

## “Penumbral Connection”

Kit Fine introduces *penumbral connection* in his seminal paper “Vagueness, Truth and Logic”.<sup>1</sup> According to Fine, penumbral connections are “logical relations [that] hold between indefinite sentences.”<sup>2</sup> Here, indefinite sentences are sentences that are neither definitely true nor definitely false due to the vagueness of one or more term. What Fine means by ‘logical relations’ is a matter we must come to understand with respect to his theory of the logic and semantics of vagueness, which is called ‘supervaluationism’.<sup>3</sup>

In this paper, I analyze Fine’s account of penumbral connection and offer a clearer picture of penumbral connection in the light of my analysis. In §1, I provide some background on supervaluationism in order to situate properly Fine’s account of penumbral connection. In §2, I argue that supervaluationism over-generates the number of logical relations that count as exhibiting penumbral connection. I do this by discussing two logical relations that exhibit penumbral connections on Fine’s view before explaining why neither actually does. Next, in §3, I consider two examples of logical relations between indefinite sentences that do exhibit penumbral connections and then account for why Fine’s view falls short of expressing the connections exhibited in this second pair of examples. At the end of this section, I offer a refined picture of penumbral connection. Penumbral connections, I suggest, are material relations that hold between vague terms.

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<sup>1</sup> Fine, Kit (1975): “Vagueness, Truth and Logic” *Synthèse* (30) pp. 265-300. Fine (287) takes penumbral connections to be a “distinctive feature of [linguistic] vagueness”. It is notable that Fine no longer endorses the analysis of vagueness presented in his (1975). Although a new positive view from Fine has not yet appeared in print, the esteemed Professor has spoken about the old view’s problems and mistakes on a number of occasions (in a talk presented several times entitled “A New Approach to Vagueness”). For a very short recap of one version of this talk, see [http://philosophywiki.org/main/A\\_New\\_Approach\\_to\\_Vagueness](http://philosophywiki.org/main/A_New_Approach_to_Vagueness). In 2008, Fine offered a new perspective on vagueness in his paper “The Impossibility of Vagueness” (*Philosophical Perspectives* (22) pp. 111-136), however, penumbral connections are not mentioned and it is not clear what Fine might have to say about them now. Whatever Fine’s future views may be, “Vagueness, Truth and Logic” will forever remain the birthplace of discourse on penumbral connections.

<sup>2</sup> Fine (1975: 270).

<sup>3</sup> The backbone of supervaluationism goes back to Henryk Mehlberg’s 1956 book *The Reach of Science* (Toronto: University of Toronto Press), and it was redeveloped and named by Bas van Fraassen in his 1966 paper “Singular Terms, Truth-Value Gaps, and Free Logic” (*Journal of Philosophy* (63) pp. 481-495). See also van Fraassen (1968): “Presupposition, Implication, and Self-reference” *Journal of Philosophy* (65) pp. 136-152 as well as van Fraassen (1969): “Presuppositions, Supervaluations, and Free Logic” in Lambert, Karel (ed.) *The Logical Way of Doing Things* (New Haven, CT: Yale University Press) pp. 67-92.

Supervaluationism<sup>4</sup> is an analytical method built around the notion that sentences containing terms with indeterminate meanings admit a range of interpretations. Fine's supervaluationism is the first systematic version of supervaluationism designed for the analysis of vagueness.<sup>5</sup> Specifically, Fine uses the method of supervaluations to construct a three-valued semantic system capable of expressing linguistic vagueness.

According to Fine's system, which hereafter I'll just call 'supervaluationism', linguistic vagueness is a matter of semantic under-determination. Vague sentences admit a range of interpretations because the meanings of the vague terms they contain can be determined further.<sup>6</sup> For example, when we consider the predicate 'is bald', we can notice that there is a range of ways to draw the line between what counts as bald and what does not. Each way is a potential borderline. Fine refers to these potential borderlines as 'specifications'.<sup>7</sup>

In order to compute the truth value of a vague sentence, we begin by considering what truth-value the sentence would have in relation to each individual specification and then we assign a truth-value to the sentence for each specification. Here, a truth-value assignment is an

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<sup>4</sup> Those who pioneered the application of supervaluationism to vagueness in a less systematic way include David Lewis and J. A. W. Kamp. See Lewis, David (1970): "General Semantics" *Synthese* (22) pp. 18-67 and Kamp, J. A. W. (1975): "Two Theories about Adjectives" in Keenan, Edward L. (ed.) *Formal Semantics of Natural Language* (Cambridge, UK: Cambridge University Press) pp. 123-155. Richmond Thomason contributed to the developing method of supervaluations by offering a future-tense semantics on which the future is open to various possible *histories* from the standpoint of the present. Here, there are truths (falsities) about the future insofar as these truths (falsities) are common to each of the various possible histories. See Thomason, Richmond (1970): "Indeterminist Time and Truth-Value Gaps" *Theoria* (36) pp. 264-281. Notice that Mehlberg's interpretations, van Fraassen's assessments, and Thomason's histories are all analogous. These are just three. Another version of the method of supervaluations is the system of *delineation coordinates* presented in Lewis (1970).

<sup>5</sup> Vagueness is approached in a variety of different ways and through a variety of different methods. Some philosophers take an epistemic approach and claim that we are really just ignorant of rigid boundaries when we think there are borderline cases. Timothy Williamson says we just don't know where the sharp cut-offs are. Roy Sorensen says we can't know this. See Williamson, Timothy (1992): "Vagueness and Ignorance" *Proceedings of the Aristotelian Society* (66 supp. vol.) pp. 145-162 as well as Williamson (1994): *Vagueness* (London, UK: Routledge). Also see Sorensen, Roy (2001): *Vagueness and Contradiction* (Oxford, UK: OUP). Other philosophers worry about the vagueness of objects, sometimes called ontic vagueness. See Tye, Michael (1990): "Vague Objects" *Mind* (99) pp. 535-537 and Tye (2000): "Vagueness and Reality" *Philosophical Topics* (28) pp. 195-209. See also van Inwagen, Peter (1990): *Material Beings* (Cornell University Press).

<sup>6</sup> Fine (1975: 267).

<sup>7</sup> The potential ways the meaning of a vague term may be made precise are also sometimes called 'precisifications' or 'sharpenings'. For present purposes, I'll just refer to specifications. Also, I am concerned only with what Fine calls *complete* and *admissible* specifications. A specification is complete when it is completely precise, and it is admissible when it is accordance with natural uses of ordinary English [Fine (1975: 297) acknowledges that term 'admissible specification' is vague and admits borderline cases]. So, in order to keep my discussion focused on penumbral connections, I'll just use 'specifications' to refer to complete and admissible specifications.

*interpretation* of the sentence for a given specification. Once we have an interpretation of the sentence for each individual specification, we look to see whether or not all the interpretations are in agreement.

Statements containing vague terms may be assigned the value ‘True’ on some interpretations and ‘False’ on other interpretations, or they will be assigned either ‘True’ on all interpretations or ‘False’ on all interpretations. For example, statements that do not involve borderline cases are assigned either ‘True’ on all interpretations or ‘False’ on all interpretations. Other statements, e.g., literals involving borderline cases of a vague term, will be assigned ‘True’ on some interpretations and will be assigned ‘False’ on other interpretations.<sup>8</sup> With respect to *all* interpretations, the statements in this second group are neither true nor false.

Fine considers literals involving borderline cases to be neither true nor false in the sense that they are neither true *simpliciter* nor false *simpliciter*.<sup>9</sup> Here, truth *simpliciter* is not truth-on-an-interpretation, rather, it is truth-on-all-interpretations.<sup>10</sup> Similarly, falsity *simpliciter* is falsity-on-all-interpretations. Because literals involving borderline cases are neither true-on-all-interpretations nor false-on-all-interpretations, these sentences are assigned truth-value gaps. This is the motivation behind Fine’s proposed three-valued semantics for linguistic vagueness.<sup>11</sup>

We are now in a position to take up vague complex statements and situate properly Fine’s account penumbral connections. Recall that, according to Fine, penumbral connections

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<sup>8</sup> Here, use ‘literals’ in the customary way to refer to atomic statements and their negations. I specify literals because complex sentences involving borderline cases may be true-on-all-interpretations and others may be false-on-all-interpretations. I take up some examples of complex sentences like these in §2 and §3.

<sup>9</sup> This notion of truth (falsity) *simpliciter* goes back to van Fraassen (1966). Fine adopts van Fraassen’s definition of truth *simpliciter* as truth on all assessments and introduces ‘supertruth’ as being coextensive with ‘truth on all ways of being made more precise’. For the sake of clarity, I’ll avoid simpliciter-talk and continue to refer to Fine’s notion of truth as ‘truth-on-all-admissible-interpretations’.

<sup>10</sup> Truth-on-an-interpretation and truth-on-all-interpretations are not obviously two distinct notions of truth. Truth-on-an-interpretation quantifies over single interpretations. Truth-on-all-interpretations quantifies over every single interpretation.

<sup>11</sup> Notice that there is no vagueness at the level of a single interpretation. Fine offers supervaluationism as a three-valued extension of two-valued classical logic. Truth-on-an-interpretation is classical. It observes the principle of bivalence because individual interpretations are assigned to atomic statements in relation to completely precise specifications (cut-off points). In contrast, truth-on-all-interpretations is built on classical truth but is non-classical. It does not observe bivalence, as gappy statements are be neither true-on-all-interpretations nor false-on-all-interpretations.

are “logical relations [that] hold between indefinite sentences.”<sup>12</sup> By now, we should understand that ‘indefinite sentences’ refers to statements that are neither true-on-all-interpretations nor false-on-all-interpretations. It is time to find out which logical relations are ones Fine thinks hold between indefinite sentences.

Some complex statements have definite truth-values even though the truth values of their component statements are indefinite. That is, a complex statement can be true-on-all-interpretations (or false-on-all-interpretations) even when the literals it contains are neither true-on-all-interpretations nor false-on-all-interpretations. Fine thinks that this can only happen due some penumbral connection, i.e., some *logical relation*, which holds between the indefinite component statements. Actually, there are two types of logical relation that can contribute to this result, although Fine does not distinguish between them. I discuss examples of one type of logical relation in the next section, and I discuss examples of the other in §3.

## §2

When we consider the way supervaluationism computes the truth-values of vague sentences, we can observe that logically valid complex sentences are true-on-all-interpretations regardless of whether their component sentences are true-on-all-interpretations, false-on-all-interpretations, or neither true-on-all-interpretations nor false-on-all-interpretations. In the light of this observation, I aim to make clear that Fine’s view over-generates the types of sentences that count as exhibiting penumbral connection. More specifically, it treats logically valid complex sentences as though they were bearers of penumbral connections. This, I shall make clear, is a mistake.

I’ll proceed by discussing two examples of complex statements that exhibit logical (formal) relations between indefinite sentences. Each example showcases a complex sentence containing multiple instances of the vague predicate ‘is red’. Consider a color blob that is a

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<sup>12</sup> Fine (1975: 270).

borderline case of red.<sup>13</sup> Let ‘*Rb*’ stand for the sentence ‘The blob is red’ and let ‘not-*Rb*’ stand for the negated sentence ‘It is not the case that the blob is red’. Although both ‘*Rb*’ and ‘not-*Rb*’ are neither true-on-all-interpretations nor false-on-all-interpretations, some complex statements containing these literals are true-on-all-interpretations and other complex statements containing these literals are false-on-all-interpretations. For example, consider the conjunction ‘The blob is red and the blob is not red’, i.e., ‘*Rb* and not-*Rb*’. It is false-on-all-interpretations, false *simpliciter*. Let’s consider what makes this so.

There will be disagreements between interpretations regarding truth-values assigned to the literals ‘*Rb*’ and ‘not-*Rb*’. For example, we will assign ‘True’ to ‘*Rb*’ and ‘False’ to ‘not-*Rb*’ on the basis of some specifications, and we will assign ‘True’ to ‘not-*Rb*’ and ‘False’ to ‘*Rb*’ on the basis of the other specifications. Despite these disagreements, each interpretation assigns ‘False’ to ‘*Rb* and not-*Rb*’.<sup>14</sup>

The statement ‘*Rb* and not-*Rb*’ is an instance of the formula  $\exists x (Fx \wedge \neg Fx)$ .<sup>15</sup> This formula is the negation of the logically valid formula  $\neg \exists x (Fx \wedge \neg Fx)$ . On Fine’s supervenience, every instance of  $\neg \exists x (Fx \wedge \neg Fx)$  is assigned true-on-all-interpretations. Further every instance of  $\exists x (Fx \wedge \neg Fx)$ , e.g., ‘*Rb* and not-*Rb*’, is assigned false-on-all-interpretations. Statements of these forms have definite truth-values whether or not any vague terms are involved. Whatever logical relation holds between the indefinite sentences ‘*Rb*’ and ‘not-*Rb*’, the complex statement ‘*Rb* and not-*Rb*’ does not exhibit a special relation between the meanings of any vague terms.

Let’s turn to the next example. Once again, consider our color blob that is a borderline case of red. Also, again, let ‘*Rb*’ stand for the sentence ‘The blob is red’ and let ‘not-*Rb*’ stand for the negated sentence ‘It is not the case that the blob is red’. I’ve already pointed out that truth-

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<sup>13</sup> I modify Fine’s (1975: 269) example.

<sup>14</sup> “Surely,” Fine (1975: 270) remarks, “[‘*Rb* and not-*Rb*’] is false even though [*Rb*] is indefinite.” What Fine fails to point out is that this is a formal result. The statement ‘*Rb* and not-*Rb*’ is false *simpliciter*, but not because of any special relation between the meanings of vague terms.

<sup>15</sup> I use ‘ $\exists x$ ’, ‘ $\forall x$ ’, ‘ $\neg$ ’, ‘ $\wedge$ ’, and ‘ $\vee$ ’ in the classical ways.

on-*an*-interpretation is classical. In my discussion of the last example, I made it clear that truth-on-an-interpretation observes bivalence but truth-on-*all*-interpretations does not. In order to present the second example, I wish to emphasize that both truth-on-an-interpretation and truth-on-all-interpretations obey the law of excluded middle.

Each specification of 'is red' on the basis of which '*Rb*' is assigned 'True' is a specification of 'is red' on the basis of which '*not-Rb*' is assigned 'False', and *vice versa*. On some interpretations, '*Rb*' will be assigned 'True' and '*not-Rb*' will be assigned 'False'. On other interpretations, '*Rb*' will be assigned 'False' and '*not-Rb*' will be assigned 'True'. However, each individual interpretation will assign 'True' to the disjunction 'Either the blob is red or the blob is not red'. Accordingly, the complex statement 'Either the blob is red or the blob is not red' is true-on-all-interpretations.

It is significant that 'Either *Rb* or *not-Rb*' is an instance of the formula  $\forall x (Fx \vee \neg Fx)$ . This is the formal expression of the law of excluded middle. On Fine's supervaluationism, every instance of  $\forall x (Fx \vee \neg Fx)$  is assigned true-on-all-interpretations. We will assign 'True' to '*Rb*' and 'False' to '*not-Rb*' on the basis of some specifications, and we will assign 'True' to '*not-Rb*' and 'False' to '*Rb*' on the basis of the other specifications. Despite these disagreements, all interpretations assign 'True' to 'Either *Rb* or *not-Rb*'.

This is puzzling because neither of the disjuncts makes the disjunction true in every case. One disjunct makes the statement true on the basis of some specifications, the other makes it true on the basis of other specifications. Also, uniform truth-value assignments are given to instances of excluded middle regardless of whether or not any vague terms are contained in the disjuncts. This means that whatever logical relation holds between the indefinite sentences '*Rb*' and '*not-Rb*', the complex statement 'Either *Rb* or *not-Rb*' does not exhibit a special relation between the meanings of any vague terms.

Each of the two examples discussed above exhibit some logical relation that holds between indefinite sentences. Neither, I submit, exhibits a penumbral connection. For

something to count as a penumbral connection, it should have something to do with a relation that obtains between the meanings of vague terms. To see this, let's step back for a moment in order to consider what penumbral connections are connections between.

The term 'penumbra' is introduced to the literature by Bertrand Russell in his 1923 paper "Vagueness".<sup>16</sup> Russell writes:

"[A]ll words are attributable without doubt over a certain area, but become questionable within a penumbra... Someone might seek to obtain precision in the use of words by saying that no word is to be applied in the penumbra, but unfortunately the penumbra is itself not accurately definable, and all the vagueness which apply to the primary use of words apply also when we try to fix a limit to their indubitable applicability."<sup>17</sup>

Penumbral areas are the spaces of borderline cases. For example, the penumbra of red is the space of all red's borderline cases. For a logical relation to count as a penumbral relation/connection, it must have something to do with the space of borderline cases.

The first pair of examples exhibit formal relations that hold between sentences regardless of whether or not they are vague. These formal relations apply to definite sentences as well as indefinite sentences, so it would be misleading to think of them as relations or connections that hold between indefinite sentences. They work the same way regardless of whether or not any under-determined semantic content is present.

Fine's supervaluationism does not explain why the two examples discussed above fail to exhibit penumbral connection. In fact, examples like these do exhibit penumbral connection according to his view. It is in this sense that Fine's supervaluationism over-generates the number of logical relations that count as penumbral connections. If we're going to get an account of penumbral connections right, it must be geared toward relations that hold between vague terms. It must also rule out formal considerations.

Earlier I explained that indefinite statements can combine to make a definite statement, and I mentioned that this may result from either some formal relation or some material relation.

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<sup>16</sup> See Russell, Bertrand (1923): "Vagueness" *Australasian Journal of Philosophy and Psychology* (1) pp. 84-92.

<sup>17</sup> Russell (1923: 87-88). Here, besides introducing penumbral areas, Russell also points out that the bounds of a penumbra are not precise. In other words, he observed that the space of vagueness itself admits borderline cases and has vague boundaries. The phenomenon behind this observation became famous half a century after Russell's paper and is now referred to as 'higher-order vagueness'.

I've since discussed why formal relations cannot be penumbral connections. Let's now turn to a second pair of examples. These ones exhibit *material* relations between vague terms.

### §3

The predicate 'is tall' is vague.<sup>18</sup> If we consider the domain of all human beings, it is not clear where to draw the borderline between what things count as being tall and things that do not. In fact, there are many admissible places to draw the line. That is, there are many ways to specify the meaning of the predicate 'is tall'. No two such specifications draw the line between tall and not-tall in the same way.

On all interpretations, a man 7' 8.95" in height, e.g., Xi Shun, counts as being tall. Likewise, on all interpretations, a man 4' 1.7" in height, e.g., Kiran Shah, does not count as being tall. Hence, we can understand why Fine assigns the value 'true-on-all-interpretations' to the statement 'Xi Shun is tall' and why he assigns the value 'false-on-all-interpretations' to the statement 'Kiran Shah is tall'. Now consider a domain consisting of nine men. A pictorial representation of the domain is as follows:



<sup>18</sup> There is an important sense in which 'is tall' might be understood as being a relative predicate. For example, many people who count as tall in Mexico City will not count as tall in Berlin. But relativism will not dissolve the vagueness of 'is tall'. In Mexico City, Berlin, and everywhere else, there are borderline cases of what counts as tall. After all relativist concerns are addressed, there is still vagueness left to be considered.

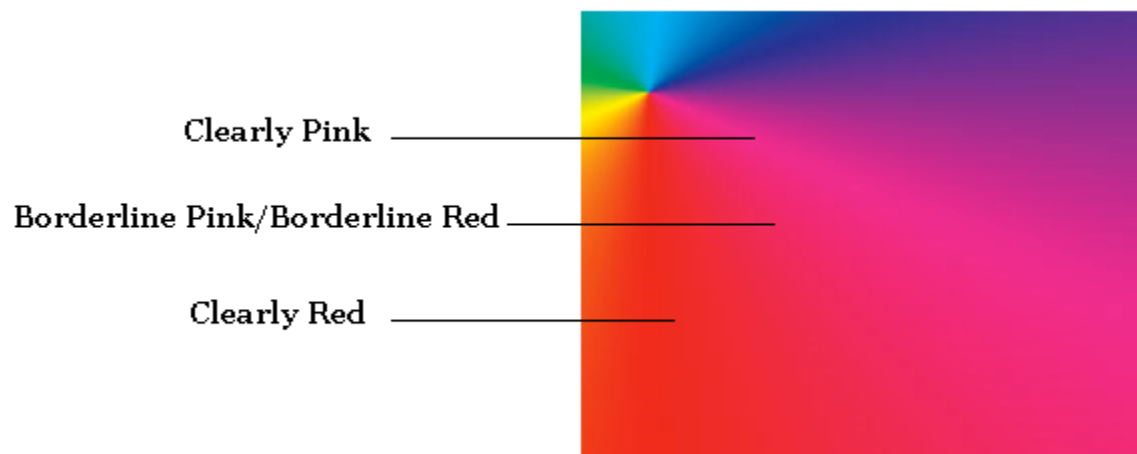
We'll suppose that Xi Shun is the only man in the domain who is a clear case of 'is tall', that Kiran Shah is the only man in the domain who is a clear non case of 'is tall', and that each of the remaining seven men are borderline cases of tall. If we sequence the domain from the least controversial cases of 'is tall' to more controversial cases, we end up with the ordered domain {Xi Shun 2, 6, 5, 7, 4, 3, 1, Kiran Shah}. Given this sequenced domain, any interpretation on which man #1 (the most controversial of the borderline cases) is assigned to the extension of 'is tall' is an interpretation on which *all* the others are also. Also, for example, any interpretation on which man #7 is assigned to the anti-extension of 'is tall' is one on which man #4, man #3, and man #1 are also assigned to the anti-extension.

Let's call examples like this one 'sequenced examples'. When we consider one potential borderline (specification) between the extension and anti-extension of 'is tall' in relation to a sequenced domain of individuals, we notice an obvious relation. We start with a single specification  $s$  and consider some borderline case from the sequenced domain in relation to specification  $s$ . If the borderline case we select falls in the extension of 'is tall' according to specification  $s$ , then any less controversial borderline case also falls in the extension of 'is tall' on that specification. If the borderline case we select falls in the anti-extension of 'is tall' on specification  $s$ , then any more controversial borderline case also falls in the anti-extension of 'is tall' on specification  $s$ .

In sequenced examples, unlike examples of sentences that are logical validities, connections holding between the meanings of vague terms are relevant. Sequenced examples such as the one above exhibit penumbral connections. I will now turn to the next example, which, unlike each of the examples discussed thus far, holds between instances of different vague predicates. I'll use a more illustrious version of Fine's blob example.

The color pink shares its borders with red as well as purple, and red shares its borders with pink as well as orange. The space of pink's borderline cases, i.e., pink's penumbra, and the

space of red's borderline cases, i.e., red's penumbra, share a common area. We might say that pink's penumbra and red's penumbra overlap or *connect*. Consider the piece of the color wheel presented below.



Now consider the swatch labeled above as being on the border of pink and red. The swatch is a borderline case of 'is pink' and is a borderline case of 'is red'.

On some specifications of 'is red', the swatch will be included in the predicate's extension. On others specifications, the swatch will be included in the anti-extension of 'is red'. Similarly, on some specifications of 'is pink', the swatch will be included in this predicate's extension, while it will be included in the anti-extension of 'is pink' on other specifications. However, on no specification is the swatch included in either the extensions of both 'is pink' and 'is red' or the anti-extensions of both.

Let 'Ps' represent the statement 'The swatch is pink' and let 'Rs' represent the statement 'The swatch is red'. According to supervaluationism, neither 'Ps' nor 'Rs' has a definite truth-value. Both will come out neither true-on-all-interpretations nor false-on-all-interpretations. Consider the conjunction 'Ps and Rs'. Given that Fine interprets conjunction and disjunction in the classical way, we can see that the conjunction 'The swatch is pink and red' is false on all interpretations of 'is pink' and 'is red' and that the disjunction 'Either the swatch is pink or it is red' is true on all interpretations of the two predicates. Fine calls the former a 'penumbral

falsity' and the latter a 'penumbral truth'. Accordingly, penumbral falsities are uniformly assigned the value 'False' by each interpretation for each specification. Similarly, penumbral truths are uniformly assigned the value 'True'.

It is significant that penumbral truths and falsities receive truth-value assignments uniformly by all interpretations. However, what is more important is that penumbral truths (falsities) are true (false) no matter how their vague elements are made more precise because some material relation obtains between the meanings of vague terms. Penumbral connections are not just a matter of uniform truth assignments across all interpretations.

The two examples discussed in this section are materially valid. Each exhibits penumbral connection because each exhibits a relation which holds *between the meanings of vague terms*. Fine's account of penumbral connections is too coarse to express the true nature of these relations. To be more specific, supervaluationism is not equipped to distinguish formal validities from material validities.

All along, I've been setting up the following view of penumbral connections:  
*Penumbral connections are material relations that hold between vague terms.* I will say just a few more words about this suggestion. Not all statements containing vague terms have indefinite truth-values. For example, as I discussed, formally valid statements have definite truth-values. Another class of sentences containing vague terms that can have definite truth values are sentences that do not involve borderline cases.

When a sentence contains a vague term but does not involve a borderline case of that term, the vagueness of the term does not make vague the meaning of the sentence as a whole. So, sentences containing vague terms have indefinite truth-values only when they involve borderline cases. Fine should have noticed that penumbral connections are relations between the meanings of vague terms. It is misleading to think of them as relations between indefinite sentences. According to supervaluationism, the meaning of a sentence is one of three truth-values, but the range of meanings a vague term could have are indicated by their various

specifications. Penumbral connections are connections between the meanings of the terms. Any account of penumbral connections given in terms of relations between sentences accounts for what these connections are connections between indirectly, at best. Understanding the nature of penumbral connections requires attention to material relations between the meanings of vague terms.

### Conclusion

In this paper, I have attempted only to propose a clearer picture of penumbral connections developed in the light of my analysis of Fine's supervaluationism. I've argued that in order to understand penumbral connections properly, we must distinguish between formally valid sentences and materially valid ones. Doing this enables us to see that penumbral connections are not relations between sentences but are material relations between vague terms. I have not sought to give a new account of the logic and semantics of vagueness. My analysis of Fine's supervaluation strictly concerns penumbral connection. With regard to the merits of supervaluationism as a whole, the jury can continue to deliberate. The only judgment that has been made here is that supervaluationism fails to identify the nature of penumbral connection in an accurate and precise way.

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