

# Logic and poetry

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## Summary

This article addresses the question: Can one represent a poem, especially a lyrical one, in symbolic logic? The authors' actual attempt to do so reveals that such representation is more plausible than they had expected on the basis of pure theorizing. Such an attempt can enhance one's appreciation of both the aesthetic qualities of the poem and the worth of formal logic. The process of interpretation and formalization draws one's attention to certain relations and structures within a poem and also brings about a keener understanding of the relations between reading, interpreting and formalizing. Contrary to what is usually intimated in textbooks, this is not a one-way process. The mutual elucidation which form and content can provide does not have the nature of a given, a datum; it must be generated by active interpretation.

## Opsomming

Hierdie artikel bespreek die volgende vraag: Kan 'n gedig, veral 'n liriese gedig, in simboliese logika weergegee word? Die outeurs se daadwerklike poging om dit te doen toon aan dat so 'n weergawe in 'n groter mate uitvoerbaar is as wat hulle op grond van blote teoretisering sou verwag het. So 'n onderneming kan 'n mens se waardering van die estetiese eienskappe van 'n gedig sowel as van die waarde van die formele logika verhoog. Die proses van interpretasie en formalisering vestig die aandag op sekere relasies en strukture binne 'n gedig en bring ook 'n skerper besef van die relasies tussen lees, interpreteer en formaliseer tot stand. Anders as wat in handboeke gewoonlik gesuggereer word, is dit nie 'n eenrigtingsproses nie. Die wedersydse opheldering wat vorm en inhoud vir mekaar kan verskaf, het nie die aard van 'n gegewe, 'n 'datum', nie; dit moet deur aktiewe interpretasie geskep word.

## 1. Background (Michael Macnamara)

Can one render a poem in symbolic logic?

This question arose in a teaching context. Some students who study philosophy also study literature, particularly English. When, in our philosophy course, we deal with the topic of meaning in life, we make use of a number of examples, taken from world literature, of people's concern with existential meaning. What may happen then is that a student, having already discovered the cognitive power of philosophical analysis in application to fields other than literature, assumes that it must be a philosophical or formal-logical interpretation, rather than a literary one, which elucidates the 'real' meaning of a poem.

As an attempt to anticipate and correct such an assumption, I have posed the following question: *Is it possible to rewrite a poem – especially a lyrical one – in the notation of symbolic logic?* The question has also been raised in the context of the features and evaluative criteria of world views, where it has been suggested that one might be making a category-mistake in 'trying to capture all the peculiar subtleties of a lyric poem in the specialized calculus of

mathematical logic, (Macnamara, 1980: 39-40). In any event, this question does have jolt-value and it seems to make the point; but, as it looks worthy of far more than such perfunctory *ad hoc* treatment, I suggested to my co-author that we select a specific example of a lyrical poem and actually subject it to formal-logical analysis. Working thus from a concrete example should appeal to analytically minded philosophers; it should also appeal to literati who have stressed the need for a connection, and regretted the gulf, between certain abstract theories of literature and the practical business of analysing concrete literary texts (Wellek & Warren, 1963: 39; Jefferson & Robey, 1982: 14-15; Ryan & Van Zyl, 1982: 10-11).

I proposed also that the poem chosen be one by a well-known poet, that it be a familiar example from his corpus, and that it be a lyrical one – in order to obtain an effective contrast with formal logicizing – say a sonnet from Shakespeare, rather than a didactic poem like Lucretius’s *De natura rerum*, or a ‘philosophical’ one from Wordsworth or T.S. Eliot. We decided on Shakespeare’s Sonnet No. 18.<sup>1</sup>

The general plan of action adopted was that a professional logician should try to formalize the poem (Section II below), and that conclusions then be drawn (Section III).

Sonnet 18 by William Shakespeare (1564-1616) is, in modern spelling, as follows:

Shall I compare thee to a summer’s day?	1
Thou art more lovely and more temperate:	
Rough winds do shake the darling buds of May,	3
And summer’s lease hath all too short a date.	
Sometime too hot the eye of heaven shines,	5
And often is his gold complexion dimm’d;	
And every fair from fair sometime declines,	7
By chance, or nature’s changing course, untrimm’d;	
But thy eternal summer shall not fade,	9
Nor lose possession of that fair thou ow’st;	
Nor shall Death brag thou wand’rest in his shade,	11
When in eternal lines to time thou grow’st.	
So long as men can breathe, or eyes can see,	13
So long lives this, and this gives life to thee.	

A few preparatory comments on this sonnet may be convenient. As regards Shakespeare’s sonnets generally, Booth (1977: 543), referring to intriguing but speculative matters such as the story behind the sonnets and the identities of the Dark Lady and W.H., judges that ‘the facts are so few and . . . the theories are so many, so foolish’; so apparently we cannot appeal much to those factors in an analysis. However, he sees no reason to doubt the authorial authenticity of the sonnets. Concerning the literary worth of the poems, Chambers (1951) notes that Milton characterized Shakespeare’s art by speaking of the latter’s ‘native wood notes wild’. Landry (1976: 1-2; 143-144) observes how much judgments of worth have varied between periods and critics: some 18th-century readers found the sonnets unforgivably flawed, and Wordsworth at first disliked them though later he came to admire them

warmly. Coleridge praised them well. Wilson (1967: vii) rated the sonnets 'the finest love poetry in the world'.

As regards Sonnet 18 in particular, the same writer (1967: 115) rates it 'one of the finest in the language' and considers it 'eager and impassioned' in contrast to the 'lovely poetical exercises' of the preceding sonnets. Booth (1977: 162), *pace* Wilson, speaks of the 'imperceptibility of the dividing line' between the preceding sonnets and No. 18. However, the question of the order of the sonnets is itself a vexed one. Rowse (1973: 39), again, regards this sonnet as 'direct and straightforward', with 'no problems of interpretation'. Prosodically speaking, the poem has the usual Shakespearian (English) – versus Spenserian, Petrarchan (Italian) or other – sonnet form, that is, it has fourteen lines in iambic pentametric metre, with the rhyme pattern *abab cdcd efef gg*.

Rowse (1973: 39) offers this *prose version* of the sonnet:

Shall I compare you to a summer's day? You are more gracious and more even tempered. Rough winds shake the buds of May, and summer is all too short: sometimes the sun is too hot, or often is clouded over; everything that is fair loses beauty, by chance or in the course of nature coarsened. But your eternal summer shall not fade, nor lose the beauty that belongs to it; nor shall death boast possession of you, when in eternal verse you grow one with time. So long as men can breathe, or eyes can see, so long will this live, giving you immortality.

In comparison, the following extracts are from a *literary criticism* of the poem (Kossick, 1983: 28-30):

While this sonnet is essentially a love poem, a tribute to the beauty of the loved one, it is also, and perhaps more importantly, a tribute to the changelessness and timelessness of art. At the same time (and this reveals the complexity and compression of thought achieved in Shakespeare's sonnets) the poet describes the changeability and transience of summer and, by implication, of life . . .

The last three lines of the poem are the poet's answer to . . . transience. Only art remains changeless . . . And it is in art that the beloved is immortalized. The closing lines are at once a declaration of love, a defiance of time, and an assertion of art's perpetuity.

A second literary critic (Poisson, 1976: 7-8) writes:

At the outset . . . a perplexity besets the speaker, who is both poet and lover . . . The opening line of Sonnet 18 has a characteristic spontaneity . . . But once the lover enters on the exchange of terms . . . the very properties of youth and beauty are by a complex irony apprehended in terms of the transient . . . the apt figure of joy, the summer's day as imaged idyll, is troubled by harsh overtones of the actual ['Rough winds do shake . . .']. The serenity disappears with the legal term 'lease', a *memento mori* . . . The 'summer's day' changes to a kind of moral emblem, spelling out the message of transience – *tempus edax rerum* . . . In the last six lines of the sonnet he solemnly declares the faith of the poet and closes with a sort of doxology of eternal love . . .

Booth (1977: 161) typifies the sonnet as playing on the proverbial formula, 'as good as one shall see in a summer's day', that is, 'as good as the best'.

The following brief notes from Wilson (1967: 115-116) and Booth (1977: 161-162) on perhaps unfamiliar Elizabethan and other word meanings may also be found informative:

Line	Note
3	<i>May</i> : in the pre-Gregorian calendar, May ran up to nearly midsummer.
4	(a) <i>date</i> = duration (often in Shakespeare). (b) <i>lease</i> = allotted time.
8	<i>untrimm'd</i> = stripped of ornament.
10	<i>fair thou ow'st</i> = beauty you own (with a play on 'to own' meaning 'to be under obligation to render up').
12	<i>to time thou grow'st</i> : the grafting metaphor (a graft is bound in place by cords until it coalesces with the stock).

It will now be as well to characterize our attitude in this article since we anticipate certain misreadings of our intentions. First, we anticipate the Travesty Reaction – the indignant or melancholic protestation that transforming a lyrical poem into leaden-footed mathematical symbols is a bizarre, grotesque, ludicrous, or even immoral act. But that reaction would just not be pertinent to our study. It would be inappropriate in that we are *not* presupposing that a lyric can be transmuted, without poetic residue, into a calculus; in fact, we do not think that all the nuances, subtleties and non-cognitive elements of a fine lyric could be captured in any existing form of logic. And we admit happily that attempting such poem-to-calculus transvestations does have its comical moments. Our aim, in short, is the explorative one of finding out what happens when one stops talking *in vacuo* and actually gets to grips with the transformation of a particular poem. In other words, we mean to 'do and see'. It follows that we are neither confusing a logical analysis with a literary criticism, nor asserting that the one is somehow better or truer than the other. We are not trying to demote either of these activities.

Second, we appreciate that there is no 'one, proper meaning' of any subtle poem, and that a literary interpretation of it will depend, *inter alia*, on what school of criticism – say the New Critical, Textual-Critical, Structuralist or Marxist – is applied, and also on the particular person doing the criticism within that school. Some differences of interpretation may readily be seen on comparing the samples of criticism of Sonnet 18 by the two critics quoted earlier, and also the comments by the two other quoted authors on the nature of this sonnet *vis-à-vis* the earlier ones. Our own literary-critical perspective is, for the *present* purpose of logical analysis, probably closer to the Textual-Critical school than to the other ones. Again, as two further critics have written (Brooks & Warren, 1965: 346), 'the meaning' of a poem is not given by any single element of it, say the statements, symbols (literary) or rhythms; it is given by all of these in combination. Indeed, one might go further and doubt whether there is ever one 'true' meaning, interpretation or translation of even a single phrase, for instance Homer's famous 'wine-dark sea' (*oinops pontos*) from his *Iliad* and *Odyssey* (cf. Macnamara, 1984: 590). There are all these factors, and several others too, such as the dependence of an interpreta-

tion on the critic's location along the spectrum between the poles of Pope-ish Didacticism and Poe-ic Aestheticism or *fin de siècle* Wilde-ness, or along the axis from descriptive to prescriptive criticism.

Third, turning now to matters of logic: we anticipate that what emerges from a logical translation will, similarly, depend on the sort of logic used – say propositional, or predicate, or modal logic – and also on the particular person who interprets and transforms it into logical notation. To exemplify: a colleague,<sup>2</sup> when invited to try a formalization, experimented with the translation of Sonnet 18 into propositional logic, together with a modal symbol, rather than into the predicate logic appearing in Table 1 below. And more: logicians are not in close agreement among themselves as to what the proper conception, role and task of formal logic are (cf. Moulder, 1982: 117-127; Kistner, 1982: 162 & 1984: 8-12).

Fourth, there would be a danger of committing a specious generalization were one to talk about Poetry *in toto*, for there are many different categories of poetry, such as lyrical, epic, metaphysical, didactic, satirical and concrete; however, our concern here will be restricted almost wholly to one lyrical poem. It would have been interesting, had space permitted, to include logical consideration of a poem from the very different category of concrete poetry (see Williams, 1967, for many examples of such concrete poetry).

Fifth, in speaking of 'formalizing' a poem, we realize that different things can be meant by that august term. As one mathematician<sup>3</sup> put it when asked whether he thought a poem could be formalized: to formalize may mean simply to abbreviate symbolically, which is unproblematic, but it may also mean 'render as a set of well-formed formulae in some known logical calculus'. It is more the latter, problematic sense which we had in mind for the present inquiry.

Sixth, there is a further matter which relates to the Travesty Reaction considered in the first point above: it is sometimes claimed, as a colleague<sup>4</sup> reminded us, that a poem works as much by what the poet does not write down as by what he does. What, then, of these unwritten parts and any attempt at formalization? Well, the claim about significant omission itself is quite true; but, as regards the formalizability of the unsaid: if you can verbalize whatever it is that has been left unsaid, you can try – with or without success – to formalize it. However, if by 'unsaid' is meant 'ineffable', that is another matter again (cf. Macnamara, 1970: 27-32). It might be added that legal, scientific, and even formal-logical arguments leave *something* unsaid. Moreover – to boot the other foot and point to the presence of art in calculi – we find a number of aesthetic factors significantly present in both scientific and mathematical discourse (cf. Macnamara, Kistner & Wilkinson, 1985: 93-99).

Seventh, our present interest is more formal than ontological: it focuses on matters of critical method more than on questions of literary theory, such as whether literature is bound to socio-political reality (cf. Marxism) or psychological reality (cf. Psychoanalyticism), or whether it 'defamiliarizes' reality (cf. Russian Formalism). And we are not message-hunters when in a literary wood.

Eighth, it may with point be asked: Will a logical analysis, with or without symbolization, simply ravish a poem aesthetically, or will it enrich one's overall appreciation of it? Perhaps the attempt at formalization that follows will make an answer easier . . .

## 2. Formalization (Wietske Kistner)

Before I try to formalize the particular poem selected, I shall discuss the purpose of formalization *in general*. There is much misunderstanding about this, even on the part of professional logicians.

Formalization is not merely *symbolization*, that is, it is not just putting an ordinary-language utterance in symbols. We could, say, symbolize a sentence or poem by taking the first letter of each word, or by representing each line by a number. But this is hardly a useful move. A formalization involves symbolizing within the context of a logical system, and its purpose is to show the deductive structure of the bit of language that is to be formalized, that is, to show the implication relations. If we represent the statement 'John is wearing a jacket and a scarf' by 'j.s' then our use of the symbol '.' (for conjunction) indicates that we consider the original sentence, in its context, to be equivalent to 'John is wearing a scarf and a jacket' ('s.j'), since one of the logical aspects of the conjunction symbol is that it allows commutation. Similarly, we normally do *not* represent 'He drank poison and died' by 'p.d', for here commutation of the original to 'He died and drank poison' hardly provides an equivalent statement.

Thus, formalizing is not just a matter of thoughtlessly transposing a linguistic structure into logical terms. It may involve the introduction of new elements. For example, 'Dogs bark' is formalized as the literal translation of 'For all x, if x is a dog, then x barks', that is ' $(x) (Dx \supset Bx)$ '. We have not merely made the implicit generality of 'dogs' explicit; we have added an 'if-then' term. On the other hand, we may represent different words by one and the same symbol, for instance the words 'and', 'but', 'although', 'however', 'also' and 'in addition' may all be represented by the same conjunction symbol. There is, again, an important logical difference between the verb 'exists' and other verbs, as in 'Fido barks', 'Bf', and 'Fido exists', ' $(\exists x) (x=f)$ '. This difference is not evident in the grammatical form of these two sentences.

In short, formalization must show the logical import of statements *within their contexts*. Statements as such do not have a logical form in any absolute sense; their form is linked with their deductive context. 'All human beings are mortal' may be formalized as 'p', or as 'All S are P', or as ' $(x) (Hx \supset Mx)$ ', depending on the context in which the statement is used. Thus, formalization should never become a mechanical operation in which only the apparent (surface) structure of statements is considered. Sometimes verb tenses, for instance, are important. They are significant when they influence the validity of an argument, though normally they can be ignored. This matter was discussed by Strawson (1952), who complained about the logicians' indifference to verb tenses. He was answered by Quine (1953: 246):

[The formal logician] does not care how inadequate his logical notation is as a reflexion of the vernacular, as long as it can be made to serve all the particular needs for which he, in his scientific programme, would have otherwise to depend on that part of the vernacular. He does not even need to paraphrase the vernacular into his logical notation, for he has learned to think directly in his logical notation, or even (which is the beauty of the thing) to let it think for him.

Another logician who has missed this point is S.N. Thomas (1986: 448). He, too, seems to believe that formalizing consists in schematizing the superficial structure of a sentence, rather than bringing out its logical powers. He gives the following example:

The need for choline in the human diet has been established. (Therefore) people require some choline as part of their nutrition.

This he formalizes as:

- (1)  $(\exists x) (\exists t) (Nx \cdot Ext)$
- (2)  $(x) (Px \supset Rx)$

That is:

- (1) There is an  $x$  and there is a  $t$  such that  $x$  is a need for choline in the human diet and  $x$  has been established at time  $t$ ; and
- (2) for all  $x$ , if  $x$  is a person, then  $x$  requires choline as part of  $x$ 's nutrition.

He claims that then validity of the original cannot be proved deductively. But in this case 'x has been established' clearly functions logically as 'it is true that', and so should not be formalized as ' $(\exists t) Ext$ '. Also, 'the need for choline in the human diet' reflects a *general* proposition, like 'The whale is a mammal', and should thus be formalized as 'All diets for human beings need choline'. Adding the premiss that 'nutrition' means the same as 'diet', we get:

1. For all  $x$  and all  $y$ , if  $x$  is a diet and  $y$  a person and  $x$  belongs to  $y$ , then  $x$  needs choline.  
 $(x) (y) \{[(Dx \cdot Py) \cdot Bxy] \supset Nxc\}$
2. 'x is a diet' is equivalent to 'x is nutrition'.  
 $(x) (Dx \equiv Nx)$

Therefore:

For all  $x$  and all  $y$ , if  $x$  is a person and  $y$  is nutrition and  $y$  belongs to  $x$ , then  $y$  needs choline.

$$(x) (y) \{[(Px \cdot Ny) \cdot Byx] \supset Nyc\}$$

This argument is valid. Thus, if we avoid pitfalls like blindly formalizing 'the' by means of the existential quantifier, or the misguided idea that different words necessarily have different meanings and so cannot be brought together in a deductive context, we can show that formal logic is a powerful tool – often more so than it is given credit for.

What I have said so far concerns the formalization of *deductive* contexts. But does this apply to poems? In general, if it were asked whether one can formalize some poem  $X$ , I should reply that this depends on the nature of  $X$ . All significant use of a language has a deductive component. The very use of a predicate implies that there is a difference between the items to which the

predicate applies and those to which it does *not*: negation is implicit in any language use. Moreover, concepts logically imply other concepts: 'thought' implies 'consciousness', 'sentence' is related to 'word', and so on. Descriptions imply other descriptions: when I say 'It is raining', it follows that it is wet outside, that you may need an umbrella, and that you may stop watering the garden for the moment. Knowing what is meant by 'It is raining' is knowing such implications.

There are, however, examples of language in which such logical relations do not apply. An example would be Lewis Carroll's 'Jabberwocky' (before Humpty Dumpty starts explaining it). Since most of the words have no distinct meaning, there are no clear relations between them. However, as Alice says, 'Somehow it seems to fill my head with ideas – only I don't exactly know what they are!' Patricia Meyer Spacks (1961: 321) remarks that Humpty Dumpty's interpretation, 'reducing the splendid stanza to an account of animals resembling badgers, lizards, and corkscrews, going through various gyrations in the plot of land around a sundial during the part of the afternoon when one begins broiling things for dinner', destroys the poem. She adds: 'Surely, the filling of the head with cloudy ideas is a higher poetic achievement than the reduction of these ideas to the ridiculous'. This example alerts us to the very real possibility that an interpretation – *any* interpretation, whether in logical or other terms – may destroy a poem altogether. However much may be captured in the intellectual exercise, important poetic elements must have escaped. We have this when rhythm or sound is lost, or the haunting effect of a refrain vanishes, or the shock of a break in a regular rhyme scheme is omitted. For example, poetic quality would be lost by transforming the Dutch poet Marsman's lines:

Denkend aan Holland  
 zie ik brede rivieren  
 traag door oneindig  
 laagland gaan

Here, the slow movement of the river is conveyed in the sound of the words. You could not say or even think these lines in fast tempo.

We see that transformation, including formalization, cannot capture *all* the poetic qualities of a poem. But who would want to make such a claim anyway? Let us discuss a more modest question: Could a poem be formalized *at all* and, if so, could a formalization be of any help in *understanding or appreciating* the poem? I claim that we can, in some cases anyhow, capture important aspects in an attempted formalization. And this is so because we do not literally formalize that which presents itself to immediate, superficial inspection; it is rather the case that, in formalizing, we are compelled to *study* the subject in order to make assumptions, presuppositions and meanings explicit, as we did in the case of 'Dogs bark' and 'Fido exists' above.

I shall now try to formalize Shakespeare's Sonnet 18. There will be no attempt to give 'the' form of the poem: it will be clear from the preceding argument that there is no *one* form which is *the* form of any language expression, for logical form depends on context. Moreover, one can fill in a



given form in various ways, depending on the values of the variables. So it is impossible in theory, not just in practice, to recognize a poem from its logical form. There is no one-to-one, or even one-to-many, correlation between a poem and a form. Different interpretations can lead to dissimilar forms. Poems are usually complex, often intentionally ambiguous, and therefore open to more than one interpretation. I shall now choose a particular interpretation in order to show that a formalization is possible, but I am not claiming that it is the only interpretation, or even the best available one.

I do not think it is worth attempting an exhaustive treatment which takes account of all possible nuances, connotations and logical relations between concepts. Such detail is important for the appreciation of the poem, but its function – because it is the function of the poem itself – is not primarily argumentative. Thus we can ignore a good deal of detail for present purposes. But where there are fascinating ambiguities, or particularly rich or difficult passages, attending to logical structure may reveal some otherwise unnoticed feature of a poem.

Before one can meaningfully formalize the poem, it has to be paraphrased. Such a paraphrase is necessary to show logical relations between parts, relations which remain more or less implicit in the original. Moreover, the paraphrase will be a simplification. Any paraphrase of a poem means a loss in poetic quality, yet we paraphrase (whether for formal or other reasons) in order to bring out more clearly some not immediately obvious aspects of poems. Obviously my paraphrase, in this case, will disregard subtle distinctions and we shall lose much that is valuable. Nevertheless, as I said above, if some aspect is really important we can cater for it by, say, spelling out what was implicit, or providing more than one version when ambiguities occur.

The paraphrase will bring out which words are logically related to each other: a case is ‘summer’s day’, the meaning of which reappears in the buds ‘of May’. On the other hand, I shall ignore the I-thou form of the poem, important as this may be in a literary analysis. I am not trying to *replace* a literary analysis but to provide an *additional* approach which may reveal something new in the poem.

There is an interesting relation between interpreting and formalizing a fragment of language, a relation that is missed by many people, even (or mainly?) by logicians. The idea is that one first *interprets* the non-formal language (in our case, the poem) to show its meaning. Next, this interpretation is *formalized*. This formalization thus crystallizes the meaning. But, it is argued, since one must know the meaning in order to provide an interpretation, the interpretation, and *a fortiori* the subsequent formalization, are totally superfluous. Quite contrary to this claim, however, I have found time and again that the attempt at formalizing, that is, the pinning down of a *tentative* interpretation, brings out unsuspected flaws and/or felicities of that interpretation. This may happen with philosophical arguments, and it also happened in my work on Shakespeare’s sonnet. In other words, the reading-interpreting-formalizing of a poem involves all three aspects in a circular movement. One *tests* one’s interpretation by formalizing it, then comparing the symbols with the original; or, if one cannot formalize an interpretation,

one may try a different one, and so on. Logic textbooks treat this reading-interpreting-formalizing as unidirectional, a one-step-at-a-time sequence. But, except in the simplest examples, it is nothing of the kind. I tried to bring this out in my treatment of S.N. Thomas's example above.

A rough paraphrase of the poem might read as follows (cf. Sonnet 18, reproduced in Section I above):

1. Suppose you are compared to a summer's day
2. (Then we see that) you are more lovely and more temperate than any summer's day
3. For summer days are rough
4. And are short-lived
5. And are sometimes too hot
6. and sometimes ('too often') dim
7. Everything (other than you) loses its beauty
8. For various reasons
- 9-10. But you will be beautiful forever (that is, not short-lived, not dim, etc)
11. You will not die
12. If you are always remembered
13. (All this will be brought about because) as long as people live
14. This poem lives and therefore you live.

I have disregarded the question-form of line 1, treating it as a supposition or part of an if-then statement. A feasible alternative would be to read it as a modal statement: 'It is possible to compare . . .' But what to do about 'compare'? 'Compare' has various meanings but, in the context of this poem, it can be rendered as 'having identical properties', a rendering which is then, however, denied in the following line: the loved one's properties are different (more lovely, more temperate). This line, as a conclusion, is supported by a series of premisses describing summer days, followed by a description of the loved one's differing properties. The reason for this difference in properties is provided by the last two lines. In short, lines 3-6 are premisses about the summer, generalized to other things in lines 7-8. Lines 9-14 are premisses about the loved one, with 13-14 providing the reasons for line 12, which in turn is a reason for lines 9-11. Line 2 follows from, or sums up, lines 9-11. Thus, though the emphasis of the poem, as a poem, falls on lines 13-14, if its reasoning is followed we can regard line 2 as its conclusion. Obviously, we must see the poem as a unit in which the reader moves backward and forward through its lines and not in a straight path of inexorably deductive reasoning. Yet it is surprising that we have been able to detect as much logic as we have found in its circling thought.

I shall now simplify further, using the following symbols:

- Tx x is a time  
 Hx human beings live at x  
 Lx x is long-lived (not short-lived)

Bxy x belongs to y  
 Fx x fades  
 Sx x is a summer's day  
 Rx x is rough  
 Hxy x is hot at y  
 Dxy x is dim at y  
 m the (my) loved one.

A transcription, with corresponding logical symbolism, is given in Table 1 for various lines of the poem.

**Table 1:** Transcription and formalization

Lines	Literal transcription	Form
12-14 implying 9-11	If, for any time y, human beings live at y, then m will not be short-lived and not all beauties z belonging to m will fade	$(y) (Ty \supset Hy) \supset [Lm . \sim (z) (Bzm \supset Fz)]$
3-4	Summer days are rough and short-lived (few)	$(x) [Sx \supset (Rx . \sim Lx)]$
5	Summer days are sometimes hot	$(x) [Sx \supset (\exists y) (Ty . Hxy)]$
6	And sometimes dim	$(x) [Sx \supset (\exists y) (Ty . Dxy)]$
implied by 7	All beauties of sum- mer days fade	$(x) [Sx \supset (z) (Bzx \supset Fz)]$
1-2: conclusion	Therefore, as long as human beings live, my love is not the same as any summer's day	$\therefore (y) (Ty \supset Hy) \supset (x)(Sx \supset x \neq m)$

The above is a valid argument which shows, in simplified form, some of the logical structure of the poem.

Some aspects of the poem can now be treated in detail. Line 3, for instance, can itself be seen as a bit of implicit reasoning. The import of the line, 'Rough winds do shake the darling buds of May', is that summer days can be rough. Why? Because the tender, fragile ('darling') buds of May (half-open and thus more vulnerable than in, say, February) are shaken by the winds. But whatever shakes any vulnerable thing (such as the buds of May) must be rough. Therefore there are rough summer days. Thus:

Anything that is a bud in May is vulnerable ('the darling buds of May')

$(x) [(Bx \cdot Mx) \supset Vx]$

There are winds that shake some buds of May

$(\exists y) \{Wy \cdot (\exists x) [(Bx \cdot Mx) \cdot Syx]\}$

For all x and all y, if x is vulnerable and y shakes x, then y is rough

$(x) (y) [(Vx \cdot Syx) \supset Ry]$

Therefore there are rough winds

$\therefore (\exists y) (Wy \cdot Ry)$

Here, attending to logical form brings an increased appreciation of the richness of the thought in this particular line: the adjectives, verbs and nouns are all related for specific reasons.

Without going further into formal detail, I can say that this attempt at formalization has brought certain other interesting points to light:

(1) There is a difference in the sorts of words used to describe summer and the loved one respectively. Our attempt at formalization highlights this difference in kind between *abstract* and *concrete* descriptions. Abstract terms are on a higher logical level than terms referring to concrete properties. This means that if both occur in one context, either different types of predicates must be used (say, in terms of first and higher order), or the abstract terms must be 'translated' into concrete terms. For example, 'Red is a colour' can be rendered in first-order predicate logic as 'Everything that is red, is coloured':  $(x) (Rx \supset Cx)$ . Such a translation is necessary if the structure of the text relies on the link between different logical types of predicates. In the case of Shakespeare's sonnet, moving backward and forward in order to see the links between its parts draws attention to the way in which the poet uses abstract and concrete terms. Looking at Sonnet 18, we find that the first line is very general: 'Shall I compare thee to a summer's day?' It can be rendered as 'Suppose there is a summer's day such that you have all, or some, of the properties that it has'. This is highly abstract for we are talking about properties in general rather than individuals. In the next line, some more specific groups of properties are singled out: 'Thou art more lovely and more temperate'. We are, nevertheless, still comparing abstract properties. These have now to be manifested in a more concrete form. Descending from the abstractness of the talk about the loved one, we arrive at the concrete fierceness of summer: rough winds, hot sun, and so on. In line 7-8 we return to a more general plane and then to the loved one. The last two lines enshrine the loved one's qualities forever in the poem itself. Note again how the specific verbs in these lines, 'breathe' and 'see', though they serve to imply the saying or reading of the poem, are also manifestations of the more general verb 'lives' in the last line, which is then (when it refers to the loved one) repeated in the higher-order abstract noun 'life', the note on which the poem ends. This attempt to relate meanings, then, makes us aware that the poet shifts to more abstract descriptions whenever he is referring to the loved one.

(2) I mentioned earlier that the thought in the poem moves forward and backward, as if in circles. The last two lines form an exceptionally tight,

interlocking figure, as if to intensify the impression of the entire poem: they are an example of *self-reference*. This case is logically interesting because, strictly speaking, such a figure is not formalizable unless it is paraphrased, say as 'You live forever in the poet's art'. So this is a case in which poetic language cannot be captured in logical form.

(3) The difficulty in formalizing the sonnet has highlighted the role of the concept of *time* in the poem. We were obliged to represent the words 'some-time', 'short', 'often', 'every', 'eternal' and 'so long as'. But there are other words also associated with time: 'summer's lease' (emphasizing the ephemeral), 'decline', 'nature's changing course', 'fade' and 'death'. Not all these words were captured in logical form, yet they played a role in the original interpretation.

### 3 Review (Michael Macnamara)

Can one, then, render a poem in symbolic logic?

Yes and no. The fact is that some parts of a Shakespearian sonnet have just been 'put in symbolic logic'. But other parts of it have not been. And some aspects, of course, just cannot be. They cannot be, in present formal-logical practice if not in principle.

Supposing one *could* partly or wholly formalize a poem, it would still have to be asked: *Why* do so? Is not the whole enterprise misguided? It might be judged so by the proponents of certain schools of literary theory and criticism. A clear example would be a staunch Romantic critic who insists that the only appropriate way to talk about an artwork or a poem is the (supposedly paradigm-free?) Romantic way, particularly if the poem is lyrical and certainly if it is itself Romantic. On the other hand, a logician has just indicated above that, while formalization cannot *replace* interpretation for the simple reason that one or another interpretation must precede any reflective formalization, formalization *can* yield an appreciably enhanced understanding and aesthetic appreciation of a poem. This surely holds for *some casts of mind*, if not for all. The benefits were evident in the logical analysis of Sonnet 18: formalization highlighted the crucial role of the concept of time in the poem; the logical basis of the relation between, and the choice of, words; the shift in level of abstraction, especially in references to the loved one; and the circular passage of thought, culminating in that tightest of linguistic loops: self-reference. This is not to claim that no such points would have emerged from a non-formal-logical analysis. As regards the weaving of thought in the sonnet, for instance, Coleridge (1772-1834) had already observed that 'in Shakespeare one sentence begets the next naturally; the meaning is all inwoven . . . [his] intellectual action is wholly unlike that of Ben Jonson or Beaumont or Fletcher. The latter see the totality of a sentence or passage, and then project it entire. Shakespeare goes on creating, and evolving B out of A, and C out of B, and so on . . .' (Landry, 1976: 129). It is, however, not intimated here that Shakespeare wrote his sonnet as a conscious logical exercise; if it is true that he composed with scarce a blot, then presumably 'it all came naturally'.

It was also found above that certain aspects of the poem could not be transmitted when formalizing, for instance some nuances and effects of sound, rhythm, rhyme, word order and alliteration. Few, one imagines, would care or venture to play down the strong tradition of linguistic indirection in poetry, particularly in the form of metaphor (and some theorists regard metaphor as the essence of poetry). And, after all, for a few kinds of poetry the yardstick of logical coherence will be irrelevant and perhaps some other mode of cohesion, say the imaginative or affective one, will be appropriate. As T.S. Eliot had it, there is a logic of imagination as well as a logic of concepts. Moreover, turning over the coin and thinking of the aptness of the logical tool to the material, we might reflect that the standard logic was designed for use on informative utterances, rather than expressive or directive ones, and on the indicative mood more than the subjunctive mood or the imperative one, so that application strains will be felt and lacunae will yawn. All this has a bearing on the analytic-looking claim, made from time to time, that to paraphrase a poem is to filter out precisely those distinctive qualities which had made it poetic. Or reversing the metaphor, it is to have the essence run through one's fingers.

Could a poem, like some logically couched piece of scientific prose, ever be *completely* formalized, that is, transformed without any remainder? Formalized, in all its many facets? Not succinctly and in the existing varieties of logic. Then perhaps in page upon page of expanded formulation, or with the aid of a new variety of logic? But what would – or *could* – that new logic be like? Would we argue, using present formal logic, for or against that new logic?<sup>5</sup> The prior problem here is to couch these questions meaningfully – a point which will reappear sharply in the final sentence of this article. In any event, it is plainly *not the object* of existing formal logic to capture all the facets of ordinary language, for it was designed expressly to exclude some of them.

Concerning the vexed question of 'the' meaning of a poem, the outcome of the above attempt at formalizing Sonnet 18 supports the idea noted earlier that there is no one, exclusively 'correct' interpretation of a complex poem, for even the professional interpretations done by skilled literati and logicians are functions of the interpretative literary or logical frameworks they have adopted, whether explicitly or implicitly, and then also of the particular interpreter's make-up (cf. some of the Structuralists' emphasis on the role of the reader in the determination of meaning). This holds all the way from the elevated indirections of lyrical poetry to portmanteau words, whether Jabberwockian or Deconstructionistic. This does not, however, condone an 'anything goes' attitude to professional interpretation and evaluation, for there always remain at work the particular criteria of *some* approach, whatever one it may be. A corollary is that we are not suggesting that a formal-logical analysis of a poem is inherently 'superior' to a literary criticism of it (cf. the opening paragraphs on the origin of this article). About the farthest we shall go down that stony path is to observe that, if second-order talk *about* a poem is to qualify for the description 'academic', then that talk must, per definition, be logical in the sense that it is reasoned; that is, it is open to argumentation.

The upshot of this inquiry appears, then, to be that (a) one *can* put parts of

a lyrical poem in symbolic logic, though one *cannot*, using propositional or predicate logic, formalize it in all facets, and (b) the application of formalization can enhance one's understanding and appreciation of both the poem and formal logic. Though we did not mean to, it seems we may now have let loose another explorative paradigm to prowl through the tangle of contemporary literary theories and critical trends.

This investigation has been focused on the notion of *transformation*. The kind of transformation involved in the present discussion is the reduction of a poem from poetic language to prose paraphrase and then translation into logical symbols. It should be added in conclusion that there are many other possible kinds of transformation, each with its own peculiar problems. These kinds are of diverse degrees of interest and they include the translation of a poem from one natural language to another (how difficult), transliteration from one alphabet or script to another, translation from phonetic to ideogrammatic representation, transmutation from the written to the spoken medium, transformation from the spoken word to an oscilloscopic (waveform) display, and finally – fraught though it be with aesthetic thistles – transmutation from the literary to the fine-art or the musical medium.

And thus to an interrogative *au revoir*: Could you 'put' a painting, or a piece of music, or a bit of ballet 'in symbolic logic'?

## Notes

1. Numbered thus in the 1609 ordering of his series of 154 sonnets. For all the sonnets, both in the original Elizabethan version and in modern spelling, see Booth, 1977: 4-133.
2. Jeanette Boers, Philosophy Department, University of South Africa.
3. Willem Labuschagne, Department of Computer Science and Information Systems, University of South Africa. *Memorandum* of 29 May 1986, in response to a request from M. Macnamara.
4. The poetess Marlene van Niekerk, Philosophy Department, University of South Africa.
5. For a philosophical discussion of different kinds of logic, see Haack, 1974; for an application of first-order logic to linguistic problems, see Martin, 1981.

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