**4.A**: the ***Philosophyldeas*** overview of

# *Syllogistic Logic*

We can spot patterns in a long sequence of argument. Some arguments seem persuasive, while others are rejected. Since the patterns occur in varied contexts, ancient students mapped the patterns in an abstract way, and thereby created formal logic. Simple sentences have a 'subject' and a 'predicate' – they pick out an object, and say something about it. We can say 'the sun is hot' attributes a quality to an object, or we can describe it as a relation between the terms 'sun' and 'hot'. The earliest (syllogistic) logic focused on the '**terms**' of a sentence. If the two terms are F and G, they identified four basic relations (**copulas**, or 'joiners') between terms: F *all-are* G, F *none-are* G, F *some-are* G, and F *some-are-not* G. Some terms will be subjects (S) and other terms will be predicates (P). Ordinary sentences may need some rewriting to fit the simple abstract form. If we say 'fools take risks', this becomes 'fools all-are risk-takers', which is awkward but clear. All logic has to rewrite ordinary language to fit some system.

A **syllogism** is two sentences which imply a third sentence, because there is something in common between their terms. Our syllogism is laid out in this way, with two premises above the line, and the conclusion below the line:

| | |
|---|---|
| Fools *all-are* risk-takers | [M *all-are* P |
| <u>Philosophers *some-are* fools</u> | <u>S *some-are* M</u> |
| Philosophers *some-are* risk-takers | S *some-are* P] |

'Philosophers' is the subject term (**S**) of the conclusion, and 'risk-takers' is the predicate term (**P**) of the conclusion. 'Fools' is the *middle term* (**M**), which is what the first two sentences (the premises) had in common, and which drops out for the conclusion. The particular argument is said to be '**valid**', meaning that this pattern always works (or preserves truth), no matter what the terms S, P and M mean. The two premise sentences can contain pairs of terms in either order, so the possible patterns in the premises are 1) MP+SM, 2) PM+SM, 3) MP+MS, and 4) PM+MS (called the four **figures**). If we now incorporate the four different types of copula (*all-are*, *none-are*, *some-are*, *some-are-not*), that gives 64 different possible syllogisms for each of the four figures, so there are 256 possible syllogisms altogether.

But which of these syllogisms is a valid argument? For example, is this version of the fourth figure valid?

| | |
|---|---|
| Risk-takers *some-are-not* fools | [P *some-are-not* M |
| <u>Fools *none-are* philosophers</u> | <u>M *none-are* S</u> |
| Philosophers *none-are* risk-takers | S *none-are* P] |

Modern Venn diagrams (overlapping circles to represent the three terms) can help with this, but we can intuitively assess the claim, and see that it is not valid (because philosophers could be wise risk-takers). It was also observed that the four basic relations were connected in distinct ways (laid out in a *square of oppositions*), which ruled some inferences as invalid. Care also had to be taken to avoid '**equivocation**', where a term shifted its meaning from one sentence to the next. Having done these assessments, it was concluded that **19** of the 256 possible syllogism are valid arguments. A tradition developed of learning these 19 valid patterns by heart (with memorable names assigned to them), so that lawyers and theologians could test their syllogisms for validity.

Syllogistic logic reached a height of popularity in the medieval period. The system worked well, but didn't seem to cover enough of our reasoning processes. Its most important omission was that you could relate terms, but not **whole sentences**, so the full development of Propositional Logic (linking sentences with 'and', 'or, and 'if…then') greatly extended the range of logic. A rather surprising development was the observation that a few of the 19 famous syllogisms were not actually valid, because they can become invalid if the item referred to by a term does not actually exist. Also the terms used in the syllogistic logic were largely confined to categories of thing, rather than individuals. The eventual result was a new logic ('predicate calculus'), which dealt with 'atomic' sentences combining a subject (referring to an individual) and a predicate (referring to its properties), and treating the relations between terms ('all' and 'some' – the *quantifiers* – and 'not' – *negation*), as operators on the sentences, whose components were indicated by variables. Using the combination tools from propositional logic, it could also now reason with complex compound sentences. After this, syllogistic logic became a matter of mainly historical interest.

A further weakness of syllogistic logic was that it did not handle complex **relations** well, because it had reduced the relations to the four basic ones. Some general relations could be translated into the syllogistic style, but it was hard to reason with very specific relations like 'to the left of' or 'better than'. It was gradually realised that relations had a logic of their own, which needed to be incorporated into the new predicate calculus. The one clear strength of syllogistic logic, though, was that although some translation was needed to make ordinary language fit the syllogisms, the new logic was even further from ordinary speech, with completely symbolic formulas that looked nothing like normal sentences, and major rewrites were needed to find the elusive 'logical form' of tricky cases. But if logic was meant to map everyday reasoning, logic relating 'terms' still had a lot to be said for it, mainly because it retains some ordinary language, which reasoners grasp much more quickly than systems of symbols.

An interesting modern development has been a bold revival of syllogistic logic, under the title **Term Logic**, with some ingenious shifts in the original rules, to cope with the problems that had arisen, and introduce more flexibility. The primary thought was that the categories represented by traditional terms can be represented in an interrelated hierarchy, and that the relations between the ingredients of the hierarchy can be represented as positive ('+') or negative ('-'). This led to a logic which was effectively an arithmetic of sentences containing combined terms. The act of negation applies to terms, rather than to sentences, and terms usually come in pairs (one +, the other -). By also treating entire sentences as terms, the logic can extend to relations of propositions, and interesting accounts of reference and category mistakes emerge from the system.

Modern logicians have shown that every truth in syllogistic logic can be proved (so it is 'complete'). That fact, and its use of ordinary language, which keeps it close to the way people actually reason, means that syllogistic logic (though unfashionable) will always remain of interest.