical logical theory one may be justified in exploring a non-classical logic as an alternative.

I explore two possible nonclassical logics that I believe can contend with vague persistence.

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6Haack, *Deviant Logic, Fuzzy Logic*, 41
7Haack, *Deviant Logic, Fuzzy Logic*, 1
8Haack, *Deviant Logic, Fuzzy Logic*, 26
3.0.1.1 Trivalent

Merrie Bergmann begins her book on non-classical logic by looking at the problem of vagueness and how it gives rise to problems on a classical interpretation. She then moves on to evaluate a few different possible theories of logic that can account for vagueness. The first is Stephen Kleene’s Strong Three-Valued logic. On a trivalent theory a statement can be given the values, true (1), false (0), or indeterminate (i). Kleene gave the following truth tables for his Strong trivalent logic:  

<table>
<thead>
<tr>
<th>$f_\neg$</th>
<th>$f_\land$</th>
<th>$f_\lor$</th>
<th>$f_\rightarrow$</th>
<th>$f_\leftrightarrow$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>i</td>
<td>i</td>
<td>i</td>
<td>i</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Before moving on to see how to use a trivalent logic for the identity relation, I will look at another possible interpretation of a trivalent logic.

Jan Łukasiewicz offered a slightly different evaluation of the tables for the conditional and the biconditional:  

<table>
<thead>
<tr>
<th>$f_\rightarrow$</th>
<th>$f_\leftrightarrow$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>i</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

In these tables the value for $i \rightarrow i$, and $i \leftrightarrow i$, are valued as 1. This follows from the same reasoning as when both values are true or false on the classical operators. It seems intuitive that “IF $x$ THEN $x$” will always be true as long as the value of both variables is the same. Łukasiewicz captures this in his trivalent system.

In trying to offer an alternative to the classical interpretation of identity, let us return to the Ship of Theseus case and see if by using a trivalent logic we can redefine the identity.

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9Bergmann, 72  
10Bergmann, *An introduction to many-valued and fuzzy logic*, 77
Call the ship that leaves Athens “Theseus$_a$” and the ship that returns “Theseus$_b$”. Remember that in the original case the question of whether “Theseus$_a$ is identical to Theseus$_a$” is indeterminate. In the previous proof I used the construction of Leibniz’s Law as $\forall x[\forall y[(x = y) \rightarrow \forall P[Px \leftrightarrow Py]]]$. This construction will not work, in this case, as we cannot assume that Theseus$_a$ and Theseus$_b$ are identical because (i) this will not accomplish the goal, and (ii) our intuition is that it is indeterminate. As such I will use another, similar, construction of Leibniz’s Law, $\forall P[\forall x[\forall y[(Px \leftrightarrow Py) \rightarrow (x = y)]]]$ Using this construction, is there a way that we can make this statement true? Let me stipulate that $L_{a_1}$ means that “Theseus$_a$ leaves Athens is determinately true,” and that $L_{b_1}$ means that “Theseus$_b$ leaves Athens is indeterminate.” Now, what then is the value of $L_{a_1} \leftrightarrow L_{b_1}$, and what does this imply for the identity of Theseus$_a$ and Theseus$_b$? (For a more technical reconstruction see page 33.)

23. Based on Łukasiewicz’s truth tables, $L_{a_1} \leftrightarrow L_{b_1}$ is indeterminate.

24. Following from this, $(L_{a_1} \leftrightarrow L_{b_1}) \rightarrow (a_1 = b_1)$ comes out true only when the equivalence is also indeterminate.

At first glance this does not seem to be a substantial result, all that I have shown is what we concluded originally, it is indeterminate as to whether Theseus$_a$ is identical to Theseus$_b$. However, this is the first step in the right direction. Even though it seems that all that can be achieved by assuming a trivalent theoretical structure is that we can semantically articulate that an indeterminate identity relation is, in fact, indeterminate, I have shown that there are alternatives to a classical logic for the identity relation. This is however not completely sufficient. I now move on to look at a continuum logic and whether it can offer a better alternative as a theoretical framework.

3.0.1.2 Continuum

In the previous section, I demonstrated that a trivalent logic can give an alternative semantics for the identity relation. In this section, I argue that a continuum logic is better
equipped as a theoretical framework for the identity relation as it relates to vague persistence.

Where a trivalent logic gives a single value to the penumbral space between true and false, a continuum logic builds on this interpretation and offers that there are in fact an infinite range of values that can be assigned between true and false. For any statement $p$, the value of $p$, $[p]$, will be a number from 0 to 1. On this interpretation a determinately true statement, Theseus left Athens, $T$, will be valued at 1, $[T] = 1$. A determinately false statement will be valued at 0, $[\neg T] = 0$. A simple case of this type of reasoning would be the progression of a perfect gradient between black and white. Take a square that is wholly black at the beginning of the experiment and transitions to white over the course of one minute. We can conclude the following:

(25) At $t_1$ “the square is black,” will be determinately true. $[B] = 1$
(26) At $t_2$ “the square is white,” will be determinately true. $[W] = 1$
(27) At any point between $t_1$ and $t_2$ $[B]$ and $[W]$ will be greater than 0, and less than 1.
(28) At the exact middle point from black to white, $[B] \leq [W]$ when $W$ is at least as true as $B$.

The example of color is a good way to start with a continuum due to the fact that we are very familiar with the idea of a greyscale and how any particular shade of grey can be created by mixing black and white in varying quantities. The question now is whether this same intuition can be applied to the identity relation.

Before moving on to that argument, I first walk through one theoretical way of reasoning with a continuum logic. Williamson offers a semantic interpretation for a continuum logic. I here walk through some of the main points of that system.

The first intuition that Williamson relies on is that the value of the conjunction of a statement and itself will be equal to or less than the value of the statement itself. $B_{t_1}$ is just as true as $(B_{t_1} \land B_{t_1})$.

$$(\land_1) [p] \leq [p \land p]$$

\footnotesize
11Williamson, \textit{Vagueness}, 114
12Williamson, \textit{Vagueness}, 115
Given this, the value of a conjunction of two statements will be no more true than either of the individual statements. The value of $B \land W$ cannot be greater than the value of $B$ or $W$.

$$(\land_2) \ [p \land q] \leq [p] \text{ and } [p \land q] \leq [q]^13$$

The third intuition that Williamson draws on is that if $x$ is less than or equal to $y$, and $z$ is less than or equal to $w$, then the conjunction of $x$ and $z$ will be less than or equal to the conjunction of $y$ and $w$.

An example of this would be that if $Bt_n$ is no more true than $Wt_n$, and $Bt_{n+1}$ is no more true than $Wt_{n+1}$ then the conjunction of $Bt_n \land Bt_{n+1}$ will be no more true than $Wt_n \land Wt_{n+1}$

$$(\land_3) \ \text{If } [p'] \leq [p] \text{ and } [q'] \leq [q] \text{ then } [p' \land q'] \leq [p \land q]^14$$

Taking all of these statements together Williamson argues that the value of $p \land q$ will be equal to the minimum value of $p$, and $q$.

$$(\land) \ [p \land q] = \min \{[p],[q]\}^15$$

Similarly for a disjunction there are three intuitions that Williamson draws on:\(^16\)

(i) The value of $(p \lor p)$ will not be greater than the value of $p$.

$$(\lor_1) \ [p \lor p] \leq [p]^17$$

(ii) The value of $p \lor q$ will not be greater than either the value of $p$ or the value of $q$.

$$(\lor_2) \ [p] \leq [p \lor q] \text{ and } [q] \leq [p \lor q]^18$$

(iii) If the value of $p'$ is no greater than the value of $p$, and the value of $q'$ is no greater than the value of $q$, then the value of $p' \lor q'$ will be no greater than the value of $p \lor q$

$$(\lor_3) \ \text{If } [p'] \leq [p] \text{ and } [q'] \leq [q] \text{ then } [p' \lor q'] \leq [p \lor q]^19$$

Following from these points we can conclude that:

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13 Williamson, *Vagueness*, 115  
14 Williamson, *Vagueness*, 115  
15 Williamson, *Vagueness*, 115  
16 Williamson, *Vagueness*, 116  
17 Williamson, *Vagueness*, 116  
18 Williamson, *Vagueness*, 116  
19 Williamson, *Vagueness*, 116
Williamson then offers a semantic interpretation of the conditional and bi-conditional.

\[
(\rightarrow) \ [p \rightarrow q] = 1 + \min\{[p], [q]\} - [p]^21 \\
(\leftrightarrow) \ [p \leftrightarrow q] = 1 + \min\{[p], [q]\} - \max\{[p], [q]\}^22
\]

Now that we have the semantic structure of the continuum logic in place. I turn to examine how this can be used to reinterpret the identity relation. Remember that Hawley argues that the endurance theorist must locate vagueness in the names “Alpha” and “Omega” because the identity relation does not admit vagueness. I have shown that there are in fact ways in which the identity relation can be made to admit vagueness, and I will now demonstrate how this will work in the case of a continuum and the case of the fiendish cabinet.

(29) Let \( I \) stand for “...entered the cabinet.”
(30) Let \( E \) stand for “...exited the cabinet.”
(31) Let \( a \) stand for Alpha
(32) Let \( o \) stand for Omega
(33) \( Ia \) is determinately true, \( [Ia] = 1 \)
(34) \( Ea \) is indeterminate, \( [Ia] < 1 \)
(35) \( Io \) is indeterminate, \( [Io] < 1 \)
(36) \( Eo \) is determinately true, \( [Eo] = 1 \)
(37) \( \forall P \forall x \forall y ((Px \leftrightarrow Py) \rightarrow (x = y)) \)
(38) \( [Ia \leftrightarrow Io] = [Io] \)

What this proof shows is that the value of “Alpha entered the cabinet and Omega entered the cabinet” will be valued the same as the statement that “Omega entered the cabinet.”

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20Williamson, Vagueness, 116
21Williamson, Vagueness, 117
22Williamson, Vagueness, 117
The purpose of this is to show that there is an alternative semantics to exploring the identity relation. On a continuum, the next question would be what is the value of this indeterminacy. Although I think that there could be an answer to this issue, I instead focus on the fact that by using a continuum we can respond to the original problem of Hawley.

Recall that for Hawley the trilemma leaves an endurance theorist with two options, “either ‘is identical to’ has an underspecified meaning, or else the names in question do not have definite referents.” Hawley argued that it is implausible that the definition of ‘is identical to’ would not be fixed and as such the only room for the indeterminacy is in the names. By appealing to a continuum valued understanding of the identity relation the possibility of vagueness is reintroduced. Now the vagueness of “Alpha is identical to Omega” is opened to being located in either the names, or the identity relation.

\(^{23}\) Hawley, *How Things Persist*, 131–132
CHAPTER 4

OBJECTIONS AND REPLIES

Although there are many avenues that a detractor of endurance theory may raise to the arguments that I have presented, I will focus on objections that are related to the logical and semantic aspects. I will leave off any points against the endurance theory that do not relate to the logical or semantic. First I will look at a potential reply from Hawley, from the notion that there is a need for a change in our semantics relating to persistence, but that this change is better accounted for within perdurance or stage-theory. The second and third objections are inter-related. Williamson argues that a many-valued semantics should not be invoked to deal with vagueness as it puts pressure on classical logic. Although I have already argued for a change of logics, I will strengthen the position by looking at a criticism from Haack, who argues that vagueness is not a sufficient reason to adopt a deviant logic. If I can defend the position that vagueness is a valid reason to adopt a deviant logic, then Williamson’s argument will be rejected as well.

4.0.1 Hawley’s Objection

For Hawley, the identity relation is a rigid semantic predicate that links one entity at a time to that same entity at the same time or another time. She argues that this is problematic for the endurance theorist as it means that endurance cannot account for vagueness semantically. Perdurance does not suffer from this objection because the vagueness in a statement like “Alpha is identical to Omega” comes in with how we carve up the names “Alpha” and “Omega”. In the cabinet case the entity that enters the cabinet may, in fact, be the same as the one that leaves the cabinet, but what is indeterminate is to what the names apply. Stage-theory avoids the objection entirely by saying that there are not in fact
two things that should be linked as identical; rather there are two entirely separate entities
that bear a particular relation to each other that is typically (though mistakenly) construed
as being the identity relation. On this view, neither perdurance nor stage-theory needs to
alter the identity relation to account for the indecision that is taking place.

Hawley does acknowledge that there will be ways in which our ordinary talk will
need to be altered to account for a four-dimensional view. “But we are then faced with the
question of how our ordinary thought and talk about material objects . . . can be successful in
a four-dimensional world.”\(^1\) However, according to Hawley this way of altering our ordinary
talk is better than altering the identity relation.

For the perdurance theorist the statement that “Alpha is identical to Omega” can
be accounted for by arguing that the names “Alpha” and “Omega” refer to determinate
objects and that the vagueness is whether these determinate objects are part of the same
space-time worm. On this view, the identity relation does not determinately refer to parts of
the space-time worms, but to the entirety of the worm. The question is like asking whether
the part of the ruler next to the 0 is the same as the part of the ruler by the 12. The answer is
clearly no, but it is the wrong question. The right question is whether “the ruler is identical
to the ruler” which is clearly true. This helps to solve the problem because the way that we
ordinarily talk about entities being identical to each other is only a way of talking about
conceptual divisions of an entire entity.

Stage-theory takes a different approach and again states that the question of whether
momentary instance \(x\) is identical to momentary instance \(y\) is the wrong question. On this
view, it is like asking whether the first domino in a string is the same as the last one in the
string. Clearly they are not identical, but again the question is wrong because the interesting
relation is not whether part \(x\) is identical to part \(y\) but whether \(x\) and \(y\) are members of the
same string.

Both of these views avoid the problem of redefining the identity relation by appealing

\(^1\)Hawley, *How Things Persist*, 45
to an alternative way of altering the typical semantics of talking about persistent entities, but are these the right ways of going about this? I contend that it is not. On the continuum view that I have presented the question of whether “Alpha is identical to Omega” can be evaluated on a degree of truth. There may or may not be a determinate fact of the matter, but if there is, a continuum logic can get closer to this than either a perdurance or stage-theory interpretation. On the perdurance picture, the statement is vague because the names “Alpha” and “Omega” cannot be determinate references to an entity; otherwise, the vagueness would be cleared up. On the endurance-continuum view both “Alpha” and “Omega” do determinately refer, and the vagueness is whether or not they determinately refer to the same entity. Stage-theory does not just punt on the question but states that the question is really irrelevant. Even if it was determined that “Alpha” and “Omega” refer to parts of the same string they are not, and never were identical and as such the question is irrelevant.

I contend that what is given up with a continuum logic concerning the semantics of the identity relation is not nearly as problematic as what is given up by appeal to a perdurance or stage-theory view. One example of this revolves around counting and reference. One of the reasons that stage-theory was developed as a theory of persistence was to avoid issues of counting and reference that came out of critical analysis of the perdurance theory. Briefly, perdurance has the problem that when trying to count the number of objects present at a moment in time there are some tricky results. Take a fission case, there is a single entity at \( t_1 \) that separates into two entities at \( t_3 \). How many entities are present at \( t_2 \)? For a perdurance theorist the answer to this has to be two, even though the intuitive answer is that there is only the one thing.

Stage-theory was in part developed to give an answer to this kind of problem. If what is referred to are momentary instances the problem of fission and fusion cases is avoided. The thing at \( t_1 \) is just that thing. However, the stage-theory suffers from another problem of reference. What is referred to when the sentence, “the coffee cup that has been on the
table for an hour”, is uttered? There are potentially an infinite number of entities that are present in that span of time.

As a further point, the idea that the identity relation cannot be applied in all cases in exactly the same way, and therefore needs revision, is not unique to this paper. Thomas Reid in his response to John Locke’s notion of identity makes a distinction between notions of identity and how they can be applied in particular cases. Here I look into Reid’s argument.

Reid makes a distinction between personal identity and the identity of things. He argues that personal identity is so secure a concept that it cannot be questioned without “producing some degree of insanity.” He claims that “identity in general . . . [is] a relation between a thing which is known to exist at one time, and a thing which is known to have existed at another time.” And, that this concept “is too simple a notion to admit of logical definition.” This notion of identity, which we might call the mathematical notion of identity, is so simple and straightforward that it cannot be questioned or redefined. However, there is another notion of identity that is commonly talked about:

The identity . . . which we ascribe to bodies, whether natural or artificial, is not perfect identity; it is rather something which, for the conveniency of speech, we call identity. It admits of a great change of the subject, providing the change be gradual; sometimes, even of a total change. And the changes which in common language are made consistent with identity differ from those that are thought to destroy it, not in kind, but in number and degree. It has no fixed nature when applied to bodies; and questions about the identity of a body are very often questions about words.

Admittedly Reid would disagree with the way that I am redefining identity as he immediately after says, “But identity when applied to persons, has no ambiguity, and admits not of degrees, or of more or less. It is the foundation of all rights and obligations, and of all accountableness; and the notion of it is fixed and precise.” However, I think that his

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3 Reid, 108
4 Reid, 108
5 Reid, 112
6 Reid, 112
distinction is important and when properly understood supports the point I am making. Reid claims that there is a notion of identity that is so secure as to admit no doubt. This is the simple relation that he applies to persons and claims is the foundation of rights and obligations. But, if we look again at the type of entity that he is describing in the longer quotation I think we can see exactly what it is that I am arguing. There are entities that we call identical that admit of change, that we commonly call identical in the typical sense. These entities are the common objects of the world, tables, chairs, rocks, etc. Reid is unwilling to apply this notion of identity to persons because he believes that there is something about persons that makes them different from ordinary objects. The debates over personal identity are too many and too varied to get involved in here, but note that the theory that I am proposing is not strictly about persons. I am interested in the nature of persistence in and of itself. As such, Reid’s argument that there is another notion of identity that needs to be kept in mind is precisely what I am arguing.

Where Hawley contends that the endurance theorist cannot avail themselves of modifying the notion of identity I have shown that on multiple fronts the redefinition of the identity relation is a better alternative to the redefinition that is required of the perdurance or stage-theory views.

4.0.2 Williamson’s Objection

For Williamson, the problem with a continuum valued semantics for an object language is the problem of higher-order vagueness. Williamson uses the following statement as an example, “(#1) ‘It is wet’ is true to a degree greater than 0.729.” He argues that this is a vague statement because there are many contexts in which it is “neither clearly true nor clearly false.” This vagueness, he argues, comes from the idea that “[t]he mathematical terms in (♯1) may be precise, but the notion of the degree of truth of a sentence is not a mathematical one. It represents an empirically determined mapping from sentences in con-

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7Williamson, Vagueness, 128
8Williamson, Vagueness, 128
text to real numbers. Even if statistical surveys of native speaker judgements were relevant to deciding (#1), the results would be vague.”\textsuperscript{9}

Why is this a problem for Williamson? Because, he argues that it invalidates classical logic.

If a vague language requires a continuum-valued semantics, that should apply in particular to a vague meta-language. The vague meta-language will in turn have a vague meta-meta-language with a continuum-valued semantics, and so on all the way up the hierarchy of meta-languages. \ldots There is a problem. The many-valued semantics invalidates classical logic.\textsuperscript{10}

For Williamson the deployment of a many-valued semantics is intended to offer a stepped solution to the problem of vague predicates. The ideal situation is then to deploy a many-valued semantic interpretation of the vague object language that would then be interpreted on a classical meta-language. Put more succinctly:

\begin{center}
\begin{tikzcd}
\text{Classical Logic} \arrow{d} \\
\text{Many-Valued Semantics} \arrow{d} \\
\text{Vague Object Language}
\end{tikzcd}
\end{center}

For Williamson, this project fails because instead of ending in a classical logical interpretation the many-valued semantics resist a classical interpretation and will require further many-valued semantic layers \textit{ad infinitum}.

The first response that I have to Williamson is that his project seems to miss the reason for offering a many-valued semantics in the first place. The idea that vague predicates defy classical interpretation is precisely why a many-valued semantics is offered. Although I can understand the desire to ground such statements in a classical logic, I think that it

\textsuperscript{9}Williamson, \textit{Vagueness}, 128

\textsuperscript{10}Williamson, \textit{Vagueness}, 128
misses the point. A statement like “It is wet” will be a vague statement, and the intention behind a many-valued semantics is to allow for using such vague statements in reasoning. The underlying vagueness will not be eliminated, but I contend that it is not supposed to be eliminated.

The second response to Williamson is that his assumption that a system must be grounded in classical logic is incorrect. To better answer this, I turn to look at the objection from Haack. If my theory can stand against her objection, then the objection from classical logic will no longer be an issue.

4.0.3 Haack’s Objection

At the conclusion of her chapter on vagueness, Haack offers the following reconstruction of her argument against vagueness being a valid motivation for a deviant logic:

(1) Vague sentences may not be bivalent.

(2) They are, furthermore, within the scope of logic.

(3) However, a division of vague sentences into three classes — true, false, and neither, is liable to give results as counterintuitive as those consequent on the use of bivalent logic.

(4) And the programme advocated by Carnap, of ‘precisifying’ ordinary language arguments is feasible. For though replacing vague by precise expressions may lead to uncertainty due to inadequacies of measuring techniques, this uncertainty does not threaten bivalence.

(5) So it seems most economical not to modify logic to cope with vagueness, but rather to regard classical logic as an idealisation of which arguments in ordinary discourse fall short, but to which they can be approximated.\textsuperscript{11}

The points of this argument that I will focus on are (4) and (5). I argue that vague persistence is a case where precisification has been exhausted, and there is still vagueness at work, and given this, a deviant logic should be offered as it will be the most economical.

\textsuperscript{11}Haack, \textit{Deviant logic, fuzzy logic}, 125
The first point that Haack makes for this argument is that there are two ways of viewing uncertainty as to whether or not a particular predicate applies in a particular situation,

(1) The qualifications for being $F$ are imprecise.

(2) The qualifications for being $F$ are precise, but there is difficulty in determining whether certain cases satisfy them.\(^{12}\)

She argues that type (2) uncertainty does not constitute a case that would necessitate a deviant logic. A statement that exemplifies type (2) uncertainty is “$x$ is exactly 3.001 cm long.” This extremely precise predicate is one that would be difficult to determine whether or not it applies in a situation, but this is not a problem of vague application rather it is a case of needing more precise tools.

What then is the status of type (1) uncertainty? Firstly there needs to be a better definition of the term “imprecise” is included in the statement. Therefore, Haack offers the following ways that (1) can be better defined:

(a) The qualifications are complex . . . and it is indeterminate how many of the qualifications must be satisfied, and how the qualifications are to be weighed.

(b) The qualifications are complex, and in certain cases conflicting.

(c) The qualifications are simple, but in certain cases it is indeterminate whether the conditions, or one of the conditions, is satisfied.\(^{13}\)

Given this, if it were possible for a predicate to actually fall into one of these categories, then there would be a reason to think that a deviant logic would be applicable. However, Haack argues that, given the proper precisification, no predicate will actually fall into one of these categories.

Let us return to the statement that has been of central focus to the paper, “Alpha is identical to Omega.” As I argued earlier, the endurance theorist is committed to the idea

\(^{12}\)Haack, *Deviant Logic, Fuzzy Logic*, 110

\(^{13}\)Haack, *Deviant Logic, Fuzzy Logic*, 111

*Italics in the original.*
that the name “Alpha” and “Omega” are determinately referential, and it was the contention of Hawley that the endurance theorist cannot account for vague persistence semantically because the identity relation is too rigid to admit vagueness. It is exactly when the terms of this sentence are precisified that vagueness emerges.

What I conclude is that the terms involved in “Alpha is identical to Omega” are sufficiently precise, given determinate reference and a classical interpretation of identity and that vagueness is still present. As such, I argue that vague persistence is precisely the type of situation that would make a deviant logic a valid solution for more simply and adequately dealing with the data at hand. This shows that Haack’s objection is not directed at the vagueness of persistence; given that, a deviant logic is permissible and so Williamson’s objection also not a concern here.
CHAPTER 5

CONCLUSION

Hawley argues that when trying to contend with vague persistence, the endurance theory is unable to account for vagueness semantically. This inability comes from the presumption that the identity relation is a fixedly bivalent relation. I have shown here that there are alternative ways to define the identity relation than on a bivalent picture. Given this, I have argued that the trilemma of Hawley falls away as an objection to the endurance theory.

One area that this paper has not been able to explore, but that I contend needs further analysis, is that the identity relation has been historically interpreted in a way that presupposes bivalence. This assumption is one that requires greater exploration to understand better the historical and philosophical traditions that surround the identity relation.

Another element that has not been dealt with in this paper is objections to the endurance theory that may come from other realms of discourse. I am in no way attempting to say that this paper has shown that all of the objections to the endurance theory have been answered only that if one who is an endurance theorist was motivated by Hawley’s concerns, they need no longer be.


Reid, Thomas in Perry, John *Personal Identity.* (Berkeley: University of California Press, 2008).


APPENDICES
Hawley’s Reliance on Classical Logic

Let $P$ be a variable for any predicate.

Let $D$ stand for “it is determinate that ... emerged from the cabinet”

Let $a$ stand for “Alpha”

Let $o$ stand for “Omega”

\[ \begin{align*}
1 & \quad \forall x[\forall y[(x = y) \rightarrow \forall P[Px \leftrightarrow Py]]] & \text{Premise 1 - Leibniz’s Law} \\
2 & \quad \neg Da & \text{Premise 2} \\
3 & \quad Do & \text{Premise 3} \\
4 & \quad (a = o) & \text{ARAA} \\
5 & \quad \forall y[(a = y) \rightarrow \forall P[Pa \leftrightarrow Py]] & 1, \text{Universal Elimination} \\
6 & \quad (a = o) \rightarrow \forall P[Pa \leftrightarrow Po] & 5, \text{Universal Elimination} \\
7 & \quad (a = o) \rightarrow (Da \leftrightarrow Do) & 6, \text{Universal Elimination} \\
8 & \quad (Da \leftrightarrow Do) & 2,7 \text{ MP} \\
9 & \quad (Da \rightarrow Do) \land (Do \rightarrow Da) & 8, \leftrightarrow \text{ def} \\
10 & \quad Do \rightarrow Da & 9, \land \text{ E} \\
11 & \quad Da & 3,10 \text{ MP} \\
12 & \quad \neg(a = o) & 2,4,11 \text{ RAA}
\end{align*} \]

Trivalent Logic Proof of the Indeterminacy of Identity

\[ \begin{align*}
1 & \quad L_{a_1} \leftrightarrow L_{b_i} \\
2 & \quad (L_{a_1} \rightarrow L_{b_i}) \land (L_{b_i} \rightarrow L_{a_1}) \\
3 & \quad (L_{a_1} \rightarrow L_{b_i}) = i \\
4 & \quad (L_{b_i} \rightarrow L_{a_1}) = 1 \\
5 & \quad (L_{a_1} \leftrightarrow L_{b_i}) = i \\
6 & \quad \forall P[\forall x[\forall y[(Px \leftrightarrow Py) \rightarrow (x = y)]]] \\
7 & \quad \forall x[\forall y[(Lx \leftrightarrow Ly) \rightarrow (x = y)]] \\
8 & \quad \forall y[(La_1 \leftrightarrow Ly) \rightarrow (a_1 = y)] \\
9 & \quad (La_1 \leftrightarrow Lb_i) \rightarrow (a_1 = b_i) = 1
\end{align*} \]
Hawley’s Trilemma

Let $T$ stand for “...is a theory of persistence”

Let $V$ stand for “...accounts for vague persistence”

Let $S$ stand for “...accounts for vagueness semantically”

Let $e$ stand for “endurance theory”

1. $\forall x [Tx \rightarrow Vx]$ Premise
2. $\forall x [Vx \rightarrow Sx]$ Premise
3. $Te \rightarrow \neg Se$ Premise
4. $Te \rightarrow Ve$ 1. UE
5. $Ve \rightarrow Se$ 2. UE
6. $Te$ ARAA
7. $Ve$ 4., 6. MP
8. $Se$ 5., 7. MP
9. $\neg Se$ 3., 6. MP
10. $Se \land \neg Se$ 8., 9. $\land$ I
11. $\neg Te$ 6., 10. RAA
VITA

RESEARCH INTERESTS

Primary: Philosophy of Language, Philosophy of Logic, Logical Systems
Secondary: History of Analytic Philosophy, Medieval Philosophy, Metaphysics, Philosophy of Mind

EDUCATION

2016 — M.A. in Philosophy from the University of Mississippi Thesis: A Non-Classical Solution to Identity Over Time
2013 — B.Phil. in Philosophy from Saint John Vianney College Seminary
2011 — B.A. in Theatre Arts from Palm Beach Atlantic University

GRANTS AND FELLOWSHIPS

2015 – 2016 Graduate Writing Fellowship, University of Mississippi, Department of Writing and Rhetoric 2014 – 2015 Graduate Assistantship, University of Mississippi, Department of Philosophy and Religion

PRESENTATIONS

COMMENTARIES

  2015 – Response to Tom Lockhart’s “Re-evaluating Frege’s Anti-Psychologism” at University of Mississippi Colloquium Series

  Response to Valerie Hardcastle’s “Addiction, Chronic Illness, and Responsibility” at University of Mississippi Colloquium Series

  Response to Danielle Wylie’s “Reasoning in Moral Judgment” at University of Mississippi Colloquium Series

SERVICE


Logic Tutor 2014 – 2015 Testing Proctor, School of Liberal Arts, Student Disability Services

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