

APPLICABILITY. Recall the pattern of indispensability arguments: the best scientific theory quantifies over mathematical objects. Hence, mathematical objects exist. Not only that, we can add, but also mathematical statements are truth-apt. Viewed from inside, from within pure mathematics, the whole edifice may appear nothing but a game. Rules of formation and transformation are formulated, elementary postulates are laid down, but nothing convinces us that this is different from a game where similar stipulations can be done. Games, however, are not used in science. And mathematics receives its special status from its usefulness in science.

This is a double-edged argument. By the same token, you may marvel how and why mathematics *is* useful. If mathematical objects are causally inert, if mathematical discoveries are made independent of scientific enquiry, then the usefulness of mathematics in science is a puzzle. 89

FIELD'S NOMINALISM. If a nominalist rejects the existence of mathematical objects, what can he say about applicability? Field's approach echoes Frege: mathematics (with its ontological commitments taken at face value, or 'R-mathematics') is essential in providing inferential tools to theorists. However, nominalised mathematics, according to the claim of conservative extension, will be just as adequate as R-mathematics. 91

Yet Field has failed to explain the actual usefulness of R-mathematics. Supposing that R-mathematics is false (since mathematical objects do not exist), why would all these false theories be useful as a tool for other, true scientific theories? Right, Field has given an account of how R-mathematics is dispensable. But he has not addressed at all the issue of its actual usefulness. 92

REPRESENTATIONS. We often make statements that we believe are true, yet curiously disbelieve in its *literal* truth. So the statement: 94

The average family has 2.7 bank accounts (13-1)

is believed to be true. Yet no one believe that there is 'the average family' out there, or that there are 2.7 accounts to be had by anyone.

By the same token, if a physicist in doing mechanics wishes to record a regularity observed between velocities, masses, and distances, he would have to write down an infinite disjunction of sentences 'Either the mass is F and the distance is G and the velocity is H , or the mass is F' and the distance is G' and the velocity is H' , or ...' He can drop this talk in terms of adjectives and avail himself of universal and existential quantification over numbers. He need not seriously believe in numbers. He needs only to 'momentarily take them for granted'. 95

A SKETCH OF YABLO'S PROPOSAL. Ontological commitments are born out of linguistic pressures. The practice of R-mathematics is useful in helping theorists to represent how things are. But, as with many other instances of representation, we need not believe in the literal truth of representations—although in some other, yet unspecified sense, representations are correct.

DIGRESSION: ARTISTIC REPRESENTATION. Consider Ingres' painting (Figure 1). Napoleon is represented *as* a Roman emperor, also *as* a Holy Roman Emperor, and also *as* Zeus. But no observer is supposed to believe that Napoleon *is* a Roman emperor or Zeus.

In this instance Napoleon is nevertheless supposed to be real. But of course everything in the picture may be unreal, and believed to be so. So there is no 'Reason' and there are no winged 'monsters' beget by it (Figure 2). Yet Goya's painting represents *something* real without literally saying so.

METAPHORS. The analogy, then, is with metaphors. The nominalist interprets the mathematical discourse, or any other problematic ontological discourse, as one might interpret a metaphor. Consider:

Juliet is the sun, (13-2)

as uttered by Romeo.

Remark 1. The full text is:

It is the east, and Juliet is the sun.
Arise, fair sun, and kill the envious moon,
Who is already sick and pale with grief,
That thou, her maid, art far more fair than she.



Figure 1: Napoleon on his throne

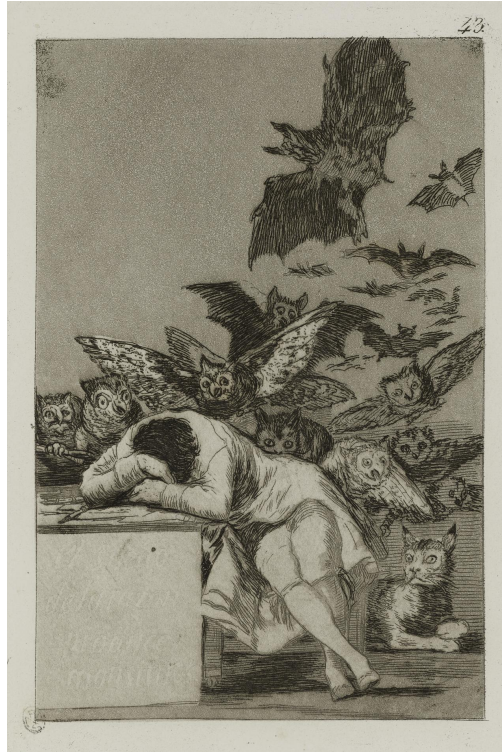


Figure 2: Sleep of reason begets monsters

Romeo does not assert, literally, that Juliet is the sun, i.e. a mass of helium and hydrogen billions of years old. But he asserts something, namely the real content—presumably some long disjunction of the girl Juliet's characteristics. There is a disagreement in the literature on metaphors whether Romeo says something trivially false (that Juliet consists of helium) and something non-trivially true (that Juliet is central to his life etc.) at the same time. Perhaps he says, but does not assert, that Juliet consists of helium in the first place, or perhaps he does not say that in the first place.

LITERAL CONTENT AND REAL CONTENT. The statement:

There are at least two prime numbers. (13-3)

will have a similar status in the eyes of a nominalist. There is a level of literal content that is not asserted (or perhaps there is no such *content* at all). And there is a level of figurative content, the real content, that is asserted, and that is a logicist paraphrase of the statement.

Linguistic rules, together with the state of the world, determine the truth value of our statements. So the literal content of a statement S will be the worldly condition just enough to make S true according to linguistic rules. So we have:

$$\text{LitCon}(S) = \log_R(S) \quad (13-4)$$

The same can be done with fiction. We will formulate the condition under which S comes out true within fiction:

$$\text{RealCon}(S) = \log_F(S). \quad (13-5)$$

Thus we get, for example:

$$\text{RealCon}(\text{the number of planets equals nine}) = \text{there are nine planets} \quad (13-6)$$

and, incidentally:

$$\text{RealCon}(\text{there is a world where Obama is a sailor}) = \text{Obama could have been a sailor.} \quad (13-7)$$