

$a_0 = 1 [a_0]$

# Algebra as an Analogy to Language

Is this the panacea  
we have been  
looking for?

# Simple Algebra

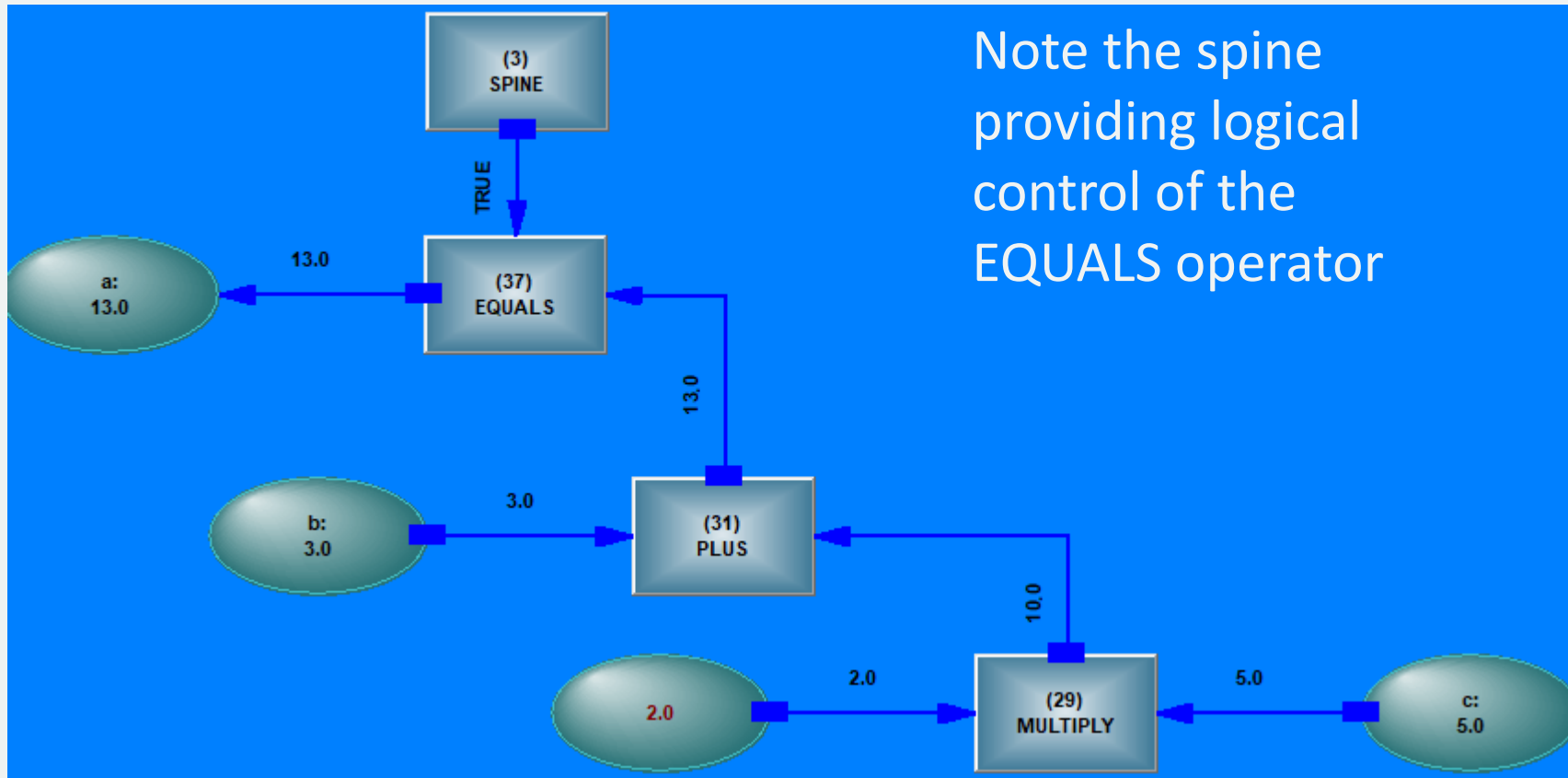
$$A = B + 2C$$

We can turn that into

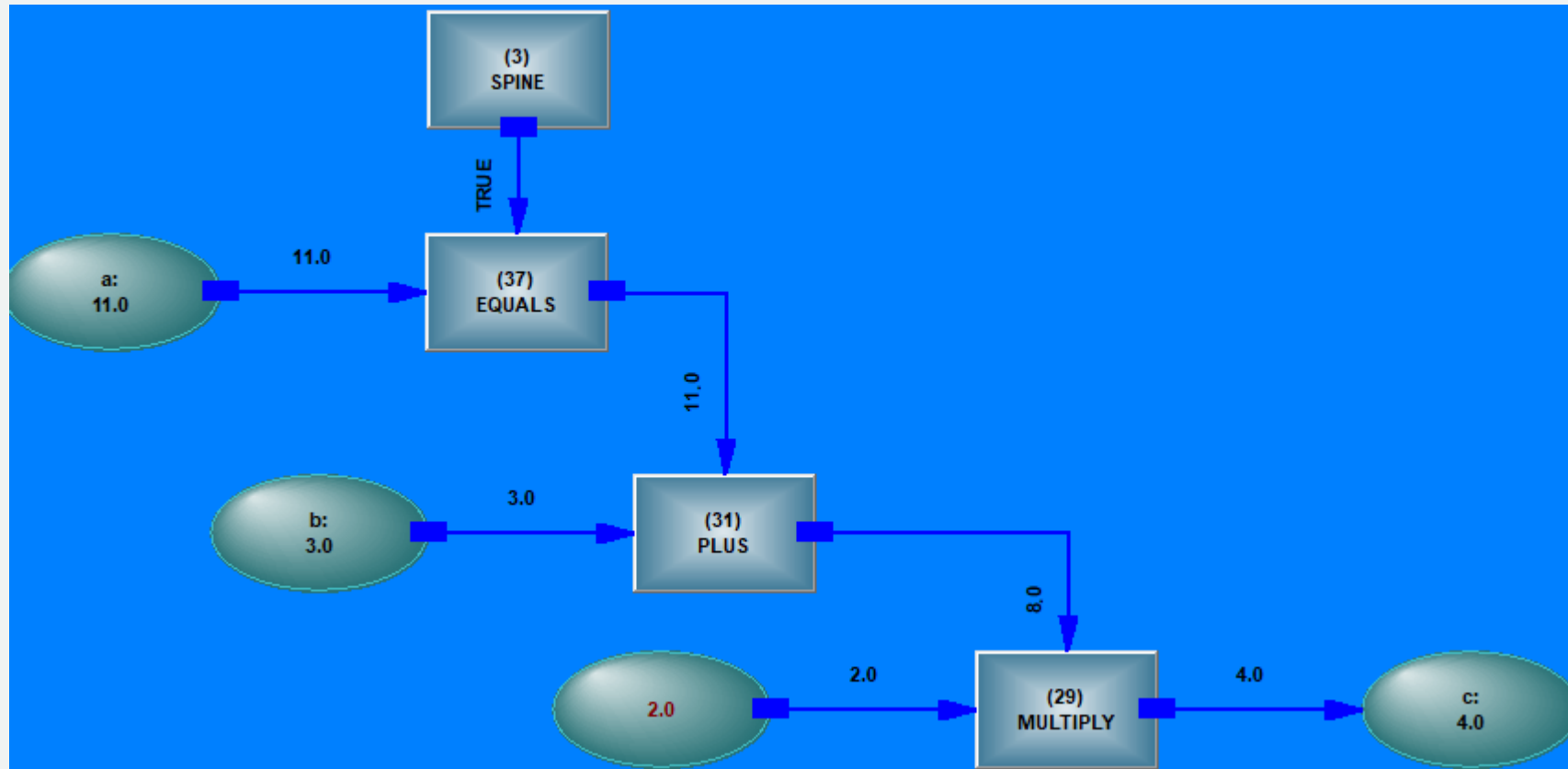
$$C = (A - B) / 2$$

That's really clever

# If the Formula Suits Its Use



# What Your Unconscious Mind Does When You Are Not Looking



# Is Rearrangement Necessary

There are some equations that can't be rearranged

If we have an undirected network which can tolerate the transmission of logical states and values, we don't need rearrangement

IF  $A = B + C$  THEN  $D = E + F$

If we can propagate logical values, we can include propositional logic with algebra

A bit more clever, and we can include existential logic

# How Strong Is the Analogy?

$$3X^2 + 7X = 0$$

We have  $X$  appearing in two places – will this be a problem?

No, because it is the same object, with the same instantaneous value.

Not so with language – “Fred was a lovely baby, but look at him now”

# Language Is More Complex

He knew he would have to beat him

This could be

Fred knew John would have to beat Thomas

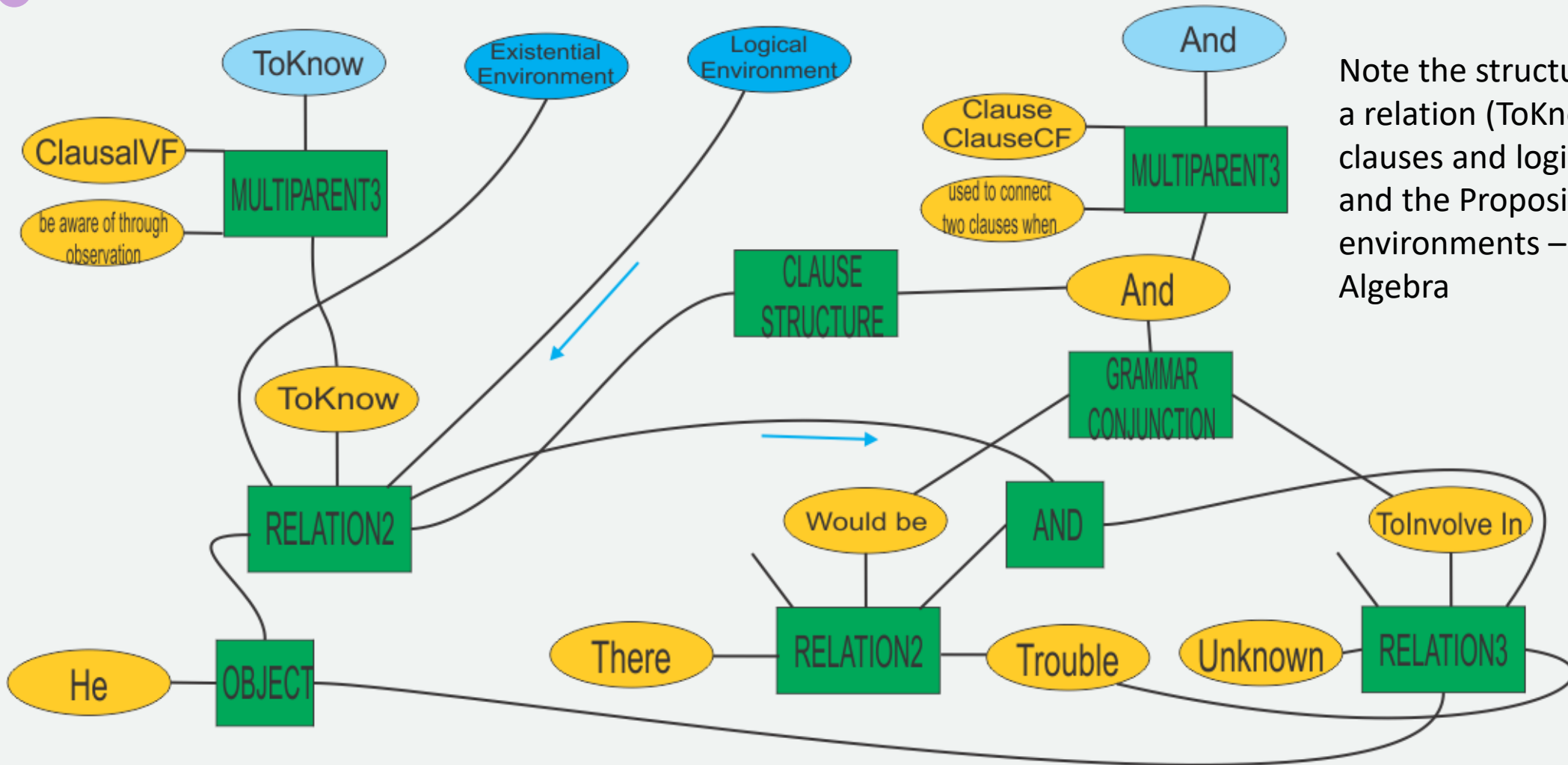
Fred knew that John would have to beat Fred

Fred knew that Fred would have to beat John

etc

Unlike algebra, language is full of abstractions, and inferences have to be drawn from context

# Lots of Connections



Note the structural and logical ANDs, a relation (ToKnow) linking to ANDed clauses and logically controlling them, and the Propositional and Existential environments – this isn't your father's Algebra

He knew there would be trouble and he would be involved in it



# Turn Something into Something Else

The preposition By can provide the subject of a passive verb

He was shot by the sheriff

Here the words “preposition” and “verb” are being used as nouns – no-one gets excited about that

Such slipperiness in the handling of groups would destroy the usefulness of Algebra

# The Analogy Breaks Down Immediately

The analogy between language and algebra to provide rearrangement only works in the simplest cases, and is not necessary if undirected forms of algebra and language don't need rearrangement.

*An undirected network structure used for algebra (Orion) was used as the bones for an undirected network structure for language – with many extensions and transformations to handle the abstractions of language*



**Active  
Structure**

# We Need It Now

Humans are much more comfortable using their natural language to describe complex situations than they are using mathematical symbols (which are narrow, ill-fitting and clunky in comparison).

It used to be that things changed slowly, and solutions to problems could take decades to emerge.

Now we need solutions to emerge in years, so we need to greatly increase the utility of our analytic tools, while softening their edges.