

2.15. Formal Semantics: Disjunctions

Disjunctions are the last of the molecular sentences, the product of the fourth construction rule.

4. If \bullet and \blacktriangle are formal sentences, then $(\bullet \vee \blacktriangle)$ is a formal sentence.

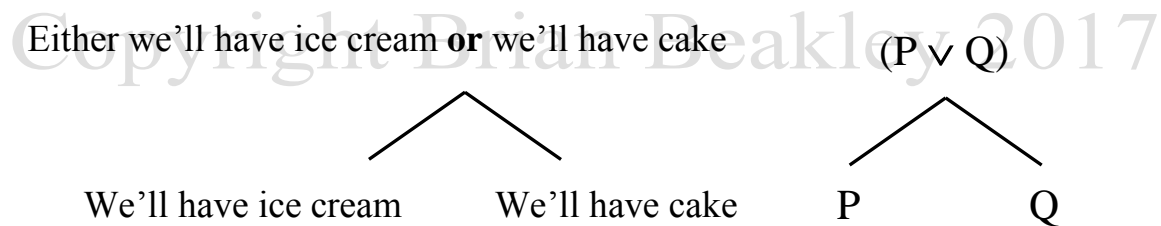
As always, we take a small English sentence as our guide.

P: We'll have ice cream

Q: We'll have cake.

Either we'll have ice cream, or we'll have cake $(P \vee Q)$

The construction tree is similar to the tree for a conjunction.



The truth table will follow the construction, in its horizontal way.

P	Q	$(P \vee Q)$
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With two sentence letters, the truth table calls for four valuations.

4 =	2	x	2	
	P		Q	$(P \vee Q)$
	1		1	
	1		0	
	0		1	
	0		0	

The first valuation resents a situation where it's true that we'll have ice cream, and true that we'll have cake. Now recall that the vel is intended as an **inclusive** disjunction: " $(P \vee Q)$ " means "P, or Q, or possibly both". With that in mind, we see that the first valuation, where we have both ice cream and cake, makes the disjunction **true**.

	P	Q	$(P \vee Q)$
⇒	1	1	1
	1	0	
	0	1	
	0	0	

In the second valuation we have ice cream, but no cake. While the disjunction allows for the possibility of both, it only *promises* that we'll have one or the other. In an ice-cream-enhanced but cake-free situation like Valuation 2, that promise is kept. So long as we have at least one, the disjunction is **true**.

	P	Q	$(P \vee Q)$
	1	1	1
⇒	1	0	1
	0	1	
	0	0	

For the same reason, in the third valuation – where we have no cake, but ice cream –the disjunction is also true.

	P	Q	$(P \vee Q)$
	1	1	1
	1	0	1
⇒	0	1	1
	0	0	

In the fourth valuation it’s false that we’ll have ice cream, and false that we’ll have cake. Here the disjunction is **false**: a prediction of ice cream or cake, followed by neither, is a false prediction.

P	Q	$(P \vee Q)$
1	1	1
1	0	1
0	1	1
⇒ 0	0	0

The same pattern holds for *any* inclusive disjunction, regardless of subject matter. So we present the semantic rule for disjunctions in full generality.

Disjunction Rule

●	▲	$(\bullet \vee \blacktriangle)$
1	1	1
1	0	1
0	1	1
0	0	0

Compared to conjunctions, a disjunction is easy to please: a disjunction is true as long as at least one of its parts is true. Put the other way around: **a disjunction is only false when both its parts are false.**

We find a striking symmetry between conjunctions and disjunctions, where truth and falsehood are concerned.

	conjunction	true	true
A	is only	when both its parts are	
	disjunction	false	false

We will later explore this symmetry in considerable detail.¹ But already it provides a simple way of remembering the semantic rules for conjunctions and disjunctions.

¹ Beginning with 2.33.

Formal Semantics: Chapter Two

1. Principle of Bivalence: In any possible situation, a sentence is either true or false in that situation (not both).

2. Negation Rule

▲	~▲
1	0
0	1

3. Conjunction Rule

●	▲	(● ∧ ▲)
1	1	1
1	0	0
0	1	0
0	0	0

4. Disjunction Rule

●	▲	(● ∨ ▲)
1	1	1
1	0	1
0	1	1
0	0	0