The Fight Is Won By Whoever Sees First

Review of Robert L. Shaw, *Fighter Combat: Tactics and Maneuvering* (Naval Institute Press, 447 pp.)

TLDR / 80-20

> **Air combat is a trade between angles and energy, and the currency is sight.**
> Every manoeuvre in the book spends one of those two to buy the other. The pilots who die mostly never saw who was spending it on them.

The Keys

The two currencies

- **Angles or energy — you pick one.** An angles fighter trades speed for position now; an energy fighter keeps speed and takes position over several passes.
- **Corner speed is where the trade is cheapest.** Minimum turn radius comes from starting the turn at corner speed, pulling maximum available G, and letting speed decay.
- **Turn rate and turn radius are different goods.** Very slow airspeeds cause dramatic rises in level turn radius even while rate stays usable — slow is not automatically tight.
- **Altitude taxes the turn.** Below corner speed both rate and radius degrade with altitude because of reduced lift capability; above it, structural limits bind instead.
- **The energy fighter's optimum is maximum sustained turn rate,** provided that speed exceeds minimum vertical-manoeuvring speed. Below that, it loses its whole advantage.
- **Flight-path separation is worthless if unusable.** Shaw's own moral: a fighter that generates separation but lacks energy for a second vertical move cannot cash it.

Pursuit geometry

- **Three pursuit curves, three different bills.** Lead closes fastest but drives angle off tail up; pure closes less but holds angle; lag preserves energy and gives up closure.
- **Lead pursuit is self-tightening.** As range closes the attacker must turn with decreasing radius and increasing rate, eventually out-turning the target just to hold lead.
- **Lead has a visibility ceiling.** Practical maximum lead is limited by over-the-nose visibility — blind lead turns risk collision and losing the bogey entirely.
- **Pure pursuit hides you.** Nose-on presents the minimum frontal area to the defender, which makes the attacker harder to see as well as harder to track.
- **The lead turn is the highest-value single move.** Turning early against a merging opponent converts a neutral pass into a decisive angular advantage.
- **Start it too early and you cross his nose.** The reward grows the earlier you turn, and so does the chance of handing the fight away.
- **Yo-yos manage the mismatch.** A high yo-yo trades speed for a repositioned turn circle; the lag roll pulls out of plane rather than bleeding energy in plane.

When it goes wrong

- **The scissors is a slow-speed trap.** Flat scissors rewards low wing loading; Shaw says less manoeuvrable high-speed fighters should avoid it "like the plague."
- **Rolling scissors comes from the fast overshoot,** flat scissors from the slow one. The overshoot you make determines which fight you are about to be in.
- **Winning a scissors means getting in phase.** As one fighter gains, the nose-to-nose phase shortens, the lead turn lengthens, and eventually the overshoot stops happening.
- **Each pass is a chance to be shot.** Shaw counts three passes for the bogey to gain 90° in a nose-low sustained turn, each pass exposing the energy fighter to a snapshot.
- **Overshoots create blind periods,** and a longer overshoot means a longer one — blind time loses fights more reliably than bad geometry does.

Why two aircraft, not one

- **Hartmann's line is the thesis:** "There are no eyes for your backside, no eyes for who is coming from below... if you are single you have too many blind spots."
- **Mutual support is a vision system before it is firepower.** Each pilot covers the other's blind cone so an attack can be pressed without checking six.
- **Combat spread leaves one danger zone.** Line-abreast gives near-total coverage except the cross-hatched region between the aircraft — the geometry is explicit, not vague.
- **Spacing is set by turn radius, not by taste.** Optimum lateral spacing varies with speed and altitude because it must allow the wingman room to turn and point weapons.
- **Vertical splits have a limit.** Too large and the low aircraft cannot climb to help without losing so much speed it arrives useless.
- **Mutual support by presence is real.** Knowing a second fighter is in the area makes a bogey less aggressive against either one, before a shot is fired.
- **Fighting wing is judged ineffective** two-versus-two except against clearly inferior opposition — Shaw grades doctrines rather than presenting them neutrally.

The dissimilar fight

- **Know which fighter you are before the merge.** Shaw structures the book around similar versus dissimilar aircraft, because the right move inverts between them.
- **The angles fighter's job is to arrive early.** Unloaded acceleration back to corner speed between turns, then a minimum-radius turn at the lead-turn point.
- **A 90° aspect view is the cue.** Shaw gives the visual trigger — a hard-turning bogey showing full planform is about the optimum moment to commit.
- **The energy fighter should not expect a tracking shot** against a well-flown low-wing-loaded opponent, which can generate enough turn to stay out of steady parameters.
- **Its exceptions are human.** The tracking shot appears when the bogey pilot loses sight or misjudges — not when the energy fighter out-flies the airframe.

- **Diving guns passes work better shallowed.** Steep dives help build the heading change, but the firing pass itself succeeds more often flattened out.

AI's Take

- **The book's central claim is not tactical, it is perceptual.** "The vast majority of fighter pilots lost have been unaware of their attacker until it was too late."
- **That reframes everything before it.** All the geometry is about arriving where you can see and he cannot — the weapons envelope is downstream of the visual one.
- **Design follows from it.** Shaw argues fighters and tactics must be built to reduce crew task loading and improve field of view, which is an ergonomics argument.
- **The evidence base is experience, not data.** No statistics, no controlled comparison, no engagement dataset — assertions from a practitioner with diagrams.
- **The diagrams carry the argument,** and that is a real limitation in a text summary: the reasoning is genuinely spatial and does not survive compression well.
- **It is honest about aircraft dependence.** Advice is conditioned on wing loading and thrust-to-weight rather than given as universal, which is rare in a tactics manual.
- **The transferable idea is the angles/energy trade.** Any contest between an opponent who converts resources into position now and one who banks them has this structure.
- **The second transferable idea is the blind cone.** Two agents covering each other's unobservable regions beats two agents each individually stronger.
- **It is pre-stealth and pre-datalink.** The visual-acquisition premise that makes the book coherent is exactly what modern sensors were built to break.