

Refutation of hexagons of opposition for statistical modalities

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Abstract: We evaluate pragmatic hypotheses in the evolution of science as based on probabilistic squares and hexagons of opposition under coherence. Neither conjecture is tautologous, and hence both are refuted.

We assume the method and apparatus of Meth8/VL4 with Tautology as the designated *proof* value, **F** as contradiction, **N** as truthity (non-contingency), and **C** as falsity (contingency). For results, the 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET $p, q, r, s: p; x; r; s;$
 \sim Not, \neg ; + Or, \vee, \cup ; - Not Or; & And, \wedge, \cap ; \ Not And;
 $>$ Imply, greater than, \rightarrow, \vdash ; $<$ Not Imply, less than, \in
 $=$ Equivalent, \equiv, \vDash ; @ Not Equivalent, \neq ;
 $\%$ possibility, for one or some, \exists, \diamond, M ; # necessity, for every or all, \forall, \square, L ;
 $(p=p)$ **T** as tautology; $(p@p)$ **F** as contradiction;
 $(\%p<\#p)$ **C** as contingency, Δ ; $(\%p>\#p)$ **N** as non-contingency, ∇ ; $(\%r>\#r)$ Ordinal 1.
 $\sim(y < x)$ ($x \leq y$), ($x \subseteq y$).

From: Esteves, L.G.; Izbicki, R.; Stern, R.B.; Stern, J.M. (2018).
 Pragmatic hypotheses in the evolution of science. arxiv.org/pdf/1812.09998.pdf
lesteves@ime.usp.br, rafaelizbicki@gmail.com, rbstern@gmail.com, jmstern@hotmail.com

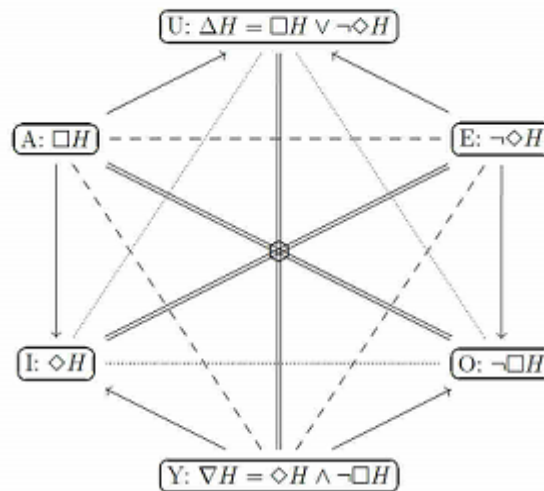


Figure 1: Hexagons of Opposition for Statistical Modalities.

We found the following expressions to be tautologous: $A = \sim(E+Y)$; $E = \sim(A+Y)$; $U = (A+E)$; $U = (A\&E)$; $Y = (I\&O)$; $I = \sim(O+U)$; $O = \sim(I+U)$.

This lead us to evaluate the source of the atomic, statistical modalities as so cited below.

From: Pfeifer, N.; Sanfilippo, G. (2017).
 Probabilistic squares and hexagons of opposition under coherence.
 arxiv.org/pdf/1701.07306.pdf
 niki.pfeifer@lmu.de, giuseppe.sanfilippo@unipa.it

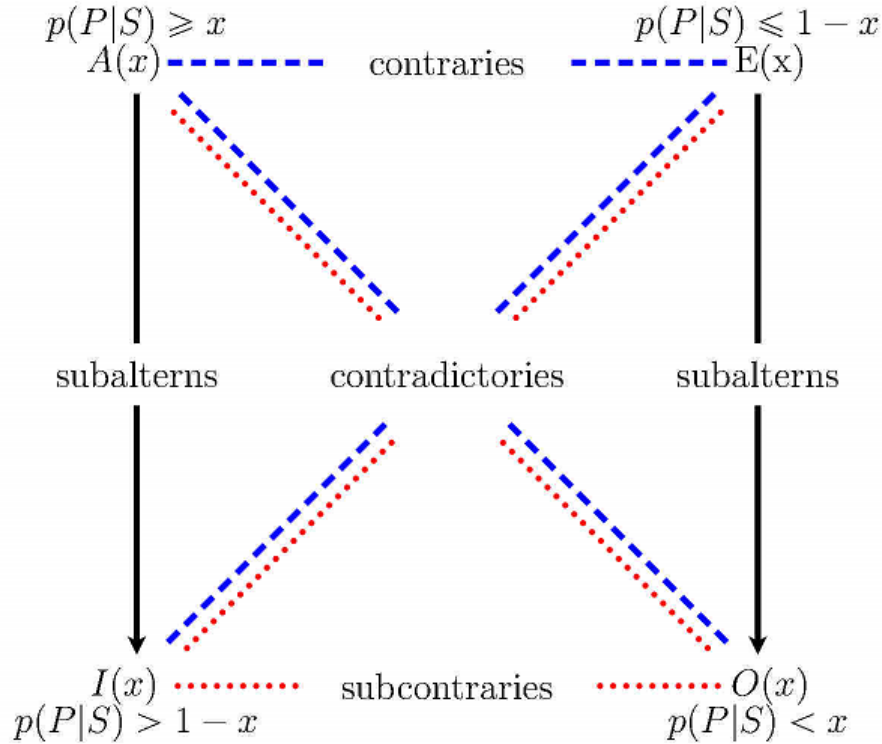


Figure 3: Probabilistic square of opposition $\mathbf{S}(x)$ defined on the four sentence types $(A(x), E(x), I(x), O(x))$ with the threshold $x \in]\frac{1}{2}, 1]$ (see also Table 1). It provides a new interpretation of the traditional square of opposition (see, e.g., [38]), where the corners are labeled by “Every S is P ” (A), “No S is P ” (E), “Some S is P ” (I), and “Some S is not P ” (O).

We evaluate the assigned probabilities above in the square of opposition as corrected by Meth8 below.

From: James, C. (2016-2019).

Recent advances in refutation and confirmation using the Meth8 modal logic model checker.
 "Square of opposition Meth8 corrected". Artifact 312:444. vixra.org/pdf/1812.0397v2.pdf

Source type	Definitia	Meth8 corrections	Valid as	Statistical probabilities	Truth table results
Corner	A	$\#(s=p)$		$\sim(q>\#(s=p))$	FFCT FFCT FFTC FFTC
	E	$\#(s=\sim p)$		$\sim(((\%r>\#r)-q)<\#(s=\sim p))$	NNTT NNTT NNTT NNTT
	I	$\%(s=p)$		$(\%(s=p)>((\%r>\#r)-q))$	CT FN CT FN TC NF TC NF
	O	$\%(s=\sim p)$		$(\%(s=\sim p)<q)$	CT FF CT FF TC FF TC FF
Contraries	AE	$\#(s=p)\#(s=\sim p)$	$A \setminus E$	$\sim(q>\#(s=p)) \setminus \sim(((\%r>\#r)-q)<\#(s=\sim p))$	TT NF TT NF TT FN TT FN
Subalterns	AI	$\#(s=p)>\%(s=p)$	$A > I$	$\sim(q>\#(s=p))>(\%(s=p)>((\%r>\#r)-q))$	TTNN TTNN TTNN TTNN
Contradictories	AO	$\#(s=p) \setminus \%(s=\sim p)$	$A \setminus O$	$\sim(q>\#(s=p)) \setminus (\%(s=\sim p)<q)$	TTTT TTTT TTTT TTTT
Contradictories	EI	$\#(s=\sim p)\%(s=p)$	$E \setminus I$	$\sim(((\%r>\#r)-q)<\#(s=\sim p)) \setminus (\%(s=p)>((\%r>\#r)-q))$	TCTC TCTC CTCT CTCT
Subalterns	EO	$\#(s=\sim p)>\%(s=\sim p)$	$E > O$	$\sim(((\%r>\#r)-q)<\#(s=\sim p))>(\%(s=\sim p)<q)$	CT FF CT FF TC FF TC FF
Subcontraries	IO	$\%(s=p)+\%(s=\sim p)$	$I + O$	$(\%(s=p)>((\%r>\#r)-q))+(\%(s=\sim p)<q)$	CT FN CT FN TC NF TC NF

The equation for AO contradictory is tautologous, as expected, however the other nine are not. This indicates mistakes in the assignments for probabilistic squares and hexagons of opposition under coherence. What follows is that since pragmatic hypotheses in the evolution of science are based thereon, they also are suspicious. In other words, both probabilistic squares and hexagons of opposition under coherence and the derived pragmatic hypotheses in the evolution of science are refuted.