

TACTICS & STRATEGY

First edition

6 units

30 lessons + exams

A video for every lesson

FIRST EDITION

COURSE GUIDE

Tactics & Strategy is a one-semester elective for students in grades 8–12. It teaches the art of making and carrying out a plan against an opponent who is also thinking: how to choose an objective, gather strength where it counts, use surprise and deception honestly within the rules, read an opponent, adapt when the plan meets reality, and lead others so that they can act wisely without waiting for orders. The same ideas run through a chess game, a Go board, a battle map and a basketball court, and the course moves among them on purpose, so that each one lights up the others.

The course begins with the vocabulary of the subject: strategy, operations and tactics; the classic principles of war; Sun Tzu’s “know the enemy and know yourself”; Clausewitz’s friction; and the king of Luke 14 who sits down first and counts the cost. It then turns to the board, where the principles can be tested a hundred times a week: opening principles, forks and pins, Steinitz’s and Capablanca’s middlegame planning, influence and territory in Go, and the counting of a checkers or chess endgame. Two units of history follow, from Gideon’s three hundred and Joshua’s ambush at Ai through Gaugamela, Cannae and Zama, to Trenton, Austerlitz, Trafalgar, the Shenandoah Valley and the codebreakers of Midway. The military history teaches maneuver, terrain, timing, supply and leadership, never gruesome detail. The fifth unit carries the same ideas onto the field: soccer and football formations, man and zone defense, the power play and the scouting report. The last unit is about the strategist’s character: clear intent, honest supply, humility when the plan fails, and the lawful striving Paul commends in 2 Timothy 2:5.

Every lesson moves from **the story** to **the plan**, then to **the principle**, and finally on **the board and the field**, where students use the idea in a game or a sport. Worked examples are real reasoning: reading a battle map, counting tempo and material, computing a march rate or an Elo expectation, comparing two formations. Projects ask students to play and record games, replay famous battles on a grid with counters, chart a team’s formation from a broadcast, and test a strategy over many

games. Scripture is woven in lightly, because the Bible is honest about both the wisdom of counsel and the limits of human plans: “A man’s heart deviseth his way: but the LORD directeth his steps.”

Videos were chosen lesson by lesson from chess and Go teachers, military-history channels that teach with maps and moving symbols, sports film-study and coaching channels, and a few careful lecturers. Every video was previewed frame by frame and its description read. The military-history videos were chosen because they explain maneuver, terrain, timing and supply with maps; none shows wounds, and none was chosen for spectacle. Some of the history channels are run by individual historians; they were chosen because they teach the lesson’s exact plan clearly. The “when” note says when to watch, and a parent note flags anything to know in advance. Pause often, and draw the map in the scorebook before the narrator finishes the story.

Start with Lesson 1.1 →

WHO IT IS FOR

Grades 8–12. There is no formal prerequisite beyond pre-algebra (ratios, percents and simple equations); students who know how the chess pieces move will start faster, and Lesson 2.1 teaches what they need. An 8th grader can follow every lesson, while the hard and challenge problems stretch an 11th grader. Students read the lessons and work the examples largely on their own; a parent checks the practice sets against the answers, plays some of the games, and discusses the essay questions. Nothing needs to be bought beyond ordinary household items, a chess set and a checkers set.

HOW TO USE THIS COURSE

1. **The weekly rhythm.** Each lesson takes three sessions of about 50 minutes. Session 1: the warm-up, the video, the core ideas and the worked examples. Session 2: the project and the scorebook. Session 3: the practice set, checked against the answers, with every missed problem reworked. Each unit ends with a test day, and the midterm and final each have a review day. At five sessions a week the course fills a semester of 20 weeks.

2. **Story, plan, principle, field.** Read the core ideas in order. *The story* gives a real moment with names, dates and places; *the plan* shows what the commander, player or coach actually intended and how he carried it out; *the principle* names the idea that can be carried to other situations; *on the board and the field* shows how it works in chess, Go, checkers and team sports today. Cover the solution to each worked example, try it yourself, and compare line by line.
3. **Maps and notation.** Draw every battle you study as a simple map in the scorebook: north arrow, scale, terrain, the two sides in different colors, and numbered arrows for the moves in order. Chess positions are written in algebraic notation: the files are a to h from White's left, the ranks are 1 to 8 from White's side, and a move such as Nf3 means a knight moves to the square f3. Set up every chess position on a real board before reading the solution.
4. **Picture study.** Each lesson has one public-domain painting, map, portrait or historic photograph. Look at it quietly for two minutes, put it away and describe what you saw, then work through the "look for" items and the questions, which point back to the lesson's plan or principle. The pictures show commanders, councils, maps and games, not carnage.
5. **The scorebook habit.** Keep one bound graph-paper notebook for the semester: your scorebook. Every project follows the same four steps: *plan* (write your intended plan before you play or replay), *record* (the moves, the map, the tally), *compare* (what happened against what you planned) and *decide* (what you would change, and why). Record what actually happened, not what should have happened.
6. **Practice sets and corrections.** Problems are marked easy, medium, hard and challenge. Do all of the easy and medium problems and most of the hard ones; the challenge problem is for students who want more. Check against the answers the same day and rework every miss in the scorebook until you understand it.
7. **Unit tests, midterm and final.** Each unit test is worth 100 points and mixes reasoning problems, short calculations, concept questions and one short essay. The midterm (after Unit 3) and the final (after Unit 6) are each worth 100 points. Calculators are allowed, and all work must be shown.
8. **How we handle war.** Much of the history of strategy is military history, and the course tells it honestly as history: real commanders, real plans, real stakes. It teaches maneuver, terrain, timing, supply, intelligence and leadership. It gives

casualties only as plain numbers where the story needs them, shows no disturbing images, stays before about 1950, gives the two world wars a single plan-focused lesson, and includes no instruction in arms. Battles from Scripture are taught as history from the text itself.

9. **Optional books and games.** Each unit lists a few free classics, free study sites and family games that extend the lessons. They are never required; every project works with a chess set, a checkers set, paper, pencil, a few household items and a soft ball.
10. **Safety for the field projects.** A few projects in Unit 5 run a drill or a small game in the yard. Warm up first, use a soft ball, keep clear of windows, streets and people, and wear proper shoes. Any trip to a court, field or rink is optional and supervised by a parent.

SCOPE AND SEQUENCE

UNIT 1 • WEEKS 1-4

What Strategy Is

The vocabulary of strategy: the three levels of strategy, operations and tactics; the principles of war shown in games and sports; Sun Tzu on knowing the enemy and yourself; Clausewitz on friction and uncertainty; and counting the cost before a contest, with Lanchester's square law and the council at Fili.

- 1.1 Strategy, Operations and Tactics
- 1.2 The Principles of War
- 1.3 Sun Tzu: Know the Enemy and Know Yourself
- 1.4 Clausewitz: Friction and the Fog of War
- 1.5 Counting the Cost

UNIT 2 • WEEKS 4-7

The Board as a Battlefield

The board as a battlefield: Morphy and the opening principles of center, development, king safety and tempo; forks, pins and skewers; Steinitz's and Capablanca's middlegame planning; influence, territory and sente in Go; and counting and the opposition in checkers and chess endgames.

- 2.1 Chess Openings: Center, Development, King Safety and Tempo
- 2.2 Forks, Pins and Skewers
- 2.3 Planning in the Middlegame: Steinitz and Capablanca
- 2.4 Go: Influence, Territory and Sente
- 2.5 Checkers and the Endgame: Counting and the Opposition

UNIT 3 • WEEKS 7–10

Great Plans of the Ancient and Biblical World

Great plans of the ancient and biblical world: Gideon's night attack, Joshua's ambush at Ai, Alexander's oblique advance at Gaugamela, Hannibal's double envelopment at Cannae, and Scipio's victory at Zama, won by learning from his enemy.

- 3.1 Gideon's Three Hundred
- 3.2 Joshua's Ambush at Ai
- 3.3 Alexander at Gaugamela: The Oblique Attack
- 3.4 Hannibal at Cannae: The Double Envelopment
- 3.5 Scipio at Zama: Learning from the Enemy

UNIT 5 • WEEKS 14–17

Tactics in Team Sports

Tactics in team sports: soccer formations from the 2-3-5 to Total Football, football's single wing, T formation and West Coast offense, man and zone defense and John Wooden's UCLA, the power play and the forecheck, and the honest scouting report.

- 5.1 Soccer Formations: From the Pyramid to Total Football
- 5.2 Football Formations: Single Wing, T and West Coast
- 5.3 Basketball: Man, Zone, Spacing and John Wooden
- 5.4 Hockey and Lacrosse: The Power Play and the Forecheck
- 5.5 The Scouting Report

UNIT 4 • WEEKS 11–14

Generals and Admirals, 1776–1944

Generals and admirals from 1776 to 1944: Washington's surprise at Trenton, Napoleon's feigned weakness at Austerlitz, Nelson's shared intent at Trafalgar, Jackson's marches in the Shenandoah Valley, and the intelligence and deception behind Midway and D-Day.

- 4.1 Washington at Trenton: Surprise and Morale
- 4.2 Napoleon at Austerlitz: The Feigned Weakness
- 4.3 Nelson at Trafalgar: Breaking the Line
- 4.4 Jackson's Valley Campaign: Maneuver and Interior Lines
- 4.5 Deception and Intelligence: Midway and Operation Fortitude

UNIT 6 • WEEKS 17–20

The Strategist's Character

The strategist's character: commander's intent, supply and Minard's map of 1812, adapting when the plan fails, honor and lawful striving, and a capstone in which the student designs and tests an original strategy or compares a battle with a game.

- 6.1 Commander's Intent
- 6.2 Supply: Minard's Map of 1812
- 6.3 When the Plan Fails
- 6.4 Honor and Lawful Striving
- 6.5 Capstone: Your Strategy Report

WEEKLY PACING CALENDAR

WEEK	PLAN
1	- Day 1: Lesson 1.1 Strategy, Operations and Tactics: video, teaching and worked examples - Day 2: Lesson 1.1: project and notebook - Day 3: Lesson 1.1: practice set and corrections - Day 4: Lesson 1.2 The Principles of War: video, teaching and worked examples - Day 5: Lesson 1.2: project and notebook <i>Five sessions a week of about 50 minutes. Families on a four-day week can combine the practice day of one lesson with the teaching day of the next.</i>
2	- Day 1: Lesson 1.2: practice set and corrections - Day 2: Lesson 1.3 Sun Tzu: Know the Enemy and Know Yourself: video, teaching and worked examples - Day 3: Lesson 1.3: project and notebook - Day 4: Lesson 1.3: practice set and corrections - Day 5: Lesson 1.4 Clausewitz: Friction and the Fog of War: video, teaching and worked examples
3	- Day 1: Lesson 1.4: project and notebook - Day 2: Lesson 1.4: practice set and corrections - Day 3: Lesson 1.5 Counting the Cost: video, teaching and worked examples - Day 4: Lesson 1.5: project and notebook - Day 5: Lesson 1.5: practice set and corrections
4	- Day 1: Unit 1 test - Day 2: Lesson 2.1 Chess Openings: Center, Development, King Safety and Tempo: video, teaching and worked examples - Day 3: Lesson 2.1: project and notebook - Day 4: Lesson 2.1: practice set and corrections - Day 5: Lesson 2.2 Forks, Pins and Skewers: video, teaching and worked examples

WEEK	PLAN
5	- Day 1: Lesson 2.2: project and notebook - Day 2: Lesson 2.2: practice set and corrections - Day 3: Lesson 2.3 Planning in the Middlegame: Steinitz and Capablanca: video, teaching and worked examples - Day 4: Lesson 2.3: project and notebook - Day 5: Lesson 2.3: practice set and corrections
6	- Day 1: Lesson 2.4 Go: Influence, Territory and Sente: video, teaching and worked examples - Day 2: Lesson 2.4: project and notebook - Day 3: Lesson 2.4: practice set and corrections - Day 4: Lesson 2.5 Checkers and the Endgame: Counting and the Opposition: video, teaching and worked examples - Day 5: Lesson 2.5: project and notebook
7	- Day 1: Lesson 2.5: practice set and corrections - Day 2: Unit 2 test - Day 3: Lesson 3.1 Gideon's Three Hundred: video, teaching and worked examples - Day 4: Lesson 3.1: project and notebook - Day 5: Lesson 3.1: practice set and corrections
8	- Day 1: Lesson 3.2 Joshua's Ambush at Ai: video, teaching and worked examples - Day 2: Lesson 3.2: project and notebook - Day 3: Lesson 3.2: practice set and corrections - Day 4: Lesson 3.3 Alexander at Gaugamela: The Oblique Attack: video, teaching and worked examples - Day 5: Lesson 3.3: project and notebook
9	- Day 1: Lesson 3.3: practice set and corrections - Day 2: Lesson 3.4 Hannibal at Cannae: The Double Envelopment: video, teaching and worked examples - Day 3: Lesson 3.4: project and notebook - Day 4: Lesson 3.4: practice set and corrections - Day 5: Lesson 3.5 Scipio at Zama: Learning from the Enemy: video, teaching and worked examples
10	- Day 1: Lesson 3.5: project and notebook - Day 2: Lesson 3.5: practice set and corrections

WEEK	PLAN
	- Day 3: Unit 3 test - Day 4: Review day for the midterm - Day 5: Midterm exam
11	- Day 1: Lesson 4.1 Washington at Trenton: Surprise and Morale: video, teaching and worked examples - Day 2: Lesson 4.1: project and notebook - Day 3: Lesson 4.1: practice set and corrections - Day 4: Lesson 4.2 Napoleon at Austerlitz: The Feigned Weakness: video, teaching and worked examples - Day 5: Lesson 4.2: project and notebook
12	- Day 1: Lesson 4.2: practice set and corrections - Day 2: Lesson 4.3 Nelson at Trafalgar: Breaking the Line: video, teaching and worked examples - Day 3: Lesson 4.3: project and notebook - Day 4: Lesson 4.3: practice set and corrections - Day 5: Lesson 4.4 Jackson's Valley Campaign: Maneuver and Interior Lines: video, teaching and worked examples
13	- Day 1: Lesson 4.4: project and notebook - Day 2: Lesson 4.4: practice set and corrections - Day 3: Lesson 4.5 Deception and Intelligence: Midway and Operation Fortitude: video, teaching and worked examples - Day 4: Lesson 4.5: project and notebook - Day 5: Lesson 4.5: practice set and corrections
14	- Day 1: Unit 4 test - Day 2: Lesson 5.1 Soccer Formations: From the Pyramid to Total Football: video, teaching and worked examples - Day 3: Lesson 5.1: project and notebook - Day 4: Lesson 5.1: practice set and corrections - Day 5: Lesson 5.2 Football Formations: Single Wing, T and West Coast: video, teaching and worked examples
15	- Day 1: Lesson 5.2: project and notebook - Day 2: Lesson 5.2: practice set and corrections

WEEK	PLAN
	- Day 3: Lesson 5.3 Basketball: Man, Zone, Spacing and John Wooden: video, teaching and worked examples - Day 4: Lesson 5.3: project and notebook - Day 5: Lesson 5.3: practice set and corrections
16	- Day 1: Lesson 5.4 Hockey and Lacrosse: The Power Play and the Forecheck: video, teaching and worked examples - Day 2: Lesson 5.4: project and notebook - Day 3: Lesson 5.4: practice set and corrections - Day 4: Lesson 5.5 The Scouting Report: video, teaching and worked examples - Day 5: Lesson 5.5: project and notebook
17	- Day 1: Lesson 5.5: practice set and corrections - Day 2: Unit 5 test - Day 3: Lesson 6.1 Commander's Intent: video, teaching and worked examples - Day 4: Lesson 6.1: project and notebook - Day 5: Lesson 6.1: practice set and corrections
18	- Day 1: Lesson 6.2 Supply: Minard's Map of 1812: video, teaching and worked examples - Day 2: Lesson 6.2: project and notebook - Day 3: Lesson 6.2: practice set and corrections - Day 4: Lesson 6.3 When the Plan Fails: video, teaching and worked examples - Day 5: Lesson 6.3: project and notebook
19	- Day 1: Lesson 6.3: practice set and corrections - Day 2: Lesson 6.4 Honor and Lawful Striving: video, teaching and worked examples - Day 3: Lesson 6.4: project and notebook - Day 4: Lesson 6.4: practice set and corrections - Day 5: Lesson 6.5 Capstone: Your Strategy Report: video, teaching and worked examples
20	- Day 1: Lesson 6.5: project and notebook - Day 2: Lesson 6.5: practice set and corrections - Day 3: Unit 6 test - Day 4: Review day for the final - Day 5: Final exam

MATERIALS

A chess set and board

Any standard set. A free online analysis board (lichess.org/analysis works without an account) is helpful for checking variations, but every lesson can be done on a real board.

A checkers set

Checkers use the same 8×8 board as chess. Coins or buttons of two colors work in a pinch.

A Go board and stones, or a printed 9×9 grid and two colors of beans or buttons

Lesson 2.4 uses a 9×9 board, which can be drawn with a ruler on card stock.

A bound graph-paper notebook (the scorebook), pencil, ruler and colored pencils

For maps, game records, formation diagrams, tallies and corrected practice problems. Two colors for the two sides of every map.

Counters for replaying battles

Two colors of coins, buttons, game pieces or paper squares, about twenty of each, used on a grid drawn in the scorebook or on poster board.

Two ordinary dice and a calculator

Dice resolve uncertain events in the battle replays; the calculator handles rates, ratios and Elo expectations.

A soft ball and household markers (cones, shoes or bottles)

For the small-sided formation and defense drills in Unit 5, done in a yard or open room.

Access to free maps and game databases

The West Point (U.S. Military Academy) history atlases online, the Library of Congress map collection, and the free game databases on lichess. A parent should preview any site with advertising.

GRADING

Grades come from the practice sets, the projects, the scorebook, the six unit tests, the midterm and the final. A reasoning answer earns full credit when it states the plan or principle, supports it with specific evidence from the map, the board or the record, and reaches a clear conclusion. A project earns full credit for an honest record carefully kept and compared with the plan, even when the plan failed, as long as the student explains why.

PART	%
Practice sets (completed and corrected)	15
Projects (plan, record, analysis)	25
Scorebook (organization, honesty, completeness)	10
Unit tests	30
Midterm exam	10
Final exam	10

Scale: A 90–100, B 80–89, C 70–79, D 60–69, F below 60.

- Practice sets are graded for completion and correction, not first-try accuracy: a problem done, checked and correctly reworked earns full credit.
- On tests, give partial credit for a correct principle or a correct map even if a detail or a calculation slips. An answer with no reasoning earns at most half credit.
- A project earns full marks when it has a written plan made before play, a complete record (moves, map or tally), a comparison of result with plan, and a written decision with a reason.
- For a high-school transcript this course is one half credit of elective (history and strategy). Keep the scorebook and the unit tests as the record of work.

A NOTE TO PARENTS

You do not need to be a chess master or a military historian to supervise this course well. Your jobs are to keep the rhythm (three sessions per lesson), check the practice sets against the answers, play some of the games with your student, ask him to explain one map or one chess position aloud each week, and look at the scorebook. The best question you can ask is “What was the plan, and how do you know it worked?” A student who can answer it from his own record is learning strategy.

Much of this course is military history, and it is handled with care. Battles are taught as problems of maneuver, terrain, timing, supply, intelligence and leadership. Casualties appear only as plain numbers where the story needs them; there are no

disturbing images, no instruction in arms, and nothing after about 1950. The two world wars appear in one lesson, which studies how intelligence and deception shaped Midway and D-Day. Battles from Scripture are taught as history from the text, with the text's own emphasis on trusting God rather than numbers.

The course is also a course in character. Scripture commends counsel and planning ("with good advice make war," Proverbs 20:18) and also humbles every plan ("A man's heart deviseth his way: but the LORD directeth his steps," Proverbs 16:9). The best strategists in these lessons were diligent, humble, honest about the rules and generous with credit. Praise careful planning, honest records and gracious winning and losing more than any single victory.

UNIT 1

WHAT STRATEGY IS

Before you can study a plan, you need words for it. This unit gives you the vocabulary that generals, chess players and coaches have used for centuries: strategy, operations and tactics; the classic principles of war; Sun Tzu's rule to know the enemy and know yourself; Clausewitz's friction, the thousand small things that make the simplest plan hard; and the king of Luke 14 who sits down first and counts the cost.

Each idea comes with a real story and a real calculation. You will measure how many miles of coast each Union ship had to watch in 1861, map the nine principles onto a soccer field, read false campfire counts the way Sun Bin's enemy did, compute how quickly small chances of failure multiply in a long plan, and test Lanchester's square law with dice and counters. By the end you will be able to name what kind of decision you are looking at, and say which principle it serves.

PREREQUISITES

- Ratios, rates and percents
- Multiplying decimals and using a calculator's power key
- Reading a simple map with a scale and a north arrow

MASTERY CHECKLIST

- ☐ I can sort a decision into strategy, operations or tactics and explain why.
- ☐ I can name the nine principles of war and give a game or sports example of each.
- ☐ I can explain Sun Tzu's rule about knowing the enemy and knowing yourself, and use it to plan against an opponent.
- ☐ I can explain Clausewitz's idea of friction and compute how small chances of failure multiply in a plan with many steps.
- ☐ I can use Lanchester's square law to compare two forces and explain what it means to count the cost before a contest.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **The Art of War, translated by Lionel Giles (Project Gutenberg)**: Free. The 1910 translation quoted in Lesson 1.3, with Giles’s notes and the old Chinese commentators’ stories. Ages 13+ with a parent previewing; a few commentators’ anecdotes are harsh.
- **On War, by Carl von Clausewitz (Project Gutenberg)**: Free. J. J. Graham’s 1873 translation. Read Book I, Chapter VII, “Friction in War,” for Lesson 1.4; it is only a few pages long. Ages 14+.
- **Lichess analysis board**: Free, with no account needed. Useful for checking the chess examples in this unit and the next. Ages 10+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

1.1 Strategy, Operations and Tactics	3 sessions of 50 minutes
1.2 The Principles of War	3 sessions of 50 minutes
1.3 Sun Tzu: Know the Enemy and Know Yourself	3 sessions of 50 minutes
1.4 Clausewitz: Friction and the Fog of War	3 sessions of 50 minutes
1.5 Counting the Cost	3 sessions of 50 minutes

UNIT 1 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Answer the concept questions in complete sentences, with specific examples. The test has 15 problems worth a total of 100 points.

1. **6 pts**

Define strategy, operations and tactics, and give one chess example of each.

2. (6 pts)

The Union Navy had about 42 ships in commission in April 1861 to blockade about 3,500 miles of coast. How many miles per ship is that? Why was the early blockade weak?

3. (5 pts)

How many days from May 18 to July 4, 1863? What event began and ended on those dates?

4. (7 pts)

List the nine principles of war.

5. (7 pts)

A soccer team of 10 field players puts 5 on the right wing, 3 in the middle and 2 on the left. The opponent spreads its 10 as 3, 4 and 3. Find the local ratio in each zone, name the principles used, and name the risk.

6. (6 pts)

Quote Sun Tzu's three cases of knowing the enemy and yourself (in your own words is acceptable), and explain the case that is hardest in practice.

7. (7 pts)

Sun Bin's camps showed 100,000, then 50,000, then 20,000 fires. Compute the overall percent drop and explain why the deception worked.

8. (5 pts)

Quote Clausewitz's sentence about friction beginning "Everything is very simple in War."

9. (7 pts)

A play needs six independent steps, each 92% reliable. What is the probability the whole play works?

10. (7 pts)

Three messengers are sent by separate roads, each with a 65% chance of arriving. What is the chance at least one arrives? What assumption are you making?

11. **6 pts**

Under the square law with equal quality, compare the strengths of 4,000 and 12,000.

12. **7 pts**

Under the square law, 15,000 meet 9,000 of equal quality. How many of the 15,000 remain? How many would remain under the linear law?

13. **6 pts**

Explain Kutuzov's decision at Fili as an example of counting the cost.

14. **6 pts**

Why should a chess player who is ahead in material usually trade pieces? Give a numerical illustration.

15. **12 pts**

Short essay (8–10 sentences): Choose one principle of war and one idea from Sun Tzu or Clausewitz. Show how both apply to a game or sport you know well, using a specific example, and explain how a wise player balances that principle against another one.

ANSWER KEY

1. Strategy: the overall plan toward the final goal (e.g., play solidly for a draw to win the tournament). Operations: a connected plan within a game (e.g., a queenside attack over many moves). Tactics: a single forcing sequence (e.g., a knight fork).
2. $3500/42 \approx 83$ miles per ship. With so few ships, most of the coast was unwatched, and many blockade runners got through until the Navy grew.
3. $13 + 30 + 4 = 47$ days: the siege of Vicksburg.
4. Objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, simplicity.
5. Right 5:3, middle 3:4, left 2:3. Mass on the right with economy of force elsewhere; the risk is to security on the left and middle if the opponent switches play quickly.
6. Know both: no need to fear a hundred battles. Know yourself only: a defeat for every victory. Know neither: defeat in every battle. Knowing yourself is often hardest, because vanity hides our weaknesses.
7. $(100000 - 20000)/100000 = 80\%$. It confirmed what Pang Juan hoped to believe, that the enemy was deserting, and he did not check evidence the enemy controlled.
8. "Everything is very simple in War, but the simplest thing is difficult."
9. $0.92^6 \approx 0.606$, about 61%.
10. $1 - 0.35^3 = 1 - 0.0429 \approx 0.957$, about 96%. The assumption is that the messengers fail independently.
11. $12000^2/4000^2 = 9$: the larger force is nine times as strong.
12. $\sqrt{225 - 81} \times 1000 = 12,000$; linear law: $15000 - 9000 = 6000$.
13. Another battle before Moscow risked destroying Russia's only army. By giving up the city he preserved the army, gained time to reinforce it, and left Napoleon far from home with a supply problem and no peace offer.
14. Each trade makes the extra material a larger share of what remains. Ahead 21 to 18 is a ratio of about 1.17; after trading 18 points each, 3 to 0 is overwhelming.
15. Answers will vary. A full-credit essay names a principle and an idea correctly, gives a specific and accurate example, explains a real tension (for example, mass against security, or surprise against simplicity), and ends with a reasoned judgment.

PORTFOLIO PIECE: A STRATEGIST'S HANDBOOK, PART 1

Begin a handbook that you will add to all semester. Part 1 has four pages: (1) a one-page glossary of the vocabulary of this unit, with a chess and a sports example for every term; (2) a page with the nine principles, each illustrated with a small diagram from a game or sport you know; (3) a page applying Sun Tzu's five factors to a real upcoming contest (a family tournament, a team game, a match you will watch), with a written plan; and (4) a page of calculations showing friction (p^n) and Lanchester's laws, with one example of each worked out and a sentence explaining what the numbers mean for a decision.

LOOK FOR	WHAT IT MEANS
Vocabulary	Every term from the unit is defined accurately and illustrated with a correct chess and sports example.
Principles diagrams	All nine principles are shown with clear, labeled diagrams that a reader could understand without the text.
Assessment and plan	The five factors are applied honestly to a real contest, and the plan follows from the assessment.
Calculations	Friction and Lanchester calculations are correct, shown step by step, and tied to a real decision.

1.1 STRATEGY, OPERATIONS AND TACTICS

OBJECTIVES

- Define strategy, operations and tactics, and explain how each level serves the one above it.
- Analyse Winfield Scott's Anaconda Plan of 1861 and Grant's Vicksburg campaign as examples of the three levels.
- Sort decisions in chess, basketball and soccer into the three levels, and compute simple rates that a strategist uses.

Warm-up. Write three decisions a basketball coach makes: one before the season, one before a particular game, and one during a single possession. Then write three decisions a chess player makes: one before the tournament, one in the opening of a game, and one on a single move. Keep the list; by the end of the lesson you will label each one.

WATCH

Tactics vs. Strategy: Levels of War Explained - Military History Handbook

[DigitalBattlefieldTours](#) · 12:47

<https://www.youtube.com/watch?v=k1HGUEI8syA>

WHEN TO WATCH

After “the plan” paragraph. Watch how the narrator builds the ladder of levels from tactics to strategy; his example is the Allied campaign in Normandy in 1944, told with maps and photographs.

BACKUP VIDEO

Explained: Tactics - Operations - Strategy

[Military History not Visualized](#) · 14:13

<https://www.youtube.com/watch?v=4yk0gROTHnI>

Optional, after the worked examples. A military historian explains how battles, campaigns and wars line up with tactics, operations and strategy.

KEY TERMS

strategy

The plan for using all of one's contests, campaigns and resources to reach the final goal. In Clausewitz's words, the combination of battles "with a view to the ultimate object of the War."

operations

The middle level: a campaign or series of connected actions in one region or over one season, arranged in time and space to serve the strategy.

tactics

The arrangement and conduct of a single fight, game or play: how forces or players are placed and moved when they actually meet the opponent.

objective

The clearly defined goal toward which every action is directed.

blockade

The closing of an enemy's ports and coasts by ships so that goods cannot come in or go out.

CORE IDEAS

The story. In May 1861, a month after the Civil War began, the general-in-chief of the U.S. Army was Winfield Scott, seventy-four years old and too heavy to ride a horse. Many in the North wanted a quick march on Richmond. Scott proposed something slower. In a letter to George McClellan on May 3 he described a plan to close the Southern coast with a naval blockade and to send a strong force down the Mississippi River to the Gulf of Mexico, cutting the Confederacy in two and squeezing it until it could not supply its armies. Newspapers mocked the idea as the "Anaconda Plan," and a Cincinnati printer sold a cartoon map of a great snake coiled around the South. Scott's plan was not adopted as a single order, but its two big ideas, the blockade and control of the Mississippi, became the backbone of Union strategy for the next four years.

The plan. Look at the plan at three heights. At the top was **strategy**: strangle the South's trade and split it along the river. President Lincoln had already proclaimed a blockade on April 19, 1861, though the Navy then had only about 90 ships, of which about 42 were in commission, to watch roughly 3,500 miles of coastline. In the

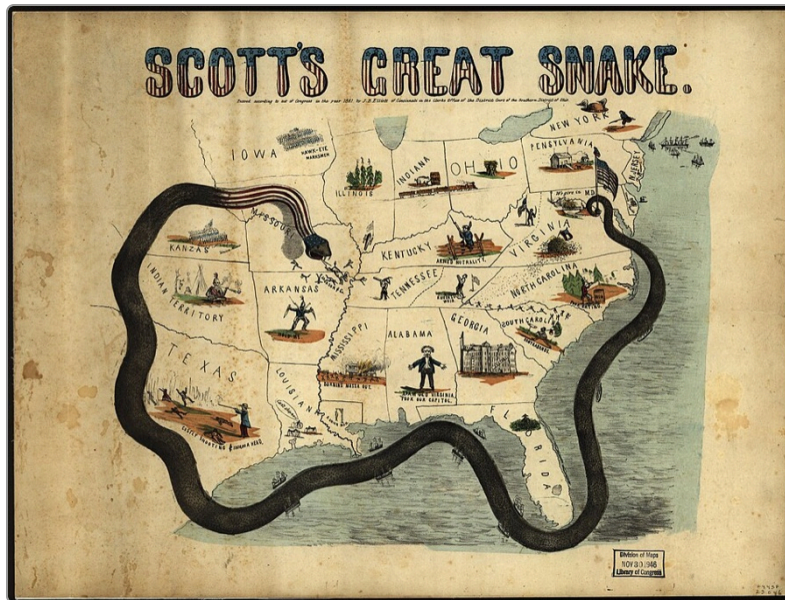
middle was **operations**: in the spring of 1863 Ulysses S. Grant marched his army down the west bank of the Mississippi, crossed the river below Vicksburg on April 30, fought five battles in less than three weeks while moving inland, and then besieged the city from May 18 until it surrendered on July 4, 1863. Port Hudson surrendered five days later, and the whole river was in Union hands. At the bottom were **tactics**: how a brigade was placed on a ridge at Champion Hill on May 16, or how a regiment crossed a bayou. Each level served the one above it.

The principle. The Prussian officer Carl von Clausewitz, whose book *On War* was published in 1832, drew the line this way: tactics is the “formation and conduct” of the single combats, and strategy is their “combination ... with one another, with a view to the ultimate object of the War.” Later soldiers added the middle level of **operations**, the campaign, and the U.S. Army made it part of its official teaching in 1982. The rule that follows is simple and often broken: *a brilliant tactic cannot rescue a bad strategy, and a good strategy can survive many tactical losses*. The South won many battles; the Union’s strategy still slowly closed the ring. To judge any decision, first ask which level it belongs to, and then ask whether it serves the level above.

On the board and the field. Chess players speak the same language. Strategy is the long plan: which pawn structure you want, which side of the board you will play on, which weakness you will attack. Tactics are the short, forcing sequences of checks, captures and threats that win material or deliver checkmate. A basketball coach’s strategy is the character of his team for the whole season (for example, “we win with defense and rebounding”); his operational plan is the game plan for Friday’s opponent; his tactics are the set play he calls on one possession. A soccer coach may plan to rest his best players in an early cup game so that they are fresh for the league: a strategic decision that may cost a tactical result. Wise players and coaches keep all three levels in view and do not let a single exciting play distract them from the goal.

Think it through. Scott’s plan was unpopular because it was slow and did not promise glory. Strategy is often like that. The patient plan that fits your real strength usually beats the dramatic plan that fits your hopes.

PICTURE STUDY



Scott's Great Snake, J. B. Elliott (publisher), 1861 · Hand-colored lithograph cartoon map · Library of Congress, Washington, D.C.

Image: [Wikimedia Commons](#), public domain

This cartoon map was printed in Cincinnati in 1861 to illustrate Winfield Scott's plan. The snake wraps along the coast from Virginia to Texas and lies along the Mississippi River. It was partly a joke, but it shows the whole strategy in a single picture, which is more than most plans can claim.

Look closely

- Trace the snake's body with your finger. Which part stands for the blockade and which for the river campaign?
- Find the Mississippi River. What would happen to the states west of it if the river were held by the Union?
- Look at the size of the area inside the coils. Why would squeezing so large a region take years rather than weeks?
- Notice the small details the artist drew in the Southern states. What resources would a blockade try to cut off?

Talk about it

1. Is this a picture of strategy, operations or tactics? Explain.
2. Why might a simple picture of a plan be useful to soldiers, sailors and citizens who must carry it out?

3. What does the picture leave out that a real commander would need to know?

PROJECT

Three Levels in One Game

You will play two games of chess (or checkers) against a family member or a computer at an easy level, writing down your plan at all three levels before and during the game, and then sort every important decision by level.

You will need

- A chess or checkers set
- The scorebook, pencil and two colored pencils
- An opponent (a family member, or the free lichess computer at a low level)

Steps

1. Before the first game, write your *strategy* for the pair of games in one sentence (for example, “Win at least one game by keeping my pieces safe and trading when ahead”).
2. Write your *operational* plan for the first game: what you will try to do in the first ten moves and where on the board you will play.
3. Play the first game and record every move in notation (or, for checkers, by square numbers).
4. Each time you make a decision that feels important, put a star beside the move and write a word: S, O or T, for strategy, operations or tactics.
5. After the game, mark in one color the moves where you followed your plan and in another color the moves where you changed it.
6. Before the second game, revise your operational plan in light of what you learned about your opponent.
7. Play and record the second game the same way.
8. Count your starred decisions at each level for both games and make a small table.
9. Write a paragraph: Did your tactics serve your plan, or did a tactic tempt you away from it? What would you change?

Tips

- A move is tactical if it forces an immediate reply (a check, a capture or a direct threat).
- Your strategy for two games can be modest. A clear modest goal is better than a vague grand one.

Check your work

- ☐ I wrote my strategy and operational plan before playing.
- ☐ I recorded both games and labeled at least eight decisions by level.
- ☐ I wrote an honest paragraph comparing my plan with what happened.

SCOREBOOK

1. Draw a simple map of the eastern United States from memory and mark Scott's two lines of pressure in different colors. Add the dates April 19, 1861, and July 4, 1863.
2. Make a three-column table, Strategy | Operations | Tactics, and fill it with two examples each from chess, basketball and soccer.
3. "What I would decide and why": you coach a team that is very strong on defense but has no great shooter. Write its strategy in one sentence.

KEY FORMULAS

$$\text{rate} = \frac{\text{quantity}}{\text{time}} \quad \text{coverage} = \frac{\text{length of coast}}{\text{number of ships}}$$

From history. The word *strategy* comes from the Greek *stratēgos*, a general; *tactics* comes from the Greek *taktikē*, the art of arranging troops in order. Scott had commanded the American army in Mexico in 1847, where he captured Mexico City after a march inland from Veracruz, so he knew how hard it was to supply an army far from the sea.

WORKED EXAMPLES

Example 1. In April 1861 the Navy had about 42 ships in commission to blockade about 3,500 miles of Southern coastline. By the end of the war it had about 670 ships of all kinds. Compute the miles of coastline per ship at the beginning and at the end, and say what the numbers mean for the blockade as a strategy.

Show solution

1. Beginning: $3500 \div 42 \approx 83$ miles per ship.
2. End: $3500 \div 670 \approx 5.2$ miles per ship.
3. Ratio of coverage: $83 \div 5.2 \approx 16$, so each ship had about one-sixteenth as much coast to watch.
4. Not every ship was on blockade duty, so these are rough figures, but the trend is clear.

Answer: About 83 miles per ship in 1861 and about 5 miles per ship by 1865. The blockade began as a paper strategy that leaked badly and became effective only as the Navy grew. A strategy can be sound before the means to carry it out exist, but it cannot work until they do.

Example 2. Grant's army besieged Vicksburg from May 18 to July 4, 1863. How many days did the siege last, counting from May 18 to July 4?

Show solution

1. Days left in May after May 18: $31 - 18 = 13$.
2. All of June: 30 days.
3. July 1 through July 4: 4 days.
4. Total: $13 + 30 + 4 = 47$.

Answer: 47 days. This is the figure historians usually give for the siege. Date arithmetic like this is a basic skill of operational planning: supplies, rest and reinforcements are all counted in days.

Example 3. Sort these decisions by level (strategy, operations or tactics): (a) A chess player decides to play only solid openings in a tournament because a draw is enough to win first place. (b) In one game he chooses to attack on the queenside for the next fifteen moves. (c) On move 23 he plays a knight fork that wins a rook. (d) A soccer coach chooses a high-pressing style for the whole season. (e) For one match he assigns his fastest midfielder to follow the opponent's playmaker. (f) On a corner kick he sends his tallest defender to the near post.

Show solution

1. (a) concerns the whole tournament and the final goal: strategy.
2. (b) is a plan for a connected series of moves within one game: operations (the middle level).
3. (c) is one forcing sequence: tactics.
4. (d) shapes every match of the season: strategy.
5. (e) is a game plan for one opponent: operations.
6. (f) is the arrangement for one set play: tactics.

Answer: Strategy: (a), (d). Operations: (b), (e). Tactics: (c), (f). The test is always: how much time and how many contests does the decision cover, and what does it serve?

PRACTICE

1. **Easy** Define strategy, operations and tactics in one sentence each.

Show answer

Strategy: the overall plan for using all one's contests and resources to reach the final goal. Operations: a campaign or connected series of actions that serves the strategy. Tactics: the arrangement and conduct of a single fight, game or play.

2. **Easy** What were the two main parts of Winfield Scott's Anaconda Plan?

Show answer

A naval blockade of the Southern coast, and control of the Mississippi River from the north down to the Gulf, splitting the Confederacy in two.

3. **Easy** Classify: a quarterback changes the play at the line of scrimmage after seeing the defense.

Show answer

Tactics: it concerns a single play against the opponent in front of him.

4. **Medium** Why did newspapers call Scott's plan the "Anaconda Plan," and why was it unpopular at first?

Show answer

An anaconda overcomes its prey by slowly squeezing, and the plan aimed to squeeze the South by blockade and the river rather than win in one great battle. It was unpopular because it was slow and many in the North expected a quick victory.

5. **Medium** In 1861 the blockade covered about 3,500 miles of coast with about 42 ships in commission. Suppose the Navy wanted one ship for every 10 miles. How many ships would it need, and how many more than it had?

Show answer

$3500 \div 10 = 350$ ships, which is $350 - 42 = 308$ more than it had.

6. **Medium** Vicksburg surrendered on July 4, 1863, and Port Hudson on July 9. How many days apart were they, and why did the second surrender matter for the strategy?

Show answer

5 days. With Port Hudson taken, the Union controlled the whole Mississippi, completing the second half of the Anaconda idea: the Confederacy was split, and Texas, Arkansas and most of Louisiana were cut off from the east.

7. **Medium** Explain the rule "a brilliant tactic cannot rescue a bad strategy" with an example from a game or sport.

Show answer

Sample answer: A chess player may win a pawn with a clever trick, but if his plan has left his king exposed, the opponent's attack will still win the game. Or: a basketball team can score a beautiful set play, but if its strategy ignores defense and rebounding it will lose more often than it wins.

8. **Medium** A team plays 30 games in a season. The coach decides to rest his two best players in 6 games against weak teams so they stay healthy for the playoffs. What percent of games will they rest, and which level of decision is this?

Show answer

$6/30 = 0.20 = 20\%$. It is a strategic decision: it concerns the whole season and the final goal, the championship.

9. **Hard** Grant crossed the Mississippi on April 30, 1863, and Vicksburg surrendered on July 4. How many days was that? What fraction of that time was spent in the siege (47 days)?

Show answer

April 30 to May 31 is 31 days, June has 30, and July 1–4 adds 4:

$31 + 30 + 4 = 65$ days. The siege was $47/65 \approx 0.72$, about 72% of the campaign.

10. **Hard** The Confederacy won many battles in 1861–1863 but lost the war. Using the three levels, explain how that can happen.

Show answer

Tactical victories did not change the strategic situation: the blockade kept tightening, the Mississippi was lost, and the Union's larger resources were steadily brought to bear. Tactical wins that do not serve or change the strategy cannot decide the outcome.

11. **Challenge** Suppose the Navy added ships at a steady rate, from 42 ships in April 1861 to 670 ships in April 1865. How many ships per month is that? In which month would it first have reached one ship per 10 miles of coast (350 ships)?

Show answer

48 months: $(670 - 42)/48 \approx 13.1$ ships per month. Need $350 - 42 = 308$ more: $308/13.1 \approx 23.5$ months, so about 24 months after April 1861: around April 1863 (under this simple steady-growth assumption).

COMMON MISTAKES

- Thinking strategy means “a clever trick.” Clever short-term tricks are tactics; strategy is the big plan.
- Judging a strategy by one battle or one game. Strategy is judged over the whole campaign or season.

- Forgetting the middle level. Many failures come from a good strategy and good tactics joined by a poor campaign plan.

Make it a game · Three Levels Sort. Pick a game you both know, such as checkers or chess. Write strategy, operations and tactics on three sheets of paper. Your parent calls out actions: win the whole game, control the center for the next ten moves, trap one piece with a double jump. Place each slip on the right sheet and defend the choice. Your parent sneaks in one tricky action.

1.2 THE PRINCIPLES OF WAR

OBJECTIVES

- Name and define the nine classic principles of war: objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise and simplicity.
- Recognize each principle in chess, soccer, basketball and football.
- Use simple ratios to show how mass at the decisive point creates local superiority even when the total forces are equal.

Warm-up. Without looking ahead, list as many rules as you can that good teams follow in every sport (for example, “don’t leave the goal unguarded”). Give yourself three minutes. At the end of the lesson, match each of your rules to one of the nine principles.

WATCH

Historian Breaks Down Napoleon's Battle Tactics | WIRED

WIRED • 7:07

<https://www.youtube.com/watch?v=56uJd9AqMFA>

WHEN TO WATCH

After “the plan” paragraph. A British general and historian moves counters on a map table to explain Napoleon’s battles; each segment opens with the battle’s objective. Write down every time you hear an idea from the nine principles (objective, mass, maneuver, surprise, economy of force).

Note: Made when a feature film about Napoleon was released; a few brief, non-graphic clips from the film appear between the map segments, along with old battle paintings.

KEY TERMS

principles of war

A short list of general rules drawn from the study of many campaigns. They are guides for judgment, not formulas that guarantee victory.

mass

Concentrating strength at the decisive place and time, so that you are stronger there even if you are not stronger overall.

economy of force

Using the smallest force that will do in places that are not decisive, so that more strength can be massed where it matters.

maneuver

Moving forces to put the opponent at a disadvantage, so that fighting is easier or unnecessary.

unity of command

Placing every part of a force under one responsible leader for a given goal, so that the parts work together.

local superiority

Having more strength than the opponent at one particular point, whatever the overall totals.

CORE IDEAS

The story. After the First World War, officers in Britain and America asked what lessons could be carried from the study of Napoleon, Clausewitz and their own hard experience into the training of young leaders. The British army printed a short list of principles in its *Field Service Regulations* of 1920, and in 1921 the U.S. Army published nine principles of war in a training regulation. The names have been adjusted since, but the American list taught today is almost the same: **objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise and simplicity.** Cadets remember them with the made-up word MOOSEMUSS.

The plan. Each principle answers a question a commander must ask. *Objective:* what exactly are we trying to achieve? *Offensive:* how will we seize and keep the initiative, rather than only reacting? *Mass:* where is the decisive point, and how will we be strongest there? *Economy of force:* where can we accept weakness so that we can mass elsewhere? *Maneuver:* how will we move to put the opponent at a disadvantage? *Unity of command:* who is in charge of each task? *Security:* how will we avoid being surprised ourselves? *Surprise:* how will we act at a time, place or manner the opponent does not expect? *Simplicity:* is the plan clear enough to be understood and carried out under stress?

The principle. The most important lesson is that the principles pull against each other and must be balanced by judgment. Mass at one point requires economy of force at another, which is a risk to security. Surprise often requires a complicated plan, which is a risk to simplicity. A list of principles cannot make a decision for you; it reminds you of the questions to ask. Notice also how **mass** works: two equal forces can meet, and yet one can be much stronger at the point that matters. If eleven

players face eleven, but four attackers meet two defenders on the left side of the field, the attack has a local superiority of 2 to 1 there.

On the board and the field. In chess, the objective is checkmate; the offensive is the side with the initiative; mass is bringing more attackers to a square than there are defenders; economy of force is leaving one rook to hold a whole file; maneuver is rerouting a knight to a better square; unity of command is your one mind (a team game, like doubles or a relay, must create it); security is keeping your king safe; surprise is the move your opponent did not consider; simplicity is the clear plan you can actually play. On a soccer field, an overload on one wing is mass, a lone striker left high to hold two defenders is economy of force, a captain who organizes the back line is unity of command, and a defensive midfielder who stays home when the full-backs attack is security. A football team's onside kick is surprise, and a playbook of a few plays executed perfectly is simplicity.

Think it through. Proverbs 20:18 says, "Every purpose is established by counsel." The principles of war are a kind of counsel from the past: the gathered experience of many commanders. They do not replace thinking; they help you think of everything.

PICTURE STUDY



Snap the Whip, Winslow Homer, 1872 · Oil on canvas · Butler Institute of American Art, Youngstown, Ohio

Image: [Wikimedia Commons](#), public domain

In the game of snap the whip, children hold hands in a line and run. The leader suddenly stops or turns, and the force travels down the line until the children at the far end are flung loose. Winslow Homer painted the game in 1872, with a country schoolhouse behind. It is a picture of a team acting as one, with one leader, a simple plan and a sudden change of direction.

Look closely

- Find the leader of the line. How do the other boys know when he will turn?
- Look at the boys at the end of the line. Where has the force of the turn arrived?
- Count the boys still holding on and those who have let go. What holds a line together, and what breaks it?
- Notice the open ground. Why does a game like this need space?

Talk about it

1. Which principles of war can you see in this game: unity of command, simplicity, maneuver, surprise? Explain each one you choose.
2. If the leader turns without warning, is that good surprise against an opponent, or a failure of communication with his own team?

3. What would happen to the game if two boys both tried to lead?

PROJECT

Principles Scouting Chart

You will watch one full game (live, on television or in a free replay) of a team sport and record every clear example of the nine principles you can find, then write a short report on which principles decided the game.

You will need

- One game to watch: soccer, basketball, football, hockey or lacrosse
- The scorebook with a nine-row chart (one row per principle)
- A pencil and a watch or the game clock

Steps

1. Before the game, rule a chart with nine rows (the principles) and four columns: time, team, what happened, result.
2. Predict which team will win and which principle you think will matter most. Write it down.
3. During the game, record at least two examples of each principle, with the game time.
4. Mark each example with a plus if it helped the team that used it and a minus if it backfired.
5. Count the pluses and minuses for each team for each principle.
6. Find one moment where two principles conflicted (for example, a team pushed forward for mass and lost security).
7. After the game, compare the result with your prediction.
8. Write a one-page report: which two principles decided this game, with your evidence.

Tips

- Watch away from the ball sometimes. Economy of force and security are usually seen in the players who are not near the action.
- If the game is too fast, watch a replay of one period and pause it.

Check your work

- ☐ My chart has at least two examples for each of the nine principles.
- ☐ I found and explained one conflict between principles.
- ☐ My report names two deciding principles and supports them with evidence from the chart.

SCOREBOOK

1. Copy the nine principles with MOOSEMUSS as a heading, and write a one-line chess example beside each.
2. Draw a soccer field and show an overload on one wing with circles and crosses. Write the local ratio on each third of the field.
3. “What I would decide and why”: your team is ahead by one goal with five minutes left. Which three principles matter most now, and why?

KEY FORMULAS

$$\text{local ratio} = \frac{\text{your strength at the point}}{\text{opponent's strength at the point}}$$

From history. Lists of military principles are much older than 1921. Napoleon left many maxims, Jomini wrote of concentrating at the decisive point in the 1830s, and Sun Tzu's chapters read in places like a list of principles. The 1921 list simply gave them a short, memorable form for training.

WORKED EXAMPLES

Example 1. In a 7-a-side soccer game, each team has 6 field players. Team A places 4 attackers on the left side, 1 player in the middle and 1 defender on the right. Team B spreads its 6 players evenly: 2 on the left, 2 in the middle, 2 on the right. Find the local ratio on each side and name the principles Team A is using.

Show solution

1. Left: Team A 4, Team B 2. Ratio $4 : 2 = 2 : 1$.
2. Middle: 1 : 2. Right: 1 : 2.
3. Team A is strongest where it chose to attack (mass) and weaker elsewhere (economy of force).
4. The risk: if Team B wins the ball and switches quickly to the right, Team A is outnumbered there. That is a question of security.

Answer: Left 2:1 in A's favor; middle and right 1:2 against. Team A uses mass on the left and economy of force elsewhere, and must manage the security risk on the right, for example by keeping its goalkeeper alert and its middle player ready to drop back.

Example 2. In a chess position, the square f7 next to Black's king is attacked by White's queen, bishop and knight (3 attackers) and defended only by Black's king (1 defender). Which principle is White using? If the values are queen 9, bishop 3 and knight 3, and White captures on f7 with the knight first, what has White risked?

Show solution

1. Three attackers against one defender at one square: mass, which gives local superiority.
2. The knight captures first because it is the least valuable attacker.
3. Kings cannot capture a piece that is defended, so with the queen and bishop still aiming at f7, the knight on f7 is safe from the king.
4. White has risked only a knight (3) to break open the king's defenses.

Answer: Mass: three attackers on one square defended once. By leading with the least valuable piece, White risks the least. This is the same idea as massing cheap forces first and keeping the strongest in reserve.

Example 3. Match each football decision to a principle: (a) a coach installs only twelve running plays and practices them all week; (b) the offense lines up with three receivers on one side; (c) a team kicks an onside kick in the first quarter; (d) a safety stays deep on every play; (e) the head coach, not his assistants, decides on fourth down.

Show solution

1. (a) Fewer plays, better learned: simplicity.
2. (b) More receivers on one side than defenders can cover: mass (an overload).
3. (c) An unexpected kick at an unexpected time: surprise.
4. (d) Protection against the long pass: security.
5. (e) One person responsible for the decision: unity of command.

Answer: (a) simplicity, (b) mass, (c) surprise, (d) security, (e) unity of command.

PRACTICE

1. Easy List the nine principles of war.

Show answer

Objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, simplicity.

2. Easy In what year did the U.S. Army first publish nine principles of war?

Show answer

1921.

3. Easy Which principle is a basketball team using when it double-teams the opponent's best scorer?

Show answer

Mass (two defenders on the decisive player). It also requires economy of force elsewhere, because one other opponent is now left open.

4. Medium Explain why mass and economy of force always go together.

Show answer

If you concentrate more than your share of strength in one place, you must have less than your share somewhere else. Economy of force is accepting the smallest safe strength in the less important places so that mass is possible at the decisive one.

5. Medium In a 5-on-5 basketball game, the offense puts 3 players on the right side of the court and 2 on the left. The defense matches player for player. Then the offense passes quickly to the left, and one defender is slow to rotate. What is the local ratio on the left during that moment, and which principles are involved?

Show answer

2 attackers against 1 defender: 2:1. The offense used maneuver (moving the ball) to create mass and local superiority at a point the defense could not cover in time.

6. Medium Give an example from chess of the principle of security.

Show answer

Castling early and keeping pawns in front of the king, or not leaving a piece undefended where the opponent can capture it.

7. **Medium** How do surprise and simplicity sometimes conflict? Give a sports example.

Show answer

Surprise often needs an unusual, complex plan that players have not practiced as much. A trick play with a reverse and a throwback pass may surprise the defense, but it has more ways to go wrong than a simple run.

8. **Medium** In worked example 1, Team B shifts one player from its right to its left. Find the new ratios on the left and on the right.

Show answer

Left: A 4, B 3, ratio 4 : 3. Right: A 1, B 1, ratio 1 : 1. B has reduced A's superiority by weakening a place A was not attacking.

9. **Hard** Write the objective for (a) a chess player who needs only a draw to win a tournament, and (b) a soccer team trailing 1–0 with ten minutes left. Explain how the objective changes which principles matter most.

Show answer

(a) Secure at least a draw: security and simplicity dominate; he avoids risky attacks. (b) Score one goal: offensive and mass dominate; the team accepts less security (more players forward) to create chances.

10. **Hard** Why are the principles of war called “guides for judgment” rather than rules that guarantee victory?

Show answer

They often conflict (mass against security, surprise against simplicity), and the right balance depends on the situation, the opponent, the terrain and the goal. A commander must still decide; the principles only help him ask the right questions.

11. **Challenge** A team of 10 must defend 4 lanes and attack through 1 of them. It wants at least a 2:1 local ratio in its attacking lane against an opponent who spreads 10 players evenly (2.5 per lane on average), and it wants at least 1 player in every other lane. What is the largest number it can put in the attacking lane, and does it achieve 2:1?

Show answer

At least 1 player in each of the 3 other lanes uses 3 players, leaving $10 - 3 = 7$ for the attacking lane. Against 2.5 defenders the ratio is $7 : 2.5 = 2.8 : 1$, which beats 2:1. (In practice the defenders will shift, so the advantage lasts only as long as the attack is fast.)

COMMON MISTAKES

- Thinking that mass means having a bigger team. Mass means being stronger at the decisive point.
- Treating the principles as a checklist that guarantees success. They often conflict, and judgment must balance them.
- Forgetting that security includes protecting against surprise, not only guarding the goal.

Make it a game • Nine in Sixty. Set a timer for sixty seconds and name all nine principles of war from memory: objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise and simplicity. Your parent counts. Then your parent describes a game situation and you name which principle it shows. Beat your own count in a second round.

Scripture. “Every purpose is established by counsel: and with good advice make war.” (Proverbs 20:18, KJV)

The principles of war are counsel from the past. Wise people do not plan alone or from scratch; they learn from those who went before.

1.3 SUN TZU: KNOW THE ENEMY AND KNOW YOURSELF

OBJECTIVES

- Describe what is known about Sun Tzu's *Art of War*, including the 1972 discovery of bamboo copies and Lionel Giles's 1910 translation.
- Explain Sun Tzu's rule about knowing the enemy and knowing yourself, and his five factors for assessing a contest.
- Use an honest self-assessment and an opponent assessment to plan a game, and recognize when an opponent is feeding you false information.

Warm-up. Rate yourself from 1 to 5 in five parts of a game you play often (for chess, for example: openings, tactics, endgames, time management, staying calm). Then rate a regular opponent in the same five parts. Where is the biggest gap in your favor? Where is the biggest gap against you?

WATCH

Offensive Strategy - Sun Tzu's Art of War #3 - Revisited

Military History Visualized • 6:31

<https://www.youtube.com/watch?v=r3NwaTXf1yg>

WHEN TO WATCH

After “the plan” paragraph. An animated summary of chapter three, “Attack by Stratagem,” including the line about knowing the enemy and yourself; compare its translation with Giles's in the lesson.

Note: Opens with a short sponsor mention for an online course service. The narrator uses a modern Chinese general's translation, so the wording differs a little from Giles's.

KEY TERMS

The Art of War

An ancient Chinese book on strategy in thirteen short chapters, traditionally credited to Sun Tzu (Sun Wu), a general of the state of Wu in about the late sixth century BC. Its present form probably took shape over the following two centuries.

assessment

A careful comparison of the strengths and weaknesses of both sides before a contest begins.

deception

Leading the opponent to believe something false about your strength, position or intentions. In games and sports it must stay inside the rules.

intelligence

Information about the opponent, gathered and checked before and during a contest.

CORE IDEAS

The story. In April 1972 workers digging near the city of Linyi, in Shandong province in eastern China, opened two tombs from the Han dynasty, sealed in the second century BC. Inside were nearly five thousand slips of bamboo, each a strip about the width of a finger, once tied together with cord to make books. Among them was a copy of *The Art of War* more than two thousand years old, and a second military book by Sun Bin, a later descendant of Sun Tzu, which had been lost for centuries. The discovery proved that the book we read today is very close to what readers of the Han dynasty read. In English, the most widely read translation is still the one Lionel Giles, an assistant at the British Museum, published in 1910; it is free on Project Gutenberg.

The plan. Sun Tzu's method begins before any fighting, with assessment. "The general who wins a battle makes many calculations in his temple ere the battle is fought," Giles translates, and "many calculations lead to victory, and few calculations to defeat." Sun Tzu names five factors to compare: "(1) The Moral Law; (2) Heaven; (3) Earth; (4) The Commander; (5) Method and discipline." By the Moral Law he means whether the people are united with their ruler; Heaven means weather and seasons; Earth means distances and ground; the Commander means the general's wisdom, sincerity, benevolence, courage and strictness; and Method means organization and supply. His summary is his most famous line: "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle."

The principle. Victory is usually decided by information and preparation before the contest. Knowing *yourself* is as hard as knowing the enemy, because vanity hides our weaknesses from us. Sun Tzu also wrote that "all warfare is based on deception," and that the best victory is "breaking the enemy's resistance without fighting." Giles's notes tell how Sun Bin used this in the fourth century BC. Retreating before a stronger enemy, Sun Bin ordered his camp to show 100,000 cooking fires on the first

night, 50,000 on the second and only 20,000 on the third. The enemy general, Pang Juan, concluded that more than half of Sun Bin's men had deserted, hurried after him with a small fast force, and was ambushed in a narrow pass. Pang Juan knew the numbers, but he did not ask who was showing them to him.

On the board and the field. Strong chess players prepare for an opponent by studying his past games: which openings he plays, where he spends his time, whether he likes quiet or sharp positions. Coaches watch film of next week's opponent and of their own team. A tennis player notices that her opponent's backhand breaks down under high balls. In games, deception must stay honest and inside the rules: a feint, a disguised pass, a quiet move that hides a threat, a varied serve. Deceiving an opponent within the game is part of the contest; lying to an official or breaking the rules is cheating, and Sun Tzu's advice never excuses it.

Think it through. "The simple believeth every word: but the prudent man looketh well to his going" (Proverbs 14:15). Pang Juan believed the campfires. A wise strategist asks of every piece of information: who wants me to see this, and why?

PICTURE STUDY



Bamboo Slips of The Art of War, Unknown scribes of the Han dynasty, Second century BC (excavated 1972; shown in a museum copy) · Ink on bamboo slips · Museum display in Beijing (reproduction of the Yinqueshan slips)

Image: [Wikimedia Commons](#), public domain

These narrow bamboo strips are the oldest known copy of Sun Tzu's book. Each strip holds a single column of characters, read from top to bottom, and the strips were once tied together with cord and rolled up like a mat. When the cord rotted, the slips had to be sorted again by scholars, one by one, like a puzzle.

Look closely

- Look at how narrow each slip is. How many characters fit on one?
- Notice the gaps and broken ends. What problems would a scholar face in putting the book back in order?
- Compare these slips with a printed book. What would it cost, in time and materials, to copy a book this way?

Talk about it

1. Why would a general want a book of strategy that was short enough to memorize?
2. Sun Tzu says many calculations lead to victory. What does this careful, laborious way of writing tell you about how much the people of that time valued his calculations?

3. How does the discovery of an old copy help us “know” what Sun Tzu actually wrote, rather than what later writers said he wrote?

PROJECT

Scouting Report on an Opponent and on Yourself

You will scout one regular opponent in a game (a sibling or parent at chess, checkers or a card or board game) and scout yourself, then play five games with a plan built from both reports, and record the results.

You will need

- A game you play often with one opponent
- The scorebook
- Records of at least five earlier games, or five new games played first as a baseline

Steps

1. If you do not have records, play five games first and record each one carefully.
2. From the records, write a self-scouting report: your three strengths and three weaknesses, each with evidence (for example, “I lost two of five games by leaving a piece undefended”).
3. Write the same report on your opponent.
4. Using Sun Tzu’s five factors loosely (morale, conditions, ground, leadership, method), note anything else that affects the games: time of day, tiredness, a favorite opening.
5. Write a plan of three specific actions: one to avoid your weakness, one to attack the opponent’s weakness, and one to play to your strength.
6. Play five more games and record them.
7. Tally your results before and after the plan.
8. Write a one-page report: did the plan work? Which part of your scouting was wrong?

Tips

- Be honest about yourself. A scouting report that flatters you is worse than none.

- Five games is a small sample. Treat a change of one or two wins as a hint, not proof.

Check your work

- ☐ I wrote both scouting reports with evidence from real games.
- ☐ I wrote a three-part plan before the second set of games.
- ☐ I compared results before and after, and named one thing my scouting got wrong.

SCOREBOOK

1. Draw Sun Tzu's three cases as a 2×2 table: know yourself (yes or no) against know the enemy (yes or no). Write the result in each box, including the box Sun Tzu leaves out.
2. Graph Sun Bin's fires (100,000, 50,000, 20,000) as a bar chart. Under it, write what the chart was meant to make Pang Juan believe.
3. "What I would decide and why": your opponent always attacks early. Write a one-sentence plan that uses that knowledge.

From history. Little is known for certain about Sun Tzu himself. The historian Sima Qian, writing about 100 BC, tells of a general Sun Wu who served King Helü of Wu around 500 BC. Many scholars think the book was shaped over the following two centuries by Sun Wu's school. Lionel Giles worked on the book at the British Museum and criticized the earlier English translation of 1908 for its many errors.

WORKED EXAMPLES

Example 1. In Giles's account, Sun Bin's camps showed 100,000 fires, then 50,000, then 20,000. Compute the percent drop from night 1 to night 2, from night 2 to night 3, and overall. Then explain what conclusion Pang Juan drew and what he should have asked.

Show solution

1. Night 1 to 2: $(100000 - 50000)/100000 = 0.50 = 50\%$.
2. Night 2 to 3: $(50000 - 20000)/50000 = 0.60 = 60\%$.
3. Overall: $(100000 - 20000)/100000 = 0.80 = 80\%$.
4. Pang Juan reasoned that the men were deserting. But the fires were the evidence Sun Bin chose to show. A real army of deserters would also show other signs: abandoned equipment, stragglers, a slower march.

Answer: Drops of 50%, 60% and 80% overall. Pang Juan accepted evidence controlled by his opponent. He should have checked it against evidence the enemy could not easily fake.

Example 2. A chess player studies 20 of her next opponent's games. With White, the opponent opened 1.e4 in 14 games and 1.d4 in 6. With Black against 1.e4, he played 1...c5 (the Sicilian Defense) in 11 of 13 games. What percent of the time did he open 1.e4 with White, and how should she use the second fact if she has White?

Show solution

1. $14/20 = 0.70 = 70\%$.
2. Against 1.e4: $11/13 \approx 0.85 = 85\%$.
3. If she plays 1.e4 with White, she can expect the Sicilian about 85% of the time and should prepare that opening most carefully.
4. Knowing herself also matters: if she dislikes the Sicilian, she might choose 1.d4 instead and steer the game away from his strongest ground.

Answer: He opened 1.e4 about 70% of the time. As White she should expect 1...c5 about 85% of the time after 1.e4, and choose her first move by comparing his preparation with her own strengths.

Example 3. Use Sun Tzu's three cases to fill in a table for a basketball team. Case A: they know their own weakness (poor free-throw shooting) and the opponent's (a slow center). Case B: they know their own weakness but not the opponent's. Case C: they know neither. Describe a sensible plan in each case.

Show solution

1. Case A: avoid close games decided by fouls (play steady defense, lead early), and attack the slow center with pick-and-rolls.
2. Case B: protect against their own weakness, but they cannot target the opponent; results will be mixed, "for every victory ... a defeat."
3. Case C: they foul in close games and attack the opponent's strengths without knowing it: they will lose often.
4. The cost of gaining knowledge (watching film, keeping statistics) is small compared with the cost of ignorance.

Answer: Knowing both sides lets a team avoid its weakness and attack the opponent's; knowing only itself lets it avoid disaster but not seize advantage; knowing neither invites defeat. Scouting yourself is the cheapest and most neglected kind of intelligence.

PRACTICE

1. Easy Quote Sun Tzu's rule about knowing the enemy and yourself (Giles translation), first sentence only.

Show answer

"If you know the enemy and know yourself, you need not fear the result of a hundred battles."

2. Easy What did workers discover near Linyi in 1972, and why did it matter?

Show answer

Han-dynasty tombs containing bamboo slips with *The Art of War* and Sun Bin's lost military book. It showed that our text is very close to the one read over two thousand years ago.

3. Easy List Sun Tzu's five factors.

Show answer

The Moral Law, Heaven, Earth, the Commander, and Method and discipline.

4. Medium Give a sports example of each of Sun Tzu's factors "Heaven" and "Earth."

Show answer

Heaven: weather, such as wind in a football kicking game or rain on a soccer pitch. Earth: the ground, such as a small, narrow court or a long outfield that favors certain players.

5. Medium Why is knowing yourself sometimes harder than knowing the enemy?

Show answer

We see our own strengths more easily than our weaknesses, and vanity or hope makes us overrate ourselves. An honest record of one's own games or statistics is needed.

6. Medium A tennis player charts her opponent's serves: of 40 first serves, 26 went to the backhand side. What percent is that? How should she stand to receive?

Show answer

$26/40 = 65\%$. She can shade slightly toward her backhand side, while staying ready for the other 35%.

7. Medium What is the difference between deception within a game and cheating? Give one example of each.

Show answer

Deception within the rules misleads the opponent about your intention: a head fake in basketball, a disguised pass in soccer. Cheating breaks the rules or deceives the officials: moving a piece when the opponent is not looking, or pretending to be fouled.

8. **Medium** Explain how Pang Juan's mistake fits the line "If you know yourself but not the enemy."

Show answer

Pang Juan believed he knew the enemy, but his knowledge was false: it came from evidence the enemy controlled. He was overconfident in his own judgment and did not check it, so he acted on a picture of the enemy that was wrong.

9. **Hard** In Giles's account the fires fell from 100,000 to 20,000 in two nights. If the true army had stayed the same size and showed only 20,000 fires, what fraction of the usual fires were lit? Why would that make the deception believable?

Show answer

$20000/100000 = 1/5$. The steady, large drop matched what a pursuer hoped to see: an army falling apart. Deception works best when it confirms what the opponent already wants to believe.

10. **Hard** Sun Tzu wrote that the supreme excellence is "breaking the enemy's resistance without fighting." Give one example from chess and one from sport where a side wins without a direct fight.

Show answer

Chess: a player gains such a strong position that the opponent resigns before material is lost, or forces a winning endgame by trades. Sport: a team so controls possession that the opponent rarely gets the ball, or a defense so takes away the main play that the opponent cannot run its offense.

11. **Challenge** A coach can either spend 4 hours studying the opponent or 4 hours drilling his own team's weakest skill. Using Sun Tzu's three cases, argue for a split of the time, and say what evidence would change your mind.

Show answer

Sample answer: If the team already knows its own weaknesses well, more time on the opponent gives a new advantage; if the team has never measured itself, time spent on self-scouting prevents disasters. A reasonable split is 2 and 2. Evidence that the opponent is unusual (a rare defense, a dominant player) would shift time toward scouting; evidence of a recurring self-inflicted loss (turnovers, missed free throws) would shift it toward drilling.

COMMON MISTAKES

- Treating Sun Tzu as a book of tricks. Most of it is about preparation, assessment, supply and leadership.
- Studying the opponent but never studying yourself.
- Using “all warfare is based on deception” to excuse dishonesty. In games, deception must stay inside the rules.

Make it a game • Scout the Opponent. Play ten rounds of rock, paper, scissors with your parent, with a twist: you only record what your parent throws, and do not guess for the first five rounds. Then use that intelligence to predict the last five. Count your hits. Then tell the story of the 1972 bamboo copies and Lionel Giles's 1910 translation of The Art of War.

Scripture. “The simple believeth every word: but the prudent man looketh well to his going.” (Proverbs 14:15, KJV)

Pang Juan believed the campfires. Good intelligence asks where information came from and checks it before acting on it.

1.4 CLAUSEWITZ: FRICTION AND THE FOG OF WAR

OBJECTIVES

- Describe Carl von Clausewitz's life and the publication of *On War* (1832).
- Explain friction and the uncertainty of information (the “fog of war”) in Clausewitz's own words.
- Compute how the probability of success falls as a plan gains more steps, and how backups and simplicity reduce friction.

Warm-up. Think of the last time a simple plan went wrong: getting the family out the door on time, a group project, a set play in a game. List every small thing that went wrong. How many were things you could have predicted, and how many were pure chance?

WATCH

Crash course: The nature of war according to Clausewitz

Det Norske Videnskaps-Akademi · 8:20

<https://www.youtube.com/watch?v=K7XSsAgb2Co>

WHEN TO WATCH

After “the plan” paragraph. Sir Hew Strachan, one of the leading Clausewitz scholars, lists the features of war that Clausewitz thought never change; listen for where friction appears on his slide.

KEY TERMS

friction

Clausewitz's word for the countless small difficulties (delays, mistakes, weather, fatigue, misunderstanding) that make the simplest action in a contest hard, and that distinguish real war from war on paper.

fog of war

The uncertainty of information during a contest: commanders must act on reports that are incomplete, late or wrong. Clausewitz compared it to the effect of “a fog or moonshine.”

independent events

Events where the outcome of one does not change the probability of the other. The probability that all of them happen is the product of their probabilities.

redundancy

Having a backup, so that one failure does not ruin the whole plan.

CORE IDEAS

The story. Carl von Clausewitz was born in Prussia in 1780 and joined the army at the age of twelve. He was captured by the French after the Prussian defeat of 1806, served with the Russian army against Napoleon in 1812, and was chief of staff of a Prussian corps in the campaign of 1815. For the last years of his life he directed the war college in Berlin and wrote, again and again revising, a book on the nature of war. He died in 1831 before it was finished. His wife, Marie von Clausewitz, edited his papers and published *On War* in 1832. It is still read at every military academy, and much of it applies to any contest.

The plan. Clausewitz noticed that plans on paper always look easy. In Book I, Chapter 7, he wrote: “Everything is very simple in War, but the simplest thing is difficult. These difficulties accumulate and produce a friction which no man can imagine exactly who has not seen War.” He compared it to a traveler who expects to finish the last two stages of a journey by evening, “it is nothing,” and then finds no fresh horses, bad roads, a hilly country and a dark night. In Book II he added that “all action must, to a certain extent, be planned in a mere twilight, which in addition not unfrequently—like the effect of a fog or moonshine—gives to things exaggerated dimensions and an unnatural appearance.” From that sentence later writers took the phrase **fog of war**.

The principle. Friction can be measured with probability. If a plan needs several steps to all go right, and each step succeeds independently with probability p , then the chance that all n steps succeed is p^n . Ten steps that are each 95% reliable give only $0.95^{10} \approx 0.60$, a 60% chance that the whole plan works. That is why the principle of **simplicity** matters so much. A plan with fewer steps, or with a backup for its weakest steps, survives friction better. If a message is carried by two riders on different roads, each 80% likely to arrive, the chance at least one arrives is $1 - 0.2^2 = 0.96$.

On the board and the field. In chess, friction is the clock, fatigue and the move you did not see. A plan that needs eight precise moves fails more often than a plan that needs three. In football, a trick play that needs a pitch, a reverse and a long throw has three or four points of failure; a simple dive play has one or two. In basketball, a set play that depends on a perfect pass under pressure often becomes a turnover. Good coaches drill until each step is close to 100% reliable, keep the playbook simple, and teach players what to do when the plan breaks down. Wise players expect friction instead of complaining about it.

The risk side. Friction also creates opportunities. The opponent faces the same fog. A side that stays calm, keeps a simple plan and acts quickly when the opponent stumbles can win even when it is weaker. Scripture describes it plainly: the battle is not always to the strong, “but time and chance happeneth to them all” (Ecclesiastes 9:11).

PICTURE STUDY



Carl von Clausewitz, After Karl Wilhelm Wach, about 1830 · Portrait (reproduction of a painting) · Original painting in a German collection
Image: [Wikimedia Commons](#), public domain

Karl Wilhelm Wach was a Berlin portrait painter who painted Clausewitz near the end of his life, when he was director of the war college and quietly writing *On War*. The uniform shows a soldier; the face shows a thinker. Clausewitz was both, and he believed a commander needed both kinds of strength: a clear mind to see through the fog, and a firm will to push through the friction.

Look closely

- Look at his expression. Does he seem excited, worried or calm?
- Notice the uniform and its details. What does it tell you about his rank and experience?
- Compare this portrait with what you know of his life: captured in 1806, a campaign in Russia in 1812, Waterloo's campaign in 1815. What has his experience taught him?

Talk about it

1. Clausewitz said friction can be overcome by an “iron will,” but that the will also wears down the machine. What does that mean for a team that plays hard but carelessly?

2. Why might a man who had seen plans fail many times write a book about the nature of war rather than a book of rules?
3. If you could ask Clausewitz about your own game or sport, what question would you ask?

Safety first. Warm up before throwing. Use a soft ball indoors, and keep clear of windows, lamps and people.

PROJECT

Measuring Friction

You will design a three-step and a six-step plan in a game, test each one many times, and compare the measured success rates with the probability formula.

You will need

- A soft ball and a bucket or basket, or a chess set and a family member
- A stopwatch
- The scorebook

Steps

1. Choose a short physical sequence: for example, (1) bounce-pass to a partner, (2) partner catches and passes back, (3) you toss the ball into a bucket from 3 meters. Practice it a few times.
2. Record 20 attempts of each single step separately and compute each step's success rate.
3. Use the product rule to predict the success rate of the full three-step sequence.
4. Run the full three-step sequence 20 times and record the result.
5. Now design a six-step sequence by doubling the routine (or adding three new steps), and predict its success rate.
6. Run the six-step sequence 20 times. Then repeat it with a 10-second time limit and record how the rate changes.
7. Make a table: steps, predicted rate, measured rate, measured rate under time pressure.
8. Write a paragraph: Where did friction appear that the formula did not predict (fatigue, rushing, distraction)?

Tips

- If you use a chess version instead: set up five tactical puzzles of increasing length from a free puzzle site, and record how often you solve 1-move, 2-move and 4-move puzzles in one minute each.
- Keep attempts honest. Do not redo a failed attempt because it “didn’t count.”

Check your work

- ☐ I measured each step separately and predicted the full rate with the product rule.
- ☐ I recorded at least 20 attempts of each full sequence, with and without time pressure.
- ☐ I explained at least one source of friction the formula did not capture.

SCOREBOOK

1. Graph 0.95^n for $n = 1$ to 15 on graph paper, and mark where it falls below 50%.
2. Write Clausewitz's traveler story in your own words and add a sports version: a team traveling to a tournament.
3. "What I would decide and why": you have a plan with one step that fails often. Do you add a backup, simplify the plan, or practice that step? Explain.

KEY FORMULAS

$$P(\text{all } n \text{ steps succeed}) = p^n$$

$$P(\text{at least one of } k \text{ backups succeeds}) = 1 - (1 - p)^k$$

From history. Clausewitz's book is famous for the line that war is "a continuation of State policy by other means." He meant that a contest must always serve a larger purpose, the objective, and that the purpose should limit how it is fought. Marie von Clausewitz's preface to the first edition is a moving account of her husband's years of quiet work.

WORKED EXAMPLES

Example 1. A football trick play needs four things to go right: the snap and handoff (98%), the reverse pitch (90%), the receiver getting open (70%) and an accurate throw and catch (60%). Assuming these are independent, what is the probability the whole play works? Compare it with a simple run that needs a good snap (98%) and a hole in the line (55%).

Show solution

1. Trick play: $0.98 \times 0.90 \times 0.70 \times 0.60 = 0.370$.
2. Simple run: $0.98 \times 0.55 = 0.539$.
3. The trick play gains many more yards when it works, so the right comparison is expected yards, but its success rate is much lower.
4. The friction of four steps cut the chance from about 98% (the first step) to 37%.

Answer: About 37% for the trick play against about 54% for the simple run. Each extra step multiplies in another chance of failure; that is friction in numbers. (These percentages are illustrative.)

Example 2. A plan has 10 steps, each 95% reliable. (a) What is the chance that the whole plan succeeds? (b) How reliable must each step be for the whole plan to reach 90%?

Show solution

1. (a) $0.95^{10} \approx 0.599$, about 60%.
2. (b) Solve $p^{10} = 0.90$: $p = 0.90^{1/10} \approx 0.9895$.
3. Each step must be almost 99% reliable.

Answer: (a) About 60%. (b) About 98.9% per step. A long plan demands nearly perfect execution at every step, which is why armies and teams drill so hard and why simple plans are prized.

Example 3. Before Waterloo, important orders were often sent by more than one rider. Suppose each rider has a 70% chance of getting through. How many riders must be sent, by different roads, for the chance that at least one arrives to be at least 95%?

Show solution

1. Chance one rider fails: 0.30.
2. With k riders, all fail with probability 0.3^k .
3. $k = 2$: $1 - 0.09 = 0.91$. $k = 3$: $1 - 0.027 = 0.973$.
4. Three riders are needed.

Answer: Three riders give about 97%. Redundancy is one of the best cures for friction, as long as the backups do not all fail for the same reason (for example, all taking the same flooded road).

PRACTICE

1. Easy Quote Clausewitz's sentence about simple things in war.

Show answer

“Everything is very simple in War, but the simplest thing is difficult.”

2. Easy When was *On War* published, and who published it?

Show answer

In 1832, after Clausewitz's death in 1831; his wife, Marie von Clausewitz, edited and published it.

3. Easy Compute 0.9^3 and explain what it means for a plan with three 90% steps.

Show answer

$0.9^3 = 0.729$. The whole plan works about 73% of the time.

4. Medium List four sources of friction in a basketball game.

Show answer

Sample: fatigue, a slippery spot on the floor, a misunderstood play call, crowd noise, a referee's unexpected call, a player in foul trouble.

5. **Medium** A chess combination requires you to find 5 correct moves in a row, and you think you find each correct move 90% of the time. What is the chance you play the whole combination correctly?

Show answer

$0.9^5 \approx 0.59$, about 59%.

6. **Medium** Explain the phrase “fog of war” and where it comes from.

Show answer

It means the uncertainty of information during a contest. It comes from Clausewitz’s comparison of planning in war to acting in a twilight that, “like the effect of a fog or moonshine,” makes things look larger and stranger than they are.

7. **Medium** Two independent backups each succeed 60% of the time. What is the chance at least one succeeds?

Show answer

$1 - 0.4^2 = 1 - 0.16 = 0.84$, 84%.

8. **Medium** Why might friction help the weaker side in a contest?

Show answer

Friction affects both sides. A stronger side with a complicated plan may stumble, and a weaker side that keeps things simple and stays alert can take advantage of the mistakes.

9. **Hard** A coach can either add one more step to a play, which raises the yards gained when it works from 6 to 15, with the new step 80% reliable, or keep the play as it is (70% success, 6 yards when it works, 0 otherwise). Compare expected yards, assuming the new play gains 0 when it fails.

Show answer

Old: $0.70 \times 6 = 4.2$ yards. New success rate: $0.70 \times 0.80 = 0.56$; expected yards $0.56 \times 15 = 8.4$. The new step is worth it here, because the extra reward is large. Friction is a cost, not a veto: count it, then decide.

10. **Hard** Explain why redundancy fails if all the backups share one weakness. Give an example.

Show answer

The formula $1 - (1 - p)^k$ assumes the backups fail independently. If all riders take the same road and the bridge is out, all fail together. In sport, two receivers running routes to the same area can both be covered by one zone defender.

11. **Challenge** A plan has n steps each with reliability 0.97. What is the largest n for which the plan still succeeds at least 75% of the time? Use logarithms or trial and error.

Show answer

Need $0.97^n \geq 0.75$: $n \leq \ln 0.75 / \ln 0.97 = (-0.2877) / (-0.03046) \approx 9.4$. So $n = 9$; check $0.97^9 \approx 0.760$ and $0.97^{10} \approx 0.737$.

COMMON MISTAKES

- Adding probabilities instead of multiplying them for steps that must all succeed.
- Assuming backups are independent when they share the same weakness.
- Thinking friction means plans are useless. Clausewitz's point is that plans must be simple, drilled and flexible, not abandoned.

Make it a game • Chain of Friction. Plan a six-step task, such as building a card tower, a paper boat, then crossing the room. Each step needs a 2 or higher on a die to succeed. Estimate your chance of finishing all six, then try ten times and tally. Compare your guess to the result. Say how Clausewitz would describe the friction and the fog of war.

Scripture. “nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all.” (Ecclesiastes 9:11, KJV)

Clausewitz saw what the Preacher saw: no plan controls every circumstance. Strength and skill matter, and friction humbles them both.

1.5 COUNTING THE COST

OBJECTIVES

- Explain the decision at the council of Fili (1812) as an example of counting the cost before a contest.
- Use Lanchester's linear and square laws to compare two forces, and explain why concentration matters so much.
- Apply Luke 14:31-32 and the idea of counting the cost to decisions in games and sport.

Warm-up. Your chess opponent offers a trade of queens. You are a pawn ahead. Before any analysis, write whether you will accept, and why. Then do the same if you are a pawn behind. Keep your answers and test them at the end of the lesson.

WATCH

Lanchester's Laws: The Maths of War

Tom Rocks Maths · 12:46

<https://www.youtube.com/watch?v=KRZWdScezdc>

WHEN TO WATCH

After “the principle” paragraph and before the worked examples. The hand-drawn video derives the linear and square laws with simple calculus; follow the pictures even if the calculus is new to you.

BACKUP VIDEO

The Fabian Strategy

Everything Everywhere (Everything Everywhere) · 9:13

<https://www.youtube.com/watch?v=SF94uk1lgFk>

Optional, after the story. A short audio talk (with a still image) on Fabius and the strategy of not giving battle.

KEY TERMS

counting the cost

Comparing, before a contest begins, what it will require and what you have, so that you fight only when you can win or when you must, and choose another way otherwise.

Lanchester's linear law

The model for one-on-one fighting, where only a few units can engage at a time: strength grows only in proportion to numbers.

Lanchester's square law

A model published by Frederick Lanchester in 1916: when every unit on each side can engage the enemy at once, a side's fighting strength grows with the *square* of its numbers times the quality of each unit.

Fabian strategy

Avoiding a decisive battle with a stronger opponent while wearing him down, named after the Roman general Quintus Fabius Maximus, who used it against Hannibal in 217 BC.

CORE IDEAS

The story. On September 7, 1812, the Russian army under Mikhail Kutuzov fought Napoleon at Borodino, about seventy-five miles west of Moscow. Both armies suffered terribly, and neither was destroyed. A week later, on September 13, Kutuzov gathered his generals in a peasant's log house in the village of Fili, just outside Moscow. Some wanted to fight again before the city. Kutuzov listened and then decided to give up Moscow without another battle, so that the army, which was Russia's only real defense, would survive. Napoleon entered an almost empty city on September 14. He waited there for a peace offer that never came, and on October 19 began the long retreat in which most of his army was lost.

The plan. Kutuzov counted the cost. A second battle in front of Moscow, against a still-powerful enemy, might destroy the Russian army and end the war on Napoleon's terms. Losing the city was painful, but the army could be rebuilt, reinforced and supplied while Napoleon's, more than a thousand miles from Paris, could not. The Roman general Quintus Fabius Maximus had made a similar choice against Hannibal in 217 BC, following the Carthaginian army without giving battle; Romans mocked him as "the Delayer" until a disastrous battle a year later showed the wisdom of his caution. Both men chose not to fight where the cost was too high.

The principle. In 1916 the British engineer Frederick Lanchester gave the idea of counting the cost a mathematical form. In ancient combat, where men fought one against one along a line, a force's strength was roughly proportional to its numbers: the **linear law**. But when every unit can engage any enemy unit at once, as with ranged combat, each side's losses depend on the size of the other side, and fighting strength grows with the **square** of the numbers: $\text{strength} = qN^2$, where N is the number of units and q their quality. With equal quality, a force of 20,000 is not twice as strong as 10,000 but four times as strong. If the larger force wins, it keeps $\sqrt{20000^2 - 10000^2} \approx 17,300$ of its men. The square law is a model, not a law of nature, but it explains why concentration matters so much, and why a smaller force should never fight a larger one all at once.

On the board and the field. Jesus asked: "What king, going to make war against another king, sitteth not down first, and consulteth whether he be able with ten thousand to meet him that cometh against him with twenty thousand?" (Luke 14:31). In games the same counting applies. A chess player who is behind in material should avoid trades, because each trade makes the opponent's extra material count for more; a player who is ahead should seek them. A soccer team that is much weaker may defend deep and wait for a counterattack, a modern Fabian strategy. A coach may decide that winning a meaningless late-season game is not worth risking an injured star. Counting the cost is not cowardice; it is choosing the contest you can win.

Think it through. In Luke 14 the king who cannot win "sendeth an ambassage, and desireth conditions of peace." Sometimes the wisest strategy is not to fight at all. Strategy includes knowing when to say no.

PICTURE STUDY



The Council at Fili, Aleksey Kivshenko, 1880 · Oil on canvas · Russian collection (the artist painted more than one version)

Image: [Wikimedia Commons](#), public domain

Aleksey Kivshenko painted the council at Fili nearly seventy years after it happened. The generals stand and sit around a table spread with maps in a peasant's log house, lit by the window. Kutuzov, old and heavy, sits apart on the left in a chair, listening. Family tradition said that the peasant's young granddaughter watched the council from the top of the stove.

Look closely

- Find Kutuzov. How has the painter shown that he is the one who must decide?
- Look at the faces and gestures of the other generals. Which ones seem to be arguing for battle?
- Find the maps on the table. What would the generals need to measure on them to count the cost?
- Look at the plain log walls and the icon in the corner. Why might the painter want us to notice that so great a decision was made in so humble a room?

Talk about it

1. Kutuzov listened to counsel and then decided alone. How does this picture show both Proverbs 24:6 (“in multitude of counsellors there is safety”) and

unity of command?

2. Why is it harder to choose not to fight than to fight, when your own city is at stake?
3. What did the Russian army keep by giving up Moscow?

PROJECT

Testing Lanchester with Dice

You will replay small battles with counters and dice to test whether concentration matters as much as Lanchester's square law predicts, and compare the results with the linear law.

You will need

- About 30 counters in two colors (coins, buttons or paper squares)
- Two or more dice
- The scorebook and a calculator

Steps

1. Rules for "aimed" combat (square law): each round, every surviving counter on each side rolls one die; every 5 or 6 removes one enemy counter. Both sides roll at the same time, then remove losses.
2. Fight 10 Blue against 10 Red to the end, five times. Record the number of survivors each time.
3. Fight 10 Blue against 15 Red, five times. Record the survivors.
4. Predict the survivors of the 15 with the square law, $\sqrt{15^2 - 10^2} \approx 11.2$, and compare with your average.
5. Rules for "one-on-one" combat (linear law): each round, only 3 counters from each side may fight (roll); the rest wait in line.
6. Fight 10 Blue against 15 Red with the one-on-one rules, five times. Predict 5 survivors (linear law) and compare.
7. Finally, let Blue's 10 fight Red's 15 in two groups of 7 and 8, one after the other, with the aimed rules. Record what happens to Blue.
8. Make a table of predicted and average results for each setup, and write a paragraph on what you learned about concentration and dividing an enemy.

Tips

- Five battles per setup is a small sample; your averages will wobble. If you have time, run ten.

- A free spreadsheet can run hundreds of battles with =RANDBETWEEN(1,6) if you want more data.

Check your work

- ☐ I recorded at least five battles for each of the four setups.
- ☐ I compared my averages with the square-law and linear-law predictions.
- ☐ I explained in writing why fighting a divided enemy helped the smaller side.

SCOREBOOK

1. Make a table of N and N^2 for $N = 1$ to 10, and draw both as graphs on the same axes.
2. Draw a sketch map of Moscow, Fili and Borodino with the distance between them, and write the dates September 7, 13 and 14, 1812.
3. “What I would decide and why”: you are a pawn ahead in chess and your opponent offers a queen trade. Decide, and explain using this lesson.

KEY FORMULAS

Square law: $q_A A^2$ vs. $q_B B^2$

Survivors of the winner (equal quality): $\sqrt{A^2 - B^2}$

Linear law: $q_A A$ vs. $q_B B$, survivors = $A - B$

From history. Lanchester was an automobile and aircraft engineer who wrote his laws in a series of articles in 1914 and in his 1916 book *Aircraft in Warfare*. Similar equations were worked out independently in Russia by M. Osipov in 1915. Operations researchers still use versions of them to study how forces should be divided and concentrated.

WORKED EXAMPLES

Example 1. Use the square law with equal quality for the two kings of Luke 14: 10,000 against 20,000. (a) Compare their fighting strengths. (b) If they fight to the end, how many of the larger army remain? (c) Repeat (b) using the linear law.

Show solution

1. (a) $10000^2 = 1.0 \times 10^8$; $20000^2 = 4.0 \times 10^8$. Ratio 1 : 4.
2. (b) $\sqrt{4.0 \times 10^8 - 1.0 \times 10^8} = \sqrt{3.0 \times 10^8} \approx 17,320$.
3. (c) Linear law: $20000 - 10000 = 10000$.

Answer: Under the square law the larger king is four times as strong and keeps about 17,300 men; under the linear law he keeps 10,000. Either way, the smaller king should count the cost and seek peace, as Jesus said.

Example 2. A smaller force of 12,000 faces 18,000 of equal quality. Its commander can make the enemy fight in two halves of 9,000 each, one after the other (for example, by holding a river crossing). Use the square law to see whether the smaller force can win both fights.

Show solution

1. First fight: 12,000 against 9,000. Survivors:
 $\sqrt{12000^2 - 9000^2} = \sqrt{144 - 81} \times 1000 = \sqrt{63} \times 1000 \approx 7,940$.
2. Second fight: 7,940 against 9,000. Now the enemy is larger: survivors of the enemy $\sqrt{9000^2 - 7940^2} \approx \sqrt{81 - 63.0} \times 1000 \approx 4,240$.
3. Compare with fighting all at once: 12,000 against 18,000 leaves the enemy $\sqrt{324 - 144} \times 1000 \approx 13,400$.

Answer: The smaller force still loses the second fight, but the enemy is left with about 4,240 instead of 13,400. Dividing the enemy helps enormously; to win outright, the smaller force would need the halves to be smaller still, or its own quality to be higher. This is the mathematics behind “divide and conquer.”

Example 3. In chess, you are ahead by a knight (3 points) with 18 points of other material each (for example, two rooks and two bishops each, ignoring pawns). Compare your material ratio now and after all the other pieces are traded, leaving only the extra knight plus kings and pawns. Why do experienced players say “when ahead, trade pieces”?

Show solution

1. Now: you have $18 + 3 = 21$, the opponent has 18. Ratio $21/18 \approx 1.17$.
2. After trades: you have 3 points of pieces and the opponent has 0. The ratio of pieces is infinite: he has no piece left to stop your knight helping your pawns.
3. The extra knight's relative weight has grown as the board emptied.

Answer: Your advantage grew from about 17% to overwhelming. Trading when ahead makes the advantage count for more; avoiding trades when behind keeps the game complicated and gives you chances. This is the chessboard version of counting the cost.

PRACTICE

1. Easy What did Kutuzov decide at Fili, and when?

Show answer

On September 13, 1812, he decided to abandon Moscow without another battle in order to preserve the Russian army.

2. Easy Under the square law with equal quality, how much stronger is a force of 3,000 than a force of 1,000?

Show answer

$3000^2/1000^2 = 9$: nine times as strong.

3. Easy What does Luke 14:32 say the weaker king should do?

Show answer

While the other is still far away, he sends an embassy (a delegation) and asks for conditions of peace.

4. **Medium** Under the square law, 500 meet 300 of equal quality. How many of the 500 remain at the end?

Show answer

$$\sqrt{500^2 - 300^2} = \sqrt{250000 - 90000} = \sqrt{160000} = 400.$$

5. **Medium** Why was Fabius called “the Delayer,” and why did his strategy look wiser after 216 BC?

Show answer

He refused to give battle to Hannibal and followed him instead, which Romans thought timid. In 216 BC the Romans abandoned his method and suffered a crushing defeat at Cannae, which showed that his caution had been wise.

6. **Medium** A force of 6,000 with quality 1.5 meets 8,000 with quality 1.0. Compare strengths using qN^2 .

Show answer

$1.5 \times 6000^2 = 1.5 \times 3.6 \times 10^7 = 5.4 \times 10^7$; $1.0 \times 8000^2 = 6.4 \times 10^7$. The larger force is still stronger, though quality has closed much of the gap.

7. **Medium** In chess, why should the side that is behind in material usually avoid trades?

Show answer

Each trade removes equal material from both sides, so the extra material of the opponent becomes a larger share of what is left. Keeping pieces on the board keeps complications and chances.

8. **Medium** Give an example from a sport of counting the cost and deciding not to fight a particular contest.

Show answer

Sample: a coach rests injured starters in a game that cannot change his team's playoff position; a soccer team that cannot match a stronger opponent in possession chooses to defend compactly and counterattack.

9. **Hard** Using the square law with equal quality, what is the smallest force that can defeat 10,000 if it is willing to lose at most half of itself?

Show answer

If the winner A keeps $A/2$: $A^2 - 10000^2 = (A/2)^2$, so $\frac{3}{4}A^2 = 10^8$,
 $A = \sqrt{1.333 \times 10^8} \approx 11,550$.

10. **Hard** Explain why Kutuzov's decision was strategy rather than tactics, and what he gained and lost.

Show answer

It concerned the whole war, not one fight. He lost the city of Moscow and much prestige; he gained the survival of the army, time for reinforcement and supply, and the chance to let distance, winter and supply problems wear down Napoleon's army.

11. **Challenge** Under the square law, two forces of equal quality have sizes $A > B$. Show that the winner's losses are $A - \sqrt{A^2 - B^2}$, and compute them for $A = 13,000$ and $B = 5,000$. Compare with the linear law.

Show answer

Survivors are $\sqrt{A^2 - B^2}$, so losses are $A - \sqrt{A^2 - B^2}$. Here $\sqrt{169 - 25} \times 1000 = 12,000$, so losses are 1,000. Under the linear law losses would be 5,000. A large superiority under the square law wins at very low cost.

COMMON MISTAKES

- Thinking that twice as many units are always twice as strong. Under the square law they are four times as strong.
- Using Lanchester's laws as exact predictions. They are models that ignore terrain, leadership, morale and supply.
- Thinking that counting the cost means always avoiding contests. It means choosing them wisely.

Make it a game • Council of Fili. Your parent plays a general facing a hard choice: stay and fight, or give up the city to save the army. You lead the council. Write costs and gains in a two-column chart in sixty seconds, then speak your decision. Add what happened at Fili in 1812 and name a Fabian strategy. Your parent scores the reasoning from one to five.

Scripture. “Or what king, going to make war against another king, sitteth not down first, and consulteth whether he be able with ten thousand to meet him that cometh against him with twenty thousand? Or else, while the other is yet a great way off, he sendeth an ambassage, and desireth conditions of peace.” (Luke 14:31-32, KJV)

Jesus used this picture to teach that following Him must be chosen with eyes open. It is also simply good strategy: count first, then commit.

UNIT 1

WHAT STRATEGY IS

Before you can study a plan, you need words for it. This unit gives you the vocabulary that generals, chess players and coaches have used for centuries: strategy, operations and tactics; the classic principles of war; Sun Tzu's rule to know the enemy and know yourself; Clausewitz's friction, the thousand small things that make the simplest plan hard; and the king of Luke 14 who sits down first and counts the cost.

Each idea comes with a real story and a real calculation. You will measure how many miles of coast each Union ship had to watch in 1861, map the nine principles onto a soccer field, read false campfire counts the way Sun Bin's enemy did, compute how quickly small chances of failure multiply in a long plan, and test Lanchester's square law with dice and counters. By the end you will be able to name what kind of decision you are looking at, and say which principle it serves.

PREREQUISITES

- Ratios, rates and percents
- Multiplying decimals and using a calculator's power key
- Reading a simple map with a scale and a north arrow

MASTERY CHECKLIST

- ☐ I can sort a decision into strategy, operations or tactics and explain why.
- ☐ I can name the nine principles of war and give a game or sports example of each.
- ☐ I can explain Sun Tzu's rule about knowing the enemy and knowing yourself, and use it to plan against an opponent.
- ☐ I can explain Clausewitz's idea of friction and compute how small chances of failure multiply in a plan with many steps.
- ☐ I can use Lanchester's square law to compare two forces and explain what it means to count the cost before a contest.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **The Art of War, translated by Lionel Giles (Project Gutenberg)**: Free. The 1910 translation quoted in Lesson 1.3, with Giles’s notes and the old Chinese commentators’ stories. Ages 13+ with a parent previewing; a few commentators’ anecdotes are harsh.
- **On War, by Carl von Clausewitz (Project Gutenberg)**: Free. J. J. Graham’s 1873 translation. Read Book I, Chapter VII, “Friction in War,” for Lesson 1.4; it is only a few pages long. Ages 14+.
- **Lichess analysis board**: Free, with no account needed. Useful for checking the chess examples in this unit and the next. Ages 10+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

1.1 Strategy, Operations and Tactics	3 sessions of 50 minutes
1.2 The Principles of War	3 sessions of 50 minutes
1.3 Sun Tzu: Know the Enemy and Know Yourself	3 sessions of 50 minutes
1.4 Clausewitz: Friction and the Fog of War	3 sessions of 50 minutes
1.5 Counting the Cost	3 sessions of 50 minutes

UNIT 1 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Answer the concept questions in complete sentences, with specific examples. The test has 15 problems worth a total of 100 points.

1. **6 pts**

Define strategy, operations and tactics, and give one chess example of each.

2. (6 pts)

The Union Navy had about 42 ships in commission in April 1861 to blockade about 3,500 miles of coast. How many miles per ship is that? Why was the early blockade weak?

3. (5 pts)

How many days from May 18 to July 4, 1863? What event began and ended on those dates?

4. (7 pts)

List the nine principles of war.

5. (7 pts)

A soccer team of 10 field players puts 5 on the right wing, 3 in the middle and 2 on the left. The opponent spreads its 10 as 3, 4 and 3. Find the local ratio in each zone, name the principles used, and name the risk.

6. (6 pts)

Quote Sun Tzu's three cases of knowing the enemy and yourself (in your own words is acceptable), and explain the case that is hardest in practice.

7. (7 pts)

Sun Bin's camps showed 100,000, then 50,000, then 20,000 fires. Compute the overall percent drop and explain why the deception worked.

8. (5 pts)

Quote Clausewitz's sentence about friction beginning "Everything is very simple in War."

9. (7 pts)

A play needs six independent steps, each 92% reliable. What is the probability the whole play works?

10. (7 pts)

Three messengers are sent by separate roads, each with a 65% chance of arriving. What is the chance at least one arrives? What assumption are you making?

11. **6 pts**

Under the square law with equal quality, compare the strengths of 4,000 and 12,000.

12. **7 pts**

Under the square law, 15,000 meet 9,000 of equal quality. How many of the 15,000 remain? How many would remain under the linear law?

13. **6 pts**

Explain Kutuzov's decision at Fili as an example of counting the cost.

14. **6 pts**

Why should a chess player who is ahead in material usually trade pieces? Give a numerical illustration.

15. **12 pts**

Short essay (8–10 sentences): Choose one principle of war and one idea from Sun Tzu or Clausewitz. Show how both apply to a game or sport you know well, using a specific example, and explain how a wise player balances that principle against another one.

ANSWER KEY

1. Strategy: the overall plan toward the final goal (e.g., play solidly for a draw to win the tournament). Operations: a connected plan within a game (e.g., a queenside attack over many moves). Tactics: a single forcing sequence (e.g., a knight fork).
2. $3500/42 \approx 83$ miles per ship. With so few ships, most of the coast was unwatched, and many blockade runners got through until the Navy grew.
3. $13 + 30 + 4 = 47$ days: the siege of Vicksburg.
4. Objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, simplicity.
5. Right 5:3, middle 3:4, left 2:3. Mass on the right with economy of force elsewhere; the risk is to security on the left and middle if the opponent switches play quickly.
6. Know both: no need to fear a hundred battles. Know yourself only: a defeat for every victory. Know neither: defeat in every battle. Knowing yourself is often hardest, because vanity hides our weaknesses.
7. $(100000 - 20000)/100000 = 80\%$. It confirmed what Pang Juan hoped to believe, that the enemy was deserting, and he did not check evidence the enemy controlled.
8. "Everything is very simple in War, but the simplest thing is difficult."
9. $0.92^6 \approx 0.606$, about 61%.
10. $1 - 0.35^3 = 1 - 0.0429 \approx 0.957$, about 96%. The assumption is that the messengers fail independently.
11. $12000^2/4000^2 = 9$: the larger force is nine times as strong.
12. $\sqrt{225 - 81} \times 1000 = 12,000$; linear law: $15000 - 9000 = 6000$.
13. Another battle before Moscow risked destroying Russia's only army. By giving up the city he preserved the army, gained time to reinforce it, and left Napoleon far from home with a supply problem and no peace offer.
14. Each trade makes the extra material a larger share of what remains. Ahead 21 to 18 is a ratio of about 1.17; after trading 18 points each, 3 to 0 is overwhelming.
15. Answers will vary. A full-credit essay names a principle and an idea correctly, gives a specific and accurate example, explains a real tension (for example, mass against security, or surprise against simplicity), and ends with a reasoned judgment.

PORTFOLIO PIECE: A STRATEGIST'S HANDBOOK, PART 1

Begin a handbook that you will add to all semester. Part 1 has four pages: (1) a one-page glossary of the vocabulary of this unit, with a chess and a sports example for every term; (2) a page with the nine principles, each illustrated with a small diagram from a game or sport you know; (3) a page applying Sun Tzu's five factors to a real upcoming contest (a family tournament, a team game, a match you will watch), with a written plan; and (4) a page of calculations showing friction (p^n) and Lanchester's laws, with one example of each worked out and a sentence explaining what the numbers mean for a decision.

LOOK FOR	WHAT IT MEANS
Vocabulary	Every term from the unit is defined accurately and illustrated with a correct chess and sports example.
Principles diagrams	All nine principles are shown with clear, labeled diagrams that a reader could understand without the text.
Assessment and plan	The five factors are applied honestly to a real contest, and the plan follows from the assessment.
Calculations	Friction and Lanchester calculations are correct, shown step by step, and tied to a real decision.

UNIT 2

THE BOARD AS A BATTLEFIELD

A game board is a small battlefield where the principles of Unit 1 can be tested a hundred times a week, with no one hurt and every move recorded. Chess, Go and checkers have been called war games for centuries, and they teach the same lessons: control the center, bring every piece into play, keep the king safe, take the initiative, count before you capture, and make a plan that fits the position.

This unit follows the great players who discovered those lessons: Paul Morphy and his famous game at the Paris opera in 1858, the early writers Damiano and Greco, Wilhelm Steinitz and José Raúl Capablanca, Honinbo Shusaku and the ear-reddening move of 1846, and Marion Tinsley, the checkers champion who held off a computer. You will count tempi and material, compute Elo expectations, count territory on a small Go board, and solve endgames by counting squares. Every lesson has a project in which you play, record and analyse real games.

PREREQUISITES

- How the chess pieces move (Lesson 2.1 reviews algebraic notation)
- The principles of war (Lesson 1.2)
- Fractions, decimals and powers of ten

MASTERY CHECKLIST

- ☐ I can read and write chess moves in algebraic notation and explain the four opening principles.
- ☐ I can recognize and set up forks, pins and skewers, and count a sequence of captures on one square.
- ☐ I can evaluate a position by material, king safety, pawn structure and piece activity, make a plan, and compute an Elo expected score.
- ☐ I can explain liberties, territory, influence and sente in Go, and count a small Go game.
- ☐ I can use the opposition and the rule of the square in king-and-pawn endings and explain why checkers is a draw with perfect play.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **Chess Fundamentals, by José Raúl Capablanca (Project Gutenberg)**: Free. The world champion's own 1921 primer, with clear chapters on endings, middlegame planning and opening principles. Fits Lessons 2.1–2.5. Ages 12+.
- **Lichess analysis board and puzzles**: Free, with no account needed for puzzles. Thousands of tactical puzzles sorted by theme (fork, pin, skewer) for Lesson 2.2. Ages 10+.
- **American Go Association**: Free. The American Go Association's site, with beginner lessons, rules and places to play, for Lesson 2.4. Ages 10+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

2.1 Chess Openings: Center, Development, King Safety and Tempo

3 sessions of 50 minutes

2.2 Forks, Pins and Skewers

3 sessions of 50 minutes

2.3 Planning in the Middlegame: Steinitz and Capablanca

3 sessions of 50 minutes

2.4 Go: Influence, Territory and Sente

3 sessions of 50 minutes

2.5 Checkers and the Endgame: Counting and the Opposition

3 sessions of 50 minutes

UNIT 2 TEST

Calculators are allowed. Set up chess positions on a board if you wish. Show your work for every calculation and every exchange count. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **5 pts**

State the four opening principles and the principle of war that each one matches.

2. **6 pts**

In the Opera Game, after 9.Bg5, how many pieces had each side developed, and what had Black done with its tempi instead?

3. **6 pts**

Count the material at the end of the Opera Game (P1, N3, B3, R5, Q9). Who was ahead, by how much, and who won?

4. **6 pts**

Define fork, pin and skewer, and give one example position (in notation) of a fork.

5. (7 pts)

A Black rook on d5 is defended by a pawn on e6. White attacks d5 with a knight and a bishop. Count the exchange if White captures with the knight first.

6. (6 pts)

Who wrote the first printed chess book in Italy, and what did Greco contribute?

7. (7 pts)

A player rated 1450 plays one rated 1650. Find the lower-rated player's expected score and her rating change for a win with $K = 32$.

8. (6 pts)

State Steinitz's rules about the side with the advantage and the side without it.

9. (6 pts)

Describe Capablanca's method of planning in three steps.

10. (7 pts)

Compute the points per stone for enclosing a 4×4 block in a corner, on a side and in the center.

11. (6 pts)

Define sente and influence in Go, and give a sports example of each.

12. (6 pts)

Black has 35 points of territory and 2 prisoners; White has 31 points and 1 prisoner; komi 6.5. Who wins, and by how much?

13. (7 pts)

White pawn on h4, Black king on c6. Does the king catch the pawn (a) with Black to move, (b) with White to move?

14. (7 pts)

Tell the story of Tinsley and Chinook, including the 1992 result and what was proven in 2007.

15. **12 pts**

Short essay (8–10 sentences): Choose chess, Go or checkers. Explain how three principles of war appear in it, with one specific example of each from this unit or from your own games.

ANSWER KEY

1. Center (mass), development (maneuver/offensive), king safety (security), not wasting time (offensive/initiative).
2. White 4 (Bc4, Qb3, Nc3, Bg5); Black 2 (Nf6, Qe7). Black had spent moves on pawn moves (c6, b5) and lost its c8 bishop in a trade.
3. White 15 (R, B, 7 pawns); Black 25 (Q, R, B, N, 5 pawns). Black was ahead by 10, but White won by checkmate.
4. Definitions as in the lesson. Example: White knight b5, Black king e8 and rook a8: 1.Nc7+ forks king and rook.
5. $Nxd5 +5$; $exd5 -3 (+2)$; $Bxd5 +1 (+3)$. White wins the exchange plus a pawn: net +3.
6. Pedro Damiano (Rome, 1512). Greco wrote manuscripts of short instructive games full of tactics in the 1620s; they were printed in English in 1656.
7. $E = 1/(1 + 10^{0.5}) \approx 0.240$. Win: $32(1 - 0.240) \approx +24.3$.
8. The side with the advantage must attack or lose the advantage; the side without it must defend economically and wait.
9. Evaluate the position (material, king safety, pawns, activity, space); choose a plan to exploit a weakness or improve the worst piece; then calculate moves that carry out the plan.
10. Corner 8 stones: $16/8 = 2$; side 12 stones: $16/12 \approx 1.33$; center 16 stones: $16/16 = 1$.
11. Sente: a move the opponent must answer, keeping the initiative (sports: a corner kick or full-court press that forces a response). Influence: strength facing the open board that pays later (sports: possession that pins the opponent in its half).
12. Black 37; White $31 + 1 + 6.5 = 38.5$. White by 1.5.
13. Square h4–h8–d8–d4. (a) Black plays Kd5 or Kd6 or Kd7, inside the square: catches it. (b) After 1.h5 the square is h5–h8–e8–e5; from c6 the king reaches d5, d6, d7, none inside (file d): the pawn promotes.
14. Tinsley, the great checkers champion, beat Chinook 4–2 with 33 draws in London in 1992; the 1994 rematch ended after six draws when Tinsley withdrew because of illness. In 2007 Schaeffer's team proved checkers is a draw with perfect play.
15. Answers will vary. A full-credit essay names three principles correctly, gives a specific, accurate example of each (a position, move or game), and explains how the principle helped decide the result.

PORTFOLIO PIECE: MY ANNOTATED GAMES

Choose three of your own games from this unit, one in each of two different games (chess, Go or checkers) and a third of your choice. Write each one out in full with notation (or a sequence of sketches for Go) and annotate it like a master: mark the opening principles kept or broken, every tactic that was played or missed, your written evaluation and plan at one turning point, and the endgame counting if the game reached an ending. Finish each game with a paragraph naming the principle of war that decided it. Include your Elo table for the family or club.

LOOK FOR	WHAT IT MEANS
Accurate records	All three games are recorded completely and correctly in notation or sketches.
Annotation	Opening principles, tactics, a written evaluation and plan, and any endgame counting are marked and explained correctly.
Connection to strategy	Each game ends with a clear paragraph linking the decisive moment to a principle of war.
Honesty	Mistakes are admitted and explained, and the Elo table is calculated correctly.

2.1 CHESS OPENINGS: CENTER, DEVELOPMENT, KING SAFETY AND TEMPO

OBJECTIVES

- Read and write chess moves in algebraic notation.
- Explain the four opening principles (control the center, develop pieces, keep the king safe, do not waste time) and connect each to a principle of war.
- Count development and material in Paul Morphy's Opera Game of 1858, and explain why time can be worth more than material.

Warm-up. Set up a chess board. Without moving anything, count how many squares a knight on g1 attacks, then move it to f3 and count again. Do the same for the bishop on f1 before and after the pawn on e2 moves to e4. Write the four numbers. What do they tell you about the purpose of the first few moves?

WATCH

The Most Famous Chess Game Ever Played || "A Night at the Opera" (feat. in Netflix's Queen's Gambit)

[agadmator's Chess Channel](#) • 5:44

<https://www.youtube.com/watch?v=Z-2FpiEzeYI>

WHEN TO WATCH

After “the story” paragraph. Set up a board and play along with the moves as the presenter shows them; stop before move 10 and guess Morphy's next move.

BACKUP VIDEO

Chess Basics: Opening Principles

[thechesswebsite](#) • 8:08

<https://www.youtube.com/watch?v=kURU67G98O8>

Optional, before the worked examples. A calm board-only lesson on the opening principles: center, development and king safety.

KEY TERMS

algebraic notation

The standard way to record chess moves. Files are lettered a–h from White’s left, ranks numbered 1–8 from White’s side. K, Q, R, B and N stand for king, queen, rook, bishop and knight; a pawn move gives only the square. “x” means a capture, “+” check and “#” checkmate; O-O is castling kingside and O-O-O queenside.

tempo (plural tempi)

A unit of time in chess: one move. Gaining a tempo means reaching a useful position a move sooner than the opponent, often by making a move that also creates a threat.

gambit

An opening in which a player gives up material, usually a pawn, to gain time or the center.

development

Moving the knights and bishops (and later the rooks) from their starting squares to active squares where they control the board.

initiative

The ability to make threats that the opponent must answer, so that you choose the course of the game.

CORE IDEAS

The story. Paul Morphy was born in New Orleans in 1837, learned chess by watching his father and uncle, and won the First American Chess Congress in New York in 1857 at the age of twenty. In 1858 he sailed to Europe and defeated its strongest masters. One evening in Paris that autumn he was invited to the box of the Duke Karl of Brunswick at the Italian opera, where the Duke and Count Isouard played him in consultation while the music went on. Morphy is said to have wanted to watch the opera; he finished the game in seventeen moves. It is the most famous teaching game in chess.

The plan. Here is the whole game. 1.e4 e5 2.Nf3 d6 3.d4 Bg4 4.dxe5 Bxf3 5.Qxf3 dxe5 6.Bc4 Nf6 7.Qb3 Qe7 8.Nc3 c6 9.Bg5 b5 10.Nxb5 cxb5 11.Bxb5+ Nbd7 12.O-O-O Rd8 13.Rxd7 Rxd7 14.Rd1 Qe6 15.Bxd7+ Nxd7 16.Qb8+ Nxb8 17.Rd8#. Morphy’s plan was

simple: bring every piece into the game as fast as possible, put pressure on the f7 and b7 squares, castle so that his rooks joined the attack, and then open lines toward the Black king while two of Black's pieces were still asleep on their starting squares. On move 10 he began giving material back to keep the lines open. At the end he had given up a knight, both bishops, a rook and his queen, and checkmated with his last two pieces.

The principle. Four opening principles summarize what Morphy did. **Control the center** (the squares d4, d5, e4 and e5), because pieces in the center reach both sides of the board: this is the principle of mass at the decisive point. **Develop your pieces** quickly to active squares, knights usually before bishops, and do not move the same piece twice without a reason: this is maneuver and economy of time. **Keep the king safe**, usually by castling early: this is security. **Do not waste tempi**, for example by bringing the queen out early where it can be chased: this is the offensive, since the side that develops faster gains the initiative. In the opening, time is often worth more than material; an old rule of thumb says one pawn is worth about three tempi.

On the board and the field. Strong players learn the reasons behind the principles rather than long memorized lines, because an opponent who leaves the book on move 5 will ruin a memorized plan but not a principle. The same is true on the field: a soccer team that controls the middle of the field controls the game, a basketball team that gets all five players involved early is hard to defend, and every coach knows that the first minutes of a game set its tempo. When you play, ask after each opening move: did this move help me control the center, develop a piece, or protect my king? If not, why am I playing it?

Think it through. Morphy won with material down because his pieces were all working and the Duke's were not. Count what is *active*, not only what is on the board.

PICTURE STUDY



Paul Morphy, the Chess Champion, Winslow Homer (drawn for a wood engraving), 1859 · Wood engraving from *Harper's Weekly* · Cleveland Museum of Art

Image: [Wikimedia Commons](#), public domain

When Paul Morphy came home from Europe in 1859, the young illustrator Winslow Homer drew him for *Harper's Weekly*, and the picture was cut into a woodblock and printed for readers across the country. Morphy was barely twenty-two and the strongest player in the world. Players who met him said he moved quickly and calmly, as if he simply saw where every piece belonged.

Look closely

- Look at Morphy's posture and hands. Does he look like a nervous competitor or a calm one?
- Look at the board. Can you tell whether the pieces are in their starting position?
- Notice his age. What advantages and disadvantages might a twenty-year-old have against older masters?

Talk about it

1. Morphy's great strength was development: getting every piece into play. How might a calm temperament help a player follow principles under pressure?
2. Why would a magazine in 1859 picture a chess player beside a board rather than with a book or a desk, and why might so many readers want his picture?

3. If Morphy could see a modern opening book, which of his principles do you think he would find still true?

PROJECT

Development Contest

You will replay the Opera Game on a real board, then play five games of your own in which you record a development count after move 10, to test whether the side that develops faster wins more often.

You will need

- A chess set
- The scorebook
- An opponent (family member or a low-level computer)

Steps

1. Replay the Opera Game on a real board from the moves in the lesson. After move 9 and after move 12, count the developed pieces for each side and record them.
2. Rule a table for five games: game number, your color, your development count after move 10, opponent's count after move 10, castled by move 10 (yes or no), result.
3. Before each game, write a one-line opening plan (for example, "1.e4, knights out, castle by move 7").
4. Play each game and record all the moves in notation.
5. After move 10 in each game, pause and fill in the development counts (count knights, bishops and queen off their starting squares, and add 1 for castling).
6. After all five games, compare: did the side with the higher count win more often?
7. Choose your worst opening of the five and rewrite its first ten moves following the four principles.
8. Write a paragraph: which principle do you break most often, and why?

Tips

- If you are playing a much stronger or weaker opponent, the result may depend more on skill than on development. Note that in your conclusion.
- Pause the clock if needed to count; this is study, not a tournament.

Check your work

- ☐ I replayed the Opera Game and recorded the development counts after moves 9 and 12.
- ☐ I recorded five games with development counts after move 10.
- ☐ I rewrote one opening following the principles and named my most common mistake.

SCOREBOOK

1. Draw an 8×8 grid with files and ranks labeled. Shade the four center squares and the twelve squares around them.
2. Write the Opera Game in two columns (White, Black). Circle every developing move in one color and every pawn move in another.
3. “What I would decide and why”: your opponent offers a pawn on move 4 that would cost you two tempi to take. Do you take it? Explain.

From history. Morphy retired from serious chess in his early twenties and returned to New Orleans to practice law, without much success. Many strong players since, including the world champion Bobby Fischer, studied his games for their clear, fast development.

Example 1. In the Opera Game, after 9.Bg5, count the developed pieces for each side (knights, bishops and queen off their starting squares, and whether each side has castled). Which principle has Black neglected?

Show solution

1. White: bishop c4, queen b3, knight c3, bishop g5 are developed (the knight from g1 was traded on f3). White has not castled but can castle queenside next.
2. Black: knight f6 and queen e7 are developed; the bishop from c8 was traded on f3. The knight on b8 and bishop on f8 have not moved, and the rook on h8 is blocked by them. Black has not castled and cannot castle soon.
3. White has 4 active pieces, Black 2, and Black has spent moves on pawn moves (c6, b5) instead of development.

Answer: White 4, Black 2. Black has neglected development and king safety, and spent tempi on pawn moves. Morphy's sacrifice on b5 was possible because his pieces outnumbered Black's defenders.

Example 2. At the end of the Opera Game (after 17.Rd8#), count the material for each side using pawn 1, knight 3, bishop 3, rook 5, queen 9. Then explain how the side with far less material won.

Show solution

1. White has a rook on d8 (5), a bishop on g5 (3) and 7 pawns (a2, b2, c2, e4, f2, g2, h2): $5 + 3 + 7 = 15$.
2. Black has a queen on e6 (9), a rook on h8 (5), a bishop on f8 (3), a knight on b8 (3) and 5 pawns (a7, e5, f7, g7, h7): $9 + 5 + 3 + 3 + 5 = 25$.
3. Black is ahead by 10 points, yet the Black king on e8 is in check from the rook on d8, the bishop on g5 covers e7 and d8's defenders, and Black's own pieces block the king's escape squares.

Answer: White 15, Black 25. Material is only one part of a position. White's two remaining pieces were active and coordinated against the king, while Black's pieces were passive. The objective is checkmate, not points.

Example 3. In 1.e4 e5 2.Nf3 Nc6 3.Bc4 Nf6, White plays 4.Ng5, moving the same knight twice to attack f7. Black has developed two knights; White has developed a knight and a bishop. Count the tempi spent on development after move 4 and explain the risk White is taking.

Show solution

1. White's moves: e4 (center), Nf3, Bc4 (development), Ng5 (second move of the same knight). Three useful developing or central moves and one attacking move.
2. Black's moves: e5 (center), Nc6, Nf6 (development). Black is to move.
3. White's attack on f7 gains a pawn if Black ignores it, but White moved one piece twice while the queen, the other knight and the rooks are still at home.

Answer: White breaks the principle "don't move the same piece twice" for a concrete gain: a direct threat. That is allowed when the threat is real. The risk is that if Black defends well (with 4...d5), Black can gain tempi by chasing the knight and catch up in development.

PRACTICE

1. **Easy** What do the symbols x, +, # and O-O-O mean in algebraic notation?

Show answer

x: capture. +: check. #: checkmate. O-O-O: castling queenside.

2. **Easy** Name the four center squares.

Show answer

d4, d5, e4, e5.

3. **Easy** State the four opening principles.

Show answer

Control the center; develop your pieces; keep your king safe (castle early); do not waste time (avoid early queen moves and moving one piece repeatedly).

4. **Medium** How many squares does a knight attack from g1, and from f3, on an otherwise empty board?

Show answer

From g1: 3 (e2, f3, h3). From f3: 8 (d2, d4, e1, e5, g1, g5, h2, h4).

5. **Medium** Who played the Opera Game, when and where?

Show answer

Paul Morphy (White) against the Duke Karl of Brunswick and Count Isouard (in consultation), in Paris in 1858, in the Duke's box at the opera.

6. **Medium** Match each opening principle to a principle of war.

Show answer

Center: mass. Development: maneuver (and offensive). King safety: security. Not wasting time: offensive/initiative and economy.

7. **Medium** Why is bringing the queen out early often a mistake?

Show answer

The opponent can attack it with less valuable pieces while developing them, gaining tempi each time the queen must move.

8. **Medium** In the Opera Game, after 16.Qb8+, why must Black capture with the knight?

Show answer

The queen on b8 checks the king on e8 along the empty eighth rank (c8 and d8 are empty). The king cannot escape: d7 holds Black's own knight, e7 is covered by the bishop on g5, and f7 and f8 are blocked by Black's own pawn and bishop. Nothing can be placed between b8 and e8 in one move, so the only legal reply is to capture the queen with the knight: 16...Nxb8.

9. **Hard** Use the rule of thumb "one pawn is about three tempi" to judge a gambit: White gives a pawn and gains two tempi in development. Is the gambit sound by this rule?

Show answer

By the rule, a pawn is worth about three tempi, so gaining only two is slightly unsound. The rule is rough; the real question is whether the extra time leads to a strong attack or lasting advantage.

10. **Hard** Morphy gave back material starting on move 10. Explain how this follows the principle of the offensive.

Show answer

He used his lead in development before Black could catch up. A lead in time is temporary; by sacrificing to open lines, he converted it into a decisive attack before it disappeared.

11. **Challenge** Write the final position of the Opera Game in words (every piece and its square) and prove that 17.Rd8 is checkmate by listing each escape square of the Black king and what controls it.

Show answer

White: Kc1, Rd8, Bg5, pawns a2 b2 c2 e4 f2 g2 h2. Black: Ke8, Qe6, Rh8, Bf8, Nb8, pawns a7 e5 f7 g7 h7. The rook on d8 gives check along the eighth rank. The king cannot capture it, because the bishop on g5 defends d8 along the diagonal g5–f6–e7–d8. Escape squares: d7 is covered by the rook, e7 by the bishop, and f7 and f8 are occupied by Black's own pawn and bishop. No Black piece can capture the rook (the knight on b8 reaches only a6, c6 and d7; the queen on e6 and the rook on h8 cannot reach d8), and an adjacent check cannot be blocked. It is checkmate.

COMMON MISTAKES

- Moving many pawns in the opening instead of developing pieces.
- Bringing the queen out early where it can be chased.
- Counting material only and ignoring time and activity.
- Mixing up the files (a–h) and ranks (1–8) in notation.

Make it a game • Name That Square. Draw an eight by eight board and label the files a to h and ranks one to eight. Your parent calls out a square, such as e4 or g1, and you place a bean on it within three seconds. Then call out opening moves in algebraic notation, and place a piece for each. Add one point for each correct tempo or development comment.

2.2 FORKS, PINS AND SKEWERS

OBJECTIVES

- Recognize and set up the three basic tactical patterns: the fork, the pin and the skewer.
- Count a sequence of captures on one square (attackers and defenders) to decide whether a capture wins material.
- Connect chess tactics to the double threat in sport and battle, and use the history of Damiano and Greco to show how tactics were first written down.

Warm-up. Place a White knight on d5 and Black pieces on c7, e7, b6, f6, b4, f4, c3 and e3. How many Black pieces does the knight attack at once? Now find the square on which a knight attacks a king on e8 and a rook on a8 at the same time.

WATCH

All The Chess Tactics You NEED To Know

[Chess.com](https://www.youtube.com/watch?v=W1gWHipQNVU) · 15:59

<https://www.youtube.com/watch?v=W1gWHipQNVU>

WHEN TO WATCH

After “the plan” paragraph. Watch the sections on forks, pins and skewers closely, and pause to find each tactic before it is shown.

Note: A few frames use comic film stills to introduce sections; there is nothing objectionable.

BACKUP VIDEO

The Chess Tactics Guide For Beginners! Learn the 3 most common chess tactics: forks, pins, skewers!

[Chess Vibes](https://www.youtube.com/watch?v=MbMslp2Wcl0) · 6:56

<https://www.youtube.com/watch?v=MbMslp2Wcl0>

Optional, before the project. A shorter review of forks, pins and skewers with clear diagrams.

KEY TERMS

fork

A single piece attacking two or more enemy pieces at once, so that the opponent can save only one.

pin

An attack on a piece that cannot move without exposing a more valuable piece behind it. If the piece behind is the king, the pin is absolute: the pinned piece may not legally move off the line.

skewer

An attack on a valuable piece that must move, exposing a less valuable piece behind it to capture. It is a pin in reverse.

double threat

Any move that creates two threats at once. Forks are the most common kind.

exchange count

Counting the attackers and defenders of a square, and the values of the pieces, to see who wins material if every capture is made.

CORE IDEAS

The story. The first printed chess book in Italy was written by a Portuguese apothecary, Pedro Damiano, and published in Rome in 1512. Among its advice is a warning against the defensive move 2...f6 after 1.e4 e5 2.Nf3, which is still called the Damiano Defense because he showed it fails. A century later an Italian player, Gioachino Greco, wrote manuscripts full of short instructive games, each ending in a sharp tactical blow. Greco carried his manuscripts to Paris, London and Madrid in the 1620s, and an English edition was printed in 1656. Generations learned tactics from Greco's little games, and the patterns he showed are the same ones a beginner studies today.

The plan. A tactic is a short, forcing plan: a sequence of checks, captures and threats that leaves the opponent no good choice. The **fork** attacks two targets at once; the classic is a knight on c7 attacking a king on e8 and a rook on a8. The **pin** freezes a piece: a White bishop on b5 attacking a Black knight on c6 with the Black king on e8

behind it (and d7 empty) pins the knight, which may not move. The **skewer** drives a valuable piece off a line to win the piece behind it: a White rook giving check on e1 to a king on e5, with a queen on e8 behind, wins the queen when the king steps aside. All three rest on one idea: *two targets, one move*.

The principle. The double threat is the tactician's version of the principle of mass: one piece brings its force against two targets, and the defender cannot protect both. The second principle of tactics is careful counting. Before capturing, count the attackers and defenders of the square, and the values of the pieces that will be traded. Capture first with your least valuable attacker, and remember that the defender may stop recapturing whenever it suits him. Many tactics fail because the attacker counts only the first capture.

On the board and the field. Strong players say that tactics decide most games between beginners, and that pattern recognition is learned by solving thousands of small puzzles. On the field, the same double threat appears everywhere. A basketball player driving to the basket forces a defender to choose between stopping him and guarding the open teammate. A quarterback on a run-pass option reads a single defender who cannot both tackle the runner and cover the receiver. A soccer forward running between two defenders "pins" them both. Generals have used the double threat for centuries: Napoleon liked to place his army between two enemy forces so that each could be attacked in turn.

Think it through. A fork is only as good as the count after it. Ask: after the fork, can the opponent capture my forking piece, give check, or create a bigger threat of his own?

PICTURE STUDY



The Game of Chess, Lucas van Leyden, about 1508 · Oil on panel · Gemäldegalerie, Berlin

Image: [Wikimedia Commons](#), public domain

Lucas van Leyden painted this scene when he was a teenager in Holland. A woman and a man play on a board that is longer than our 8×8 board, a variant played in some places in that age, while a crowd of onlookers watches. The faces show every reaction to a sharp move: surprise, worry and quiet satisfaction.

Look closely

- Find the two players. Which one seems to have just made a strong move?
- Look at the onlookers. How many are watching the board, and how many are watching the players' faces?
- Count the squares along the board's long side as best you can. How is this board different from a modern chessboard?
- Look at the hands. Who is reaching, and who is holding still?

Talk about it

1. A good tactic often shows on the opponent's face before it shows on the board. What does this painting suggest about tactics and nerves?
2. Why might onlookers sometimes see a tactic that the players miss?

3. How does the crowded composition make you feel? Does it remind you of the tension in a game you have played?

PROJECT

Tactics Workbook

You will build a personal tactics workbook of 30 positions, ten each of forks, pins and skewers, solve them against the clock, and then hunt for the same patterns in your own games.

You will need

- A chess set
- The scorebook
- Free puzzles from a chess puzzle site, or a book of tactics, or positions you set up yourself
- A stopwatch

Steps

1. Draw ten small diagrams for each pattern (fork, pin, skewer), either from a puzzle source or by setting up your own positions on the board and checking them.
2. Under each diagram write the solution in notation and the material it wins.
3. A day later, cover the solutions and solve all thirty, giving yourself one minute each. Record your time and whether you were right.
4. Compute your success rate for each pattern.
5. Play three games. After each game, go through it move by move looking for any fork, pin or skewer that either side had or missed.
6. Record every missed tactic in a table: move number, pattern, who missed it.
7. Make a bar chart of your puzzle success rate by pattern, and beside it a bar chart of missed tactics by pattern in your games.
8. Write a paragraph: which pattern do you see best, and which do you miss most in real games?

Tips

- Setting up your own positions teaches as much as solving: you must check that the tactic really works.

- Look for checks, captures and threats first; most tactics begin with one of them.

Check your work

- ☐ My workbook has thirty diagrams with solutions.
- ☐ I recorded timed results and success rates by pattern.
- ☐ I searched three of my own games for tactics and charted what I found.

SCOREBOOK

1. Draw one clear diagram of each pattern (fork, pin, skewer) with arrows showing the lines of attack.
2. Make a table for an exchange count: square, attackers (with values), defenders (with values), and the running total after each capture.
3. “What I would decide and why”: you can fork the enemy king and queen, but your forking knight can be captured by a pawn. Is it still good? Explain with numbers.

From history. Greco’s games were reprinted for more than two hundred years. The English edition of 1656 was called *The Royall Game of Chesse-Play*. The word “tactics” was not used in chess until the nineteenth century, when players borrowed it from military writers.

WORKED EXAMPLES

Example 1. White: king g1, knight b5. Black: king e8, rook a8. White to move. Find the fork and count the material it wins.

Show solution

1. A knight on c7 attacks a8, a6, b5, d5, e6 and e8.
2. 1.Nc7+ checks the king on e8 and attacks the rook on a8.
3. Black must answer the check by moving the king; the rook cannot be saved.
4. 2.Nxa8 wins the rook (5 points) for nothing.

Answer: 1.Nc7+ forks king and rook; White wins 5 points. Note that a check is the strongest kind of threat, because it must be answered first.

Example 2. A Black knight on d5 is defended by a pawn on c6 and a queen on d8. White attacks d5 with a knight on c3, a bishop on b3 and a rook on d1 (the d-file is open between d1 and d5, and between d5 and d8). Count the exchange: should White capture on d5, and what does White win if Black recaptures sensibly?

Show solution

1. 1.Nxd5 (White gains 3) cxd5 (Black regains 3; White has lost the knight).
2. 2.Bxd5 (White gains the pawn, 1). Now Black must decide: 2...Qxd5 gains the bishop (3) but 3.Rxd5 wins the queen (9).
3. Black should stop recapturing after 2.Bxd5. Running total for White:
 $+3 - 3 + 1 = +1$.
4. Three attackers against two defenders: White wins the last capture, but the profit is small.

Answer: White should capture, winning one pawn if Black stops recapturing after 2.Bxd5. If Black wrongly continues with 2...Qxd5 3.Rxd5, White wins $+1 + 9 - 3 = +7$ in total. The defender always chooses when to stop.

Example 3. White: king g1, rook a1. Black: king e5, queen e8, and the e-file between e1 and e5 is empty. White to move. Find a skewer, and explain why it works.

Show solution

1. 1.Re1+ gives check along the e-file to the king on e5.
2. The king must leave the e-file (it cannot block, and nothing can capture the rook).
3. Then the rook captures the queen on e8: 2.Rxe8.

Answer: 1.Re1+ skewers king and queen; White wins the queen (9) for nothing. The more valuable piece in front was forced to move, exposing the one behind.

PRACTICE

1. Easy Define a fork, a pin and a skewer in one sentence each.

Show answer

Fork: one piece attacks two or more at once. Pin: a piece cannot move without exposing a more valuable piece behind it. Skewer: a valuable piece must move and exposes a less valuable piece behind it.

2. Easy Which piece makes the most forks, and why is it hard to defend against?

Show answer

The knight. It jumps over pieces and attacks squares in an L-shape that do not lie on the same lines as the pieces it attacks, so it cannot be blocked.

3. Easy Who wrote the first printed chess book in Italy, and when?

Show answer

Pedro Damiano, in Rome in 1512.

4. Medium White bishop b5, Black knight c6, Black king e8, d7 empty. Explain why the knight cannot move.

Show answer

It is absolutely pinned: if it moved, the bishop would be attacking the Black king, and a move that leaves one's own king in check is illegal.

5. Medium A square is attacked by your knight and bishop and defended by one enemy pawn. An enemy rook stands on it. Count the exchange if you take with the knight.

Show answer

Nx(rook) gains 5; pawn takes knight, you lose 3; bishop takes pawn, you gain 1.
Net $+5 - 3 + 1 = +3$. (Black might not recapture at all, leaving you +5.)

6. Medium A queen forks a king and an undefended rook with check. The rook is worth 5. What does White win, and what must White check first?

Show answer

White wins the rook (5) after the king moves. First check that the queen itself cannot be captured, and that Black has no check or bigger threat in reply.

7. **Medium** Give a basketball example of a double threat.

Show answer

A two-on-one fast break: the ball handler threatens to shoot and to pass, and the single defender cannot stop both.

8. **Medium** Why is a relative pin (with a queen, not the king, behind the pinned piece) weaker than an absolute pin?

Show answer

In a relative pin the pinned piece may legally move; the owner may decide to move it anyway if he gains enough (for example, a check or a bigger capture).

9. **Hard** A square holds a Black bishop (3). It is defended by a Black knight and a Black rook, and attacked by a White pawn, a White knight and a White queen. Count the exchange with White capturing first with the pawn, and say where Black should stop.

Show answer

Every recapture makes Black's loss worse. If Black does not recapture, White has won the bishop: +3. If 1...Nxpawn, then 2.Nxknight leaves White +5; if 2...Rxknight, then 3.Qxrook leaves White +7. Black should not recapture at all; White wins the bishop for nothing (+3).

10. **Hard** Explain how Napoleon's "central position" between two enemy armies is like a fork.

Show answer

Placed between two separated enemy forces, his army threatened both at once. Each enemy could be attacked in turn with the whole French force while the other was too far away to help, just as a forking piece threatens two targets and the defender can save only one.

11. **Challenge** White: king g1, knight d5. Black: king g8, queen c6, rook a8. White to move. Find the knight move that forks the king and queen. Is there any square from which the knight would attack all three Black pieces?

Show answer

1.Ne7+ attacks g8 (check) and c6, and neither the king nor the queen can capture the knight on e7; after the king moves, 2.Nxc6 wins the queen. A knight attacks the king from e7, f6 or h6, the queen from a5, a7, b4, b8, d4, d8, e5 or e7, and the rook from b6 or c7. Only e7 is shared by two lists, and no square is on all three, so no triple fork exists.

COMMON MISTAKES

- Counting only the first capture of an exchange.
- Forgetting that the defender can stop recapturing whenever he likes.
- Missing the opponent's reply: a check or capture that answers your threat with a bigger one.
- Confusing a pin with a skewer: in a pin the less valuable piece is in front; in a skewer the more valuable piece is in front.

Make it a game • Set the Trap. Use a chessboard or a drawn grid and a few buttons as pieces. In sixty seconds, set up a fork, a pin and a skewer, one at a time. Your parent names the pattern and the piece that makes the double threat. Count the exchange count aloud. Swap roles. Whoever names the most patterns correctly wins.

2.3 PLANNING IN THE MIDDLEGAME: STEINITZ AND CAPABLANCA

OBJECTIVES

- Describe Wilhelm Steinitz’s positional principles and José Raúl Capablanca’s method of planning.
- Evaluate a position by material, king safety, pawn structure, piece activity and space, and write a plan from the evaluation.
- Compute an Elo expected score and a rating change, and use ratings to judge the strength of an opponent honestly.

Warm-up. Set up any middlegame position from one of your own games (or the position after 12 moves of a game you replay). Before moving a piece, write three sentences: who has more material, whose king is safer, and which side has a weak pawn. Only then decide on a move.

WATCH

STRATEGIC ELEMENTS THEORY (Steinitz & Lasker) - Complete Chess Strategy #3

ChessDiagnostic · 7:01

<https://www.youtube.com/watch?v=8N5lnVgJMCc>

WHEN TO WATCH

After “the plan” paragraph. A whiteboard explanation of Steinitz’s and Lasker’s strategic elements; copy the list of elements into your scorebook.

BACKUP VIDEO

The Elo Rating System for Chess and Beyond

singingbanana · 7:08

<https://www.youtube.com/watch?v=AsYfbmp0To0>

Before worked example 1. A mathematician explains where the Elo formula comes from and how ratings change after a game.

KEY TERMS

positional play

Play aimed at gaining small, lasting advantages (better pawns, better squares, more space) rather than immediate material.

weakness

A pawn or square that cannot easily be defended, such as an isolated pawn or a hole in front of the king.

Elo rating

A number measuring a player's strength, devised by Arpad Elo. The difference between two ratings predicts the expected score of a game between them.

evaluation

A judgment of who stands better and why, based on material, king safety, pawn structure, piece activity and space.

plan

A goal for the next several moves, chosen from the evaluation, such as “double my rooks on the open file and attack the weak pawn.”

CORE IDEAS

The story. In 1886 Wilhelm Steinitz, born in Prague in 1836, played Johannes Zukertort in a match in New York, St. Louis and New Orleans. It was the first match billed as the world championship, and Steinitz won it with ten wins, five losses and five draws. Steinitz had been a dashing attacker in his youth, but in middle age he worked out a new theory: a sound attack must be earned by advantages in the position, and a player who attacks without them will be refuted by careful defense. Thirty-five years later the Cuban José Raúl Capablanca, born in Havana in 1888, became world champion in 1921. That same year he published *Chess Fundamentals*, a short book that explained planning so clearly that it is still read.

The plan. Steinitz taught that a position is made of many small elements: material, king safety, pawn structure, weak squares, piece activity, space and the bishop pair. Advantages accumulate; the player with the advantage must attack, or it will slip away; the player without it must defend economically and wait. Capablanca added a practical method: first evaluate, then form a plan to exploit the opponent's weakest

point or improve your worst piece, and only then calculate the moves. He liked to simplify into endgames where a small advantage became decisive.

The principle. Plans come from evaluation, not from hope. The best middlegame move is usually the one that fits a plan based on a true assessment of the position. This is Sun Tzu’s “many calculations” applied to the board, and it is the principle of the objective: a clear goal chosen from the facts. Ratings help with the outside facts. In 1960 the U.S. Chess Federation adopted a system designed by Arpad Elo, a physics professor, and the international federation (FIDE) adopted it in 1970. If player A is rated R_A and player B is rated R_B , A’s expected score is $E_A = 1/(1 + 10^{(R_B - R_A)/400})$. After the game A’s rating changes by $K(S - E_A)$, where S is the actual score (1, ½ or 0) and K is a set constant such as 20 or 32.

On the board and the field. When you reach the middlegame, stop and evaluate in writing for a while, until it becomes a habit. Ask: where are the weaknesses on both sides? Which of my pieces is worst, and where would it be best? Is my opponent’s king safe? Then choose a plan and play moves that serve it. Coaches do the same at halftime: they evaluate (our rebounding is losing, their left side is weak), make a plan (attack the left, crash the boards), and then call plays. Ratings and records keep the evaluation honest: a team that expects to win every game is not evaluating; it is hoping.

Think it through. Steinitz’s rule that the side with the advantage must attack is the principle of the offensive; his rule that the side without it must defend patiently is economy of force and security. Both are counsel against wishful thinking.

PICTURE STUDY



Johannes Zukertort and Wilhelm Steinitz, Unknown photographer, 1886 · Engraving (after a photograph) · Wikimedia Commons (reproduction)

Image: [Wikimedia Commons](#), public domain

This picture shows the two players of the first world championship match, in 1886. Zukertort, on the left, was a brilliant attacker. Steinitz, on the right, had learned to defend patiently and to win with small advantages. The match was long, and Steinitz's method gradually told.

Look closely

- Look at the two men's postures. Which one seems more at ease?
- Notice the simple table and board. What would a world championship match look like today?
- Compare the two faces. Which player would you guess is the attacker and which the patient strategist?

Talk about it

1. Steinitz said the side with the advantage must attack. Why would a patient defender still need courage?
2. A twenty-game match tests more than one game does. How does a long match reward planning over tricks?
3. If you could ask either player one question about planning, what would it be?

PROJECT

Plan Before You Move

You will play four games in which, at move 12 and move 20, you stop and write an evaluation and a plan before continuing, and then check afterward whether your plans were sound. You will also keep a small rating table for your family or club.

You will need

- A chess set
- The scorebook
- One or more opponents
- A calculator

Steps

1. Make an evaluation form: material, king safety, pawn structure, worst piece (mine and his), space, verdict, plan.
2. Play a game. At move 12, stop and fill in the form, then write a three-move plan.
3. Continue to move 20 and fill in a new form.
4. Finish the game and record the result.
5. Repeat for four games.
6. After each game, go back and mark whether each plan was carried out and whether it helped.
7. Give each player in your family or club a starting rating of 1200 and update the ratings after every game with $K = 32$. Keep a table.
8. Write a paragraph: did writing plans change how you played? What did the ratings show after four games, and why should you not trust them yet?

Tips

- Your evaluations can be short; the habit matters more than the length.
- Four games are too few for ratings to settle. Keep updating them for the rest of the course.

Check your work

- ☐ I filled in eight evaluation forms (two per game) with a plan each time.
- ☐ I checked whether each plan was followed and whether it helped.
- ☐ I kept an Elo table with correct calculations for every game.

SCOREBOOK

- Copy the Elo formula and make a table of expected scores for rating differences of 0, 100, 200, 300, 400 and 800.
- Draw a pawn structure with one isolated pawn and one doubled pawn, and mark the weak squares.
- “What I would decide and why”: you have a small advantage and your opponent is defending well. Do you keep attacking or simplify into an endgame? Explain.

KEY FORMULAS

$$E_A = \frac{1}{1 + 10^{(R_B - R_A)/400}}$$

$$R'_A = R_A + K (S - E_A)$$

From history. Steinitz lost his title in 1894 to Emanuel Lasker, who held it for 27 years until Capablanca won it in 1921. Capablanca was famous for making very few mistakes; he lost the title in 1927 to Alexander Alekhine.

WORKED EXAMPLES

Example 1. A player rated 1600 plays an opponent rated 1400. Using $K = 32$, find the stronger player’s expected score and his new rating if he wins, draws or loses.

Show solution

- $E = 1/(1 + 10^{(1400-1600)/400}) = 1/(1 + 10^{-0.5}) = 1/(1 + 0.316) \approx 0.760$.
- Win: $1600 + 32(1 - 0.760) = 1600 + 7.7 \approx 1608$.
- Draw: $1600 + 32(0.5 - 0.760) = 1600 - 8.3 \approx 1592$.
- Loss: $1600 + 32(0 - 0.760) = 1600 - 24.3 \approx 1576$.

Answer: Expected score about 0.76 (he should score about 76% against this opponent). He gains about 8 points for a win, loses about 8 for a draw and about 24 for a loss. A 200-point gap is a real but not overwhelming edge.

Example 2. Evaluate this description of a position and choose a plan: material is equal; White's king is castled safely; Black's king is castled but the pawn in front of it has advanced, leaving a weak square on f6; Black has an isolated pawn on d5; White's knight on b1 has not moved, and the c-file is open.

Show solution

1. Material: equal.
2. King safety: White better (Black has a weak square near its king).
3. Pawn structure: White better (Black's isolated d-pawn cannot be defended by pawns).
4. Piece activity: White's worst piece is the undeveloped knight on b1.
5. Plan: improve the worst piece first (bring the knight toward d4, a strong square in front of the isolated pawn), put a rook on the open c-file, and then attack the d5 pawn or the weak square near the king.

Answer: White stands better because of two lasting advantages (pawn structure and king safety). The plan is to improve the worst piece and then attack the weaknesses, as Steinitz and Capablanca taught: accumulate small advantages, then attack.

Example 3. Steinitz beat Zukertort 10 wins, 5 losses and 5 draws. Compute his match score (wins count 1, draws $\frac{1}{2}$) and his scoring percentage. What rating difference would predict that percentage?

Show solution

1. Score: $10 + 0.5 \times 5 = 12.5$ out of 20 games.
2. Percentage: $12.5/20 = 0.625 = 62.5\%$.
3. Solve $0.625 = 1/(1 + 10^{-D/400})$: $1 + 10^{-D/400} = 1.6$, so $10^{-D/400} = 0.6$,
 $-D/400 = \log_{10} 0.6 \approx -0.222$, and $D \approx 89$.

Answer: 12.5 of 20, or 62.5%, which a rating gap of about 89 points would predict. (Ratings did not exist in 1886; this is a modern way of measuring the margin.)

PRACTICE

1. Easy Who won the first world championship match, and in what year?

Show answer

Wilhelm Steinitz, who beat Johannes Zukertort in 1886.

2. Easy List five elements of a position that a player should evaluate.

Show answer

Material, king safety, pawn structure, piece activity, space (also weak squares and the bishop pair).

3. Easy What is the expected score between two players with equal ratings?

Show answer

$$1/(1 + 10^0) = 0.5.$$

4. Medium Compute the expected score of a 1500 player against a 1900 player.

Show answer

$$1/(1 + 10^{400/400}) = 1/11 \approx 0.091.$$

5. Medium With $K = 20$, how many points does the 1500 player in problem 4 gain if she wins?

Show answer

$$20(1 - 0.091) \approx 18.2.$$

6. Medium State Steinitz's rule about who must attack.

Show answer

The player with the advantage must attack, or the advantage will disappear; the player without it should defend economically.

7. Medium What is an isolated pawn, and why is it a weakness?

Show answer

A pawn with no friendly pawns on the files next to it. No pawn can ever defend it, so pieces must, and the square in front of it can become a strong outpost for the opponent.

8. **Medium** When did Capablanca become world champion, and what book did he publish the same year?

Show answer

1921; *Chess Fundamentals*.

9. **Hard** A player rated 1700 scores 3 points in 4 games against opponents all rated 1700. With $K = 32$, what is her new rating?

Show answer

Expected 0.5 per game, 2.0 total. Change $32(3 - 2) = 32$, so 1732.

10. **Hard** Explain how Capablanca's method (evaluate, plan, calculate) is like a coach's halftime adjustment. Give an example.

Show answer

The coach first evaluates what is happening (their center is dominating the boards), then forms a plan (box out harder, push the pace to tire the center), and only then chooses specific plays and substitutions. Calculating plays without an evaluation is like moving pieces without a plan.

11. **Challenge** Show that if player A's expected score against B is E , then B's expected score against A is $1 - E$, using the Elo formula.

Show answer

Let $x = 10^{(R_B - R_A)/400}$. Then $E_A = 1/(1 + x)$ and $E_B = 1/(1 + 1/x) = x/(x + 1)$. So $E_A + E_B = (1 + x)/(1 + x) = 1$.

COMMON MISTAKES

- Making moves without an evaluation, or with a plan that ignores the opponent's threats.
- Thinking a positional advantage means doing nothing; Steinitz said the side with the advantage must attack.
- Using a rating as a fixed truth. Ratings are estimates from results, and small samples mislead.

Make it a game • Sneaky Quiz: Steinitz. You are the teacher. Explain to your parent in sixty seconds Wilhelm Steinitz's ideas about weaknesses and small advantages, and how José Raúl Capablanca planned. Your parent plays the student who must catch the one false fact you slip in. Switch. Finish by writing one plan in a single sentence for a position of your choice.

Scripture. “The thoughts of the diligent tend only to plenteousness; but of every one that is hasty only to want.” (Proverbs 21:5, KJV)

Steinitz and Capablanca won by patient, diligent thought, not by hasty attacks. The same is true in most of life.

2.4 GO: INFLUENCE, TERRITORY AND SENTE

OBJECTIVES

- Explain the rules of Go: placing stones, liberties, capture and territory.
- Distinguish territory from influence, and sente from gote, and connect them to the principles of war.
- Count stones and enclosed points to show why corners are the most efficient places to make territory.

Warm-up. Draw a 9×9 grid on paper (81 points). Place one stone in the corner, one on the edge, and one in the middle. Count how many empty neighbors (up, down, left, right) each stone has. Which stone is easiest to surround?

WATCH

Territory and Influence: Kinetic and Potential Energies in Go Game

Go Magic · 13:43

<https://www.youtube.com/watch?v=ARc7BxpOoYk>

WHEN TO WATCH

After “the plan” paragraph. A Go teacher shows territory and influence on a real board; watch how a wall facing the center later becomes points.

BACKUP VIDEO

Ear-Reddening Game - Gennan Inseki vs Honinbo Shusaku

computernerdd1101 · 4:28

https://www.youtube.com/watch?v=Pjev_N7FkoY

Optional, after the lesson. A silent replay of the whole ear-reddening game; watch for move 127 in the center of the board.

KEY TERMS

liberty

An empty point directly next to a stone (or a connected group of stones) along a line. A group with no liberties is captured and removed.

territory

Empty points surrounded by one player’s stones. At the end of the game each player scores the territory he controls (and, under some rules, his stones on the board).

influence

The power of a strong wall of stones facing the open board. It does not score points at once, but it helps win fights and build territory later.

sente

A move the opponent must answer, so that the player keeps the initiative and can play elsewhere afterward. The opposite is gote: a move that ends one's initiative.

komi

Points given to White to make up for Black playing first, commonly 6.5 under Japanese rules.

CORE IDEAS

The story. Go began in China more than two thousand years ago and reached its classical height in Japan, where the government supported professional schools of players. In 1846 a seventeen-year-old player named Shusaku played Inoue Gennan Inseki, one of the strongest players of the age. Gennan was ahead in the middle of the game when Shusaku played his 127th move, a quiet stone in the center that did several jobs at once. A doctor watching the game noticed that Gennan's ears turned red, and he said that Shusaku would win. He did. The "ear-reddening move" is still the most famous move in Go. In March 2016, the computer program AlphaGo beat the professional Lee Sedol four games to one in Seoul, and its 37th move in the second game, a stone played higher than human custom allowed, became the most discussed move of the modern era.

The plan. Go is played on a grid of 19×19 lines (361 points); beginners use 9×9 (81 points). Players place one stone at a time on an empty point, Black first. Stones never move; a stone or group with no liberties is captured. The goal is to surround more territory than the opponent. Early in the game players choose between **territory** (secure points near the edges and corners) and **influence** (strong walls facing the center that will pay later). Shusaku's move 127 was great because it reduced Gennan's influence, strengthened his own groups and threatened territory, all at once.

The principle. Go teaches three strategic truths. First, **efficiency**: a corner is enclosed by two edges of the board, so it takes fewer stones to make territory there than on a side, and fewer on a side than in the center. Players say: corners first, then sides, then the center. Second, the balance of **territory and influence**: take too much

secure territory and the opponent's walls will dominate the middle; build too much influence and you may have nothing solid to count. Third, **sente**: a move that forces an answer lets you keep the initiative and play the next big point. This is the principle of the offensive in its purest form.

On the board and the field. Go players speak of “thickness,” “lightness” and “aji” (latent possibilities), words that apply to any contest. In soccer, possession that pins the opponent in its own half is like influence: it does not score points at once, but it makes goals more likely. Forcing moves that must be answered (a corner kick, a check, a full-court press) are sente. A Go player who answers every threat but never plays the biggest point is like a team that only reacts: it may avoid disaster, but it does not win.

Think it through. In Go you cannot win everywhere. Every stone is a choice of where to be strong and where to accept weakness: mass and economy of force on a 19 × 19 grid.

PICTURE STUDY



Actor Beside a Go Board, Utagawa Kuniyoshi, nineteenth century · Woodblock print · Japanese print (reproduction)

Image: [Wikimedia Commons](#), public domain

Utagawa Kuniyoshi was one of the great print artists of nineteenth-century Japan, working in the same years that Shusaku played. This print, from a series of actors in famous roles, shows a man in a samurai's dress beside a Go board on legs, with stones scattered on the floor as if the game had been broken off. Go boards in Japan were thick blocks of wood, and players sat on the floor beside them.

Look closely

- Find the board and the stones. What seems to have happened to the game?
- Look at the man's face, his fan and his posture. Is he calm or disturbed?
- Notice the thickness of the board and the fine kimono. Why might a game be honored with such fine furniture?

Talk about it

1. Go is a game of balance between territory and influence. What in this print suggests that the balance has been upset?
2. Why might a game with very simple rules produce such deep strategy?
3. Shusaku won with one quiet move rather than a show of anger. What does that teach about calm thinking under pressure?

PROJECT

Corners, Sides and Center on a 9×9 Board

You will learn Go on a 9×9 board you make yourself, play six games, and test the proverb “corners, then sides, then center” by recording where each player’s first five stones went and who won.

You will need

- A 9×9 grid drawn on card stock (or a Go set)
- About 45 beans or buttons of each of two colors
- The scorebook
- An opponent

Steps

1. Draw a 9×9 grid of lines with a ruler, about 2 cm apart. Mark the center point and the four points three lines in from each corner.
2. Learn the rules together: place one stone at a time, capture groups with no liberties, and end when both players pass. Count territory plus prisoners; give White 6.5 points of komi.
3. Play two practice games without recording strategy.
4. For four recorded games, sketch where each player’s first five stones went and label each as corner, side or center.
5. At the end of each game, count and record both scores.
6. Make a table: player, number of early stones in corners, sides and center, final score.
7. In one game, deliberately play your first five stones in the center; in another, in the corners. Compare.
8. Write a paragraph: did your data support the proverb? Find one moment when a sente move let you play a big point.

Tips

- On a 9×9 board the corners and sides are close together, so the effect is smaller than on a full board.

- Mark captured stones carefully; they count at the end.

Check your work

- ☐ I made a 9×9 board and played at least six games.
- ☐ I recorded the first five stones of each player in four games and the final scores.
- ☐ I compared corner-first and center-first openings and found one sente move.

SCOREBOOK

1. Draw a 9×9 board with three 3×3 enclosures (corner, side, center) and write the stone count and points per stone beside each.
2. Draw a small group in atari (one liberty) and show the move that captures it and the move that saves it.
3. “What I would decide and why”: your opponent has played a strong wall facing the center. Do you take more corner territory or play to reduce his influence? Explain.

From history. Shusaku later became the heir of the Honinbo house, one of the four great Go schools of Japan, and won every one of his annual “castle games” played before the shogun. He died young, in 1862, after nursing others through an epidemic in Edo.

WORKED EXAMPLES

Example 1. Count the stones needed to enclose a 3×3 block of 9 empty points (a) in a corner, (b) on a side, (c) in the center of a large board, assuming the walls run straight along the lines. Find the points per stone for each.

Show solution

1. (a) Corner: two edges are the board itself; the other two sides need walls of 3 stones each: $3 + 3 = 6$ stones. Points per stone $9/6 = 1.5$.
2. (b) Side: one edge is the board; the three other sides need $3 + 3 + 3 = 9$ stones. Points per stone $9/9 = 1.0$.
3. (c) Center: four sides of 3 stones each: 12 stones. Points per stone $9/12 = 0.75$.
4. (The corner points of each wall are not needed, because stones touching only diagonally still close the territory when the neighbors along the lines are filled.)

Answer: Corner 1.5, side 1.0, center 0.75 points per stone. The corner is twice as efficient as the center, which is why strong players take corners first.

Example 2. A single Black stone in the middle of the board is surrounded on three sides by White stones. How many liberties does it have? What happens if White plays on the last liberty? What if Black adds a stone on that last liberty instead?

Show solution

1. A stone in the middle has 4 neighbors; three are filled by White, so it has 1 liberty.
2. If White fills it, the Black stone has 0 liberties and is captured.
3. If Black plays there first, the two Black stones form a group; count the new group's liberties: the added stone has up to 3 other neighbors, so the group may have up to 3 liberties, depending on what is nearby.

Answer: 1 liberty. White captures by filling it; Black can escape by extending, which increases the group's liberties. A Black stone in this position is "in atari," and the contest for liberties is the basic tactic of Go.

Example 3. On a 9×9 board at the end of a game, Black has surrounded 30 points of territory and captured 4 White stones; White has surrounded 28 points and captured 2 Black stones; komi is 6.5 for White. Under Japanese counting (territory plus prisoners plus komi), who wins and by how much?

Show solution

1. Black: $30 + 4 = 34$.
2. White: $28 + 2 + 6.5 = 36.5$.
3. Difference: $36.5 - 34 = 2.5$.

Answer: White wins by 2.5 points. The half-point in komi makes ties impossible. Notice how much the first move is worth: Black needed more than 6.5 points of extra territory and prisoners to win.

PRACTICE

1. **Easy** How many points are on a 19×19 Go board, and on a 9×9 board?

Show answer

361 and 81.

2. **Easy** What is a liberty?

Show answer

An empty point directly adjacent (along a line) to a stone or group.

3. **Easy** How many liberties does a single stone have in the corner, on an edge (not the corner) and in the middle?

Show answer

Corner 2, edge 3, middle 4.

4. **Medium** What is the difference between sente and gote?

Show answer

Sente is a move the opponent must answer, so you keep the initiative. Gote is a move after which the opponent may play elsewhere, so you lose the initiative.

5. **Medium** Why do Go players say “corners, then sides, then center”?

Show answer

The board’s edges help enclose territory, so the corner needs the fewest stones per point of territory, the side more, and the center the most.

6. **Medium** Describe the ear-reddening game: who played, when, and why is move 127 famous?

Show answer

Shusaku (aged 17) against Inoue Gennan Inseki in 1846. Move 127 was a quiet central move that did several jobs at once and turned the game; a watching doctor saw Gennan’s ears redden and predicted Shusaku would win.

7. **Medium** Enclose a 2×4 block of 8 points in a corner (with the long side along one edge). How many stones are needed? What are the points per stone?

Show answer

Walls of 2 and 4 stones: 6 stones. $8/6 \approx 1.33$.

8. **Medium** Give a sports example of influence, a position that does not score points at once but makes scoring likelier later.

Show answer

Sample: a soccer team pinning the opponent in its own half with constant possession, or a basketball team getting the opponent’s best player into foul trouble.

9. **Hard** Black has 41 points of territory and 3 prisoners; White has 38 points and 5 prisoners; komi 6.5. Who wins by Japanese counting, and by how much?

Show answer

Black $41 + 3 = 44$; White $38 + 5 + 6.5 = 49.5$. White by 5.5.

10. **Hard** Explain how a move can be sente and also good for territory. Why are such moves especially valuable?

Show answer

A move that threatens to capture or invade forces an answer (sente) while also enlarging your own territory or reducing the opponent’s. You gain points and keep the initiative to play the next big point, so you gain twice.

11. **Challenge** On a large board, compare the points per stone for enclosing an $n \times n$ block in the corner ($2n$ stones) and in the center ($4n$ stones). Write each as a formula in n , and explain why both grow as n grows.

Show answer

Corner: $n^2/(2n) = n/2$; center: $n^2/(4n) = n/4$. Both grow because area grows as n^2 while the wall grows only as n , but the corner is always twice as efficient. In real games larger areas are harder to defend against invasion, which limits how far this goes.

COMMON MISTAKES

- Counting diagonal points as liberties. Only points along the lines count.
- Playing only in the center at the start, where territory is hardest to make.
- Answering every move locally and never taking sente to play the biggest point.

Make it a game • Territory Estimate Duel. Draw a 9 by 9 grid, then each place stones on alternating points with beans of two colors for ten moves. Stop, and each of you estimates the territory, influence and sente for both sides. Write your numbers down. Count what is actually surrounded. Closest estimate wins a point. Then say who holds sente and why.

Scripture. “For by wise counsel thou shalt make thy war: and in multitude of counsellors there is safety.” (Proverbs 24:6, KJV)

Go players review their games with stronger players and with each other. A game reviewed with counsel teaches far more than a game simply won or lost.

2.5 CHECKERS AND THE ENDGAME: COUNTING AND THE OPPOSITION

OBJECTIVES

- Tell the story of Marion Tinsley, the Chinook program and the proof that checkers is a draw with perfect play.
- Use the opposition and the rule of the square to solve king-and-pawn endings in chess, and explain “the move” in checkers.
- Explain why counting, not guessing, decides most endgames.

Warm-up. Put a White king on e1 and a Black king on e8 on an empty chessboard.

Take turns moving the kings toward each other, one square at a time, without ever standing next to each other. Who is forced to step aside first? Try again with the other player moving first.

WATCH

What's "Opposition" in chess? And why does it matter?

[Chess Vibes](#) · 5:52

<https://www.youtube.com/watch?v=52y-iy48UoY>

WHEN TO WATCH

After “the plan” paragraph and before worked example 2. Set up each position on your board as it appears.

BACKUP VIDEO

Is this the biggest blunder in checkers history?

[azcheckers](#) · 8:23

<https://www.youtube.com/watch?v=CPf2lWtYbvs>

Optional, after the story. A checkers master tells about Marion Tinsley’s record and replays a famous endgame mistake, move by move.

KEY TERMS

endgame

The last stage of a game, when few pieces remain and precise counting decides the result.

rule of the square

A counting shortcut: a lone king can catch a passed pawn if it can step inside the square whose side runs from the pawn to its promotion square.

solved game

A game whose result with perfect play by both sides has been proven, as checkers was in 2007.

opposition

In chess, two kings on the same file (or rank) with one square between them. The player who does *not* have to move “has the opposition,” because the other king must give way.

the move

The checkers equivalent of the opposition: in many endgames, the side that is not obliged to move into a losing position “has the move.”

CORE IDEAS

The story. Marion Tinsley was a mathematics professor in Florida and the greatest checkers player who ever lived. He was world champion for most of the years from 1955 to 1991 and lost only a handful of serious games in more than forty years. In 1992, in London, he played a match against Chinook, a program written by Jonathan Schaeffer’s team at the University of Alberta, and won four games to two, with thirty-three draws. A rematch in 1994 began with six draws before Tinsley withdrew because of illness; he died the next year. Schaeffer’s team kept working, and in 2007 they published a proof that checkers, played perfectly by both sides, is a draw. The program examined the game’s roughly 500 billion billion positions by working backward from the endgames.

The plan. Endgames are where counting replaces guessing. In checkers, many endings turn on **the move**: when the pieces face each other in a blocked position, the side that must move may be forced to give way, so experts count ahead to see who will be in that position. In chess the same idea is called the **opposition**. With White king on e6, pawn on e5 and Black king on e8, White wins whoever moves first: if

Black moves, 1...Kd8 2.Kf7 or 1...Kf8 2.Kd7 controls the queening square; if White moves, 1.Kd6 Kd8 2.e6 Ke8 3.e7 Kf7 4.Kd7 and the pawn promotes. The rule of the square counts a chase between king and pawn: a White pawn on a4 must travel to a8, so draw the square a4–a8–e8–e4. If the Black king, on its move, can step inside that square, it catches the pawn.

The principle. In the endgame, time is measured exactly, and a single tempo decides. Strong players count rather than hope: how many moves to promote, how many to catch, who must move when the kings meet. This is the principle of simplicity carried to its limit, and it explains Capablanca's advice to study endgames first. It also shows why a strategist who is ahead should often simplify into an endgame (Lesson 1.5): the fewer the pieces, the more surely a small advantage can be counted out to victory.

On the board and the field. The end of a close game in any sport is an endgame. A football team with a lead counts the clock: how many plays, how many timeouts, how many seconds. A basketball team decides whether to foul by counting possessions. In both, the side that has counted correctly plays calmly, and the side that has not panics. Tinsley, who was a lay preacher as well as a mathematician, prepared with the same diligence: he knew the endings so well that he could steer a game toward one he had already counted.

Think it through. A solved game is not a dull game. Checkers is a draw with perfect play, but no human plays perfectly, and the side that counts better still wins.

PICTURE STUDY



The Checker Players, George Caleb Bingham, 1850 · Oil on canvas · Detroit Institute of Arts

Image: [Wikimedia Commons](#), public domain

George Caleb Bingham painted ordinary life on the Missouri frontier. In this tavern scene one player reaches to make a move while his opponent, chin in hand, studies the board, and an older man leans in to watch. Endgames are often like this: a long silence, a careful count, and then a single move that decides everything.

Look closely

- Which player is on move? How can you tell?
- Look at the pieces left on the board. Is this the opening, the middlegame or the endgame?
- Look at the face of the man watching from behind. What does he seem to know?

Talk about it

1. Why does an endgame require more counting and less guessing than an opening?
2. The player with his chin in his hand is taking his time. When is it wise to think for a long time over one move?

3. How would you show in a painting that one player “has the move” and the other is trapped?

PROJECT

Endgame Counting Drill

You will set up twenty king-and-pawn positions in chess (and five simple checkers endings), predict each result by counting, and then play each one out against a family member or a computer to check your prediction.

You will need

- A chess set and a checkers set
- The scorebook
- An opponent or a free computer analysis board

Steps

1. Set up ten pawn-chase positions (one pawn against a lone king) with different pawn and king squares. For each, use the rule of the square to predict the result with each side to move.
2. Play out each position both ways and record whether your prediction was correct.
3. Set up ten king-and-pawn positions where both kings are near the pawn (for example, White Ke4, Pe3, Black Ke6). Predict the result with each side to move, using the opposition.
4. Play these out against a careful opponent or check them with an analysis board, and record the results.
5. In checkers, set up five endings of two kings against one king on an empty board and practice trapping the lone king in a corner. Count the moves it takes.
6. Make a table of predictions and results, and compute your percentage correct for each type.
7. Write a paragraph: which kind of ending did you count well, and where did your counting fail?

Tips

- Always check whose move it is before counting. Half of all endgame mistakes start there.

- Rook pawns (on the a- and h-files) are often drawn even when other pawns would win; note any surprises.

Check your work

- ☐ I predicted and played out twenty chess positions and five checkers endings.
- ☐ My table shows my percentage correct by type.
- ☐ I explained one counting mistake and how to avoid it.

SCOREBOOK

1. Draw the square for a pawn on d3 and mark three king squares that catch it and three that do not (Black to move).
2. Draw the kings in opposition on the e-file, and arrows showing the outflanking move.
3. “What I would decide and why”: you are a pawn ahead with queens on the board. Do you trade queens to reach a king-and-pawn ending? Explain how you would count it first.

From history. Checkers is called draughts in Britain. After Tinsley’s death, Schaeffer wrote with warm respect about the champion, who had been gracious to the Chinook team in victory and in illness.

WORKED EXAMPLES

Example 1. White: pawn a4, king far away on h1. Black: king f5. Use the rule of the square to decide whether Black catches the pawn (a) if Black is to move, (b) if White is to move.

Show solution

1. (a) The pawn on a4 needs to reach a8. The square has corners a4, a8, e8, e4 (side length 5 squares). With Black to move, Black plays 1...Ke5, which is inside the square (file e, rank 5). Black catches the pawn.
2. (b) White moves first: 1.a5. The new square has corners a5, a8, d8, d5. Black's king on f5 can reach e5 or e4 or e6, none of which is inside (file e is outside a-d). Black cannot catch the pawn.
3. Check by counting: after 1.a5, the pawn needs 3 more moves (a6, a7, a8). The king on f5 needs 4 moves to reach b8 or a8 area: e6, d7, c8, b8; too late.

Answer: (a) Black catches it; (b) the pawn promotes. One tempo, who moves first, decides the result.

Example 2. White: king e4, pawn e3. Black: king e6. Black to move. Who has the opposition, and what should White do after 1...Kd6?

Show solution

1. The kings stand on e4 and e6 with one square (e5) between them. Black must move, so White has the opposition.
2. After 1...Kd6, White should not push the pawn but outflank: 2.Kf5, heading for the squares in front of the pawn.
3. Black keeps trying to block, but White's king reaches the sixth rank in front of his pawn (for example, after 2...Ke7 3.Ke5 Kf7 4.Kd6 Kf6 5.e4 Kf7 6.e5 Ke8 7.Ke6), and then wins whoever moves, as in the lesson.

Answer: White has the opposition and wins by using it to advance the king before the pawn. With White to move in the starting position, Black would have the opposition and could draw. The king leads, the pawn follows.

Example 3. Chinook's team said checkers has about 5×10^{20} positions. If a computer could examine one billion positions per second, how many years would it take to look at every position one at a time? (Use 3.15×10^7 seconds per year.)

Show solution

1. Seconds: $5 \times 10^{20} / 10^9 = 5 \times 10^{11}$.

2. Years: $5 \times 10^{11} / 3.15 \times 10^7 \approx 1.6 \times 10^4$, about 16,000 years.

Answer: About 16,000 years. The proof did not look at every position. It worked backward from endgame databases and searched forward only along the lines that mattered, which is exactly what a strong human does: count the critical lines, not every line.

PRACTICE

1. Easy Define the opposition in chess.

Show answer

Kings on the same file or rank with one square between them; the player who does not have to move has the opposition.

2. Easy In what year was checkers proven to be a draw with perfect play, and by whose team?

Show answer

2007, by Jonathan Schaeffer's team at the University of Alberta.

3. Easy What was the result of the 1992 match between Tinsley and Chinook?

Show answer

Tinsley won 4 games to 2, with 33 draws.

4. Medium White pawn on c3, Black king on g4, Black to move. Draw the square and decide whether the king catches the pawn.

Show answer

The pawn must go from c3 to c8, so the square runs c3–c8–h8–h3. The king on g4 is already inside it (files c–h, ranks 3–8), so it catches the pawn.

5. **Medium** White: king e6, pawn e5; Black: king e8. Black to move. Show White's winning reply to 1...Kf8.

Show answer

2.Kd7, controlling e7 and e8; the pawn advances to e8 next moves (e6, e7, e8).

6. **Medium** Explain why the king, not the pawn, should usually lead in a king-and-pawn ending.

Show answer

The king must clear the way and control the squares in front of the pawn; if the pawn goes first, the defending king can stand in front of it and take the opposition, drawing.

7. **Medium** A basketball team leads by 3 points with 20 seconds left and has the ball; the shot clock is 24 seconds. Explain how counting the clock is like counting an endgame.

Show answer

If the team holds the ball, the opponent must foul to stop the clock. The leading team counts: possessions remaining, free throws, the chance of a tying three. Like an endgame, the result depends on exact counting of time, not on general play.

8. **Medium** Who was Marion Tinsley?

Show answer

An American mathematics professor and the greatest checkers champion, who held the world title for most of 1955–1991 and lost very few serious games.

9. **Hard** White pawn on b2 (it may move two squares on its first move), Black king on f5, Black to move. Does the king catch the pawn? (Hint: treat a pawn on its starting rank as if it were one rank further forward.)

Show answer

Treat the pawn as on b3: the square runs b3–b8–g8–g3. The king on f5 is already inside (files b–g, ranks 3–8), so it catches the pawn.

10. **Hard** Why can a solved game still be interesting to play?

Show answer

Perfect play is beyond any human. Players still make mistakes, and the one who counts and plans better wins. The proof tells us only what happens if both sides never err.

11. **Challenge** White: king e4, pawn e3; Black: king e6. Now it is White to move. Show that Black can hold the draw if White plays 1.Kd4 by keeping the opposition, and explain the idea in one sentence.

Show answer

After 1.Kd4 Black plays 1...Kd6, taking the opposition (kings on d4 and d6, White to move). Whenever White's king steps forward or sideways, Black answers by facing it again with one square between. The idea: the defender keeps his king directly opposite the attacking king, so it can never get in front of its pawn.

COMMON MISTAKES

- Forgetting whose move it is when counting the square or the opposition.
- Pushing the pawn before the king has cleared the way.
- Forgetting that a pawn on its starting square can move two squares at once.

Make it a game • Tinsley Newsroom. Read the news as an anchor. In forty-five seconds, report to your parent the story of Marion Tinsley, the Chinook program, and the proof that checkers is a draw with perfect play. Include one fact about the opposition or the rule of the square. Your parent counts the facts and adds a point for each term used correctly.

UNIT 2

THE BOARD AS A BATTLEFIELD

A game board is a small battlefield where the principles of Unit 1 can be tested a hundred times a week, with no one hurt and every move recorded. Chess, Go and checkers have been called war games for centuries, and they teach the same lessons: control the center, bring every piece into play, keep the king safe, take the initiative, count before you capture, and make a plan that fits the position.

This unit follows the great players who discovered those lessons: Paul Morphy and his famous game at the Paris opera in 1858, the early writers Damiano and Greco, Wilhelm Steinitz and José Raúl Capablanca, Honinbo Shusaku and the ear-reddening move of 1846, and Marion Tinsley, the checkers champion who held off a computer. You will count tempi and material, compute Elo expectations, count territory on a small Go board, and solve endgames by counting squares. Every lesson has a project in which you play, record and analyse real games.

PREREQUISITES

- How the chess pieces move (Lesson 2.1 reviews algebraic notation)
- The principles of war (Lesson 1.2)
- Fractions, decimals and powers of ten

MASTERY CHECKLIST

- ☐ I can read and write chess moves in algebraic notation and explain the four opening principles.
- ☐ I can recognize and set up forks, pins and skewers, and count a sequence of captures on one square.
- ☐ I can evaluate a position by material, king safety, pawn structure and piece activity, make a plan, and compute an Elo expected score.
- ☐ I can explain liberties, territory, influence and sente in Go, and count a small Go game.
- ☐ I can use the opposition and the rule of the square in king-and-pawn endings and explain why checkers is a draw with perfect play.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **Chess Fundamentals, by José Raúl Capablanca (Project Gutenberg)**: Free. The world champion's own 1921 primer, with clear chapters on endings, middlegame planning and opening principles. Fits Lessons 2.1–2.5. Ages 12+.
- **Lichess analysis board and puzzles**: Free, with no account needed for puzzles. Thousands of tactical puzzles sorted by theme (fork, pin, skewer) for Lesson 2.2. Ages 10+.
- **American Go Association**: Free. The American Go Association's site, with beginner lessons, rules and places to play, for Lesson 2.4. Ages 10+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

2.1 Chess Openings: Center, Development, King Safety and Tempo

3 sessions of 50 minutes

2.2 Forks, Pins and Skewers

3 sessions of 50 minutes

2.3 Planning in the Middlegame: Steinitz and Capablanca

3 sessions of 50 minutes

2.4 Go: Influence, Territory and Sente

3 sessions of 50 minutes

2.5 Checkers and the Endgame: Counting and the Opposition

3 sessions of 50 minutes

UNIT 2 TEST

Calculators are allowed. Set up chess positions on a board if you wish. Show your work for every calculation and every exchange count. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **5 pts**

State the four opening principles and the principle of war that each one matches.

2. **6 pts**

In the Opera Game, after 9.Bg5, how many pieces had each side developed, and what had Black done with its tempi instead?

3. **6 pts**

Count the material at the end of the Opera Game (P1, N3, B3, R5, Q9). Who was ahead, by how much, and who won?

4. **6 pts**

Define fork, pin and skewer, and give one example position (in notation) of a fork.

5. (7 pts)

A Black rook on d5 is defended by a pawn on e6. White attacks d5 with a knight and a bishop. Count the exchange if White captures with the knight first.

6. (6 pts)

Who wrote the first printed chess book in Italy, and what did Greco contribute?

7. (7 pts)

A player rated 1450 plays one rated 1650. Find the lower-rated player's expected score and her rating change for a win with $K = 32$.

8. (6 pts)

State Steinitz's rules about the side with the advantage and the side without it.

9. (6 pts)

Describe Capablanca's method of planning in three steps.

10. (7 pts)

Compute the points per stone for enclosing a 4×4 block in a corner, on a side and in the center.

11. (6 pts)

Define sente and influence in Go, and give a sports example of each.

12. (6 pts)

Black has 35 points of territory and 2 prisoners; White has 31 points and 1 prisoner; komi 6.5. Who wins, and by how much?

13. (7 pts)

White pawn on h4, Black king on c6. Does the king catch the pawn (a) with Black to move, (b) with White to move?

14. (7 pts)

Tell the story of Tinsley and Chinook, including the 1992 result and what was proven in 2007.

15. **12 pts**

Short essay (8–10 sentences): Choose chess, Go or checkers. Explain how three principles of war appear in it, with one specific example of each from this unit or from your own games.

ANSWER KEY

1. Center (mass), development (maneuver/offensive), king safety (security), not wasting time (offensive/initiative).
2. White 4 (Bc4, Qb3, Nc3, Bg5); Black 2 (Nf6, Qe7). Black had spent moves on pawn moves (c6, b5) and lost its c8 bishop in a trade.
3. White 15 (R, B, 7 pawns); Black 25 (Q, R, B, N, 5 pawns). Black was ahead by 10, but White won by checkmate.
4. Definitions as in the lesson. Example: White knight b5, Black king e8 and rook a8: 1.Nc7+ forks king and rook.
5. $Nxd5 +5$; $exd5 -3 (+2)$; $Bxd5 +1 (+3)$. White wins the exchange plus a pawn: net +3.
6. Pedro Damiano (Rome, 1512). Greco wrote manuscripts of short instructive games full of tactics in the 1620s; they were printed in English in 1656.
7. $E = 1/(1 + 10^{0.5}) \approx 0.240$. Win: $32(1 - 0.240) \approx +24.3$.
8. The side with the advantage must attack or lose the advantage; the side without it must defend economically and wait.
9. Evaluate the position (material, king safety, pawns, activity, space); choose a plan to exploit a weakness or improve the worst piece; then calculate moves that carry out the plan.
10. Corner 8 stones: $16/8 = 2$; side 12 stones: $16/12 \approx 1.33$; center 16 stones: $16/16 = 1$.
11. Sente: a move the opponent must answer, keeping the initiative (sports: a corner kick or full-court press that forces a response). Influence: strength facing the open board that pays later (sports: possession that pins the opponent in its half).
12. Black 37; White $31 + 1 + 6.5 = 38.5$. White by 1.5.
13. Square h4–h8–d8–d4. (a) Black plays Kd5 or Kd6 or Kd7, inside the square: catches it. (b) After 1.h5 the square is h5–h8–e8–e5; from c6 the king reaches d5, d6, d7, none inside (file d): the pawn promotes.
14. Tinsley, the great checkers champion, beat Chinook 4–2 with 33 draws in London in 1992; the 1994 rematch ended after six draws when Tinsley withdrew because of illness. In 2007 Schaeffer's team proved checkers is a draw with perfect play.
15. Answers will vary. A full-credit essay names three principles correctly, gives a specific, accurate example of each (a position, move or game), and explains how the principle helped decide the result.

PORTFOLIO PIECE: MY ANNOTATED GAMES

Choose three of your own games from this unit, one in each of two different games (chess, Go or checkers) and a third of your choice. Write each one out in full with notation (or a sequence of sketches for Go) and annotate it like a master: mark the opening principles kept or broken, every tactic that was played or missed, your written evaluation and plan at one turning point, and the endgame counting if the game reached an ending. Finish each game with a paragraph naming the principle of war that decided it. Include your Elo table for the family or club.

LOOK FOR	WHAT IT MEANS
Accurate records	All three games are recorded completely and correctly in notation or sketches.
Annotation	Opening principles, tactics, a written evaluation and plan, and any endgame counting are marked and explained correctly.
Connection to strategy	Each game ends with a clear paragraph linking the decisive moment to a principle of war.
Honesty	Mistakes are admitted and explained, and the Elo table is calculated correctly.

UNIT 3

GREAT PLANS OF THE ANCIENT AND BIBLICAL WORLD

The oldest written plans of battle come from Scripture and from the historians of Greece and Rome. This unit studies five of them: Gideon's night attack with three hundred men, Joshua's ambush at Ai after a painful defeat, Alexander's oblique advance at Gaugamela, Hannibal's double envelopment at Cannae, and Scipio's victory at Zama, won by learning from the very man he defeated. Each is a lesson in maneuver, terrain, timing and leadership, and each is still taught at military academies.

The Bible battles are taught as history from the text itself, read closely, with the text's own emphasis: the victory belongs to the Lord, and the people are not to boast in their numbers. The classical battles are taught from the ancient historians, chiefly Polybius, Livy and Arrian, with modern maps. You will draw every battle as a map in your scorebook, replay it on a grid with counters, and compute real quantities: ratios of forces, frontages and depths, marching times and distances. No lesson dwells on the fighting itself; every lesson asks how the plan worked.

PREREQUISITES

- The principles of war (Lesson 1.2), especially mass, maneuver, surprise and security
- Lanchester's laws and counting the cost (Lesson 1.5)
- Rates, ratios and percents

MASTERY CHECKLIST

- ☐ I can retell Gideon's night attack from Judges 7, identify its principles, and explain why the text says the army was made smaller.
- ☐ I can explain Joshua's ambush at Ai as a feigned retreat that used the enemy's overconfidence, and why the first attack failed.
- ☐ I can draw the oblique advance at Gaugamela and explain how Alexander created a gap in the Persian line.
- ☐ I can draw the double envelopment at Cannae and explain how Hannibal used the Romans' strength against them.
- ☐ I can explain how Scipio at Zama answered Hannibal's elephants and used Hannibal's own methods to defeat him.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **Polybius, The Histories (Project Gutenberg)**: Free. E. S. Shuckburgh's translation. Book III contains the eyewitness-era account of Cannae used in Lesson 3.4. Ages 14+ with a parent previewing.
- **Arrian, The Anabasis of Alexander (Project Gutenberg)**: Free. The main ancient account of Gaugamela for Lesson 3.3 (Book III). Ages 14+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

3.1 Gideon's Three Hundred

3 sessions of 50 minutes

3.2 Joshua's Ambush at Ai

3 sessions of 50 minutes

3.3 Alexander at Gaugamela: The Oblique Attack

3 sessions of 50 minutes

3.4 Hannibal at Cannae: The Double Envelopment

3 sessions of 50 minutes

3.5 Scipio at Zama: Learning from the Enemy

3 sessions of 50 minutes

UNIT 3 TEST

Calculators are allowed. Show your work for every calculation. For each battle question, answer from the text of Scripture or the ancient historians as taught in the lessons, and draw a sketch map where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. (7 pts)

Gideon's army went from 32,000 to 10,000 to 300. What percent of the original army remained, and what reason does Judges 7:2 give?

2. (6 pts)

Describe Gideon's plan of attack: equipment, timing, positions and signal.

3. (6 pts)

Name three principles of war in Gideon's plan and the evidence for each.

4. (7 pts)

Why did the first attack on Ai fail, according to the text, and what did the second plan use from the first defeat?

5. (7 pts)

An ambush lies 1.2 km from a gate; the enemy is drawn 2.4 km away. Both move at 6 km/h. How many minutes does the ambush have in hand after the signal?

6. (6 pts)

Define the oblique attack and explain how Alexander used it at Gaugamela.

7. **8 pts**
A 5 km Macedonian line faces a 7 km Persian line, centered together. Find the overlap on each side, and after Alexander shifts 1 km to his right.
8. **6 pts**
Using Polybius's figures, compute the Roman and Carthaginian totals at Cannae and each side's cavalry share.
9. **7 pts**
Draw a sketch of Cannae at its decisive moment and label the Roman infantry, the crescent, the African infantry and the cavalry.
10. **6 pts**
Explain how Hannibal used the Romans' strength against them.
11. **6 pts**
Hannibal won Cannae but lost the war. Explain using the three levels of strategy, operations and tactics.
12. **6 pts**
List Scipio's answers to Hannibal's elephants, cavalry and veterans at Zama.
13. **5 pts**
Put in order with dates: Zama, Cannae, Ilipa, New Carthage. How many years from Cannae to Zama?
14. **5 pts**
An elephant charges at 18 km/h down a 120 m lane. How many seconds does it take to pass through?
15. **12 pts**
Short essay (8–10 sentences): Compare one battle from Scripture and one classical battle from this unit. What principle do they share? How does the biblical text's emphasis differ from the classical historians'?

ANSWER KEY

1. $300/32000 \approx 0.94\%$. So that Israel could not boast that its own hand had saved it.
2. Three companies of 100, each man with a trumpet, an empty pitcher and a lamp inside; at the beginning of the middle watch; standing around the camp on three sides; blowing trumpets, breaking pitchers and shouting at Gideon's signal, "Look on me, and do likewise."
3. Sample: intelligence/reconnaissance (the night visit to the camp), surprise (night, change of watch), deception (300 trumpets and lights), simplicity (one rule), economy of force (stood in place).
4. Achan's sin; the Lord was not with Israel, and a small, confident force was sent. The second plan used the enemy's memory of the first battle: a feigned retreat that the men of Ai believed was real (8:6).
5. Ambush $1.2/6 \text{ h} = 12 \text{ min}$; enemy $2.4/6 \text{ h} = 24 \text{ min}$. 12 minutes in hand.
6. Advancing at an angle so one strong wing engages first and the other is held back. Alexander moved right with the Companions; the Persian left stretched to follow, opening a gap he attacked with a wedge toward Darius, while Parmenion held the refused left and a second line guarded the rear.
7. 1 km each side at first; after the shift, 0 km on the right and 2 km on the left.
8. Rome 86,000, cavalry 6000/ $86000 \approx 7\%$; Hannibal 50,000, cavalry $10000/50000 = 20\%$.
9. A full-credit sketch shows the Roman block pushed deep into a concave Carthaginian center, African infantry turned inward on both flanks, and cavalry closing the rear.
10. Their deep formation and forward push, meant to break his center, carried them into the pocket, where their packed ranks could not fight or turn when attacked on the flanks and rear.
11. Cannae was a tactical triumph, but Rome refused peace, kept its strategy and resources, returned to a Fabian approach and finally attacked Africa; tactics did not change the strategic balance.
12. Elephants: lanes, trumpets and velites. Cavalry: alliance with Masinissa gave Rome superior cavalry. Veterans: Scipio re-formed his lines to match theirs, and his returning cavalry attacked their rear.
13. Cannae 216 BC, New Carthage 209 BC, Ilipa 206 BC, Zama 202 BC. Fourteen years.
14. $18000/3600 = 5 \text{ m/s}$; $120/5 = 24 \text{ s}$.

15. Answers will vary. A full-credit essay accurately describes both plans, names a shared principle (for example, surprise, deception or using the enemy's expectations), and explains that the biblical text emphasizes the Lord's deliverance and the people's obedience or humility, while the classical historians emphasize the general's skill.

PORTFOLIO PIECE: BATTLE ATLAS, PART 1

Make a five-page battle atlas, one page for each battle in this unit. Each page has (1) a clear map drawn in your own hand, with a north arrow, a scale bar (approximate), terrain, both sides in different colors, and numbered arrows for the stages; (2) a one-paragraph summary of the plan; (3) a box naming the two or three principles of war that decided the battle; (4) one calculation from the lesson, worked out; and (5) one sentence connecting the battle to a game or sport. For the two biblical battles, include the chapter and verse for each stage of the map.

LOOK FOR	WHAT IT MEANS
Maps	Each map is clear, accurate to the sources, labeled, and shows the stages in order.
Plans and principles	Each summary explains the plan correctly, and the principles named are supported by the map.
Sources and Scripture	Biblical stages are tied to verses; classical numbers are attributed to the historian and treated with appropriate caution.
Calculations and connections	Each page has a correct, worked calculation and a thoughtful connection to a game or sport.

3.1 GIDEON'S THREE HUNDRED

OBJECTIVES

- Retell the battle of Judges 7 from the text: the reduction of the army, the night reconnaissance, and the attack by three companies.
- Identify the principles of surprise, deception, timing, simplicity and unity of command in Gideon's plan.
- Compute the reductions of the army and the force ratio, and explain the text's own reason for them.

Warm-up. Read Judges 7:1-8 aloud. Before reading further, write how many men Gideon began with, how many went home, and how many were left. Then write in one sentence what you would expect a general to do with an army that small against a camp the text describes as numerous as grasshoppers.

WATCH

Gideon's Spring, Harod Spring, Israel, Jezreel Valley, Gideon Defeats the Midianites Bible Story

HolyLandSite · 23:09

<https://www.youtube.com/watch?v=2ISZuWtIJUY>

WHEN TO WATCH

After “the story” paragraph. A Bible teacher stands at the spring of Harod with a tour group, shows the ground with aerial views, and retells Judges 6–7 with simple illustrations. Watch for the hill of Moreh and the slope down to the valley.

Note: The teacher's tour company is advertised in the description only.

KEY TERMS

reconnaissance

Gathering information about the enemy by observation before acting. Gideon and his servant Phurah went down to the edge of the Midianite camp by night (Judges 7:10-11).

night watch

A division of the night for guard duty. In Gideon's time the night was divided into three watches; he attacked at "the beginning of the middle watch," just after the guards had changed (Judges 7:19).

deception

Making the enemy believe something false. Three hundred trumpets, torches and shouts suggested an army many times larger.

pursuit

Following a beaten enemy to complete the victory. Gideon called on the men of Ephraim to hold the fords of the Jordan (Judges 7:24).

CORE IDEAS

The story. In the days of the judges, Midianites and Amalekites came up every harvest and camped in the Valley of Jezreel, "as grasshoppers for multitude" (Judges 6:5, 7:12), stripping Israel of its crops. Gideon gathered an army and camped beside the well of Harod, at the foot of the hills, with the Midianite camp to the north in the valley by the hill of Moreh (7:1). Then the Lord told him his army was too large: "lest Israel vaunt themselves against me, saying, Mine own hand hath saved me" (7:2). Of 32,000 men, 22,000 went home when the fearful were released, and of the 10,000 who remained, only the 300 who lapped water from their hands were kept (7:3-7). Judges 8:10 later gives the size of the enemy host as about 135,000.

The plan. Gideon first gathered intelligence. At night he crept with his servant to the edge of the camp and overheard a soldier telling a dream of a barley loaf that overturned a tent, and his companion's fearful interpretation (7:9-15). Gideon knew the enemy was afraid. He divided his three hundred into three companies and gave every man the same three things: a trumpet, an empty pitcher and a lamp hidden inside it (7:16). His order was simple: "Look on me, and do likewise" (7:17). At the beginning of the middle watch, just after the new guards had been posted, the three companies stood around the camp, blew the trumpets, broke the pitchers so that the lamps blazed out, and shouted, "The sword of the LORD, and of Gideon" (7:19-20). They did not rush in; they "stood every man in his place round about the camp"

(7:21). The camp was roused in confusion, the Midianites turned on one another, and the host fled east toward the Jordan, where the men of Ephraim, summoned by Gideon, held the fords (7:22-24).

The principle. The plan uses nearly every principle of Unit 1. **Intelligence:** Gideon learned the enemy's fear before he attacked. **Surprise and timing:** night, at the moment the new watch was least settled. **Deception:** a trumpet normally signaled a whole company; three hundred trumpets and lights on three sides suggested a vast army. **Simplicity and unity of command:** one set of equipment, one signal, one rule: do as I do. **Economy of force:** the three hundred did not fight their way in; they held their places and let the enemy's panic do the work, while fresh troops cut off the retreat. And above all, the text insists that the victory was the Lord's; the shrinking of the army was meant to make that unmistakable.

On the board and the field. A small force can sometimes defeat a large one by attacking its cohesion rather than its numbers. In chess, a sudden check that disorganizes the opponent's pieces can matter more than material. In basketball, a full-court press at the right moment can create panic and turnovers in a team that is better on paper. Coaches use simple signals that everyone understands, and they time changes in tactics to moments when the opponent is least ready, such as right after a timeout or a substitution. But the deeper lesson is about boasting: Gideon's army was made small so that Israel could not boast. A wise player gives credit where it belongs.

Think it through. Gideon was not naturally bold; Judges 6 shows him threshing wheat in hiding and asking for signs. The plan worked because he listened, scouted, kept it simple and obeyed. Courage grew out of trust.

PICTURE STUDY



Gideon Chooses the Three Hundred, James Tissot, about 1896–1902 · Pen and ink drawing (study for his Old Testament series) · Reproduction of a framed study

Image: [Wikimedia Commons](#), public domain

James Tissot spent his last years illustrating the whole Old Testament, after traveling in the Holy Land to study its landscape and people. This ink study shows the test at the water of Harod: a great crowd of men drinking at the stream while Gideon stands and watches. Only the three hundred who lapped from their hands were kept.

Look closely

- Find Gideon. How has the artist shown that he is choosing, not fighting?
- Look at the men at the water. How many different ways of drinking can you see?
- Look at the hills behind. Where would an army camp to have water, and where would its enemy camp?

Talk about it

1. The text does not say why the lappers were chosen; it says the Lord chose them. What does that suggest about whose plan this was?
2. Why might a general find it hard to send away most of his army before a battle?
3. How does this scene connect to Judges 7:2, “lest Israel vaunt themselves”?

Safety first. Do the experiment with a parent present. Clear the floor of anything that could be tripped over, keep the noise short, do not shine lights into anyone's eyes, and do not run in the dark.

PROJECT

How Many Are Out There?

You will test the deception in Gideon's plan with a safe experiment in a darkened room or yard: listeners will estimate how many people surround them from sound and light alone. Then you will map the battle and replay it on a grid.

You will need

- Three or four helpers, each with a flashlight and something to make noise (a pot and spoon, a whistle)
- A darkened room or a yard at dusk, with a parent supervising
- The scorebook, colored pencils and counters

Steps

1. Draw a map of the Valley of Jezreel from a Bible atlas: the hill of Moreh, the well of Harod, Mount Gilboa and the route east to the Jordan. Mark the Midianite camp and Gideon's position.
2. Set up the experiment: one listener sits blindfolded or facing a wall in the center. Helpers stand in three groups on different sides.
3. In trial 1, all helpers flash lights and make noise from one side. The listener estimates how many people there are and from where.
4. In trial 2, the same helpers split into three groups on three sides and signal at the same moment. The listener estimates again.
5. Repeat with a different listener, and record every estimate and the true number.
6. Compute the average estimate for one side and for three sides, and the ratio of the estimate to the true number.
7. Replay the battle on your map with counters: three small groups around a large camp. Write a turn-by-turn account of what each side knew and did.
8. Write a paragraph: did spreading the signals out make the force seem larger? What does that tell you about Gideon's plan, and what does it not explain?

Tips

- Keep the noise short and the lights pointed at walls, not eyes.
- Honest data matter: if the estimates did not rise, say so and suggest why.

Check your work

- ☐ My map shows the hill of Moreh, the well of Harod and the route to the Jordan.
- ☐ I recorded at least two listeners' estimates for both trials and computed averages.
- ☐ My paragraph compares the experiment with the text and keeps the text's own explanation in view.

SCOREBOOK

1. Draw a bar chart of Gideon's army at each stage: 32,000, 10,000 and 300.
2. Draw the three companies around the camp, and label the time (beginning of the middle watch) and the signal.
3. "What I would decide and why": you lead a small team against a much stronger one. Name one way to attack its cohesion fairly, within the rules.

From history. The well of Harod is usually identified with the spring of Ein Harod at the foot of Mount Gilboa, in the Jezreel Valley in northern Israel; visitors can still see where water flows from a cave in the hillside. The Jezreel Valley was a natural route between Mesopotamia and Egypt, which is why so many armies passed through it.

WORKED EXAMPLES

Example 1. Gideon's army went from 32,000 to 10,000 to 300. Compute the percent that left at each stage, the percent of the original army that remained, and the ratio of Gideon's 300 to the 135,000 of Judges 8:10.

Show solution

1. First stage: $22000/32000 = 0.6875 = 68.75\%$ left.
2. Second stage: $9700/10000 = 97\%$ were sent home; 3% stayed.
3. Remaining of the original: $300/32000 \approx 0.0094 \approx 0.94\%$.
4. Force ratio: $135000/300 = 450$, so 1 to 450.

Answer: 68.75% left first, then 97% of the rest; less than 1% of the original army remained, facing odds of 1 to 450. By any human count, including Lanchester's, the attack was hopeless, which is exactly the point the text makes in 7:2.

Example 2. Suppose the night ran from 6 p.m. to 6 a.m. and was divided into three equal watches. At what time did the middle watch begin, and why was its beginning a good moment to attack?

Show solution

1. $12 \text{ hours} \div 3 \text{ watches} = 4 \text{ hours each}$.
2. First watch 6–10 p.m.; middle watch 10 p.m.–2 a.m.; last watch 2–6 a.m.
3. The middle watch began about 10 p.m. (on these assumptions; real night length depends on the season).

Answer: About 10 p.m. The new guards had just been posted and were not yet alert to the ground, while most of the camp had fallen into first sleep. The guards going off duty were heading to bed. Confusion at a change of watch spreads quickly.

Example 3. Map the plan as three companies of 100 placed around a camp. If the camp is roughly a circle 2 km across, how far apart would the companies stand if they were spread evenly around it? (Use circumference $C = \pi d$.)

Show solution

1. $C = \pi \times 2 \approx 6.28$ km.
2. Three companies evenly spaced: $6.28/3 \approx 2.1$ km apart along the edge.
3. If each company spread its 100 men along part of the edge, the lights and trumpets would seem to come from all sides.

Answer: About 2 km apart. The sizes are illustrative, but the geometry explains the deception: sound and light from widely separated points makes a listener in the middle believe he is surrounded.

PRACTICE

1. **Easy** What three things did each of Gideon's men carry?

Show answer

A trumpet, an empty pitcher and a lamp inside the pitcher (Judges 7:16).

2. **Easy** According to Judges 7:2, why did the Lord reduce Gideon's army?

Show answer

So that Israel would not boast that its own hand had saved it.

3. **Easy** Where did Gideon camp, and where was the Midianite camp?

Show answer

By the well of Harod; the Midianites were to the north, in the valley by the hill of Moreh (7:1).

4. **Medium** What did Gideon learn on his night reconnaissance, and how did it affect his plan?

Show answer

He overheard a Midianite tell a dream of a barley loaf overturning a tent and his companion interpret it as Gideon's victory. Gideon learned the enemy was afraid, which made an attack on their nerve, rather than their numbers, likely to succeed.

5. **Medium** Name four principles of war in Gideon's plan and give the evidence for each.

Show answer

Surprise (night attack), deception (300 trumpets and lights seeming a vast army), simplicity (same equipment and one rule, "do likewise"), unity of command (all followed Gideon's signal), economy of force (they stood in place rather than fighting in).

6. **Medium** Why did Gideon call on the men of Ephraim (7:24)?

Show answer

To hold the fords of the Jordan, cutting off the fleeing Midianites. A rout becomes a decisive victory only if the enemy's escape is blocked: pursuit.

7. **Medium** In a game, what is the equivalent of attacking an opponent's cohesion rather than his numbers? Give an example.

Show answer

Sample: a sudden press in basketball that causes panic and turnovers; a surprising sacrifice in chess that disorganizes the defense; a quick free kick in soccer before the wall is set.

8. **Medium** Of the 10,000, 300 lapped putting their hands to their mouths. What fraction is that, in lowest terms?

Show answer

$$300/10000 = 3/100.$$

9. **Hard** Using Lanchester's square law with equal quality, compare the strengths of 300 and 135,000. What does the result suggest about how the victory must be explained?

Show answer

$(135000/300)^2 = 450^2 = 202,500$: the larger host was about 200,000 times stronger by the model. No human calculation explains the result; the text attributes it to the Lord, who set the enemy against itself (7:22).

10. **Hard** Explain the order “Look on me, and do likewise” as an example of commander’s intent and simplicity.

Show answer

Instead of complicated instructions, Gideon gave one rule that every man could follow in the dark under stress: watch the leader and copy him. Everyone knew the purpose and the signal, so the three companies acted together without further orders.

11. **Challenge** A trumpet in ancient armies usually signaled a company of perhaps 100 men. If the Midianites assumed each of 300 trumpets meant 100 men, how large an army would they believe surrounded them? How does this compare with their own size, and what would a frightened commander conclude?

Show answer

$300 \times 100 = 30,000$. That is still smaller than 135,000, but an attack at night from three sides by an army of 30,000, with the enemy already in their camp, would seem overwhelming to men who had just heard the dream. Deception works on fear, not only on numbers. (The 100-per-trumpet figure is illustrative.)

COMMON MISTAKES

- Saying the 300 fought their way through the camp. The text says they stood in their places (7:21).
- Forgetting the reconnaissance; the plan rested on knowing the enemy was afraid.
- Treating the story only as tactics and ignoring the text’s main point, that the Lord gave the victory.

Make it a game · Judges 7 Silent Scenes. Without speaking, act out each moment from Judges 7 in order: the army shrinking, the men drinking at the water, the night scouting, the three companies surrounding the camp. Your parent guesses the scene and then reads the verse aloud to check the details. Earn a point for each scene guessed. Swap roles and see how quietly you can act.

Scripture. “And the LORD said unto Gideon, The people that are with thee are too many for me to give the Midianites into their hands, lest Israel vaunt themselves against me, saying, Mine own hand hath saved me.” (Judges 7:2, KJV)

Strategy matters, and Gideon’s plan was wise. But the text makes sure no one could mistake where the victory came from.

3.2 JOSHUA'S AMBUSH AT AI

OBJECTIVES

- Retell the two attacks on Ai from Joshua 7–8, and explain why the first failed.
- Explain the feigned retreat and ambush, and how they used the men of Ai's overconfidence.
- Compute distances and times for the ambush and the signal, and connect the plan to feints in sport and chess.

Warm-up. Play a quick game of tag or a board game where one side pretends to be weaker than it is. Or simply answer: when a team loses to you badly once, how do you expect them to play next time? Write your answer. Then read Joshua 8:6.

WATCH

Joshua's Conquest and The Mystery of Ai - The Exodus

Patterns Of Evidence · 13:35

<https://www.youtube.com/watch?v=e6D4IBW9kcA>

WHEN TO WATCH

After “the story” paragraph. Archaeologists explain the debate over where Ai stood and walk the ground of one candidate site; notice where an ambush could be hidden.

Note: From a Christian documentary series on biblical archaeology; scholars on different sides are interviewed. There are no battle scenes.

BACKUP VIDEO

Why Did Joshua Attack the City of Ai (Khirbet el-Maqatir)?

Associates for Biblical Research · 1:48

<https://www.youtube.com/watch?v=IXO2Q75ZvqQ>

Optional, after the history note. An archaeologist who excavated Khirbet el-Maqatir explains in under two minutes why Joshua attacked Ai.

KEY TERMS

ambush

A hidden force placed to attack an enemy by surprise when he passes or when a signal is given.

feigned retreat

Pretending to flee in order to draw the enemy out of a strong position into a trap.

overconfidence

Judging the present by a past success without checking whether conditions have changed.

signal

A prearranged sign that tells separated forces to act. Joshua stretched out his spear toward the city (Joshua 8:18).

CORE IDEAS

The story. After Jericho, Joshua sent men to spy out Ai, a smaller city in the hills. They reported that two or three thousand men would be enough (Joshua 7:3). About three thousand went up, and they fled before the men of Ai, who chased them down the slope and struck down about thirty-six (7:4-5). The text gives the reason plainly: Achan had taken forbidden plunder from Jericho, and the Lord was not with Israel in that attack (7:1, 7:20-21). Only after the sin was dealt with did the Lord say, “Fear not, neither be thou dismayed: take all the people of war with thee, and arise, go up to Ai” (8:1). Archaeologists still debate which ruin is the Ai of the text; two leading candidates lie close together north of Jerusalem.

The plan. Joshua turned the first defeat into the bait for the second battle. He sent a strong force by night to lie hidden on the west side of the city, between Bethel and Ai (8:3-4, 8:9, 8:12). He himself came with the main army to the north side, in full view across a valley (8:11). When the king of Ai saw them, he hurried out, and Joshua’s army fled toward the wilderness, exactly as before. Joshua had predicted the enemy’s thinking: “they will say, They flee before us, as at the first” (8:6). Every man of Ai and of nearby Bethel poured out in pursuit and left the city open (8:16-17). Then Joshua stretched out his spear toward Ai (8:18); the ambush rose, entered the city and set it on fire. When the men of Ai looked back and saw the smoke, they were caught between the force from the city and Joshua’s army, which had turned to face them (8:20-22).

The principle. The feigned retreat works because the enemy believes what he expects to see. The men of Ai had won once; they assumed the second battle would

be the same, and they did not check. This is Sun Tzu's rule from the other side: Ai knew Israel's past but not Israel's present. The plan also required **security** (the ambush had to stay hidden all night), **timing** (it had to rise only when the city was empty), a clear **signal** visible to separated forces, and **discipline** (Joshua's main body had to flee convincingly and then turn and fight). Most important of all, the text teaches that the first defeat came from disobedience and overconfidence, and the second victory from obedience and humility. Joshua did not simply change tactics; he dealt with the real problem first.

On the board and the field. Feints are everywhere in sport. A football team runs the same play several times and then fakes it and throws deep (a play-action pass). A basketball player drives left twice and then crosses over. A soccer team sits back, invites the opponent forward, and then counterattacks into the space behind. In chess, a player may seem to retreat a piece while preparing a discovered attack. All of these depend on the opponent believing his past experience instead of reading the present. And all of them stay inside the rules: a feint deceives the opponent about your intention, never the referee about the facts.

Think it through. Ai shows two kinds of learning. Israel learned from defeat by looking honestly for its cause. The men of Ai failed to learn from victory, because victory made them careless. Which is harder for you?

PICTURE STUDY



Joshua Gives the Signal for the Attack on Ai, James Tissot, about 1896–1902 · Pen and ink drawing (study for his Old Testament series) · Reproduction of a framed study

Image: [Wikimedia Commons](#), public domain

Tissot chose the moment of decision rather than the fighting: Joshua raises his arm high toward Ai as the signal for the ambush. Everything depends on this gesture being seen by men hidden far away.

Look closely

- Find what Joshua holds up. The text says he stretched out his spear; how has the artist drawn the signal?
- Look at the men crouching below. Are they fleeing, waiting or turning?
- Look at the open sky behind Joshua. Why does a signal need to stand out against the background?
- Look at the ground. Where could an ambush be hidden?

Talk about it

1. Why does a plan with separated forces need a signal that cannot be mistaken?
2. The text says the Lord told Joshua when to stretch out the spear. How does that change our reading of the moment?

3. If you were in the ambush, what would you be thinking as you waited all night for this signal?

PROJECT

The Feint Experiment

You will test the power of a feint in a simple two-player game: one player sets a pattern and then breaks it. You will record how often the opponent is fooled before and after a pattern is established.

You will need

- A coin or two cards (left and right)
- An opponent
- The scorebook

Steps

1. Rules of the game: each round, the attacker secretly chooses Left or Right; the defender guesses. If the defender guesses correctly, he scores; if not, the attacker scores.
2. Phase 1: play 20 rounds with the attacker choosing at random (flip a coin each time). Record the defender's success rate.
3. Phase 2: the attacker chooses Left for the first 6 rounds, then mixes in Right at a moment he chooses. Record each round.
4. Phase 3: play 20 more rounds in which the attacker uses the "as at the first" trick: repeat a choice that worked, then switch.
5. Compute the defender's success rate in each phase.
6. Switch roles and repeat.
7. Draw a map of Ai with the main body, the ambush and the routes, and number the stages of the battle in order.
8. Write a paragraph: did setting a pattern make the feint more effective? How could the defender have protected himself?

Tips

- The defender should write his guess before the attacker reveals; honest records only.
- Unit 5 returns to this kind of guessing game in team sports, where coaches call it keeping the defense honest.

Check your work

- ☐ I recorded at least 60 rounds in three phases with success rates for each.
- ☐ My map of Ai shows the two forces, the signal and the numbered stages.
- ☐ I explained how the defender could have avoided being fooled.

SCOREBOOK

1. Draw a simple map: Ai, Bethel to the west, the valley to the north, Joshua's main body, the ambush and the route of the feigned retreat.
2. Make a two-column table comparing the first and second attacks on Ai.
3. "What I would decide and why": your opponent beat you easily last time. How will you prepare differently, and how might he be overconfident?

From history. Ai means "the ruin" in Hebrew. Excavations at et-Tell and at Khirbet el-Maqatir, about a kilometer apart, have each been proposed as the biblical site, and the question is still argued by archaeologists who take the text seriously.

WORKED EXAMPLES

Example 1. In the second attack, suppose the main body fled 2 km from the city before turning, and the men of Ai pursued them that far. The ambush lay hidden 1 km from the city gate. If both the ambush and the men of Ai move at 6 km/h, how long would it take the ambush to reach the gate after the signal, and how long would the men of Ai need to return? (The distances and speed are illustrative.)

Show solution

1. Ambush: $1 \text{ km} \div 6 \text{ km/h} = 1/6 \text{ h} = 10 \text{ minutes}$.
2. Men of Ai: $2 \div 6 = 1/3 \text{ h} = 20 \text{ minutes}$.
3. The ambush has about 10 minutes in hand, enough to enter the city and raise smoke before the defenders could return.

Answer: Ambush 10 minutes, defenders 20 minutes. The farther the feigned retreat draws the enemy, the larger the ambush's margin of time, which is why Joshua's army had to flee far enough to empty the city completely.

Example 2. In the first attack, about 3,000 men went up and about 36 fell. What percent is that? Why did so small a loss cause so great a fear (7:5)?

Show solution

1. $36/3000 = 0.012 = 1.2\%$.
2. Militarily the loss was small. But Israel had expected easy victory, and the defeat showed that the Lord was not with them.
3. Joshua tore his clothes and fell on his face before the ark (7:6).

Answer: 1.2%. The defeat mattered not for its size but for what it meant. Morale depends on whether a team believes its cause and its preparation are sound; Joshua rightly looked for the cause before trying again.

Example 3. Compare the two attacks in a table: force sent, plan, where the enemy was drawn, cause given in the text, and result.

Show solution

1. First attack: about 3,000 men; a direct assault uphill; the enemy came out and chased Israel down to Shebarim; cause: Achan's sin and confidence in a small force (7:1-5); result: defeat.
2. Second attack: all the people of war, with a hidden force west of the city; feigned retreat toward the wilderness; the enemy was drawn away from the city; cause: the Lord's command and promise (8:1); result: victory.
3. The second plan used the first defeat as bait.

Answer: The difference was not only tactical. The first attack combined disobedience with overconfidence; the second combined obedience, the whole army, careful preparation and a plan that used the enemy's memory of the first battle against him.

PRACTICE

1. Easy Why does the text say Israel was defeated the first time at Ai?

Show answer

Achan had taken forbidden things from Jericho, and the Lord was not with Israel (Joshua 7:1, 7:11-12).

2. Easy What signal did Joshua give to the ambush?

Show answer

He stretched out the spear in his hand toward Ai (8:18).

3. Easy Where was the ambush hidden?

Show answer

On the west side of Ai, between Bethel and Ai (8:9, 8:12).

4. Medium Quote or paraphrase Joshua 8:6 and explain what it shows about Joshua's understanding of the enemy.

Show answer

"They will say, They flee before us, as at the first." Joshua predicted that the men of Ai would interpret the new retreat by the old one and pursue carelessly.

5. Medium Name three things the ambush needed in order to work.

Show answer

Concealment through the night (security), a clear signal visible from a distance, and an empty city (the whole garrison drawn out by the feigned retreat).

6. Medium Give a football and a chess example of a feint.

Show answer

Football: play-action, faking a run the defense has seen several times, then passing deep. Chess: a move that seems to retreat or defend while preparing a discovered attack.

7. Medium If the ambush in worked example 1 had hidden 2 km from the gate instead of 1 km, how much time would it have in hand?

Show answer

Ambush: $2/6 \text{ h} = 20 \text{ min}$; defenders 20 min. No margin: the plan would be in danger. Concealment close to the city mattered.

8. **Medium** Explain how Ai's first victory caused its later defeat.

Show answer

Victory made the men of Ai overconfident. Seeing Israel flee again, they assumed the past would repeat, abandoned their city and did not check for a trap.

9. **Hard** The text mentions both 30,000 (8:3) and 5,000 (8:12) in connection with the ambush. Suggest two ways readers have understood the two numbers, and explain why careful readers note such details instead of ignoring them.

Show answer

Some read 30,000 as the whole force sent forward by night and 5,000 as the part placed in the actual ambush; others read them as two separate detachments (one ambush, one blocking force toward Bethel). Careful reading notices details because the plan depends on them, and honest study admits where interpretation is needed.

10. **Hard** Why might a coach study his own team's loss before planning a rematch, as Joshua did? Give an example of a hidden cause behind a loss.

Show answer

The visible cause (we lost the rebounding battle) may hide a deeper one (two players were not following the plan, or the team was overconfident). Fixing tactics without fixing the real cause repeats the defeat. Example: a team that loses late because of poor conditioning, not poor plays.

11. **Challenge** Model the feint as a guessing game. Ai believes the probability that Israel's retreat is real is p . If real, pursuing gains Ai 10 points; if a trap, pursuing loses 50 points; staying gains or loses nothing. For what values of p is pursuing better on average? What did the first battle do to Ai's estimate of p ?

Show answer

Pursue if $10p - 50(1 - p) > 0 \Rightarrow 60p > 50 \Rightarrow p > 0.83$. After the first battle Ai believed Israel's flight was real and set p near 1, so it pursued. Joshua's plan worked by exploiting that confident estimate.

COMMON MISTAKES

- Treating the first defeat as only a tactical error. The text gives a moral cause.

- Forgetting that the feigned retreat had to be convincing; a half-hearted feint warns the enemy.
- Confusing a feint (deceiving the opponent within the game) with cheating (deceiving the officials).

Make it a game • Fake Retreat Map. Draw a simple map of Ai with a hidden valley. Your parent plays the king of Ai and decides whether to chase your forces. Place bean ambushers under a cup, then lure with a pretend retreat. Reveal. Then explain from Joshua 7 and 8 why the first attack failed and how the second used a signal.

Scripture. “And the LORD said unto Joshua, Fear not, neither be thou dismayed: take all the people of war with thee, and arise, go up to Ai: see, I have given into thy hand the king of Ai, and his people, and his city, and his land:” (Joshua 8:1, KJV)

After the defeat, the Lord renewed His promise and commanded the whole army to go, not a small confident detachment. Humility and obedience came before the plan.

3.3 ALEXANDER AT GAUGAMELA: THE OBLIQUE ATTACK

OBJECTIVES

- Describe the armies, the ground and the plans at Gaugamela (331 BC), following Arrian.
- Explain the oblique attack and how Alexander's movement to the right opened a gap in the Persian line.
- Use frontage and timing calculations, and compare the oblique attack with overloads in sport and play on one wing in chess.

Warm-up. Lay two rulers side by side as battle lines, one longer than the other. If the shorter line is to win, where should it attack? Move the short ruler at an angle so one end meets the long ruler first. What happens to the other end?

WATCH

Alexander the Great: Battle of Gaugamela 331 BC

BazBattles · 11:42

<https://www.youtube.com/watch?v=vY3z3yh7a24>

WHEN TO WATCH

After “the plan” paragraph. The battle is shown entirely with map symbols; pause when Alexander begins moving right and predict what Darius will do.

BACKUP VIDEO

Battle of Gaugamela 331 BC - Alexander the Great DOCUMENTARY

Kings and Generals · 22:56

<https://www.youtube.com/watch?v=xwunu9gJyas>

Optional, for students who want more of the campaign before the battle, with animated maps.

KEY TERMS

oblique attack (oblique order)

Advancing a battle line at an angle so that a strong wing engages first while the weaker wing is held back (“refused”).

refused flank

A wing deliberately held back to avoid early fighting.

phalanx

A deep, close formation of infantry with long spears; the Macedonian phalanx used the sarissa, a pike about 5–6 meters long.

Companion cavalry

Alexander's elite heavy cavalry, which he led in person on the right wing.

second line

A reserve line behind the main line, ready to face an attack from the flank or rear.

CORE IDEAS

The story. On October 1, 331 BC, near the village of Gaugamela in northern Mesopotamia (modern Iraq), Alexander of Macedon met the Persian king Darius III. Darius had chosen the ground: a wide plain, which his men had leveled so that his two hundred scythed chariots could charge, and where his far larger army, especially his cavalry, could overlap both ends of Alexander's line. Arrian, writing about 450 years later from earlier accounts, gives Alexander about 40,000 infantry and 7,000 cavalry. Ancient figures for the Persians are much larger and not trustworthy, but modern historians agree that Darius had a great superiority in numbers.

The plan. Alexander could not match the Persian line, so he did not try. He placed his phalanx in the center, his Companion cavalry on the right under his own command, and Parmenion on the left with orders to hold. Behind the main line he set a second line ready to turn and face any enemy who rode around the flanks. Then he advanced not straight ahead but at an angle toward his right, edging off the leveled ground. Darius sent cavalry from his left to stop the movement, and then more cavalry, and the Persian left wing stretched sideways to follow. A gap opened in the Persian line between the left wing and the center. Alexander formed the Companions and some infantry into a wedge and drove straight into the gap toward Darius himself. Darius fled, and the Persian army came apart, though Parmenion's wing had been hard pressed all afternoon.

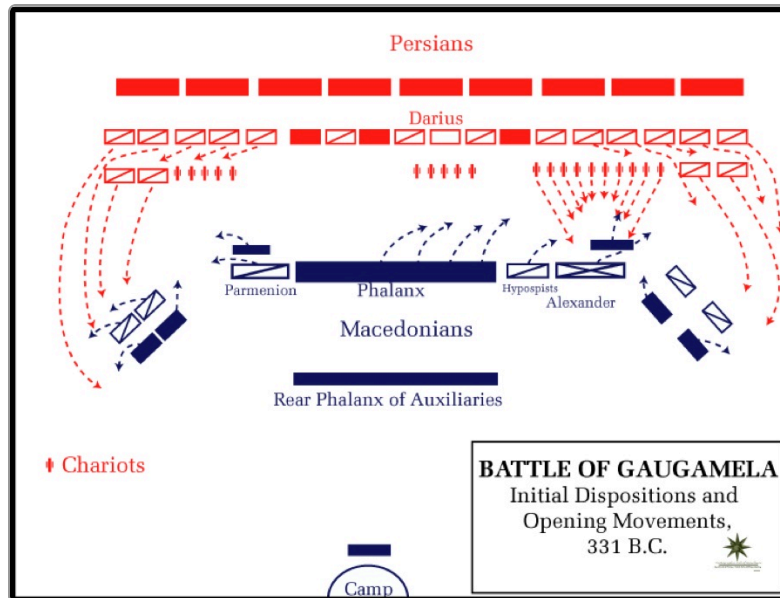
The principle. The **oblique attack** is mass and economy of force arranged in space and time. One wing is made strong and advanced first; the other is held back so that it fights later, or not at all. The opponent, seeing the threat, is tempted to shift forces

toward it and may open a gap elsewhere. Alexander's plan also used **security** (the second line against encirclement), **maneuver** (moving off the ground Darius had prepared), and personal leadership at the decisive point. The Prussian king Frederick the Great made the oblique order famous again in the eighteenth century, most famously at Leuthen in 1757.

On the board and the field. In chess, a player with a pawn majority on one wing often advances there while keeping the other side quiet, a kind of oblique order. In soccer, a team overloads one flank to draw the defense across and then switches the ball to the space it left. In football, an offense lines up in a strong-side formation, and when the defense shifts to meet it, the play goes into the gap that shift created. The lesson is the same: you need not be stronger everywhere, only where and when it counts, and a forced shift by the opponent can create the gap you need.

The risk side. The refused wing is in danger. At Gaugamela, Parmenion's wing was nearly overwhelmed, and part of the Persian cavalry broke through to Alexander's baggage camp. An oblique attack works only if the weak side can hold long enough.

PICTURE STUDY



Battle of Gaugamela: Opening Movements, Department of History, U.S. Military Academy (adapted), twentieth century · Map · Wikimedia Commons

Image: [Wikimedia Commons](#), public domain

Maps like this are used to teach Gaugamela at military academies. They reduce a battle to blocks and arrows so that the plan can be seen. Read it the way you would read a chess diagram: who is where, who moves first, and what does each move threaten?

Look closely

- Compare the lengths of the two lines. Where does the Persian line overlap the Macedonian line?
- Find Alexander's Companion cavalry. Which way are the arrows pointing?
- Find the Persian units moving to meet him. What happens to the space they leave behind?
- Find the Macedonian second line. Which way is it facing?

Talk about it

1. Using the map, explain in three sentences how a smaller army could defeat a larger one.
2. What information does the map leave out (terrain, time, morale)?

3. If you were Darius, what would you have done differently when you saw Alexander moving right?

PROJECT

Replay Gaugamela on a Grid

You will replay Gaugamela on a grid with counters, first as a straight-ahead battle and then with Alexander's oblique plan, using simple dice rules, and compare the results.

You will need

- Graph paper or poster board ruled in a grid of 2 cm squares
- Counters in two colors: about 12 Macedonian and 20 Persian
- Two dice and the scorebook

Steps

1. Draw a grid 16 squares wide. Place 20 Persian counters in a line across 16 squares (some doubled). Place 12 Macedonian counters in a shorter line facing them, with 2 more as a second line behind.
2. Mark one Macedonian counter as Alexander's Companions (it rolls two dice and keeps the higher) and one Persian counter as Darius.
3. Rules: on each turn a counter may move one square. When counters meet, each rolls one die; the lower roll is removed (ties: both stay). If a counter is attacked from two sides at once, it rolls with a penalty of -2.
4. Game A: both sides advance straight ahead. Play until one side loses half its counters or Darius is removed. Record the result.
5. Game B: the Macedonians advance at an angle, the right moving first. The Persian player must move two counters each turn toward the Companions. When a gap of two empty squares appears in the Persian line, the Companions may charge into it.
6. Play each game three times, switching sides, and record how often each side wins.
7. Make a table of results for Game A and Game B.
8. Write a paragraph: did the oblique plan help? Which rule in your game best captures what really happened, and which is least realistic?

Tips

- Keep the rules simple; the point is to see the shape of the plan, not to model every detail.
- Record each turn briefly so you can find where the battle was decided.

Check your work

- ☐ I played both versions at least three times each and recorded results.
- ☐ My table compares the straight and oblique plans.
- ☐ My paragraph judges the realism of my rules honestly.

SCOREBOOK

1. Draw the battle in three stages: the opening lines, the rightward movement and Persian response, and the wedge into the gap.
2. Draw a soccer field showing an overload on the right and the switch of play to the left.
3. “What I would decide and why”: your team is outnumbered on defense. Which wing do you refuse, and why?

From history. Arrian, a Greek who served as a Roman governor, wrote his history of Alexander in the second century AD, relying chiefly on the lost memoirs of Ptolemy and Aristobulus, who had served with Alexander. Military historians still debate the details of Gaugamela because the ancient accounts disagree.

WORKED EXAMPLES

Example 1. Suppose (illustrative numbers) Alexander's front was 4 km long and Darius's 6 km, centered on the same point. How far did each end of the Persian line overlap the Macedonian line? If Alexander moved his whole line 1 km to his right, how much overlap remained on each side?

Show solution

1. Extra Persian length: $6 - 4 = 2$ km, split evenly: 1 km of overlap on each side.
 2. After moving 1 km right, the Macedonian right end reaches the Persian left end: overlap on Alexander's right is $1 - 1 = 0$.
 3. On Alexander's left, the overlap grows to $1 + 1 = 2$ km.
-

Answer: 1 km of overlap on each side at first; after the move, none on the right and 2 km on the left. The movement removed the danger on the attacking wing and increased it on the refused wing, which is why Parmenion and the second line were essential.

Example 2. Scythed chariots needed level ground to charge. Suppose a chariot moves at 30 km/h and must cross 300 m to reach the Macedonian line, and that Alexander's light troops can throw javelins at the horses during the last 150 m. How many seconds does the chariot spend in the javelin zone?

Show solution

1. Convert speed: $30 \text{ km/h} = 30000/3600 \approx 8.3 \text{ m/s}$.
 2. Time for 150 m: $150/8.3 \approx 18 \text{ s}$.
 3. Arrian says the light troops brought down many horses and drivers, and the infantry opened lanes to let the rest pass through harmlessly.
-

Answer: About 18 seconds (illustrative numbers). A charge that depends on reaching the line in one piece can be defeated by a screen that has time to act and by a line that opens instead of standing rigid.

Example 3. Arrian gives Alexander 40,000 infantry and 7,000 cavalry. What percent of his army was cavalry? If the Persian cavalry outnumbered his by 4 to 1 (an illustrative ratio), how many Persian cavalry is that?

Show solution

1. Total: 47000. Cavalry share: $7000/47000 \approx 0.149 = 14.9\%$.
2. Persian cavalry at 4 to 1: $4 \times 7000 = 28000$.

Answer: About 15% cavalry; on the illustrative ratio, 28,000 Persian cavalry. Alexander could not win a cavalry battle of attrition; he needed to create one decisive moment where his best cavalry struck a gap.

PRACTICE

1. **Easy** When and where was the battle of Gaugamela fought, and between whom?

Show answer

October 1, 331 BC, in northern Mesopotamia (modern Iraq), between Alexander of Macedon and Darius III of Persia.

2. **Easy** What is an oblique attack?

Show answer

An advance at an angle so that one strong wing engages first while the weaker wing is held back.

3. **Easy** Why did Darius level the plain?

Show answer

So that his scythed chariots could charge, and his large army could deploy and overlap Alexander's line.

4. **Medium** How did Alexander's movement to the right create a gap in the Persian line?

Show answer

Darius sent cavalry from his left wing to stop the movement, then more; the Persian left stretched sideways and separated from the center, opening a gap that Alexander attacked.

5. **Medium** What was the purpose of Alexander's second line?

Show answer

Security against encirclement: it could turn to face enemy cavalry that rode around the flanks or broke through.

6. **Medium** Give a soccer example of the oblique attack.

Show answer

Overloading one wing with extra attackers to draw the defense across, then switching the ball to the far side or attacking the gap that opened in the middle.

7. **Medium** A chariot charges at 25 km/h across a 200 m javelin zone. How many seconds is it exposed?

Show answer

$25000/3600 \approx 6.94 \text{ m/s}$; $200/6.94 \approx 29 \text{ s}$.

8. **Medium** What is the risk of an oblique attack, and how did it show at Gaugamela?

Show answer

The refused wing may be overwhelmed before the strong wing wins. Parmenion's left was hard pressed, and some Persian cavalry broke through to the baggage.

9. **Hard** Explain how Gaugamela shows Sun Tzu's idea that the enemy's moves should be determined by the signs we give him.

Show answer

Alexander's rightward march was a sign Darius felt he had to answer; by answering it, Darius moved his own forces into a shape that opened the gap. Alexander chose the movement; Darius reacted.

10. **Hard** In chess, a player has three pawns against two on the queenside and is equal elsewhere. Explain how he can play an "oblique" plan.

Show answer

He advances his queenside majority to create a passed pawn while keeping the kingside closed and solid (the refused wing). The opponent must bring pieces to stop the passed pawn, which can open weaknesses elsewhere.

11. **Challenge** In worked example 1, suppose Alexander wanted the overlap on his left to be no more than 1.5 km while removing all overlap on his right. Is that possible with a 4 km line against a 6 km line? What else could he change?

Show answer

No: removing the right overlap (1 km) requires moving 1 km right, which makes the left overlap 2 km. The total overlap is fixed at 2 km by the line lengths. He could extend his own line (thinner ranks), angle the refused wing back, or use a second line to guard the flank, which is what he did.

COMMON MISTAKES

- Thinking the oblique attack means attacking with the whole line at an angle; the point is that one wing is strong and the other held back.
- Trusting ancient numbers for the Persian army. They are exaggerated; what is certain is a large Persian superiority.
- Forgetting the second line, which made the risk of the plan acceptable.

Make it a game · Deployment Sketch. Draw the armies at Gaugamela in ninety seconds: Darius's line, Alexander's phalanx, the Companion cavalry, the second line, and the oblique advance with its refused flank. Your parent guesses each label without a key. Count the correct labels, then swap. End by saying in one sentence what Arrian says Alexander wanted.

3.4 HANNIBAL AT CANNAE: THE DOUBLE ENVELOPMENT

OBJECTIVES

- Describe the armies, deployment and plan at Cannae (216 BC), following Polybius.
- Explain the double envelopment and how Hannibal used the Romans' depth and momentum against them.
- Compute ratios, frontages and depths, and compare Cannae with traps in chess and sport.

Warm-up. Press your palm into a pillow. What happens to the pillow at the edges of your hand? Now imagine your hand is an army pushing forward and the pillow is the enemy line. Write one sentence describing what Hannibal might have wanted the Roman army to do.

WATCH

The Battle of Cannae (216 B.C.E.)

[Historia Civilis](#) • 9:10

<https://www.youtube.com/watch?v=MroGPObEZzk>

WHEN TO WATCH

After “the plan” paragraph. The battle is drawn with simple colored blocks; watch the shape of Hannibal’s center change as the Romans push.

Note: An on-screen card gives the death toll as a plain number; nothing graphic is shown.

KEY TERMS

double envelopment (pincer movement)

Attacking both flanks of an enemy at once so that the two attacking wings meet behind him and surround him.

crescent

Hannibal’s curved center line, bulging forward toward the Romans at the start of the battle and slowly giving way.

combined arms

Using different kinds of forces (infantry, cavalry, light troops) so that each covers the others' weaknesses.

Fabian strategy

Avoiding a decisive battle with a stronger opponent while wearing him down (Lesson 1.5). Rome abandoned it before Cannae.

CORE IDEAS

The story. In 218 BC the Carthaginian general Hannibal led an army from Spain over the Alps into Italy, and within two years he had destroyed two Roman armies. For a time the Romans followed Fabius's cautious strategy, but in 216 BC they raised the largest army they had ever put in the field and sent it under the two consuls, Lucius Aemilius Paullus and Gaius Terentius Varro, to crush him. On August 2, 216 BC, the armies met near the village of Cannae in Apulia, in southeastern Italy, beside the river Aufidus. Polybius gives the Romans about 80,000 infantry and 6,000 cavalry, and Hannibal about 40,000 infantry and 10,000 cavalry.

The plan. The Romans placed their infantry in an unusually deep and narrow formation, meaning to smash through Hannibal's center by sheer weight. Hannibal arranged his center of Gallic and Spanish infantry in a crescent bulging toward the Romans, and placed his best infantry, African veterans, in deep columns on each side of the crescent, held back. His heavy cavalry under Hasdrubal stood on the left by the river; his Numidian light cavalry stood on the right. The battle unfolded as he intended. Hasdrubal's cavalry drove the Roman horsemen from the field, rode around behind the Roman army, and helped the Numidians scatter the allied cavalry on the other wing. Meanwhile the Roman infantry pressed forward and pushed the crescent back until it bent inward. The more the Romans advanced, the deeper they pushed into a pocket. Then the African infantry on each side turned inward against the Roman flanks, and Hasdrubal's cavalry attacked the Roman rear. The Roman army was surrounded, and most of it was destroyed or captured; ancient writers give Roman losses in the range of about 50,000 to 70,000.

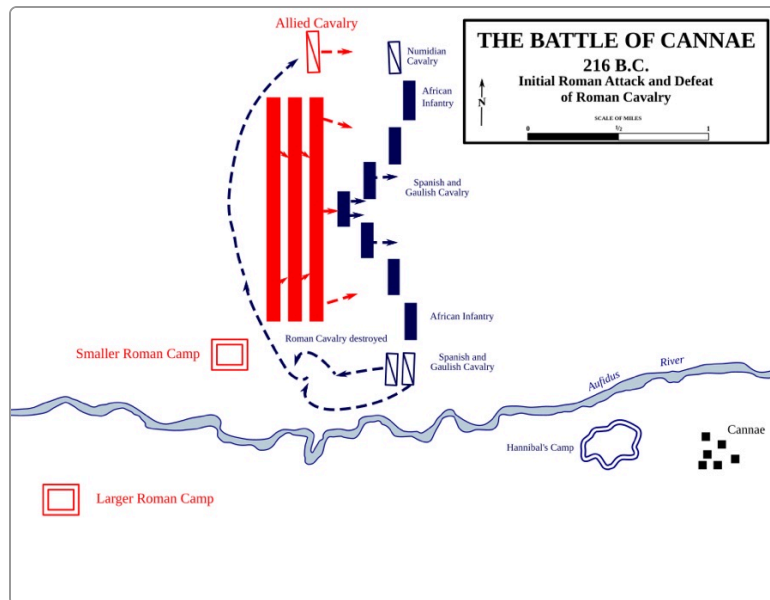
The principle. Cannae is the classic **double envelopment**. Its genius was that Hannibal used the Romans' strength against them: the deep formation and the push forward that were meant to break his center instead carried them into the trap. It depended on **combined arms** (cavalry superiority to win the wings and close the back of the pocket), on a center that could bend without breaking, on precise **timing** (the Africans turned only when the Romans were deep in the pocket), and on a

commander who stood with the center to hold it together. Yet Cannae also teaches the limits of tactics. Hannibal won the battle but not the war: Rome refused to make peace, returned to Fabius's strategy, and fourteen years later beat Carthage at Zama.

On the board and the field. In chess, a player may let the opponent advance in the center, even encourage it, while preparing to attack the advanced pawns from both sides. In soccer, a team defending deep may let an opponent push numbers forward and then win the ball and counterattack into the empty space behind. In basketball, a trapping defense lets the ball handler dribble into a corner and then closes on him from two sides. Each is a pocket: the opponent's own aggression carries him into it.

The risk side. Hannibal's center was the weakest part of his army, deliberately placed where the Romans would attack hardest. If it had broken instead of bending, the plan would have collapsed. He stood with it himself.

PICTURE STUDY



Battle of Cannae: The Roman Attack, Department of History, U.S. Military Academy (redrawn), twentieth century · Map · Wikimedia Commons

Image: [Wikimedia Commons](#), public domain

This map shows the opening of the battle. (The file name gives the year as 215 BC, but the battle was fought in 216 BC.) The Roman infantry is drawn as a large block pressing forward; Hannibal's center is curved toward them, and his African infantry waits on each side.

Look closely

- Find the Roman infantry. How does its depth compare with its width?
- Find Hannibal's crescent. Which way does it bulge at the start?
- Find the African infantry on each side. What will they do when the Romans have pushed deep enough?
- Find the cavalry on both wings, and the river. How does the river protect one flank?

Talk about it

1. Draw how the map would look an hour later, after the crescent has bent inward.
2. Why is a map like this more useful than a painting for studying the plan?

3. If you were the Roman commander, what one change to the deployment might have avoided the trap?

Safety first. Warm up first. Use a soft ball, play in a clear, level yard away from streets and windows, tag gently, and wear proper shoes. A parent should supervise.

PROJECT

Pocket Defense Drill

You will replay Cannae on a grid with counters and then test the “pocket” idea in a small backyard game: a defending team that bends and closes against an attacking team that pushes straight ahead.

You will need

- Grid paper and counters in two colors (as in Lesson 3.3)
- A soft ball, four cones or shoes, and at least four players for the yard game
- The scorebook

Steps

1. Replay Cannae on a grid: Romans in a block 4 wide and 8 deep; Hannibal’s center 6 counters in a curve, 3 counters on each wing set back, and 4 cavalry counters. Use the dice rules from Lesson 3.3. Record turn by turn.
2. Play it twice: once with Hannibal’s center in a straight line, once in a crescent. Compare the results.
3. Yard game (2 against 2 or 3 against 3): mark a 10 m square with cones. Attackers try to carry the ball across the far line; defenders tag the ball carrier to stop the play.
4. Round A: defenders stand in a straight line. Play 10 attacks and record how many succeed.
5. Round B: defenders start in a curve, give ground in the middle, and close from the sides. Play 10 attacks and record how many succeed.
6. Switch roles and repeat.
7. Make a table of success rates for both rounds.
8. Write a paragraph: did the pocket defense work better? When would it fail?

Tips

- Tag gently with a hand on the shoulder or the ball; no tackling.
- If the attackers learn the pocket and go around it, write that down: that is exactly what a smart opponent does.

Check your work

- ☐ I replayed Cannae twice on a grid and compared straight and crescent centers.
- ☐ I recorded at least 20 attacks in the yard game with success rates.
- ☐ I explained when a pocket defense would fail.

SCOREBOOK

1. Draw Cannae in three stages: the opening lines, the crescent bending inward and the cavalry riding around, and the closed pocket.
2. Make a table of forces (infantry, cavalry, totals, cavalry share) for both sides.
3. “What I would decide and why”: your opponent is pushing hard through the middle every time. Would you try to stop him there or invite him in? Explain the risk.

From history. The German general Alfred von Schlieffen wrote a series of studies of Cannae in the early 1900s and made it a model for German planning. Many later commanders tried to repeat it; few succeeded, because a Cannae needs an opponent who pushes straight into the trap and a commander whose weak center holds.

WORKED EXAMPLES

Example 1. Using Polybius’s numbers, compute the ratio of Roman to Carthaginian infantry and of Carthaginian to Roman cavalry. Then compute each side’s total and its cavalry share.

Show solution

1. Infantry: $80000/40000 = 2$: the Romans had twice as many.
2. Cavalry: $10000/6000 \approx 1.67$: Hannibal had about two-thirds more.
3. Totals: Rome 86000, Hannibal 50000.
4. Cavalry share: Rome $6000/86000 \approx 7\%$; Hannibal $10000/50000 = 20\%$.

Answer: Rome had twice the infantry; Hannibal had 1.67 times the cavalry and a much larger cavalry share (20% against 7%). Hannibal built his plan around the arm in which he was superior, and accepted inferiority where it could be made harmless.

Example 2. Suppose (illustrative) the Roman heavy infantry numbered 55,000 and stood on a front of 1.6 km, allowing about 1 m of frontage per man in each rank. About how many ranks deep was the formation? Compare with a normal depth of about 8–10 ranks.

Show solution

1. Men per rank: $1600 \text{ m} \div 1 \text{ m} = 1600$.
2. Ranks: $55000/1600 \approx 34$.
3. Ratio to normal: $34/10 \approx 3.4$ times deeper than usual.

Answer: About 34 ranks, more than three times the usual depth (illustrative figures; Polybius says only that the maniples were much deeper than their front). Only the front ranks could fight. The rest added weight for pushing but could not reach the enemy, and when the flanks were attacked they were packed too tightly to turn.

Example 3. Apply Lanchester's linear law (Lesson 1.5) to the infantry fight if only the men in contact can fight. If Hannibal's envelopment tripled the length of the Roman line in contact with his troops (front plus both flanks) without adding Roman fighters at those points, explain qualitatively how the Romans' numbers stopped helping them.

Show solution

1. Under the linear law, what matters is how many men on each side are actually in contact.
2. Once surrounded, the outer Roman ranks on three sides were in contact, but the men in the middle could not fight at all.
3. Hannibal's smaller army had nearly all its men in contact around the outside of the pocket.

Answer: Surrounding the Romans turned their numbers into a crowd that could not fight. Envelopment raises the attacker's share of men in contact and lowers the defender's, which is why a smaller force can defeat a larger one by maneuver.

PRACTICE

1. Easy When and where was Cannae fought, and who commanded each side?

Show answer

August 2, 216 BC, near Cannae in Apulia, southeastern Italy. Hannibal commanded the Carthaginians; the consuls Paullus and Varro commanded the Romans.

2. Easy Define double envelopment.

Show answer

Attacking both flanks at once so the attacking wings meet behind the enemy and surround him.

3. Easy Which arm gave Hannibal his advantage, and by how much?

Show answer

Cavalry: 10,000 against 6,000.

4. Medium Why did Hannibal place his weakest infantry in the center?

Show answer

The center was meant to give way gradually, drawing the Romans into the pocket; his best infantry was saved for the wings, where they would turn inward at the decisive moment.

5. Medium How did the Romans' deep formation help Hannibal?

Show answer

It pushed forward with great weight into the pocket, and the packed ranks could neither fight nor turn when the flanks and rear were attacked.

6. Medium What was the role of Hasdrubal's cavalry?

Show answer

It drove off the Roman cavalry by the river, rode behind the Roman army to help defeat the allied cavalry on the other wing, and then attacked the Roman infantry from the rear, closing the trap.

7. **Medium** Give a basketball example of a pocket like Cannae.

Show answer

A trapping defense lets the ball handler dribble toward the sideline or corner, then two defenders close in from both sides while others cut off passing lanes.

8. **Medium** Hannibal won Cannae but lost the war. Explain why, using the three levels of Lesson 1.1.

Show answer

Cannae was a tactical masterpiece, but Hannibal could not take Rome or make it surrender. Rome refused peace, returned to a Fabian strategy, raised new armies and attacked Carthage's bases. Tactical victory did not change the strategic balance.

9. **Hard** The total Roman force was 86,000 and the Carthaginian 50,000. Under Lanchester's square law (equal quality), which side should win and keep how many? What does the actual result tell you about the model?

Show answer

Rome: $\sqrt{86^2 - 50^2} \times 1000 = \sqrt{7396 - 2500} \times 1000 \approx 70,000$. The model predicts a large Roman victory. The real result shows that maneuver, combined arms and formation can overturn numbers; the model assumes all units fight equally, which envelopment prevented.

10. **Hard** Explain how Cannae combines several principles of war.

Show answer

Maneuver (the cavalry ride around), mass (best infantry on the wings at the decisive moment), economy of force (a thin bending center), surprise (the Romans did not see the trap), unity of command (Hannibal timed the turn), and offensive (the envelopment).

11. **Challenge** In chess, describe a “Cannae” plan in which you allow the opponent to build a big pawn center and then attack it from both sides. What must be true for this plan to work, and what is the risk?

Show answer

You develop pieces that aim at the center from the sides (bishops on long diagonals, knights and rooks) and then attack with pawn breaks on both sides of his center. It works only if your pieces are developed and ready before his center advances further; the risk is that his center rolls forward and cramps or crushes you, as the Roman infantry would have if Hannibal’s center had broken.

COMMON MISTAKES

- Thinking Hannibal’s center was his strongest part; it was deliberately the weakest.
- Forgetting the cavalry; without it the pocket would have had no back.
- Concluding that winning battles wins wars. Hannibal won at Cannae and still lost the war.

Make it a game • Pincer Beans. Your parent plays the Roman line, a row of beans advancing. You play Hannibal's line, bent forward in a crescent, with cavalry beans in reserve. Move the center back, and fold your wings around the Romans. Narrate each move aloud, naming double envelopment and combined arms. Reset and see if you can do it in fewer moves.

3.5 SCIPIO AT ZAMA: LEARNING FROM THE ENEMY

OBJECTIVES

- Describe Scipio's career from Spain to Africa and the battle of Zama (202 BC).
- Explain how Scipio answered Hannibal's elephants and three lines, and how he used cavalry and envelopment, Hannibal's own methods, to win.
- Analyse what it means to learn from an opponent, with examples from chess and sport.

Warm-up. Think of an opponent who has beaten you more than once in a game. Write one thing he does that you could learn to do yourself. Then write one way to take away his favorite move.

WATCH

Scipio's Masterpiece - Zama 202 BC - Second Punic War DOCUMENTARY

Kings and Generals • 26:38

<https://www.youtube.com/watch?v=qeAcgE3Msto>

WHEN TO WATCH

After “the story” paragraph. A full documentary of Scipio's campaign in Africa and the battle, with animated maps; watch especially for the lanes and the cavalry's return.

Note: Painted scenes of commanders and soldiers appear between the maps; no wounds are shown. The video's description lists the channel's paid memberships.

KEY TERMS

lanes

Open gaps deliberately left between units so that charging elephants could pass through without breaking the formation.

velites

Roman light infantry who skirmished in front of the main line and, at Zama, harassed the elephants and then withdrew through the lanes.

ally

A partner who fights on your side.
Scipio won the Numidian prince
Masinissa and his cavalry to Rome's
side.

adaptation

Changing one's methods in response to
an opponent's strengths, including
borrowing his best ideas.

CORE IDEAS

The story. Publius Cornelius Scipio was a young officer when Hannibal was winning his great victories in Italy; tradition says he survived Cannae. In 210 BC, at about twenty-five, he was given command in Spain, the base from which Hannibal's army drew men and money. He took New Carthage by a surprise attack across a lagoon at low water in 209 BC, and at Ilipa in 206 BC he reversed his usual deployment and enveloped a Carthaginian army. Instead of chasing Hannibal in Italy, he carried the war to Africa in 204 BC, and Carthage recalled Hannibal to defend the city. In 202 BC the two great generals met near Zama, southwest of Carthage.

The plan. Hannibal placed about eighty war elephants in front, then three lines of infantry: mercenaries first, then new Carthaginian levies, and his veterans from Italy held back in the third line. Scipio had studied him. He arranged his infantry maniples one behind another in columns, instead of in the usual checkerboard, leaving straight lanes through his army, and filled the lanes loosely with velites. When the elephants charged, trumpets and horns blared, the velites harassed them, and many elephants ran down the lanes and out the back or turned onto their own cavalry. Scipio's cavalry, including the Numidian horsemen of his ally Masinissa, drove the Carthaginian cavalry from the field and pursued it. The infantry lines met; the first two Carthaginian lines were beaten. Before facing Hannibal's veterans, Scipio reorganized his lines, moving his second and third lines out to the wings to match the length of the enemy's fresh line. The fight was hard and long, until the Roman and Numidian cavalry returned and attacked the rear of Hannibal's line. Hannibal escaped, and Carthage made peace in 201 BC.

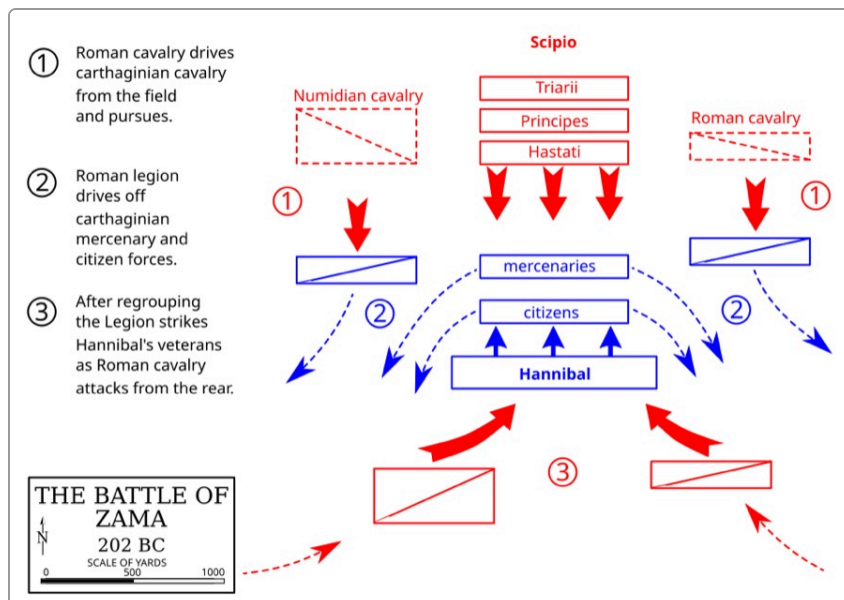
The principle. Scipio won by **learning from his enemy**. Hannibal had beaten Rome with superior cavalry and with envelopment; Scipio gained superior cavalry by winning Masinissa as an ally, and he won Zama with a cavalry attack on the rear. He studied Hannibal's strengths and designed a specific answer to each: lanes for the elephants, a disciplined reserve for the veterans. He also chose the strategic ground: by attacking Africa, he forced Hannibal to fight where Scipio wanted. Proverbs says,

“A wise man will hear, and will increase learning.” The wise strategist is not too proud to learn from the person who beat him.

On the board and the field. Chess players study the games of the players who beat them and add their opponents’ best ideas to their own repertoire. A coach who loses to a pressing team may adopt a press himself, and also design an answer to it, such as an extra ball handler or a long pass over the top. A tennis player who keeps losing to a strong serve studies return position. Learning from an opponent requires humility: admitting that he did something better. It also requires honesty: learning from what anyone can see, never from stolen signals or plans.

Think it through. Scipio did not try to beat Hannibal in the way Hannibal wanted to be fought. He changed the ground, the allies and the shape of the battle, and he answered each of Hannibal’s strengths in advance.

PICTURE STUDY



Battle of Zama, Department of History, U.S. Military Academy (redrawn), twentieth century · Map · Wikimedia Commons

Image: [Wikimedia Commons](#), public domain

This map shows Zama in three numbered stages: the Roman and Numidian cavalry drive off the Carthaginian cavalry, the Roman legion defeats Hannibal's first two lines, and the returning cavalry attacks Hannibal's veterans from the rear. It does not show the elephants or the lanes; you will add them.

Look closely

- Find the three Roman lines. What are their names?
- Count Hannibal's infantry lines. Which one holds his veterans?
- Follow the cavalry arrows marked 1 and 3. Where do they go, and when do they come back?
- Find where Hannibal's elephants would have stood. Draw them, and draw the lanes in Scipio's lines, on your own copy.

Talk about it

1. Using the map and the lesson, explain how Scipio's deployment answered each of Hannibal's strengths.
2. Compare this map with the Cannae map in Lesson 3.4. What has changed, and who has learned from whom?

3. What would you need to add to this map to show how the battle ended?

PROJECT

Answer the Opponent's Favorite Plan

You will scout a regular opponent in chess or another strategy game, identify his favorite plan, design a specific answer as Scipio did, and test it over five games. You will also replay Zama on your grid.

You will need

- A strategy game and a regular opponent
- The scorebook
- Grid, counters and dice from Lesson 3.3

Steps

1. Review at least five past games against your opponent (or play five first).
Identify his favorite plan: an opening, a kind of attack, a time-pressure habit.
2. Write down exactly how it has beaten you, with move numbers or examples.
3. Design a specific answer: a different opening, a defensive setup, a rule for yourself. Write it down before the games.
4. Also choose one of his methods that you will borrow.
5. Play five games and record them. Mark each game where his favorite plan appeared and whether your answer worked.
6. Replay Zama on your grid: elephants as counters that move three squares at once but are removed if they enter a lane; three Carthaginian lines; Roman lanes; cavalry on both wings that may return after three turns.
7. Make a table of your five games and of the grid replay results.
8. Write a one-page report: did your answer work? Did borrowing his method help? What would you change?

Tips

- Your answer should stay within the rules: study what anyone could see in the games.
- Five games are a small sample; note how confident you are in the result.

Check your work

- ☐ I identified the opponent's favorite plan with evidence from real games.
- ☐ I wrote my answer and my borrowed method before playing five recorded games.
- ☐ I replayed Zama on a grid and compared it with my games in a written report.

SCOREBOOK

1. Draw Zama in three stages: the elephant charge through the lanes, the cavalry fight on the wings, and the cavalry returning to attack Hannibal's rear.
2. Make a timeline from 218 BC (Hannibal crosses the Alps) to 201 BC (peace), with Cannae, New Carthage, Ilipa, Africa and Zama.
3. "What I would decide and why": name one opponent's idea you have been too proud to copy, and decide whether to use it.

From history. After Zama, Scipio received the name Africanus. Livy tells that Scipio and Hannibal met in person before the battle and spoke through interpreters; historians are not sure the meeting happened, but it shows how the ancients saw them: two great generals who understood each other.

WORKED EXAMPLES

Example 1. Suppose (illustrative) an elephant charges at 20 km/h and the Roman lanes are 150 m long from front to back. How long does an elephant take to pass completely through a lane? If the velites can retreat at 10 km/h, how far ahead of the elephants must they start to reach the rear first?

Show solution

1. Elephant speed: $20000/3600 \approx 5.6$ m/s; time $150/5.6 \approx 27$ s.
2. Velites: $10000/3600 \approx 2.8$ m/s. In 27 s they cover $2.8 \times 27 \approx 75$ m.
3. So they cannot outrun the elephants down the whole lane; instead they must step aside into the gaps between maniples, which is what the sources describe.

Answer: About 27 seconds to pass through. The light troops could not simply run ahead; the plan worked because they could step aside and let the elephants pass. A good plan fits the real speeds of each piece.

Example 2. Make a table matching each of Hannibal's strengths with Scipio's answer.

Show solution

1. Elephants → lanes through the army, trumpets to frighten them, velites to harass and then step aside.
2. Superior cavalry (Hannibal's advantage in Italy) → Scipio's alliance with Masinissa gave Rome the stronger cavalry at Zama.
3. Envelopment → Scipio's own cavalry returned to attack the rear.
4. Veterans held in reserve → Scipio re-formed his lines to match their length and kept his own discipline.

Answer: Every major strength of Hannibal had a prepared answer, and two of the answers (cavalry superiority and envelopment) were Hannibal's own methods turned against him.

Example 3. Put these events in order with dates: Cannae; Scipio takes New Carthage; Ilipa; Scipio lands in Africa; Zama; peace between Rome and Carthage. How many years passed from Cannae to Zama?

Show solution

1. Cannae, 216 BC; New Carthage, 209 BC; Ilipa, 206 BC; landing in Africa, 204 BC; Zama, 202 BC; peace, 201 BC.
2. With BC dates, earlier events have larger numbers: $216 - 202 = 14$.

Answer: Fourteen years from Cannae to Zama. Rome lost the great battle but kept the strategy and the will to continue, and in that time it produced a general who had learned from Hannibal.

PRACTICE

1. Easy When was Zama fought, and who commanded each side?

Show answer

202 BC; Scipio for Rome, Hannibal for Carthage.

2. Easy How did Scipio deal with Hannibal's elephants?

Show answer

He left lanes through his formation, used trumpets and horns to frighten them, and had velites harass them and step aside so they passed through or turned back.

3. Easy Who was Masinissa?

Show answer

A Numidian prince who allied with Rome and brought cavalry that gave Scipio superiority on the wings at Zama.

4. Medium How did Scipio force Hannibal to fight in Africa?

Show answer

He invaded Africa in 204 BC and threatened Carthage, which recalled Hannibal from Italy to defend the city.

5. Medium Name two of Hannibal's own methods that Scipio used against him.

Show answer

Superior cavalry and the attack on the enemy's rear (envelopment).

6. Medium Why did Hannibal keep his veterans in the third line?

Show answer

As a reserve: fresh, experienced troops to meet the Romans after they had been tired by fighting the first two lines.

7. Medium How many years passed between Ilipa (206 BC) and Zama (202 BC)?

Show answer

$206 - 202 = 4$ years.

8. Medium Give an example from chess or sport of learning from an opponent honestly.

Show answer

Sample: a chess player adds an opening he lost against to his own repertoire after studying it; a coach adopts the pressing defense that beat his team, having watched game film.

9. **Hard** Compare Cannae and Zama: in each battle, which side had superior cavalry, and how did that decide the result?

Show answer

At Cannae Hannibal had superior cavalry (10,000 to 6,000) and used it to drive off the Roman horse and attack the rear. At Zama, Scipio, with Masinissa, had superior cavalry and used it in the same way. In both, the side that won the cavalry fight closed the back of the trap.

10. **Hard** Why is learning from an opponent harder than learning from a teacher?

Show answer

It requires admitting that someone you were trying to beat did something better, which wounds our vanity. It also requires careful study of his methods under the pressure of competition, rather than receiving explanations.

11. **Challenge** Write a short “Scipio plan” for a game you play: list your opponent’s three main strengths and a specific, honest answer to each, and name one of his methods you will adopt.

Show answer

Answers will vary. A full answer names three real strengths, gives a specific, rule-abiding answer to each (as Scipio’s lanes answered the elephants), and identifies one method to borrow.

COMMON MISTAKES

- Thinking Scipio simply had more men. His victory came from preparation, alliance and adaptation.
- Confusing Zama with Cannae because both ended with an attack from the rear; the difference is who had learned the lesson.
- Confusing learning from an opponent with stealing his secrets.

Make it a game • Favorite Plan Counter. Play four games of tic-tac-toe. Your parent secretly decides a favorite opening plan. After each game, name the pattern you saw and adjust your response. Count how many games you win or draw by the third and fourth round. Explain how Scipio used the lanes and the velites at Zama to answer Hannibal's elephants and favorite plan.

Scripture. “A wise man will hear, and will increase learning; and a man of understanding shall attain unto wise counsels:” (Proverbs 1:5, KJV)

Scipio heard, even from his enemy, and increased his learning. Vanity refuses to learn from those who have beaten us; wisdom does not.

UNIT 3

GREAT PLANS OF THE ANCIENT AND BIBLICAL WORLD

The oldest written plans of battle come from Scripture and from the historians of Greece and Rome. This unit studies five of them: Gideon's night attack with three hundred men, Joshua's ambush at Ai after a painful defeat, Alexander's oblique advance at Gaugamela, Hannibal's double envelopment at Cannae, and Scipio's victory at Zama, won by learning from the very man he defeated. Each is a lesson in maneuver, terrain, timing and leadership, and each is still taught at military academies.

The Bible battles are taught as history from the text itself, read closely, with the text's own emphasis: the victory belongs to the Lord, and the people are not to boast in their numbers. The classical battles are taught from the ancient historians, chiefly Polybius, Livy and Arrian, with modern maps. You will draw every battle as a map in your scorebook, replay it on a grid with counters, and compute real quantities: ratios of forces, frontages and depths, marching times and distances. No lesson dwells on the fighting itself; every lesson asks how the plan worked.

PREREQUISITES

- The principles of war (Lesson 1.2), especially mass, maneuver, surprise and security
- Lanchester's laws and counting the cost (Lesson 1.5)
- Rates, ratios and percents

MASTERY CHECKLIST

- ☐ I can retell Gideon's night attack from Judges 7, identify its principles, and explain why the text says the army was made smaller.
- ☐ I can explain Joshua's ambush at Ai as a feigned retreat that used the enemy's overconfidence, and why the first attack failed.
- ☐ I can draw the oblique advance at Gaugamela and explain how Alexander created a gap in the Persian line.
- ☐ I can draw the double envelopment at Cannae and explain how Hannibal used the Romans' strength against them.
- ☐ I can explain how Scipio at Zama answered Hannibal's elephants and used Hannibal's own methods to defeat him.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **Polybius, The Histories (Project Gutenberg)**: Free. E. S. Shuckburgh's translation. Book III contains the eyewitness-era account of Cannae used in Lesson 3.4. Ages 14+ with a parent previewing.
- **Arrian, The Anabasis of Alexander (Project Gutenberg)**: Free. The main ancient account of Gaugamela for Lesson 3.3 (Book III). Ages 14+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

3.1 Gideon's Three Hundred

3 sessions of 50 minutes

3.2 Joshua's Ambush at Ai

3 sessions of 50 minutes

3.3 Alexander at Gaugamela: The Oblique Attack

3 sessions of 50 minutes

3.4 Hannibal at Cannae: The Double Envelopment

3 sessions of 50 minutes

3.5 Scipio at Zama: Learning from the Enemy

3 sessions of 50 minutes

UNIT 3 TEST

Calculators are allowed. Show your work for every calculation. For each battle question, answer from the text of Scripture or the ancient historians as taught in the lessons, and draw a sketch map where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. (7 pts)

Gideon's army went from 32,000 to 10,000 to 300. What percent of the original army remained, and what reason does Judges 7:2 give?

2. (6 pts)

Describe Gideon's plan of attack: equipment, timing, positions and signal.

3. (6 pts)

Name three principles of war in Gideon's plan and the evidence for each.

4. (7 pts)

Why did the first attack on Ai fail, according to the text, and what did the second plan use from the first defeat?

5. (7 pts)

An ambush lies 1.2 km from a gate; the enemy is drawn 2.4 km away. Both move at 6 km/h. How many minutes does the ambush have in hand after the signal?

6. (6 pts)

Define the oblique attack and explain how Alexander used it at Gaugamela.

7. **8 pts**
A 5 km Macedonian line faces a 7 km Persian line, centered together. Find the overlap on each side, and after Alexander shifts 1 km to his right.
8. **6 pts**
Using Polybius's figures, compute the Roman and Carthaginian totals at Cannae and each side's cavalry share.
9. **7 pts**
Draw a sketch of Cannae at its decisive moment and label the Roman infantry, the crescent, the African infantry and the cavalry.
10. **6 pts**
Explain how Hannibal used the Romans' strength against them.
11. **6 pts**
Hannibal won Cannae but lost the war. Explain using the three levels of strategy, operations and tactics.
12. **6 pts**
List Scipio's answers to Hannibal's elephants, cavalry and veterans at Zama.
13. **5 pts**
Put in order with dates: Zama, Cannae, Ilipa, New Carthage. How many years from Cannae to Zama?
14. **5 pts**
An elephant charges at 18 km/h down a 120 m lane. How many seconds does it take to pass through?
15. **12 pts**
Short essay (8–10 sentences): Compare one battle from Scripture and one classical battle from this unit. What principle do they share? How does the biblical text's emphasis differ from the classical historians'?

ANSWER KEY

1. $300/32000 \approx 0.94\%$. So that Israel could not boast that its own hand had saved it.
2. Three companies of 100, each man with a trumpet, an empty pitcher and a lamp inside; at the beginning of the middle watch; standing around the camp on three sides; blowing trumpets, breaking pitchers and shouting at Gideon's signal, "Look on me, and do likewise."
3. Sample: intelligence/reconnaissance (the night visit to the camp), surprise (night, change of watch), deception (300 trumpets and lights), simplicity (one rule), economy of force (stood in place).
4. Achan's sin; the Lord was not with Israel, and a small, confident force was sent. The second plan used the enemy's memory of the first battle: a feigned retreat that the men of Ai believed was real (8:6).
5. Ambush $1.2/6 \text{ h} = 12 \text{ min}$; enemy $2.4/6 \text{ h} = 24 \text{ min}$. 12 minutes in hand.
6. Advancing at an angle so one strong wing engages first and the other is held back. Alexander moved right with the Companions; the Persian left stretched to follow, opening a gap he attacked with a wedge toward Darius, while Parmenion held the refused left and a second line guarded the rear.
7. 1 km each side at first; after the shift, 0 km on the right and 2 km on the left.
8. Rome 86,000, cavalry 6000/ $86000 \approx 7\%$; Hannibal 50,000, cavalry $10000/50000 = 20\%$.
9. A full-credit sketch shows the Roman block pushed deep into a concave Carthaginian center, African infantry turned inward on both flanks, and cavalry closing the rear.
10. Their deep formation and forward push, meant to break his center, carried them into the pocket, where their packed ranks could not fight or turn when attacked on the flanks and rear.
11. Cannae was a tactical triumph, but Rome refused peace, kept its strategy and resources, returned to a Fabian approach and finally attacked Africa; tactics did not change the strategic balance.
12. Elephants: lanes, trumpets and velites. Cavalry: alliance with Masinissa gave Rome superior cavalry. Veterans: Scipio re-formed his lines to match theirs, and his returning cavalry attacked their rear.
13. Cannae 216 BC, New Carthage 209 BC, Ilipa 206 BC, Zama 202 BC. Fourteen years.
14. $18000/3600 = 5 \text{ m/s}$; $120/5 = 24 \text{ s}$.

15. Answers will vary. A full-credit essay accurately describes both plans, names a shared principle (for example, surprise, deception or using the enemy's expectations), and explains that the biblical text emphasizes the Lord's deliverance and the people's obedience or humility, while the classical historians emphasize the general's skill.

PORTFOLIO PIECE: BATTLE ATLAS, PART 1

Make a five-page battle atlas, one page for each battle in this unit. Each page has (1) a clear map drawn in your own hand, with a north arrow, a scale bar (approximate), terrain, both sides in different colors, and numbered arrows for the stages; (2) a one-paragraph summary of the plan; (3) a box naming the two or three principles of war that decided the battle; (4) one calculation from the lesson, worked out; and (5) one sentence connecting the battle to a game or sport. For the two biblical battles, include the chapter and verse for each stage of the map.

LOOK FOR	WHAT IT MEANS
Maps	Each map is clear, accurate to the sources, labeled, and shows the stages in order.
Plans and principles	Each summary explains the plan correctly, and the principles named are supported by the map.
Sources and Scripture	Biblical stages are tied to verses; classical numbers are attributed to the historian and treated with appropriate caution.
Calculations and connections	Each page has a correct, worked calculation and a thoughtful connection to a game or sport.

UNIT 4

GENERALS AND ADMIRALS, 1776–1944

This unit follows five commanders who changed a war with a plan: George Washington at Trenton, Napoleon at Austerlitz, Horatio Nelson at Trafalgar, Thomas J. “Stonewall” Jackson in the Shenandoah Valley, and the codebreakers and deceivers behind Midway and D-Day. Each plan turned on one idea from Unit 1: surprise and morale, a weakness shown on purpose, shared intent among captains, speed on interior lines, and the use of information.

As in Unit 3, the history is about maneuver, terrain, timing, supply, intelligence and leadership. Casualty numbers appear only where the story needs them, plainly. You will compute march rates, crossing delays, closing speeds and the odds behind an intelligence test, and you will replay each plan on a map or a board. The last lesson is the course’s one lesson on the world wars, and it studies only how intelligence and deception shaped the plans.

PREREQUISITES

- The principles of war (Lesson 1.2), friction (Lesson 1.4) and counting the cost (Lesson 1.5)
- Reading and drawing battle maps (Unit 3)
- Rates, unit conversions and simple probability

MASTERY CHECKLIST

- ☐ I can explain how Washington's crossing and attack at Trenton used surprise and restored morale, and how friction nearly ruined the plan.
- ☐ I can explain Napoleon's feigned weakness at Austerlitz and compute Davout's march rate.
- ☐ I can explain Nelson's plan at Trafalgar and why his shared intent let captains act without signals.
- ☐ I can explain interior lines and why Jackson's marches let a small army defeat larger forces one at a time.
- ☐ I can explain how the Midway "water" test and Operation Fortitude used information, and reason about evidence and deception.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **American Battlefield Trust battle maps**: Free. Clear historical maps of Revolutionary War and Civil War battles and campaigns, including Trenton and the Shenandoah Valley, for Lessons 4.1 and 4.4. Ages 12+.
- **Washington Crossing Historic Park**: Free information on the crossing site in Pennsylvania; families near the Delaware can visit the reenactment held each December. Fits Lesson 4.1. All ages.
- **Naval History and Heritage Command: Battle of Midway**: Free. The U.S. Navy's official history pages, with documents and photographs on the intelligence before Midway, for Lesson 4.5. Ages 13+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

4.1	Washington at Trenton: Surprise and Morale	3 sessions of 50 minutes
4.2	Napoleon at Austerlitz: The Feigned Weakness	3 sessions of 50 minutes
4.3	Nelson at Trafalgar: Breaking the Line	3 sessions of 50 minutes
4.4	Jackson's Valley Campaign: Maneuver and Interior Lines	3 sessions of 50 minutes
4.5	Deception and Intelligence: Midway and Operation Fortitude	3 sessions of 50 minutes

UNIT 4 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with units and a sentence explaining what it means. Draw sketch maps where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **6 pts**
Why was Trenton so important even though it was a small battle?
2. **6 pts**
The army marched about 9 miles from about 4 a.m. to 8 a.m. Find its average speed, and name two causes of the slow pace.
3. **6 pts**
Name three sources of friction in the Trenton plan and Washington's decision when they struck.
4. **7 pts**
Explain Napoleon's feigned weakness at Austerlitz: what did he show, what did he hope the Allies would do, and what actually happened?

5. (7 pts)

Davout's men marched about 110 km in about 48 hours. Find km per day and compare with a normal 25 km march.

6. (6 pts)

Describe Nelson's plan at Trafalgar and the risk it accepted.

7. (7 pts)

If 27 British ships engaged 22 enemy ships after cutting off 11, find the local ratio and the square-law strength ratio.

8. (6 pts)

Quote or paraphrase Nelson's instruction for captains who could not see signals, and explain why it mattered.

9. (6 pts)

Convert 1.5 knots to km/h and find the time to cover 2.5 km.

10. (7 pts)

Define interior lines and explain how Jackson used them in 1862.

11. (6 pts)

646 miles in 48 days: find the average per day. Why is the true marching rate higher?

12. (6 pts)

Describe the water test before Midway and explain why it was a good test.

13. (7 pts)

Starting belief 70% that AF is Midway; the report would follow with probability 0.9 if true and 0.05 if false. Find the updated probability.

14. (7 pts)

Why did Fortitude's many agreeing reports mislead the Germans? Use the idea of independence.

15. **10 pts**

Short essay (8–10 sentences): Choose two commanders from this unit. Compare how each used one principle of war (for example, surprise, mass, maneuver or shared intent) and how each dealt with friction or risk. End with one lesson for a team or game you know.

ANSWER KEY

1. It restored the army's and the country's morale at the darkest moment, persuaded many soldiers to stay beyond their enlistments, and led to further success at Princeton.
2. $9/4 = 2.25$ mph. Darkness, sleet and snow, icy roads, artillery, exhaustion.
3. River ice, the storm, a three-hour crossing delay, and two supporting forces that could not cross. He decided to go on because surprise was still possible.
4. He asked for talks, gave up the Pratzen Heights and left his right wing weak. He hoped the Allies would leave the heights to attack his right and cut the Vienna road. They did; Soult's corps, hidden by fog, seized the emptied center, Davout held the right, and the Allied army was split.
5. 55 km per day, about 2.2 times a normal march.
6. Two columns sailing straight at the enemy line to cut it and overwhelm the center and rear before the van could return. The risk: a slow approach under fire before the leading ships could reply.
7. $27/22 \approx 1.23$; $1.23^2 \approx 1.51$.
8. No captain can do very wrong if he places his ship alongside an enemy. It gave a simple default rule that let captains act in the spirit of the plan when smoke and confusion hid signals: shared intent.
9. $1.5 \times 1.852 = 2.778$ km/h; $2.5/2.778 \approx 0.9$ h $\approx$ 54 min.
10. Shorter routes between one's own forces than the enemy has. Standing between separated Union forces, Jackson moved fast through the Valley's gaps to concentrate against each in turn and defeat them one at a time.
11. $646/48 \approx 13.5$ miles per day. Some days were spent fighting or resting, so marching days averaged more.
12. Midway reported by secure cable, then in plain language, that its water plant had failed; a Japanese message then said AF was short of water. It was a good test because the response would occur only if AF was Midway, sharply separating the hypotheses.
13. $0.9(0.7) = 0.63$; $0.05(0.3) = 0.015$; $0.63/0.645 \approx 0.977$.
14. The Germans treated agreement among many sources as strong proof, as if each were independent. But all the sources were controlled by the Allies, so their agreement added no real evidence.

15. Answers will vary. A full-credit essay accurately describes both plans, names and explains the principle, discusses friction or risk specifically, and draws a sensible, honest lesson for a game or sport.

PORTFOLIO PIECE: BATTLE ATLAS, PART 2

Add five pages to your battle atlas, one for each lesson in this unit, in the same format as Part 1: a hand-drawn map with north arrow, approximate scale, terrain, both sides in color and numbered stages; a paragraph on the plan; a box naming the decisive principles; one worked calculation; and one connection to a game or sport. Then write a one-page comparison of Gaugamela or Cannae (Unit 3) with one battle from this unit, showing one principle that appears in both and one way the later commander faced a problem the earlier one did not.

LOOK FOR	WHAT IT MEANS
Maps	Each map is clear, accurate and labeled, and shows the stages of the plan in order.
Plans and principles	Each summary explains the plan correctly, and the principles are supported by evidence on the map.
Calculations	Each page has a correct, clearly worked calculation tied to a decision.
Comparison	The comparison page finds a real shared principle and a real difference, with specific evidence from both battles.

4.1 WASHINGTON AT TRENTON: SURPRISE AND MORALE

OBJECTIVES

- Describe the situation of the Continental Army in December 1776 and Washington’s plan to cross the Delaware and attack Trenton.
- Explain how surprise and morale decided the battle, and how friction nearly ruined the plan.
- Compute march rates and delays from the timeline, and connect the idea of a morale-changing victory to sport.

Warm-up. Your team has lost six games in a row, and half the players are thinking of quitting at the end of the month. Write what kind of game you would want to play next: a safe one you could probably win, or a bold one against a strong opponent that everyone would remember? Explain in two sentences.

WATCH

Washington's Crossing of the Delaware River: The Revolutionary War in Four Minutes

American Battlefield Trust • 4:16

https://www.youtube.com/watch?v=6M5sYsiVG_Q

WHEN TO WATCH

After “the story” paragraph. A historian at the crossing site explains the plan and its problems with maps and paintings; listen for the three crossings and why two failed.

BACKUP VIDEO

Washington Crosses the Delaware River and the Battle of Trenton | The American Revolution | PBS

PBS • 7:05

<https://www.youtube.com/watch?v=1FUcVUhDjSE>

Optional, after the lesson. A short, dramatic retelling of the crossing and attack, told with paintings, maps and Paine’s words.

KEY TERMS

morale

The confidence and will of a group to keep going. It can matter as much as numbers or equipment.

surprise

Acting at a time, place or manner the enemy does not expect, so that he cannot prepare.

converging columns

Separate forces moving by different routes to arrive at the same objective at the same time.

enlistment

The term for which a soldier had agreed to serve. Many Continental soldiers' enlistments ended on December 31, 1776.

CORE IDEAS

The story. In the autumn of 1776 the Continental Army had been driven out of New York and chased across New Jersey into Pennsylvania. By December George Washington had only a few thousand men fit for duty, many without shoes, and most of their enlistments would expire on December 31. Across the Delaware River, the town of Trenton was held by about 1,500 Hessian soldiers, German troops serving the British, under Colonel Johann Rall. Thomas Paine's pamphlet *The American Crisis*, which began "These are the times that try men's souls," had just been printed, and Washington had it read to his men.

The plan. Washington planned to cross the river on Christmas night with about 2,400 men at McConkey's Ferry, nine miles north of Trenton, while two other forces crossed farther south to block the Hessians' escape and keep the British posts busy. The army would land by midnight, march through the dark in two columns, one by the river road and one by the Pennington road, and attack the town from two sides at dawn. The password was "Victory or Death." Friction attacked the plan at once: ice floes and a storm of sleet and snow slowed the boats, the crossing was not finished until about 3 a.m., and the two southern forces could not get across at all. Washington decided to go on anyway. His columns reached Trenton around 8 a.m. on December 26 and arrived almost together. The Hessians, caught by surprise, tried to form in the streets under artillery fire from the heads of the streets and were surrounded. In about an hour about 900 surrendered; Rall was mortally wounded. American losses were very light.

The principle. Trenton was small as battles go, but its effect was large, because its real objective was **morale**. A victory at the darkest moment persuaded many soldiers to stay beyond their enlistments and gave the cause new life; a week later Washington struck again at Princeton on January 3, 1777. The plan used **surprise** (the Hessians did not expect an attack in such weather), **mass** (two columns converging on one town), and the **offensive**. It also shows how a commander handles friction: when the timetable failed and two of three forces could not cross, Washington judged that the most important element, surprise, was still possible, and he kept going. Afterward he ordered that the Hessian prisoners be treated humanely.

On the board and the field. Teams talk about a “statement win”: a victory that changes how a team sees itself. A chess player in a slump might choose an aggressive opening he knows well to regain confidence. A coach may call a bold play early in a big game to signal belief to his own players. But Trenton also warns against confusing boldness with recklessness: Washington’s risk was calculated. The target was isolated, the weather that hurt his march also hid it, and his forces would be concentrated against a smaller garrison.

Think it through. The weather was both an enemy and an ally. Friction slowed the crossing, but the same storm kept the Hessians indoors and their patrols careless. Wise commanders ask how each condition affects both sides.

PICTURE STUDY



Washington Crossing the Delaware, Emanuel Leutze, 1851 · Oil on canvas · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Emanuel Leutze painted this famous scene seventy-five years after the crossing. It is not accurate in every detail: the crossing was made at night in a storm, the boats were large flat-bottomed ferries, and this flag was not yet in use. But Leutze wanted to paint what the crossing meant: a determined leader and a mixed band of men pushing through the ice toward a desperate chance.

Look closely

- Find Washington. Where is he looking, and how is he standing?
- Look at the men in the boat. How many different kinds of people and clothing can you find?
- Look at the ice and the water. What is each man doing to keep the boat moving?
- Compare the light in the painting with what you know about the real crossing (night, sleet, snow).

Talk about it

1. Leutze changed some facts to show the meaning. What meaning do you see in this painting?
2. How does the painting show morale? Point to specific details.

3. If you painted the crossing accurately, what would be different, and what would the picture lose or gain?

PROJECT

Timeline and Friction Log

You will build an hour-by-hour timeline of the Trenton plan as intended and as it happened, then run your own small “crossing” exercise at home with a deadline and record the friction.

You will need

- The scorebook and colored pencils
- A stopwatch
- A family task with several steps (for example, preparing a meal or setting up a room) and willing helpers

Steps

1. Draw two parallel timelines from 6 p.m. on December 25 to 10 a.m. on December 26: the plan (land by midnight, march, attack before dawn) and what happened (crossing finished about 3 a.m., march about 4 a.m., attack about 8 a.m.).
2. Mark each source of friction on the actual timeline.
3. Draw a map: McConkey’s Ferry, the two roads to Trenton, the town and the Assunpink Creek.
4. Plan a family task with at least six steps and a deadline. Write the plan with a time for each step.
5. Carry it out, timing each step, and record every delay and its cause.
6. Make a table: step, planned time, actual time, delay, cause.
7. Compute the total delay and the percent by which the task overran its plan.
8. Write a paragraph comparing your friction log with Trenton’s: what could have been foreseen, and what was pure chance?

Tips

- Do not slow down on purpose to make the data interesting; record honestly.
- If everything went perfectly, add a realistic disruption (one helper arrives late) and run it again.

Check your work

- ☐ My two timelines and map are complete and accurate.
- ☐ My friction log has at least six steps with planned and actual times.
- ☐ I compared my results with Trenton in writing.

SCOREBOOK

1. Draw the map of the crossing and the two columns converging on Trenton, with times.
2. Make a bar chart: planned and actual times for crossing complete, march start and attack.
3. “What I would decide and why”: it is 3 a.m., the crossing is three hours late, and your supporting forces have failed. Do you go on or turn back? Explain, using what you knew then, not what you know now.

KEY FORMULAS

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

From history. The ten days from December 25, 1776, to January 3, 1777, which included Trenton, a second fight at the Assunpink Creek and the victory at Princeton, are often called the “Ten Crucial Days.” The boats that carried the army were mostly Durham boats, long, shallow freight boats used on the Delaware, poled and rowed by experienced men from Massachusetts regiments of fishermen and sailors.

WORKED EXAMPLES

Example 1. The army began marching from the landing about 4 a.m. and reached Trenton, about 9 miles away, about 8 a.m. Find the average speed in miles per hour and in kilometers per hour (1 mile $\approx$ 1.609 km).

Show solution

1. Time: 4 hours.
 2. Speed: $9/4 = 2.25$ mph.
 3. In km/h: $2.25 \times 1.609 \approx 3.6$ km/h.
-

Answer: About 2.25 mph (3.6 km/h), slower than a normal walking pace of about 3 mph, which is what one would expect at night, in sleet, on icy roads, with artillery. The timeline gives a vivid picture of friction.

Example 2. Washington planned to finish the crossing by midnight; it finished about 3 a.m. If he had kept the same marching speed and the original timetable, when would he have reached Trenton? How much daylight did the delay cost him, if dawn was about 7:20 a.m.?

Show solution

1. Original: march from midnight, 4 hours, arriving about 4 a.m., more than three hours before dawn.
 2. Actual: march began about 4 a.m. (after forming up), arriving about 8 a.m., roughly 40 minutes after dawn.
 3. The delay turned a night attack into a daylight attack.
-

Answer: He would have arrived about 4 a.m. in darkness; instead he arrived about 8 a.m. in daylight. The surprise survived only because the storm and the Hessians' carelessness covered the approach. A three-hour delay is exactly the kind of friction Clausewitz described.

Example 3. About 2,400 Americans attacked about 1,500 Hessians, and about 900 Hessians surrendered. Compute the force ratio and the percent of the garrison captured.

Show solution

1. Ratio: $2400/1500 = 1.6$.

2. Captured: $900/1500 = 0.60 = 60\%$.

Answer: Washington had 1.6 times as many men at the point of attack, although his army as a whole was far weaker than the British in America. Mass at the decisive point, achieved by surprise, produced a result far larger than the numbers suggest.

PRACTICE

1. **Easy** On what night did Washington cross the Delaware, and when did he attack Trenton?

Show answer

The night of December 25–26, 1776; he attacked about 8 a.m. on December 26.

2. **Easy** Who held Trenton, and under what commander?

Show answer

About 1,500 Hessian soldiers under Colonel Johann Rall.

3. **Easy** Why was December 31, 1776, so important to Washington?

Show answer

Many of his soldiers' enlistments ended that day; he needed a victory to persuade them to stay.

4. **Medium** Name three sources of friction in the Trenton plan.

Show answer

Ice in the river, a storm of sleet and snow, a three-hour delay in the crossing, and two supporting forces that could not cross at all.

5. **Medium** Why did Washington go on even after the timetable failed?

Show answer

He judged that surprise was still possible and that the attack's purpose, a victory to restore morale, was worth the risk; turning back would have cost the army's confidence and the chance.

6. **Medium** If the army had marched at 3 mph instead of 2.25 mph, how long would 9 miles have taken?

Show answer

$9/3 = 3$ hours.

7. **Medium** Explain what a "statement win" is in sport and how Trenton was one.

Show answer

A victory that changes a team's belief in itself and others' view of it. Trenton showed the army and the country that the cause was not lost, and many soldiers stayed on.

8. **Medium** How did the two-column plan use the principle of mass?

Show answer

The columns converged on the town from two sides at the same time, concentrating force on the garrison and cutting off escape routes.

9. **Hard** Distinguish Washington's calculated boldness from recklessness, using three facts about the plan.

Show answer

The target was an isolated garrison; his attacking force outnumbered it; the bad weather hid his approach and kept the enemy indoors; and he had a line of retreat across the river. Recklessness would have attacked a strong, alert position without these advantages.

10. **Hard** How did the weather help both sides and hurt both sides?

Show answer

It hurt Washington by delaying the crossing and slowing the march; it helped him by hiding his approach and making the Hessians careless. It helped the Hessians by slowing the attack, but hurt them because they assumed no one would march in such weather.

11. **Challenge** Suppose each of three crossings had a 70% chance of succeeding on time, independently. What was the chance that all three would succeed? That at least one would? What does the actual result (one of three) suggest about planning with several parts?

Show answer

All three: $0.7^3 = 0.343$. At least one: $1 - 0.3^3 = 0.973$. A plan that needs all parts is fragile; Washington's plan survived because the main column alone could still win. Good plans are built so that the most important part can succeed by itself.

COMMON MISTAKES

- Judging Trenton by its size; its importance was its effect on morale and the war.
- Forgetting the friction; the plan nearly failed.
- Taking Leutze's painting as an exact record of the crossing.

Make it a game • Friction Cards. Write six obstacles on slips of paper, such as ice, darkness, late boats and tired troops. Your parent draws one at a time. You have twenty seconds to say how Washington would adapt his plan to cross the Delaware and reach Trenton. Name where morale, surprise and converging columns come in. A fresh answer earns a point.

4.2 NAPOLEON AT AUSTERLITZ: THE FEIGNED WEAKNESS

OBJECTIVES

- Describe the armies, the ground and Napoleon’s plan at Austerlitz (December 2, 1805).
- Explain how Napoleon showed weakness on purpose to draw the Allies into a mistake, and how Davout’s forced march made the plan possible.
- Compute march rates and timing, and connect the idea of baiting an opponent to chess and sport.

Warm-up. In a game of checkers or chess, have you ever left a piece where it looked unprotected so that your opponent would take it and walk into trouble? Write how it worked, or how you would set one up.

WATCH

Napoleonic Wars: Battle of Austerlitz 1805

Epic History · 16:47

<https://www.youtube.com/watch?v=bhQe2cjr5XQ>

WHEN TO WATCH

After “the story” paragraph. The first part covers the 1805 campaign; the battle itself, with animated maps, comes in the second half. Pause when the Allies begin leaving the Pratzen Heights.

Note: Paintings and period cartoons appear; one battle painting shows soldiers in combat at a distance.

KEY TERMS

feigned weakness

Deliberately appearing weaker than one is, in one place or overall, to tempt the opponent into an attack that serves one’s own plan.

high ground

A hill or ridge that gives observation and an advantage in defense. At Austerlitz, the Pratzen Heights in the center of the field.

forced march

A march at much more than normal speed and length to arrive in time for a battle.

corps

A large, self-contained part of an army (often 15,000–30,000 men in Napoleon's time) with its own infantry, cavalry and artillery, able to fight alone for a time.

CORE IDEAS

The story. In the autumn of 1805 Napoleon marched his Grande Armée from the English Channel to the Danube, captured an Austrian army at Ulm, and took Vienna. But a Russian army under Kutuzov, joined by the Austrians and accompanied by the Russian Tsar Alexander I and the Austrian Emperor Francis II, gathered to the north, in Moravia (in today's Czech Republic). Napoleon was far from home with a tired army of about 73,000 facing about 85,000 Allies. On December 2, 1805, exactly one year after he had been crowned emperor, he fought them near the village of Austerlitz.

The plan. Napoleon wanted the Allies to attack him, and to attack in the wrong place. In the days before, he acted as if he were nervous: he asked for talks and withdrew from the town of Austerlitz and from the Pratzen Heights, the high ground in the middle of the field. He deliberately left his right wing, in the south, thin, so that the Allies would be tempted to march down off the heights and try to turn that flank and cut his road back to Vienna. Meanwhile he called Marshal Davout's corps from Vienna; its leading divisions marched about 110 kilometers in roughly two days to reach the weak right wing just in time. On the morning of battle, as the Allied columns came down from the Pratzen to attack the south, Marshal Soult's corps, hidden in fog in the valley below, climbed the heights and seized the center the Allies had emptied. As the fog lifted, the sun shone on the heights, the "sun of Austerlitz" that Napoleon later loved to recall. The Allied army was split in two, and by evening it was beaten.

The principle. Napoleon turned Sun Tzu's advice into a battle plan: "If our force happens to be superior," Giles quotes an old commentator, "weakness may be simulated in order to lure him on." The plan worked because it fit the enemy's hopes; the Allies believed Napoleon was weak and wanted to cut him off from Vienna. It used **economy of force** (a thin right wing), **mass** (Soult's strong corps against the emptied center), **surprise** (the fog hid Soult), **maneuver** (Davout's march), and good

intelligence about what the Allies wanted. But it carried real risk: if Davout had been late, the bait would have been swallowed and the hook lost.

On the board and the field. Chess players call this a trap or a poisoned pawn: a piece that seems free to take but costs the taker more. In basketball, a defense may leave a weak shooter open on purpose and help everywhere else. In football, a defense may show a blitz and drop back into coverage. All of these work only if the bait is believable and the trap is ready in time. And all must stay within the rules: you may hide your plan from your opponent, but never deceive the officials.

The risk side. Feigned weakness can become real weakness. The bait must be strong enough to survive until the trap closes. Napoleon's right wing held only because Davout's men arrived exhausted but in time.

PICTURE STUDY



The Eve of Austerlitz, Albert Dawant, late nineteenth century · Oil on canvas · Private collection
(reproduction)

Image: [Wikimedia Commons](#), public domain

On the night before Austerlitz, Napoleon walked among his camps. Soldiers recognized him, tied straw into torches and lit them to light his way, and the whole army took up the cheer, for the next day was the anniversary of his coronation. Albert Dawant, a French painter of the late 1800s, imagined the scene: a single figure on a dark road between rows of torches.

Look closely

- Find Napoleon. How has Dawant made him stand out in the dark?
- Look at the soldiers' raised arms and torches. What does this tell you about the army's morale?
- Notice the smoke and darkness around the edges. What might the enemy, watching from the heights, have seen and concluded?

Talk about it

1. Napoleon wanted the Allies to think he was weak. Does this scene look like a weak army? How might the Allies have read the lights?
2. Why would a commander walk among his men the night before a battle?
3. Dawant painted this scene long after it happened. What do you think he wanted viewers to feel?

PROJECT

The Poisoned Pawn Experiment

You will collect, set up and test chess traps that use feigned weakness, and then replay Austerlitz on a grid with a bait-and-trap rule, recording how often the bait works.

You will need

- A chess set and an opponent
- Grid, counters and dice from Unit 3
- The scorebook

Steps

1. Find or construct three chess positions in which a piece or pawn appears free to take but taking it loses (for example, a capture that allows a fork or traps the capturing piece). Draw each and write the refutation.
2. Test each position on a family member who has not seen it: ask what he would play, and record whether he takes the bait.
3. Replay Austerlitz on a grid: the Allies place 17 counters on high ground in the center; the French place 15 counters, with only 3 on the right.
4. Rules: the Allied player rolls a die each turn; on 3–6, he must send 2 counters to attack the weak right (the bait). French reinforcements (Davout, 3 counters) arrive on the right after a number of turns you set in advance (try 2, 3 and 4).
5. When the Allied center has fewer than 8 counters, the French may attack it with their massed center.
6. Play three games for each arrival time and record who wins.
7. Make a table of results by Davout's arrival time.
8. Write a paragraph: how did the timing of the reinforcements change the outcome? What does that show about the risk of feigned weakness?

Tips

- Bait works best when it looks natural. Note what made your chess traps believable or obvious.

- Use the dice rules from Unit 3 for combat.

Check your work

- ☐ I tested three chess traps on a real opponent and recorded the results.
- ☐ I replayed Austerlitz at least nine times with three arrival times.
- ☐ I explained in writing how timing controls the risk of bait.

SCOREBOOK

1. Draw Austerlitz in two stages: the Allies descending from the Pratzen toward the French right, and Soult climbing the heights through the fog.
2. Draw Davout's route from Vienna to the battlefield with a scale bar and his march rate.
3. "What I would decide and why": you are the Allied commander and you see the French right looking weak. What would you check before attacking?

From history. Austerlitz is called the Battle of the Three Emperors, because Napoleon, Tsar Alexander I and Emperor Francis II were all present. Kutuzov, who commanded the Russian army under the Tsar's eye and had advised against attacking, is the same general who held the council at Fili in 1812 (Lesson 1.5).

WORKED EXAMPLES

Example 1. Davout's leading division marched about 110 km in about 48 hours. Find the average speed in km/h and in km per day. Compare with a normal march of about 25 km per day.

Show solution

1. $110/48 \approx 2.3$ km/h averaged over the whole two days, including rests.
2. Per day: $110/2 = 55$ km.
3. Ratio to a normal march: $55/25 = 2.2$.

Answer: About 55 km per day, more than twice a normal march. The figures are approximate, but the speed explains why so many men fell out along the road and why the arrival of those who reached the field was decisive.

Example 2. Napoleon had about 73,000 men and the Allies about 85,000. Under Lanchester's square law with equal quality, what is the ratio of their strengths? Why did Napoleon still expect to win?

Show solution

1. $(85/73)^2 = 1.164^2 \approx 1.36$.
2. The Allies were about 36% stronger by the model.
3. But the model assumes everyone fights at once. Napoleon planned to make the Allies split their army, so that much of it was marching or fighting in the south while he concentrated against the center.

Answer: About 1.36 to 1 in the Allies' favor. Napoleon expected to win by dividing them and concentrating his own force, so that at the decisive point he would be stronger. This is how maneuver overcomes numbers.

Example 3. Soult's divisions began climbing the Pratzen Heights at about 9 a.m. If they had to cover about 2 km uphill at about 3 km/h, when would they reach the top? Why did the fog matter for this timing?

Show solution

1. $2/3 \text{ h} = 40 \text{ minutes}$: about 9:40 a.m.
2. If the Allies had seen them start, they could have stopped the columns leaving the heights or turned them back.
3. The fog in the valley hid the start of the climb, so the Allies kept marching south.

Answer: About 9:40 a.m. (illustrative figures). Forty minutes is a long time to be seen; the fog turned those minutes into surprise.

PRACTICE

1. Easy When and where was Austerlitz fought?

Show answer

December 2, 1805, near Austerlitz in Moravia (today's Czech Republic).

2. Easy Which high ground did Napoleon give up before the battle?

Show answer

The Pratzen Heights.

3. Easy Whose corps made a forced march from Vienna to reinforce the right wing?

Show answer

Marshal Davout's.

4. Medium Name three things Napoleon did to appear weak.

Show answer

He asked for talks, withdrew from Austerlitz and the Pratzen Heights, and left his right wing thin.

5. Medium Why did the Allies attack the French right?

Show answer

To turn Napoleon's flank and cut his road back to Vienna, which seemed easy because the right looked weak.

6. Medium Give a chess example of feigned weakness.

Show answer

A poisoned pawn: a pawn left apparently undefended; if the opponent takes it, his queen or piece is trapped or he falls behind in development and is attacked.

7. Medium A corps marches 80 km in 36 hours. What is its average speed in km/h and km per day?

Show answer

$80/36 \approx 2.2$ km/h; $80/1.5 \approx 53$ km per day.

8. Medium What was the "sun of Austerlitz"?

Show answer

The sun that broke through the morning fog and shone on the Pratzen Heights as Soult's men seized them; Napoleon later recalled it as a sign of victory.

9. **Hard** What would probably have happened if Davout had arrived three hours late? Explain using the idea of bait.

Show answer

The weak right wing might have collapsed before Soult took the center; the Allies would have cut the Vienna road and the bait would have been taken without the trap closing. Feigned weakness would have become real weakness.

10. **Hard** Explain why Napoleon's plan fit the enemy's hopes, and why that matters for deception.

Show answer

The Allies wanted to cut Napoleon off and believed he was weak; his plan showed them exactly that. People readily believe evidence that confirms what they hope, so deception that matches the enemy's wishes is the most convincing.

11. **Challenge** Suppose the Allies sent 40,000 of their 85,000 south and Napoleon met the remaining 45,000 in the center with 50,000 (keeping the rest on the right). Using the square law with equal quality, compare strengths in the center, and say how many of Napoleon's 50,000 would remain if the fight there went to the end.

Show answer

Center: $50^2 = 2500$ vs $45^2 = 2025$: Napoleon about 1.23 times stronger.

Survivors: $\sqrt{2500 - 2025} \times 1000 = \sqrt{475} \times 1000 \approx 21,800$. By splitting the Allies, Napoleon turned an overall disadvantage into an advantage at the center. (The numbers are illustrative.)

COMMON MISTAKES

- Thinking Napoleon was actually weaker everywhere. He was slightly outnumbered overall but planned to be stronger at the decisive point.
- Forgetting Davout; without his march the bait would have failed.
- Treating deception in games as permission to break rules.

Make it a game • Fog Story Chain. Take turns adding one sentence to the story of Austerlitz, in order: the armies, the high ground of the Pratzen, Napoleon's feigned weakness, and the forced march. If your parent says the sentence contains a wrong fact, say fog and replace it. Count how many rounds you can chain without a wrong fact. Beat your own total.

4.3 NELSON AT TRAFALGAR: BREAKING THE LINE

OBJECTIVES

- Describe the fleets and Nelson’s plan at Trafalgar (October 21, 1805).
- Explain how breaking the line created local superiority, and why Nelson’s shared intent let his captains act without signals.
- Compute approach times and convert knots, and connect shared intent to teamwork in sport.

Warm-up. Ask a family member to lead you through a short task (for example, drawing a picture) by giving instructions only by hand signals. Then try again where the leader explains the goal first and then says nothing. Which way went better, and why?

WATCH

Napoleonic Wars: Battle of Trafalgar 1805 DOCUMENTARY

Kings and Generals • 11:52

<https://www.youtube.com/watch?v=sRtUrvmok-c>

WHEN TO WATCH

After “the plan” paragraph. Watch the animated map as the two British columns approach the enemy line, and count how many enemy ships are cut off.

KEY TERMS

ship of the line

A large warship with two or three decks of guns, strong enough to stand in the line of battle.

breaking the line

Sailing through the enemy’s line to cut it into parts and engage some of its ships with more ships of one’s own.

line of battle

The standard formation of sailing fleets: ships following one another in a single line so that all could fire their broadsides.

shared intent

A plan explained so thoroughly in advance that every subordinate knows what the commander wants and can act rightly when signals fail. Nelson called his method “the Nelson touch.”

knot

A speed of one nautical mile per hour,
about 1.852 km/h.

CORE IDEAS

The story. In October 1805 a combined French and Spanish fleet of 33 ships of the line under Admiral Pierre-Charles Villeneuve sailed from Cádiz in southern Spain. Vice-Admiral Horatio Nelson, with 27 British ships of the line, had been waiting for it. On the morning of October 21, off Cape Trafalgar, the two fleets came in sight of each other in a light wind and a heavy swell. Before the battle Nelson hoisted the signal “England expects that every man will do his duty.”

The plan. For a century, fleets had usually fought in two parallel lines, firing broadsides until one side drew off; such battles were seldom decisive. Nelson planned something different, and he had explained it to his captains at dinners aboard his flagship and in a memorandum dated October 9. His fleet would attack in two columns, sailing straight at the enemy line. Nelson in *Victory* would lead one column into the enemy center; Vice-Admiral Cuthbert Collingwood in *Royal Sovereign* would lead the other into the rear. The enemy line would be cut into three parts, and the British would overwhelm the rear and center before the leading enemy ships could turn back to help. Because smoke and confusion would hide signals, the memorandum added: “in case Signals can neither be seen or perfectly understood, no Captain can do very wrong if he places his Ship alongside that of an Enemy.” The approach was slow and dangerous: in the light wind, the leading British ships took a long time to close under fire without being able to reply. But once they broke through, the plan worked. About twenty enemy ships were captured or destroyed; no British ship was lost. Nelson was mortally wounded and died during the battle.

The principle. Breaking the line created **local superiority**: about two-thirds of the enemy fleet was engaged by the whole British fleet, while the enemy’s leading ships were out of the fight. Nelson accepted a calculated risk in the approach for the sake of a decisive result. But the deepest lesson is **shared intent**. Nelson’s captains knew his purpose so well that they needed few orders. Each could act on his own judgment in the smoke and still do what the admiral wanted. Later armies called this *mission command*, and it is the subject of Lesson 6.1.

On the board and the field. Great teams play this way. A basketball team that understands its coach's philosophy ("move the ball until we get a good shot") does not need a called play on every possession. A soccer team with a clear plan ("win the ball high and attack quickly") can adjust on the field without waiting for the bench. A chess player who understands the plan of an opening can find good moves when his opponent leaves the book. Coaches build shared intent with practice, film study and explanation, just as Nelson did over dinner. The goal is a team in which every player knows what the leader would want.

The risk side. Sailing straight at the enemy line exposed the leading ships to fire while they could not fire back. Nelson judged that the light wind and the enemy's gunnery made the risk acceptable for a decisive victory. It cost him his life.

PICTURE STUDY



Vice-Admiral Horatio Nelson, Arthur William Devis, about 1805–1807 · Oil on canvas · National Maritime Museum, Greenwich, London

Image: [Wikimedia Commons](#), public domain

Arthur William Devis was aboard *Victory* when the ship returned to England after Trafalgar, and he painted Nelson from studies made at that time. Nelson had lost his right arm and the sight of one eye in earlier battles. He was loved by his sailors and trusted by his captains, whom he called his “band of brothers.”

Look closely

- Look at Nelson’s face. What qualities of a leader does the painter want to show?
- Look at the hat, the epaulettes and the star. What do they tell you about his rank and honors?
- Notice where Nelson is looking. What does the direction of his gaze suggest?

Talk about it

1. Nelson’s captains acted without signals because they knew his mind. What kind of leader makes followers want to know his mind?
2. Why might a leader who had been wounded in action be trusted by his men?
3. How is building shared intent with a team different from simply giving orders?

PROJECT

Signals versus Intent

You will test Nelson's idea with a team game: in one version a leader gives every move by signal; in the other the leader explains the goal and then lets the team act. You will time and score both.

You will need

- Three to five players
- A simple team task: building a tower of cups, sorting a deck of cards by suit and number, or moving a set of objects across a room by a set route
- A stopwatch and the scorebook

Steps

1. Choose a task with a clear goal and several steps that the team must coordinate.
2. Version A (signals): the leader may only give hand signals during the task and may explain nothing beforehand. Time it and count errors.
3. Version B (intent): the leader explains the goal and the plan for two minutes before starting and then says nothing during the task. Time it and count errors.
4. Add "fog": in a second round of each version, the leader turns his back halfway through. Record what happens.
5. Repeat each version three times, changing the leader.
6. Make a table of times and errors for each version, with and without fog.
7. Draw a diagram of Trafalgar: the two British columns, the enemy line, and where it was cut.
8. Write a paragraph: which version worked better, especially under fog, and why? Connect your result to Nelson's memorandum.

Tips

- Keep the task safe and simple; the point is coordination, not speed for its own sake.
- Make sure every version has the same goal, so the comparison is fair.

Check your work

- ☐ I timed and scored at least twelve runs (two versions, with and without fog, three times each).
- ☐ My Trafalgar diagram shows the columns and the cuts.
- ☐ My paragraph connects my results to shared intent.

SCOREBOOK

1. Draw the enemy line and Nelson's two columns, with arrows showing where they cut it, and write the local ratio.
2. Make a table converting 1, 2, 3, 5 and 10 knots to km/h.
3. "What I would decide and why": you are a captain at Trafalgar, you have broken through, and you cannot see any signal. What do you do?

KEY FORMULAS

$$1 \text{ knot} = 1 \text{ nautical mile per hour} \approx 1.852 \text{ km/h}$$

From history. Trafalgar ended Napoleon's hope of invading Britain and gave the Royal Navy command of the seas for a century. *Victory* is preserved in dry dock at Portsmouth, England, and is still a commissioned ship of the Royal Navy.

WORKED EXAMPLES

Example 1. Suppose (illustrative) the leading British ship had to close the last 2 km to the enemy line under fire, moving at 1.5 knots. How many minutes did the approach take?

Show solution

1. Speed: $1.5 \times 1.852 \approx 2.78 \text{ km/h}$.
2. Time: $2/2.78 \approx 0.72 \text{ h} \approx 43 \text{ minutes}$.

Answer: About 43 minutes under fire before the ship could fire back with its broadside. The light wind made the approach slow; Nelson judged that the enemy's gunnery was not good enough to stop the columns.

Example 2. The combined fleet had 33 ships of the line in a long line. If the British cut it so that the leading 10 ships were out of the fight at first, and all 27 British ships engaged the remaining ships, find the local ratio.

Show solution

1. Enemy ships engaged: $33 - 10 = 23$.
2. Local ratio: $27 : 23 \approx 1.17 : 1$.
3. Overall ratio before the cut: $27 : 33 \approx 0.82 : 1$.
4. Under the square law, strength ratio at the point of contact: $(27/23)^2 \approx 1.38$.

Answer: Breaking the line turned an overall inferiority of about 0.82 to 1 into a local superiority of about 1.17 to 1 (about 1.38 to 1 in square-law strength). This is mass achieved by maneuver.

Example 3. Nelson's memorandum told captains that if signals could not be seen, none would "do very wrong" if he placed his ship alongside an enemy. Turn this into a decision rule and test it on three situations: (a) your ship has broken through and an enemy ship is nearby; (b) you see a signal you cannot read; (c) a friendly ship is in trouble and two enemy ships are attacking it.

Show solution

1. Rule: when in doubt, engage the nearest enemy closely.
2. (a) Engage the nearby enemy ship.
3. (b) Do not wait; follow the rule and engage.
4. (c) Placing your ship alongside one of the attackers both engages an enemy and helps the friend.

Answer: The rule gives a sensible action in every case without new orders. A good default rule, understood by everyone, is a powerful cure for the fog of war.

PRACTICE

1. Easy When was Trafalgar fought, and how many ships of the line did each side have?

Show answer

October 21, 1805; 27 British against 33 French and Spanish.

2. Easy What signal did Nelson send before the battle?

Show answer

“England expects that every man will do his duty.”

3. Easy Who led the two British columns?

Show answer

Nelson in *Victory* and Collingwood in *Royal Sovereign*.

4. Medium Why were most battles between lines of ships indecisive?

Show answer

Fleets in parallel lines exchanged fire at a distance, and the side that was losing could usually draw off; neither line was broken up or overwhelmed.

5. Medium Convert 2 knots to km/h, and find how long it takes to cover 3 km at that speed.

Show answer

$2 \times 1.852 = 3.704 \text{ km/h}$; $3/3.704 \approx 0.81 \text{ h} \approx 49 \text{ min}$.

6. Medium What is shared intent, and how did Nelson build it?

Show answer

A purpose so well understood that subordinates can act rightly without orders. Nelson explained his plan to his captains in person and in a written memorandum before the battle.

7. Medium Give a sports example of shared intent.

Show answer

A basketball team that knows its coach's principle (“attack the paint, kick out to open shooters”) can create good shots without a called play.

8. Medium What risk did the two-column approach carry?

Show answer

The leading ships were exposed to enemy broadsides during a slow approach before they could fire back.

9. **Hard** If the British had cut off 12 enemy ships instead of 10, what would the local ratio and the square-law strength ratio have been?

Show answer

Enemy engaged: 21. Ratio $27/21 \approx 1.29$; strength $1.29^2 \approx 1.65$.

10. **Hard** Why is a simple default rule (“place your ship alongside an enemy”) better than a long list of signals in a battle full of smoke?

Show answer

Signals can be hidden, misread or delayed. A simple rule that everyone understands lets each captain act at once in the spirit of the plan. It overcomes friction and the fog of war.

11. **Challenge** Write a one-sentence “default rule” for a team you play on or coach, in Nelson’s style, and test it against three situations from real games. Does it always give a sensible action? If not, improve it.

Show answer

Answers will vary. A full answer gives a clear rule (for example, “when the play breaks down, get the ball to the open teammate nearest the basket”), tests it honestly against three real situations, and revises it if one test fails.

COMMON MISTAKES

- Thinking Nelson won because he had more ships; he had fewer.
- Forgetting the slow, risky approach.
- Thinking shared intent means no planning. It means more planning beforehand, so that fewer orders are needed during the action.

Make it a game • Two-Minute Admiral. Describe Nelson's plan at Trafalgar to your parent in two minutes, while your parent draws what they hear on a sheet of paper. Use the line of battle, the two columns, and breaking the line. Compare the drawing to the plan. Each correct element on the page earns a point. Swap, and add shared intent to your explanation.

4.4 JACKSON'S VALLEY CAMPAIGN: MANEUVER AND INTERIOR LINES

OBJECTIVES

- Describe the Shenandoah Valley Campaign of 1862 and its strategic purpose.
- Explain interior lines and how speed and terrain let a smaller army defeat separated larger forces in turn.
- Compute march rates and route lengths from a map, and connect the ideas to rotation and switching in sport and chess.

Warm-up. Place three coins at the corners of a large triangle on the table and one coin in the middle. If the middle coin can move one step per turn and each corner coin can also move one step per turn, which coin can reach any other coin fastest? Count the steps.

WATCH

Stonewall Jackson's Valley Campaign of 1862

American Battlefield Trust • 8:53

<https://www.youtube.com/watch?v=2Ta4OdtuW4A>

WHEN TO WATCH

After “the story” paragraph. Historians from the American Battlefield Trust explain the campaign on the ground in the Valley, with maps.

BACKUP VIDEO

Jackson's Valley Campaign 1862

Montemayor • 8:48

<https://www.youtube.com/watch?v=wCgi9BNjj6c>

Optional, after “the plan.” An animated campaign map shows the marches between the battles; watch how the gaps in Massanutten Mountain are used.

KEY TERMS

interior lines

Shorter routes between one's own forces than the enemy has between his, usually because one stands between separated enemy forces. They let a commander shift strength faster than the enemy can.

exterior lines

Longer routes around the outside, which make it slower for separated forces to support one another.

defeat in detail

Defeating an enemy's separated parts one at a time, before they can combine.

strategic diversion

A campaign whose main purpose is to draw enemy forces away from a more important theater.

CORE IDEAS

The story. In the spring of 1862, a large Union army under George McClellan was moving up the Virginia peninsula toward Richmond, and another Union corps under Irvin McDowell was expected to march south to join it. Meanwhile three Union forces were in or near the Shenandoah Valley of Virginia, under Nathaniel Banks, John C. Frémont and James Shields, together far larger than the Confederate force there. That force, which grew to about 17,000 men, was commanded by Thomas J. Jackson, called “Stonewall” since the first battle of Bull Run. Jackson, a former professor at the Virginia Military Institute, was a devout Presbyterian who taught a Sunday school and was known for his strict discipline and his secrecy about his plans.

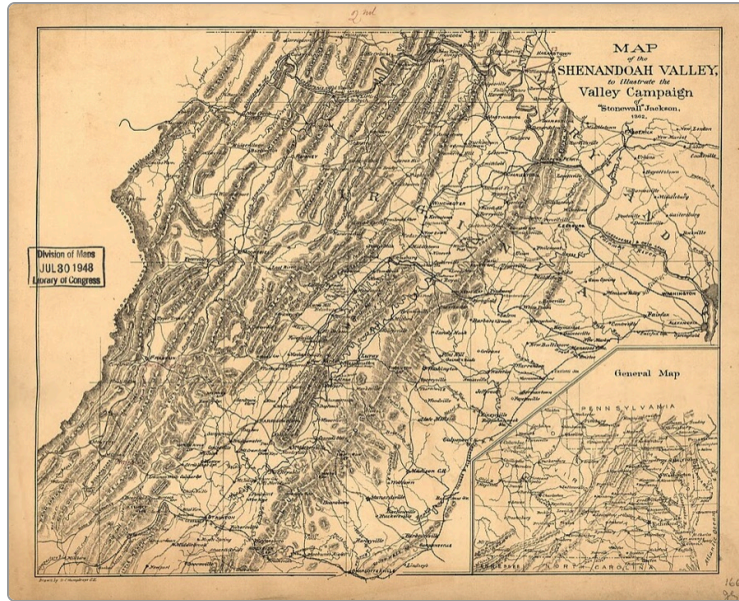
The plan. Jackson's task was a **strategic diversion**: keep the Union forces in the Valley busy and, if possible, frighten Washington into holding back troops that would otherwise reinforce McClellan. He used the Valley's shape. Massanutten Mountain splits the central Valley into two narrow valleys, with only one good road across it at New Market Gap. Jackson moved fast and in secret through the gaps, appearing where he was not expected. Between May 8 and June 9 he won at McDowell, Front Royal, First Winchester, Cross Keys and Port Republic, beating his opponents one at a time before they could combine. In the whole campaign his men marched roughly 650 miles, earning the name “foot cavalry,” and Union troops intended for McClellan were held back to guard Washington and chase Jackson.

The principle. Jackson enjoyed **interior lines**. Standing between separated enemy forces, he could march to any one of them faster than they could join each other, which let him **mass** against each in turn: **defeat in detail**. Interior lines require speed, good maps and secrecy; Jackson had all three, with the mapmaker Jedediah Hotchkiss drawing detailed maps of every road and ford. They also carry a risk: if the separated enemies move together quickly, the force in the middle can be trapped. At the end of the campaign Frémont and Shields nearly closed on Jackson from two sides, and he escaped only by beating them on successive days at Cross Keys and Port Republic.

On the board and the field. In chess, a king or queen in the center has interior lines: it can reach either side of the board faster than pieces stuck on one wing. That is why a centralized queen is so strong and why the king belongs in the center in the endgame. In basketball, a defender in the middle of a zone can help on either side faster than players on the wings can. In soccer, a central midfielder can switch the attack to either flank. Players who move quickly between positions can be in two places at once, in effect, and can outnumber the opponent at the point of the ball.

Think it through. Jackson's campaign succeeded strategically because it changed what his opponents did elsewhere. The most valuable part of a plan is sometimes its effect on decisions far away.

PICTURE STUDY



Map of the Shenandoah Valley, to Illustrate the Valley Campaign of “Stonewall” Jackson, 1862, After Jedediah Hotchkiss, late nineteenth century · Printed map · Library of Congress, Geography and Map Division

Image: [Wikimedia Commons](#), public domain

This map was drawn to illustrate Jackson’s campaign, based on the work of his mapmaker Jedediah Hotchkiss. It shows why the campaign could happen: the long Valley, the mountain ridge down its middle, the few gaps, and the roads Jackson used to move secretly between his enemies.

Look closely

- Find Massanutten Mountain in the middle of the Valley. How many gaps cross it?
- Find Front Royal, Winchester, Cross Keys and Port Republic. Trace a route between them.
- Look at the rivers. Where would bridges and fords matter most?
- Find the edges of the Valley. Where could an enemy force come in from outside?

Talk about it

1. Using the map, explain how Jackson could appear in the eastern valley while his enemies thought he was in the western one.

2. Why was a good map as valuable to Jackson as several thousand more soldiers?
3. If you were a Union commander with this map, where would you have placed your forces to deny Jackson interior lines?

PROJECT

Interior Lines Game

You will play a simple map game that tests interior lines: one player with a single fast force in the middle against two separated slower forces, and record who wins under different distances and speeds.

You will need

- A sheet of graph paper with a straight “valley road” of 20 squares and a few side roads
- Three counters: one for the middle player, two for the outside player
- Two dice and the scorebook

Steps

1. Place the middle force on square 10 with strength 6. Place the outside forces on squares 1 and 20 with strength 4 each.
2. Movement: the middle force moves 3 squares a turn; each outside force moves 2. Players move secretly by writing moves and revealing at once.
3. Combat: when forces meet on the same square, each rolls one die and adds its strength; the loser is removed. If both outside forces meet the middle force on the same turn, they add their strengths.
4. Play five games and record the winner and the turn on which the decisive fight happened.
5. Change one rule: make the outside forces move 3 squares too. Play five games and record.
6. Change again: start the outside forces on squares 5 and 15. Play five games.
7. Make a table of results for each setup.
8. Draw a sketch map of the Valley Campaign with the five battles numbered, and write a paragraph explaining when interior lines win and when they fail.

Tips

- The middle player should try to fight one outside force at a time; the outside player should try to arrive together.
- Keep a turn-by-turn record so you can see where each game was decided.

Check your work

- ☐ I played fifteen games in three setups and recorded the results.
- ☐ My table shows how speed and distance changed the outcome.
- ☐ My map and paragraph explain interior lines with evidence from my games and from 1862.

SCOREBOOK

1. Draw the Valley with Massanutten Mountain and number Jackson's five battles of May–June 1862 in order.
2. Draw a chessboard with a queen in the center and one in the corner, and count the squares each controls.
3. “What I would decide and why”: you are a Union commander with two separate forces and Jackson between you. Do you advance separately or wait to combine? Explain.

From history. Jackson was mortally wounded by mistake, by fire from his own men, at Chancellorsville in May 1863. Hotchkiss's maps survive in the Library of Congress and are still admired for their accuracy and beauty.

WORKED EXAMPLES

Example 1. Jackson's men are said to have marched about 646 miles in 48 days during the campaign. Find the average miles per day, and compare with a normal infantry march of about 12–15 miles on days when an army marched.

Show solution

1. $646/48 \approx 13.5$ miles per day averaged over all 48 days, including days of fighting and rest.
2. Since not every day was a marching day, the marching days averaged more than 13.5 miles; many were 20 miles or more.

Answer: About 13.5 miles per day on average over the whole campaign, which means many days well above a normal march. (The 646-mile figure is the one usually quoted; some historians give slightly different totals.)

Example 2. Model interior lines on a map: Jackson stands at point J. Union force A is 30 miles north of J and force B is 40 miles south of J, on the same road. (a) How far must A and B march to join each other? (b) How long does it take Jackson to reach A, defeat it in one day, and then reach B, if he marches 20 miles a day? (c) If A and B each march toward each other at 15 miles a day, how long until they meet?

Show solution

1. (a) $30 + 40 = 70$ miles between them.
2. (b) J to A: $30/20 = 1.5$ days; fight 1 day; A to B: by then B may have moved, but at most 70 miles away: $70/20 = 3.5$ days. Total at most 6 days.
3. (c) Closing speed $15 + 15 = 30$ miles a day: $70/30 \approx 2.3$ days. But they must pass through J, where Jackson stands.

Answer: The two Union forces need to march through Jackson's position to join, so they cannot combine without fighting him. Jackson can reach A in a day and a half, while A and B, separated by 70 miles, cannot support each other. This is the advantage of interior lines. (The distances are illustrative.)

Example 3. Order Jackson's battles of May–June 1862 by date, and compute the number of days between the first (McDowell, May 8) and the last (Port Republic, June 9).

Show solution

1. McDowell (May 8), Front Royal (May 23), First Winchester (May 25), Cross Keys (June 8), Port Republic (June 9).
2. Days: May 8 to May 31 is 23 days; plus 9 days of June: $23 + 9 = 32$.

Answer: Five victories in 32 days, each against a separate part of the Union forces. The tempo itself was a tool of victory: the enemy could not react before the next blow fell.

PRACTICE

1. Easy Define interior lines.

Show answer

Shorter routes between one's own forces than the enemy has between his, usually from standing between separated enemy forces.

2. Easy What was the main strategic purpose of Jackson's Valley Campaign?

Show answer

To divert and hold Union forces in and near the Valley so that they would not reinforce McClellan's attack on Richmond.

3. Easy Why were Jackson's men called "foot cavalry"?

Show answer

Because they marched so far and so fast on foot that they moved like cavalry.

4. Medium How did Massanutten Mountain help Jackson?

Show answer

It split the Valley into two parallel valleys connected by few gaps; Jackson could move through the gaps in secret and appear in either valley unexpectedly.

5. Medium What is defeat in detail? Give a sports example.

Show answer

Defeating separated parts of an enemy one at a time. Sports: overloading one side of the floor in basketball so that two attackers face one defender, then switching to the other side before the defense can rotate.

6. Medium If an army marches 22 miles a day, how many days does it need for 154 miles?

Show answer

$154/22 = 7$ days.

7. **Medium** Why is a centralized queen in chess like an army on interior lines?

Show answer

From the center it can reach either side of the board quickly, so it can join an attack or defense wherever it is needed faster than enemy pieces on the edges can.

8. **Medium** What role did Jedediah Hotchkiss play?

Show answer

He was Jackson's mapmaker, who drew detailed maps of roads, fords and gaps that made fast, secret movement possible.

9. **Hard** What is the main risk of interior lines, and how did it appear at the end of the campaign?

Show answer

The enemy forces may converge and trap the force in the middle. At the end, Frémont and Shields approached from two sides, and Jackson escaped by defeating them separately on consecutive days at Cross Keys and Port Republic.

10. **Hard** Explain how a campaign can succeed strategically even if it does not destroy the enemy.

Show answer

Its purpose may be to change the enemy's decisions elsewhere. Jackson's campaign held back Union troops from the attack on Richmond, which was its strategic objective, even though the Union forces in the Valley were not destroyed.

11. **Challenge** Two enemy forces stand 90 miles apart with you in the middle, 45 miles from each. You march 25 miles a day; they march 15 miles a day toward each other. You will march to one, fight for one day, and march back toward the other. Will you reach and defeat the first before the second arrives to help it?

Show answer

Yes. You and the first force close at $25 + 15 = 40$ miles a day, so you meet after $45/40 \approx 1.13$ days, about 28 miles from the center on its side. In that time the second force has marched about 17 miles and is also about 28 miles from the center on the other side, so it is about 56 miles from the fight. After your one-day fight it has closed only 15 more miles and is still about 41 miles away. You defeat the first force in detail before the second can help.

COMMON MISTAKES

- Thinking interior lines means fighting in the middle of the battlefield; it means having shorter routes between your forces than the enemy has.
- Forgetting the strategic purpose; the campaign mattered because of its effect on the attack on Richmond.
- Ignoring the risk of being trapped between converging enemies.

Make it a game • Shorter Road Duel. Mark three points on paper: two enemy armies and your own position between them. Measure the straight-line routes with a string. Each of you guesses which side you can reach first. Then explain interior lines and defeat in detail. Draw a second triangle with an exterior line and compare. Closest guess wins.

4.5 DECEPTION AND INTELLIGENCE: MIDWAY AND OPERATION FORTITUDE

OBJECTIVES

- Explain how U.S. Navy codebreakers identified the Japanese target before Midway (1942), including the “water” test.
- Explain how Operation Fortitude (1944) used false information to keep German forces away from Normandy.
- Reason about evidence, base rates and deception with simple probability, and apply the ideas honestly to games.

Warm-up. Play “Twenty Questions” with a family member: he thinks of an object and you ask only yes-or-no questions. Count how many questions you need. Then think: which of your questions cut the possibilities in half? Which wasted a question?

WATCH

Battle of Midway: How the US won over the Japanese Navy in World War 2 - Animated History

History on Maps · 5:45

<https://www.youtube.com/watch?v=WEkYwUWOFuo>

WHEN TO WATCH

After “the story” paragraph. A short animated overview of Midway, including the codebreaking of JN-25 and the placement of the American carriers.

Note: Simple cartoon animation shows ships hit and burning; no people are shown wounded.

BACKUP VIDEO

D-Day: The world's greatest deception operation that fooled Hitler

BFBS Forces News · 8:01

<https://www.youtube.com/watch?v=jY8uYqxvEQM>

After “the plan” paragraph, for Operation Fortitude. Historians explain the dummy equipment, false radio traffic and double agents behind the D-Day deception.

KEY TERMS

codebreaking (cryptanalysis)

Recovering the meaning of coded messages without being given the key.

intelligence

Information about the enemy, gathered, checked and interpreted to support decisions.

deception plan

A coordinated plan to make the enemy believe something false, using many sources that agree with one another.

double agent

A spy who appears to work for one side but secretly works for the other, and can pass it false information.

confirmation test

An action designed so that the enemy's reaction will confirm or refute a hypothesis.

CORE IDEAS

The story. This lesson is the course's one study of the Second World War, and it studies only how information shaped two plans. In the spring of 1942, U.S. Navy codebreakers at Pearl Harbor, in a basement office called Station HYPO under Commander Joseph Rochefort, could read parts of Japanese naval messages. They learned that a great operation was coming against a target the messages called "AF," but many in Washington thought AF might be somewhere else. Two years later, in 1944, the Allies were preparing to land in France. The Germans expected the landing and had strong forces along the coast. The question for both sides was the same: where?

The plan. Rochefort's team believed AF was Midway Island. To prove it, they arranged a test in May 1942: Midway was told by secure undersea cable to send a message in plain language reporting that its fresh-water plant had broken down. Soon a Japanese message was intercepted reporting that AF was short of water. The target was confirmed. Admiral Chester Nimitz placed his three available carriers, *Enterprise*, *Hornet* and *Yorktown* (which had been hurriedly repaired in about three days), northeast of Midway to wait. On June 4, 1942, American aircraft found and sank the four Japanese carriers of the striking force; the United States lost *Yorktown*. For Normandy, the Allies built Operation Fortitude: a fictional army group, said to be

commanded by General George Patton, was “assembled” in southeast England opposite the Pas-de-Calais, with dummy equipment, false radio traffic and reports from double agents whom the Germans trusted. When the real landing came in Normandy on June 6, 1944, the deception reported that it was only a feint, and powerful German forces were held near Calais for weeks waiting for the “main” invasion.

The principle. Both stories show that information can decide a battle. At Midway, the Americans used a **confirmation test**: they created a piece of evidence whose echo would tell them whether their hypothesis was right. In Fortitude, the Allies made sure that every source the Germans trusted told the same false story, because a deception that agrees across many sources is believed. Proverbs says, “It is the glory of God to conceal a thing: but the honour of kings is to search out a matter.” Good commanders search out the truth patiently and test their guesses; they also expect their opponent to try to deceive them, and they look for the evidence he cannot easily fake.

On the board and the field. Strong players test hypotheses about their opponents. A tennis player may hit a few balls to the opponent’s backhand early to test whether it is really weak. A chess player may make a quiet move to see how the opponent responds before committing to a plan. Football coaches watch how a defense lines up against a formation to learn its rules. Honest deception in games (a disguised serve, a hidden plan, a feint) is part of the contest. Stealing an opponent’s signals by forbidden means, or lying to officials, is not; it breaks the rules and dishonors the game.

Think it through. At Midway, a small piece of information changed the odds of the whole battle. In any contest, ask: what one fact would most change my decision, and how could I test it?

PICTURE STUDY



Commander Joseph J. Rochefort, U.S. Navy photographer, 1940s · Photograph · U.S. Navy, Naval History and Heritage Command

Image: [Wikimedia Commons](#), public domain

Joseph Rochefort led the codebreakers of Station HYPO in a windowless basement at Pearl Harbor. He and his team worked for days at a time, piecing together the meaning of fragments of messages. After the war he received little credit, but in 1986, after his death, he was awarded the Distinguished Service Medal for his work before Midway.

Look closely

- Look at Rochefort's face and expression. What qualities might a codebreaker need?
- Notice the plain uniform and setting. How is this different from the portraits of generals and admirals earlier in the unit?
- Think about the basement where he worked. What would it be like to win a battle without ever seeing it?

Talk about it

1. Why might the people who gather and interpret information be less famous than the commanders who use it?
2. Rochefort's team had to persuade skeptical superiors. How did the water test help them do it?

3. Proverbs 25:2 speaks of the honor of searching out a matter. How does Rochefort's work show that honor?

PROJECT

Hidden Information Battle

You will play a hidden-information game against a family member in which each side has a secret target and can send one “test” per game, and you will record how much the tests help. Then you will make a timeline of the two plans in this lesson.

You will need

- Two sheets of graph paper with a 6×6 grid each, and a screen (a book standing up) between the players
- Pencils and the scorebook

Steps

1. Each player secretly chooses one of four marked squares on his grid as his “base” and writes it down.
2. Each turn, a player may make one attack on a square of the opponent’s grid; the opponent answers only “hit” or “miss.”
3. Once per game, a player may send a test: he names two of the four possible base squares and the opponent must say whether the base is one of them (true answers only).
4. Play five games without using tests and five games using the test at the best moment you can find. Record the number of turns to find the base in each game.
5. Compute the average number of turns with and without the test.
6. Use probability to explain the result: how much does a test that splits four possibilities into two groups of two reduce the search?
7. Make a timeline with two rows: Midway (May–June 1942) and Fortitude (1943–June 1944), marking the key steps in each plan.
8. Write a paragraph: what made the water test and the Fortitude deception effective, and how does your game show the value of a well-designed test?

Tips

- Honest answers are a rule of this game, as in the real one: the test works only because the reply is truthful.
- If your average does not change much, look at when you used the test; timing matters.

Check your work

- ☐ I played ten games and recorded turns with and without the test.
- ☐ I explained the result with a probability argument.
- ☐ My timeline and paragraph describe both plans accurately.

SCOREBOOK

1. Draw a simple map of the central Pacific with Pearl Harbor, Midway and the approximate position of the American carriers northeast of Midway.
2. Draw a map of the English Channel showing Normandy, the Pas-de-Calais and the fictional army group in southeast England.
3. “What I would decide and why”: you suspect your opponent always starts a game the same way. Design one honest test to check before you change your plan.

KEY FORMULAS

$$P(H | E) = \frac{P(E | H) P(H)}{P(E)}$$

From history. The fictional army group of Fortitude was called the First U.S. Army Group. One of the most important double agents, a Spaniard known by the code name Garbo, had invented a whole network of imaginary sub-agents whose reports the Germans trusted; he received honors from both sides. At Midway, the codebreakers’ estimate of the date and approach was so accurate that Admiral Nimitz’s intelligence officer predicted the time and bearing of the first sighting of the Japanese carriers within minutes.

WORKED EXAMPLES

Example 1. Before the water test, suppose the codebreakers judged a 60% chance that AF was Midway and a 40% chance it was somewhere else. If AF was Midway, the Japanese would almost certainly report “AF is short of water” after the false message (say 95%). If AF was somewhere else, they would report that only by an unlikely coincidence (say 2%). After the report was intercepted, how likely was it that AF was Midway?

Show solution

1. $P(E | H)P(H) = 0.95 \times 0.60 = 0.570$.
2. $P(E | \text{not } H)P(\text{not } H) = 0.02 \times 0.40 = 0.008$.
3. $P(E) = 0.570 + 0.008 = 0.578$.
4. $P(H | E) = 0.570/0.578 \approx 0.986$.

Answer: About 98.6%. A well-designed test turned a strong suspicion into near certainty. (The starting percentages are illustrative; the logic is the one the codebreakers used.)

Example 2. In Fortitude, suppose the Germans received reports from five independent sources, each of which they believed was 70% likely to be telling the truth, and all five said the main landing would come at Calais. If the sources really were independent, what is the chance that all five were wrong? Why was this calculation misleading for the Germans?

Show solution

1. Chance a single source is wrong: 0.30.
2. All five wrong, if independent: $0.3^5 = 0.00243$, about 0.24%.
3. But the sources were not independent: the double agents were all controlled by the Allies, and the radio traffic and dummy equipment were part of the same plan.

Answer: About 0.24% if independent. The Germans reasoned as if the agreement of many sources made the story nearly certain, but the agreement was manufactured by one deceiver. The lesson: always ask whether your sources are truly independent.

Example 3. *Yorktown* was damaged in May 1942, and an early estimate suggested repairs could take about 90 days; workers at Pearl Harbor made it ready in about 3 days. What percent of the estimated time was used? Why did this matter for the odds at Midway?

Show solution

1. $3/90 \approx 0.033 = 3.3\%$.
2. Without *Yorktown*, the Americans would have had 2 carriers against the 4 of the Japanese striking force; with it, 3 against 4, plus the airfield on Midway.

Answer: About 3.3% of the estimated time. Effort and supply changed the balance of forces as much as any tactic: preparation is part of strategy.

PRACTICE

1. **Easy** What did the codebreakers call the Japanese target in the intercepted messages, and how did they confirm what it was?

Show answer

“AF.” They had Midway report by secure cable, in plain language, that its water plant had broken down; a Japanese message then reported that AF was short of water.

2. **Easy** Who led Station HYPO?

Show answer

Commander Joseph Rochefort.

3. **Easy** What was the purpose of Operation Fortitude?

Show answer

To persuade the Germans that the main Allied landing would come at the Pas-de-Calais, not Normandy, and so keep German forces away from Normandy.

4. **Medium** Name three methods used in Fortitude.

Show answer

A fictional army group under Patton; dummy equipment; false radio traffic; double agents passing false reports.

5. **Medium** What is a confirmation test? Give an example from a game.

Show answer

An action designed so the opponent's reaction shows whether a hypothesis is true. Example: in tennis, hitting several balls to the opponent's backhand early to see whether it is truly weak.

6. **Medium** Use the formula from worked example 1 with a starting belief of 50% instead of 60%. What is the probability after the report?

Show answer

$$0.95(0.5) = 0.475; 0.02(0.5) = 0.010; 0.475/0.485 \approx 0.979.$$

7. **Medium** Why does a deception that agrees across many sources work so well?

Show answer

People trust a story more when many sources agree, assuming the sources are independent. If one deceiver controls all of them, the agreement is false confidence.

8. **Medium** Explain the difference between honest deception in a game and cheating, with an example of each.

Show answer

Honest deception hides your intention within the rules (a disguised serve, a play-action fake). Cheating breaks the rules or deceives officials (stealing signals by forbidden electronic means, faking an injury to stop the clock unfairly).

9. **Hard** In Twenty Questions, if each question cuts the possibilities exactly in half, how many questions are needed to identify one object out of 1,000,000? How is a good intelligence test like a good question?

Show answer

$2^{20} = 1,048,576 \geq 1,000,000$, so 20 questions. A good test, like the water message, is designed so that its answer divides the possibilities sharply, giving the most information.

10. **Hard** How should a commander or a coach protect himself against a Fortitude-style deception?

Show answer

Check whether sources are truly independent; look for evidence the opponent cannot easily fake (supply movements, physical facts); test hypotheses actively; and keep forces flexible enough to react if the guess is wrong.

11. **Challenge** The Germans believed the main landing would be at Calais with probability 0.8 and Normandy 0.2. Then they observed a landing in Normandy. If a feint in Normandy would occur with probability 0.5 when Calais is the main target, and a Normandy landing would occur with probability 1 when Normandy is the main target, what should the Germans have concluded? What did the deception do to the first number?

Show answer

$$P(\text{Normandy main} \mid \text{landing}) = \frac{1 \times 0.2}{1 \times 0.2 + 0.5 \times 0.8} = \frac{0.2}{0.6} \approx 0.33.$$
 Even after the landing, they would still think Calais more likely (0.67). Fortitude worked by making the starting belief in Calais so high that the real landing still looked like a feint.

COMMON MISTAKES

- Thinking the codebreakers read every message completely; they read fragments and had to reason from them.
- Treating many agreeing sources as proof without asking whether they are independent.
- Using this lesson to justify dishonesty in games; deception must stay inside the rules.

Make it a game • The Water Test. Write a short message in a simple letter-shift code and your parent decodes it. Then play the Midway trick: you send a plain message saying a specific location is short of water, and your parent must notice what the reply reveals. Name the codebreakers' discovery. Swap roles. Score a point for each message correctly decoded.

Scripture. “It is the glory of God to conceal a thing: but the honour of kings is to search out a matter.” (Proverbs 25:2, KJV)

Searching out the truth patiently, testing guesses, and refusing to be fooled are honorable work. The codebreakers did it in a basement, unseen.

UNIT 4

GENERALS AND ADMIRALS, 1776–1944

This unit follows five commanders who changed a war with a plan: George Washington at Trenton, Napoleon at Austerlitz, Horatio Nelson at Trafalgar, Thomas J. “Stonewall” Jackson in the Shenandoah Valley, and the codebreakers and deceivers behind Midway and D-Day. Each plan turned on one idea from Unit 1: surprise and morale, a weakness shown on purpose, shared intent among captains, speed on interior lines, and the use of information.

As in Unit 3, the history is about maneuver, terrain, timing, supply, intelligence and leadership. Casualty numbers appear only where the story needs them, plainly. You will compute march rates, crossing delays, closing speeds and the odds behind an intelligence test, and you will replay each plan on a map or a board. The last lesson is the course’s one lesson on the world wars, and it studies only how intelligence and deception shaped the plans.

PREREQUISITES

- The principles of war (Lesson 1.2), friction (Lesson 1.4) and counting the cost (Lesson 1.5)
- Reading and drawing battle maps (Unit 3)
- Rates, unit conversions and simple probability

MASTERY CHECKLIST

- ☐ I can explain how Washington's crossing and attack at Trenton used surprise and restored morale, and how friction nearly ruined the plan.
- ☐ I can explain Napoleon's feigned weakness at Austerlitz and compute Davout's march rate.
- ☐ I can explain Nelson's plan at Trafalgar and why his shared intent let captains act without signals.
- ☐ I can explain interior lines and why Jackson's marches let a small army defeat larger forces one at a time.
- ☐ I can explain how the Midway "water" test and Operation Fortitude used information, and reason about evidence and deception.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **American Battlefield Trust battle maps**: Free. Clear historical maps of Revolutionary War and Civil War battles and campaigns, including Trenton and the Shenandoah Valley, for Lessons 4.1 and 4.4. Ages 12+.
- **Washington Crossing Historic Park**: Free information on the crossing site in Pennsylvania; families near the Delaware can visit the reenactment held each December. Fits Lesson 4.1. All ages.
- **Naval History and Heritage Command: Battle of Midway**: Free. The U.S. Navy's official history pages, with documents and photographs on the intelligence before Midway, for Lesson 4.5. Ages 13+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

4.1	Washington at Trenton: Surprise and Morale	3 sessions of 50 minutes
4.2	Napoleon at Austerlitz: The Feigned Weakness	3 sessions of 50 minutes
4.3	Nelson at Trafalgar: Breaking the Line	3 sessions of 50 minutes
4.4	Jackson's Valley Campaign: Maneuver and Interior Lines	3 sessions of 50 minutes
4.5	Deception and Intelligence: Midway and Operation Fortitude	3 sessions of 50 minutes

UNIT 4 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with units and a sentence explaining what it means. Draw sketch maps where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **6 pts**
Why was Trenton so important even though it was a small battle?
2. **6 pts**
The army marched about 9 miles from about 4 a.m. to 8 a.m. Find its average speed, and name two causes of the slow pace.
3. **6 pts**
Name three sources of friction in the Trenton plan and Washington's decision when they struck.
4. **7 pts**
Explain Napoleon's feigned weakness at Austerlitz: what did he show, what did he hope the Allies would do, and what actually happened?

5. (7 pts)

Davout's men marched about 110 km in about 48 hours. Find km per day and compare with a normal 25 km march.

6. (6 pts)

Describe Nelson's plan at Trafalgar and the risk it accepted.

7. (7 pts)

If 27 British ships engaged 22 enemy ships after cutting off 11, find the local ratio and the square-law strength ratio.

8. (6 pts)

Quote or paraphrase Nelson's instruction for captains who could not see signals, and explain why it mattered.

9. (6 pts)

Convert 1.5 knots to km/h and find the time to cover 2.5 km.

10. (7 pts)

Define interior lines and explain how Jackson used them in 1862.

11. (6 pts)

646 miles in 48 days: find the average per day. Why is the true marching rate higher?

12. (6 pts)

Describe the water test before Midway and explain why it was a good test.

13. (7 pts)

Starting belief 70% that AF is Midway; the report would follow with probability 0.9 if true and 0.05 if false. Find the updated probability.

14. (7 pts)

Why did Fortitude's many agreeing reports mislead the Germans? Use the idea of independence.

15. **10 pts**

Short essay (8–10 sentences): Choose two commanders from this unit. Compare how each used one principle of war (for example, surprise, mass, maneuver or shared intent) and how each dealt with friction or risk. End with one lesson for a team or game you know.

ANSWER KEY

1. It restored the army's and the country's morale at the darkest moment, persuaded many soldiers to stay beyond their enlistments, and led to further success at Princeton.
2. $9/4 = 2.25$ mph. Darkness, sleet and snow, icy roads, artillery, exhaustion.
3. River ice, the storm, a three-hour crossing delay, and two supporting forces that could not cross. He decided to go on because surprise was still possible.
4. He asked for talks, gave up the Pratzen Heights and left his right wing weak. He hoped the Allies would leave the heights to attack his right and cut the Vienna road. They did; Soult's corps, hidden by fog, seized the emptied center, Davout held the right, and the Allied army was split.
5. 55 km per day, about 2.2 times a normal march.
6. Two columns sailing straight at the enemy line to cut it and overwhelm the center and rear before the van could return. The risk: a slow approach under fire before the leading ships could reply.
7. $27/22 \approx 1.23$; $1.23^2 \approx 1.51$.
8. No captain can do very wrong if he places his ship alongside an enemy. It gave a simple default rule that let captains act in the spirit of the plan when smoke and confusion hid signals: shared intent.
9. $1.5 \times 1.852 = 2.778$ km/h; $2.5/2.778 \approx 0.9$ h $\approx$ 54 min.
10. Shorter routes between one's own forces than the enemy has. Standing between separated Union forces, Jackson moved fast through the Valley's gaps to concentrate against each in turn and defeat them one at a time.
11. $646/48 \approx 13.5$ miles per day. Some days were spent fighting or resting, so marching days averaged more.
12. Midway reported by secure cable, then in plain language, that its water plant had failed; a Japanese message then said AF was short of water. It was a good test because the response would occur only if AF was Midway, sharply separating the hypotheses.
13. $0.9(0.7) = 0.63$; $0.05(0.3) = 0.015$; $0.63/0.645 \approx 0.977$.
14. The Germans treated agreement among many sources as strong proof, as if each were independent. But all the sources were controlled by the Allies, so their agreement added no real evidence.

15. Answers will vary. A full-credit essay accurately describes both plans, names and explains the principle, discusses friction or risk specifically, and draws a sensible, honest lesson for a game or sport.

PORTFOLIO PIECE: BATTLE ATLAS, PART 2

Add five pages to your battle atlas, one for each lesson in this unit, in the same format as Part 1: a hand-drawn map with north arrow, approximate scale, terrain, both sides in color and numbered stages; a paragraph on the plan; a box naming the decisive principles; one worked calculation; and one connection to a game or sport. Then write a one-page comparison of Gaugamela or Cannae (Unit 3) with one battle from this unit, showing one principle that appears in both and one way the later commander faced a problem the earlier one did not.

LOOK FOR	WHAT IT MEANS
Maps	Each map is clear, accurate and labeled, and shows the stages of the plan in order.
Plans and principles	Each summary explains the plan correctly, and the principles are supported by evidence on the map.
Calculations	Each page has a correct, clearly worked calculation tied to a decision.
Comparison	The comparison page finds a real shared principle and a real difference, with specific evidence from both battles.

TACTICS IN TEAM SPORTS

The principles that won at Cannae and Trafalgar are at work every weekend on fields, courts and rinks. This unit studies how coaches arrange eleven, five or six players to gain local superiority, protect against counterattacks and give every player a clear role: soccer formations from the 2-3-5 to Total Football, football's single wing, T formation and West Coast offense, man and zone defense and John Wooden's UCLA, the power play and the forecheck in hockey and lacrosse, and the honest scouting report.

Every lesson asks you to draw formations, count players in each zone, compute points per possession or expected yards, and run a small drill or game in the yard to test an idea. You will also watch real games and chart what you see. The unit ends with a scouting report on a real team, the kind of document coaches prepare every week.

PREREQUISITES

- The principles of war (Lesson 1.2), especially mass, economy of force and security
- Local superiority and the oblique attack (Lessons 1.2 and 3.3)
- Percents, averages and expected value as a weighted average

MASTERY CHECKLIST

- ☐ I can draw the 2-3-5, WM, 4-4-2 and Total Football shapes and explain why formations changed.
- ☐ I can explain the single wing, T formation and West Coast offense and compute expected yards for short and long passing.
- ☐ I can explain man and zone defense and spacing, and describe John Wooden's Pyramid of Success.
- ☐ I can explain the power play and the forecheck and compute power-play percentages and local ratios.
- ☐ I can write an honest scouting report with data and a plan.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **U.S. Soccer Learning Center (free coaching resources)**: Free resources from U.S. Soccer on small-sided games and team shape, useful for the drills in Lessons 5.1 and 5.5. Ages 12+.
- **The Official Site of Coach John Wooden**: Free. Wooden's Pyramid of Success and his maxims, for Lesson 5.3. All ages.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

5.1 Soccer Formations: From the Pyramid to Total Football	3 sessions of 50 minutes
5.2 Football Formations: Single Wing, T and West Coast	3 sessions of 50 minutes
5.3 Basketball: Man, Zone, Spacing and John Wooden	3 sessions of 50 minutes
5.4 Hockey and Lacrosse: The Power Play and the Forecheck	3 sessions of 50 minutes
5.5 The Scouting Report	3 sessions of 50 minutes

UNIT 5 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Draw diagrams where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **7 pts**
Explain how the 1925 offside change led to Herbert Chapman's WM formation.
2. **6 pts**
Compute the percent of field players in attack for the 2-3-5 and the 4-4-2, and explain the trend.

3. (6 pts)

A back four spreads across 68 m; a compact back four covers 40 m. Find the channel width in each case and the uncovered width when compact.

4. (8 pts)

A short pass: 72% complete, 6 yards, 1% interception (−45). A deep pass: 38% complete, 24 yards, 4% interception (−45). Compute expected yards for each.

5. (6 pts)

On third-and-2, which pass in problem 4 would you call? On fourth down trailing by 4 with 5 seconds left at the opponent's 24? Explain each.

6. (6 pts)

Describe the single wing and the T formation and one advantage of each.

7. (7 pts)

A team scores 63 points on 60 possessions against man-to-man and 57 on 60 against zone. Compute points per possession and recommend a defense to its opponent.

8. (6 pts)

State John Wooden's record at UCLA and name three blocks of the Pyramid of Success.

9. (7 pts)

A team had 240 power plays and scored 48 goals; it was short-handed 260 times and allowed 52 goals. Compute both percentages.

10. (6 pts)

Tell the story behind the NHL's 1956 power-play rule change.

11. (6 pts)

Explain the trade-off of an aggressive forecheck, and when a coach should choose a conservative one.

12. (7 pts)

A hitter's grounders: 126 right, 54 middle, 20 left. Compute percentages and explain the shift a team might use (under the pre-2023 rules).

13. (6 pts)

Use $1/\sqrt{n}$ to estimate the error of a percentage from 25 observations and from 225. Which would you trust?

14. (7 pts)

Distinguish honest scouting from cheating, with two examples of each.

15. (9 pts)

Short essay (6–8 sentences): Choose one tactic from this unit and one battle from Units 3–4 that use the same principle. Explain the shared principle and one important difference.

ANSWER KEY

1. With attackers needing only two opponents between them and the goal line, a single full-back could no longer safely step up, and goals rose. Chapman added a center-back to mark the center-forward, creating the 3-2-2-3 WM.
2. 50% and 20%. Coaches shifted strength from attack to security and midfield control as passing and counterattacks improved.
3. 17 m and 10 m; 28 m uncovered (14 m each wing).
4. Short: $4.32 - 0.45 = 3.87$; deep: $9.12 - 1.8 = 7.32$.
5. Third-and-2: the short pass, which converts about 72% of the time. Final play needing a touchdown: the deep pass to the end zone; only it achieves the objective.
6. Single wing: unbalanced line, tailback taking a deep snap, mass of blockers to one side (local superiority). T: quarterback under center with backs in a T, quick handoffs and fakes (deception and speed).
7. Man 1.05, zone 0.95. The opponent should play zone.
8. Ten national titles in twelve seasons (1964–1975), including seven straight, and an 88-game winning streak. Blocks: for example, industriousness, enthusiasm, self-control, team spirit, competitive greatness.
9. Power play 20%; penalty kill $208/260 = 80\%$.
10. On November 5, 1955, Jean Béliveau of Montreal scored three power-play goals in 44 seconds against Boston during one minor penalty. The NHL then ruled that a minor penalty ends when the team with the advantage scores.
11. It wins the puck deep and creates chances (offensive) but risks odd-man rushes against if beaten (security). Choose a conservative forecheck when protecting a lead.
12. 63%, 27%, 10%. Move an infielder from the left side to the right side, accepting weakness where only 10% of grounders go.
13. 20% and about 6.7%. Trust the 225-observation estimate.
14. Honest: game film, public statistics, notes from games watched. Cheating: stealing signals with hidden cameras or other forbidden means, obtaining an opponent's plans by deceit.
15. Answers will vary. A full-credit essay accurately describes both, names a shared principle (for example, the single wing and Gaugamela both mass on one wing), and identifies a real difference (rules, scale, the possibility of adjustment).

PORTFOLIO PIECE: A COACH'S PLAYBOOK

Create a six-page playbook for one team sport you play or follow. It must include (1) your team's formation in attack and defense, drawn and explained with the principles of war it uses; (2) three set plays, each with a diagram, the principle behind it, and an expected-value or success-rate calculation from real or carefully measured data; (3) a defensive plan comparing two defenses with points per possession or a similar measure; (4) a one-page scouting report on a real opponent with tendencies, sample sizes and a plan; and (5) a closing page on the character you want your team to show, drawing on Wooden's Pyramid of Success.

LOOK FOR	WHAT IT MEANS
Formations and plays	Formations and plays are clearly diagrammed and correctly tied to principles of war.
Calculations	Each play and the defensive comparison is supported by correct, clearly shown calculations with stated assumptions.
Scouting	The scouting report uses honest sources, reports sample sizes and confidence, and anticipates adjustments.
Character	The closing page thoughtfully connects tactics to character, with specific habits drawn from Wooden's teaching.

5.1 SOCCER FORMATIONS: FROM THE PYRAMID TO TOTAL FOOTBALL

OBJECTIVES

- Trace the development of soccer formations from the 2-3-5 through Herbert Chapman's WM, the 4-4-2 and Total Football.
- Explain how a rule change (the offside law of 1925) forced a new formation, and how each formation balances attack and security.
- Count players per line and zone, compute spacing across the field, and test two formations in a small-sided game.

Warm-up. Draw a soccer field and place 10 field players for one team in any shape you like. Count how many are in the attacking third, the middle third and the defending third. Then write which principle of war your shape favors most: offensive, mass or security.

WATCH

The Evolution of Football | A Brief History of Football Formations | Pyramid, Metodo, W-M and more

Nouman · 10:48

<https://www.youtube.com/watch?v=4DpE4YRzHVo>

WHEN TO WATCH

After “the story” paragraph. A history of formations from the pyramid through the WM, the 4-2-4 and beyond, drawn on a field diagram; pause at the 1925 offside change.

BACKUP VIDEO

TOTAL FOOTBALL EXPLAINED | The Legacy of the Netherlands 1974

Thinking About Football · 6:13

<https://www.youtube.com/watch?v=d8Lz3MTdjmU>

After “the plan” paragraph. A short animated explanation of Total Football and the Dutch team of 1974.

KEY TERMS

formation

The basic arrangement of a team's players, written as numbers from defense to attack (for example, 4-4-2), not counting the goalkeeper.

offside

A law that stops an attacker from waiting near the opponent's goal. Since 1925 an attacker needs at least two opponents (usually the goalkeeper and one defender) level with or behind him when the ball is played forward.

WM

Herbert Chapman's formation of the late 1920s (3-2-2-3), shaped like the letters W and M, with a center-back added to stop the center-forward.

Total Football

The Dutch style of the early 1970s in which players constantly exchanged positions, pressed to win the ball high, and kept the team compact.

compactness

Keeping the team's lines close together, so that there is little space between them for the opponent to use.

CORE IDEAS

The story. When the Football Association wrote its first laws in 1863, the game was mostly dribbling, and teams packed their fields with forwards. As passing developed, a more balanced shape took over in the 1880s: two full-backs, three half-backs and five forwards, the 2-3-5 or "pyramid." Preston North End used it to win the first Football League in 1888–89 without losing a match. Then in 1925 the offside law was changed: an attacker now needed only two opponents, not three, between himself and the goal line. Goals poured in, because a single full-back could no longer step up to catch forwards offside. Herbert Chapman, the manager of Arsenal, answered by pulling his center-half back between the full-backs as a third defender to mark the opposing center-forward, and pulling two forwards back to link the play. The result, the WM (3-2-2-3), won Arsenal league titles in the early 1930s and was copied around the world.

The plan. Each later formation solved a problem the last one created. Brazil won the 1958 World Cup with a 4-2-4. England's manager Alf Ramsey won the 1966 World Cup

with a narrow 4-4-2 that gave up traditional wingers for hard-working midfielders. In the early 1970s Rinus Michels, coaching Ajax of Amsterdam and then the Netherlands, built Total Football around the brilliant Johan Cruyff: players changed positions freely, the whole team pressed forward to win the ball close to the opponent's goal, and the defense stepped up together to catch attackers offside. The Netherlands reached the 1974 World Cup final, losing 2–1 to West Germany, but their style shaped modern soccer.

The principle. A formation is a decision about **mass** and **security**: how many players attack, how many protect, and how the space is divided. Rules, the opponent and the players available all change the best answer. The 1925 rule change is a perfect case: it changed the cost of a single defender, so a formation with three defenders became necessary. Total Football added two ideas: **compactness** (keep the lines close so the opponent has no room) and **interchange** (any player may fill any role, so the shape survives even when players move). Both depend on shared understanding, the same idea that made Nelson's captains effective.

On the board and the field. Watch any soccer game and count the players in each third of the field when one team has the ball, and again when the other has it. Most modern teams change shape between attack and defense: a team listed as 4-3-3 may defend as a 4-5-1. In chess, the pawn structure plays the role of a formation: it decides where pieces can go and which side of the board you can attack. In every case the question is the same: does my shape put more of my strength where the decisive play will happen, while keeping me safe against a counterattack?

Think it through. No formation is best for all opponents and all players. A coach chooses one that fits his players' strengths, just as Sun Tzu would advise: know yourself first.

PICTURE STUDY



*Preston North End, 1888–89, Unknown artist, 1889 · Printed team portrait · Wikimedia Commons
(reproduction of a team photograph)*

Image: [Wikimedia Commons](#), public domain

Preston North End won the first Football League season of 1888–89 without losing a match and also won the FA Cup, earning the nickname “the Invincibles.” They played the 2-3-5 pyramid, with five forwards, and were admired for their passing at a time when many teams still relied on dribbling.

Look closely

- Count the players. How many would have been forwards in a 2-3-5?
- Look at the clothing and boots. How would they affect speed and ball control compared with today?
- Look at the players’ postures and faces. What does the photographer want us to know about this team?

Talk about it

1. Preston won with passing rather than dribbling. How does passing change what formation works best?
2. If this team played a modern 4-4-2 side, where would the gaps be in each team?
3. Why might a team that never loses still change its tactics?

Safety first. Warm up first, use a soft ball, play on level ground away from streets and windows, wear proper shoes, and do not head the ball hard; younger players should not head it at all. A parent should supervise.

PROJECT

Formation Test in a Small-Sided Game

You will chart the formations of a real soccer game and then test two shapes yourself in a small-sided game in the yard, recording chances created and conceded.

You will need

- A soft ball and cones or shoes for two small goals
- Four to eight players
- A free full-match replay or a live game to watch
- The scorebook

Steps

1. Watch the first 20 minutes of a real game. Every 5 minutes, pause and sketch where each team's players are, in attack and in defense.
2. Name each team's formation in attack and in defense, and note one moment when a team was outnumbered in one zone.
3. Set up a small field (about 25 m by 15 m) with small goals and no goalkeepers.
4. With 3 or 4 players a side, test Shape A (two defenders, one or two attackers) for 5 minutes, then Shape B (one defender, two or three attackers) for 5 minutes.
5. Record shots taken and shots allowed in each period.
6. Switch teams and repeat.
7. Make a table: shape, shots for, shots against, goals for, goals against.
8. Write a paragraph: which shape was better for your group, and how does your result compare with the history of formations?

Tips

- Keep the game friendly and safe; no slide tackles.
- Small samples are noisy. Treat your result as a hint and note what else changed (tiredness, who was on which team).

Check your work

- ☐ I sketched a real team's shape at least four times and named its formations.
- ☐ I tested two shapes for equal time and recorded shots and goals.
- ☐ I compared my results with the history in a paragraph.

SCOREBOOK

1. Draw the 2-3-5, WM, 4-4-2 and a pressing Total Football shape on four small fields.
2. Draw a back four spread across 68 m and compact across 40 m, with channel widths.
3. "What I would decide and why": your team has two fast forwards and slow defenders. Which formation would you choose, and why?

From history. Chapman was also an innovator off the field: he pressed for numbered shirts, floodlights and a clock at Arsenal's stadium, and he persuaded the London Underground to rename the nearby station "Arsenal." He died in 1934, and his team went on to win the league in 1934 and 1935.

WORKED EXAMPLES

Example 1. For each formation, count the players in defense, midfield and attack, and the percent of the 10 field players in attack: 2-3-5, WM (3-2-2-3, counting the 2-2 as midfield), 4-4-2 and 4-3-3.

Show solution

1. 2-3-5: defense 2, midfield 3, attack 5: $5/10 = 50\%$.
2. WM: defense 3, midfield 4, attack 3: 30% .
3. 4-4-2: defense 4, midfield 4, attack 2: 20% .
4. 4-3-3: defense 4, midfield 3, attack 3: 30% .

Answer: 50%, 30%, 20% and 30% in attack. Over a century the number of nominal forwards fell from five to two or three, as coaches gave more weight to security and midfield control. (Modern teams move constantly, so these numbers describe starting positions only.)

Example 2. A soccer field is about 68 m wide. If a back four spreads evenly across the full width, how wide a channel does each defender cover? If the back four instead stays compact across the middle 40 m, how wide is each channel, and what space is left uncovered?

Show solution

1. Full width: $68/4 = 17$ m per defender.
2. Compact: $40/4 = 10$ m per defender.
3. Uncovered: $68 - 40 = 28$ m, or 14 m on each wing.

Answer: 17 m per defender when spread, 10 m when compact. Compactness makes the center hard to pass through but leaves the wings open; that is economy of force, accepting weakness out wide where a goal is less likely.

Example 3. Before 1925, an attacker needed three opponents between himself and the goal line when the ball was played to him. If one full-back stepped up and the goalkeeper and other full-back stayed back, how many opponents remained? After 1925, how does the same step-up change things?

Show solution

1. Before 1925: the goalkeeper and one full-back stayed back: 2 opponents. The attacker, needing 3, was offside. One defender stepping up was enough to catch him.
2. After 1925: the attacker needed only 2. With the goalkeeper and one full-back back, he was onside, and if the stepping defender missed, the attacker was through on goal.
3. Teams needed an extra defender to cover: Chapman's center-back.

Answer: The rule change turned a safe defensive trick into a risky one. When the rules change the cost of a tactic, the best formation changes too.

PRACTICE

1. Easy What do the numbers in “4-4-2” mean?

Show answer

Four defenders, four midfielders and two forwards, not counting the goalkeeper.

2. Easy What changed in the offside law in 1925?

Show answer

An attacker needed two opponents, not three, between himself and the goal line when the ball was played forward.

3. Easy Who invented the WM, and for which club?

Show answer

Herbert Chapman, for Arsenal.

4. Medium Why did the 1925 rule change lead to the WM?

Show answer

With only two opponents needed, a single full-back could no longer safely step up to catch forwards offside, and goals increased. Chapman added a third defender, the center-back, to mark the center-forward.

5. Medium What were two key ideas of Total Football?

Show answer

Interchange (players freely exchanging positions) and pressing with a compact, high team to win the ball close to the opponent's goal.

6. Medium A back three covers a 68 m field evenly. How wide is each channel? Compare with a back four.

Show answer

$68/3 \approx 22.7$ m against 17 m: each defender has a third more ground to cover.

7. Medium Which principle of war does compactness illustrate, and what is its risk?

Show answer

Mass in the central, decisive area, with economy of force on the wings. The risk is space out wide that a quick switch of play can exploit.

8. Medium Who reached the 1974 World Cup final with Total Football, and what was the result?

Show answer

The Netherlands, coached by Rinus Michels with Johan Cruyff; they lost 2–1 to West Germany.

9. **Hard** In a 2-3-5, 50% of field players are forwards; in a 4-4-2, 20%. If a team with five forwards scores more but concedes even more, explain in terms of mass and security why coaches moved toward fewer forwards.

Show answer

Five forwards mass strength in attack but leave few to defend against counterattacks; as passing and team play improved, opponents exploited the gaps. Coaches judged that security and midfield control gave a better overall result than more forwards.

10. **Hard** How is a chess pawn structure like a soccer formation?

Show answer

Both are the relatively fixed framework that decides where the active pieces or players can operate, which side of the field or board one can attack, and where one is vulnerable.

11. **Challenge** A team defends with two lines of four, 10 m apart, spread across the middle 44 m of a 68 m field. Compute the area of the “block” between the lines and the area per player, then compute the same if the lines are 25 m apart. What does this show about compactness?

Show answer

Block: $44 \times 10 = 440 \text{ m}^2$, per player $440/8 = 55 \text{ m}^2$. At 25 m:
 $44 \times 25 = 1100 \text{ m}^2$, 137.5 m^2 per player. Keeping the lines close cuts the space each defender guards by 60%, which is why compact teams are hard to play through.

COMMON MISTAKES

- Treating a formation as fixed; teams change shape between attack and defense.
- Forgetting that rule changes, like the 1925 offside law, change the best formation.
- Counting the goalkeeper in the formation numbers.

Make it a game • Formation Speed Drill. Use ten buttons or beans as players on a paper field. Your parent calls a formation: 2-3-5, WM, 4-4-2 or Total Football. Place the pieces in under fifteen seconds, then explain offside and compactness for that formation. Beat your own time on a second round. Add a point whenever you name the coach or team connected with each one.

5.2 FOOTBALL FORMATIONS: SINGLE WING, T AND WEST COAST

OBJECTIVES

- Describe the single wing, the modern T formation and the West Coast offense, and the coaches who developed them.
- Explain how each formation creates deception, mass at the point of attack, or high-percentage plays.
- Compute expected yards and success rates for short and long passing, and compare their risk.

Warm-up. Your team needs 10 yards in three plays. Option A gains 4 yards 75% of the time and nothing otherwise. Option B gains 15 yards 35% of the time and nothing otherwise. Before calculating, guess which is better for getting a first down. Then compute each option's expected yards per play.

WATCH

The Single Wing Formation - Football's Lost Masterpiece

Hardcore College Football History · 16:13

https://www.youtube.com/watch?v=XdxqnS_WUqg

WHEN TO WATCH

After “the story” paragraph. A football historian explains the single wing with diagrams, old film and newspaper clippings.

Note: Old newspaper headlines about football injuries in the early 1900s appear briefly, as part of the history of the 1905–06 rule reforms.

BACKUP VIDEO

Bill Walsh: A Football Life - The West Coast Offense

NFL Films · 8:20

<https://www.youtube.com/watch?v=X6mFQvZxX88>

After “the plan” paragraph. Players and coaches describe how Bill Walsh built the West Coast offense, with game film.

KEY TERMS

single wing

A formation popularized by Pop Warner early in the 1900s, with an unbalanced line and a tailback taking a direct snap several yards behind the center; it overwhelmed one side with blockers.

West Coast offense

A system developed by Bill Walsh using short, precisely timed passes as a high-percentage substitute for running plays.

point of attack

The spot where a play is designed to gain local superiority.

T formation

A formation with the quarterback directly behind the center and three running backs in a line behind him, making a T. Modernized with a man in motion by Clark Shaughnessy in 1940.

expected yards

The probability-weighted average gain of a play: the sum of each outcome's yards times its probability.

CORE IDEAS

The story. Early football was a game of mass: players piled into each other in tight formations, and injuries were common. After the rule reforms of 1905–06, which legalized the forward pass, coaches looked for new ways to gain advantage. Glenn “Pop” Warner developed and popularized the single wing in the years after 1906: an unbalanced line with more linemen on one side, a tailback receiving the snap several yards deep, and blockers massed toward the strong side. For forty years it was football’s leading formation. Then in 1940 Clark Shaughnessy, coaching Stanford, revived the old T formation with a man in motion and quick-hitting plays; Stanford went unbeaten. That December the Chicago Bears, using Shaughnessy’s ideas, won the NFL championship game 73–0 against Washington, and within a decade most teams had switched to the T.

The plan. Each formation answers the defense in a different way. The single wing used **mass** at the point of attack: more blockers than defenders on one side. The T used **speed and deception**: the quarterback, under center, could hand off, fake or pass so quickly that defenders could not tell which back had the ball. Decades later

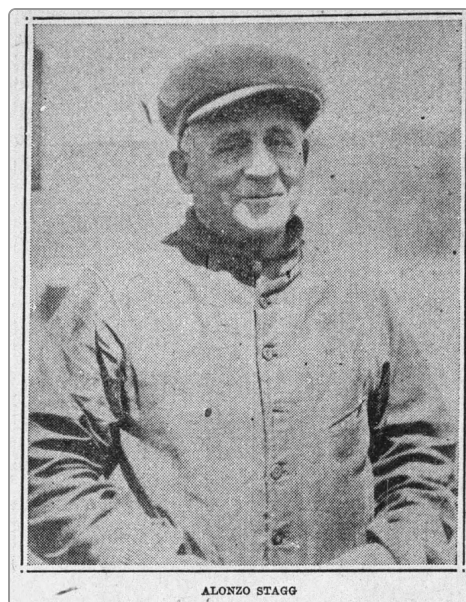
Bill Walsh, who had worked as an assistant coach for the Cincinnati Bengals in the late 1960s and early 1970s with a quarterback who had a strong mind but not a strong arm, designed an offense of short, timed passes to receivers running precise routes. Later, as head coach of the San Francisco 49ers, he won three Super Bowls with it in the 1980s. His idea was that a short pass completed most of the time could replace a running play, keeping the ball moving with little risk.

The principle. The West Coast offense is the principle of the **high-percentage play**: choose the option with the best expected result and a small chance of disaster. A deep pass gains many yards when it works, but it fails more often and sometimes ends in an interception. A short pass gains less but almost always gains something. Which is better depends on the situation: on third-and-2 the short pass is usually wiser; trailing by six with ten seconds left, only the deep pass can win. Formations are tools for creating these options: mass for the run, spread receivers for the pass, motion for deception.

On the board and the field. In chess, a high-percentage plan is a slow, sound improvement of your position; a low-percentage plan is a speculative attack that wins brilliantly or loses. In basketball, the layup and the open three are the high-percentage shots; the contested long two is not. A wise player chooses the high-percentage play most of the time and saves the long shot for when the situation demands it, the same rule Nelson followed when he accepted the dangerous approach at Trafalgar only because a decisive victory was worth it.

The risk side. A high-percentage offense can become predictable. Walsh mixed in deep passes so that defenses could not crowd the short routes. Every percentage play needs an occasional surprise to keep it working.

PICTURE STUDY



Amos Alonzo Stagg, Unknown photographer, 1928 · Newspaper photograph · Wikimedia Commons (reproduction)

Image: [Wikimedia Commons](#), public domain

Amos Alonzo Stagg trained for the ministry at Yale Divinity School before he became one of football's great coaches, first at the University of Chicago from 1892. He is credited with early versions of the huddle, the man in motion, the end-around and other formations and plays that later coaches such as Warner and Shaughnessy built on. He coached until he was in his nineties.

Look closely

- Look at Stagg's face and his practical cap and jacket. What kind of coach does he seem to be?
- Think about his long career, from 1890 to the 1950s. How much did football change in that time?
- Imagine him at a chalkboard. What tools did a coach of his day have for planning plays?

Talk about it

1. Stagg believed sport could build character. How might inventing plays and teaching them be a kind of teaching ministry?
2. Many of Stagg's innovations created deception within the rules. Why is that kind of deception fair while lying to an official is not?

3. What would Stagg think of the West Coast offense? Which of his principles does it share?

PROJECT

Expected Yards from Real Games

You will chart every pass in a real football game, sort the passes into short and deep, and compute completion rates, expected yards and interception rates for each, then decide which kind of pass suited each situation.

You will need

- A full game to watch (live, on television or a free replay) or a free play-by-play on a statistics site
- The scorebook and a calculator

Steps

1. Make a chart with columns: quarter, down and distance, short or deep (deep = thrown 15 or more yards past the line), complete or not, yards gained, interception (yes or no).
2. Record every pass by one team in the game.
3. Count the short and deep passes, and compute the completion rate for each.
4. Compute expected yards per attempt for each, treating an interception as -45 yards.
5. Find all third-down passes and record whether they gained a first down.
6. Compare: on third-and-short (1-3 yards), which kind of pass converted more often?
7. Write a play-calling rule for third-and-short and one for third-and-long, based on your data.
8. Write a paragraph comparing your data with the illustrative numbers in this lesson.

Tips

- If you cannot judge the distance of the throw, use the yards gained as a guide, and say so in your report.
- One game is a small sample; if you can, chart two.

Check your work

- ☐ My chart records every pass by one team, with all columns filled.
- ☐ I computed completion rates and expected yards for short and deep passes.
- ☐ I wrote two play-calling rules supported by my data.

SCOREBOOK

1. Draw the single wing, the T formation and a West Coast pass play with routes.
2. Make an expected-yards table for three plays of your own design.
3. “What I would decide and why”: third-and-7 in the second quarter. Short pass or deep pass? Use numbers.

KEY FORMULAS

$$E[\text{yards}] = \sum p_i y_i$$

From history. Walsh’s first quarterback with the Bengals, Virgil Carter, is the same Virgil Carter who, as a student of operations research, wrote one of the first statistical papers on football strategy in 1971. Shaughnessy later said the T formation was not new at all: it was one of the oldest formations in football, made new by motion and speed.

WORKED EXAMPLES

Example 1. A short pass is completed 70% of the time for an average of 7 yards and is intercepted 1% of the time (count an interception as −45 yards of field position, illustrative). A deep pass is completed 40% of the time for 25 yards and intercepted 4% of the time. Incompletions gain 0. Compute expected yards for each.

Show solution

1. Short: $0.70(7) + 0.01(-45) = 4.9 - 0.45 = 4.45$.
2. Deep: $0.40(25) + 0.04(-45) = 10.0 - 1.8 = 8.2$.
3. The deep pass has the higher expected yards but fails 60% of the time.

Answer: Short 4.45 yards, deep 8.2 yards. The deep pass gains more on average, but on a third down needing 3 yards the short pass converts far more often (about 70% against 40%). The best play depends on what the situation requires, not only on the average. (All numbers are illustrative.)

Example 2. In the warm-up, Option A gains 4 yards 75% of the time and Option B gains 15 yards 35% of the time. You need 10 yards in three plays. Find the probability of making the first down if you use only A three times, and if you use only B.

Show solution

1. Option A: you need 3 successes in 3 tries ($4 + 4 + 4 = 12 \geq 10$; two successes give only 8): $0.75^3 \approx 0.42$.
2. Option B: you need at least one success in 3 tries:
 $1 - 0.65^3 \approx 1 - 0.275 = 0.725$.
3. Expected yards per play: A $0.75 \times 4 = 3$; B $0.35 \times 15 = 5.25$.

Answer: Using only A converts about 42% of the time; using only B about 73%. Here the riskier play is actually the higher-percentage way to reach the goal. A high-percentage play must be judged against the objective, not only by how often it succeeds.

Example 3. The single wing put an unbalanced line with, say, 4 linemen to the right of center and 2 to the left, plus 2 backs leading the play to the right. If the defense lines up evenly with 4 players on each side of center near the line, find the local ratio of blockers to defenders on the right.

Show solution

1. Blockers on the right: $4 + 2 = 6$.
2. Defenders on the right: 4.
3. Ratio $6 : 4 = 1.5 : 1$.

Answer: 1.5 to 1 at the point of attack (illustrative counts). The single wing was football's oblique order: mass on one side, economy on the other, and a defense forced to shift, which opened the counter play to the weak side.

PRACTICE

1. Easy Who popularized the single wing, and roughly when?

Show answer

Glenn “Pop” Warner, in the years after 1906.

2. **Easy** What happened in the NFL championship game of December 1940?

Show answer

The Chicago Bears, using the modern T formation, beat Washington 73–0.

3. **Easy** What is the main idea of the West Coast offense?

Show answer

Short, precisely timed passes used as a high-percentage substitute for runs, keeping the ball moving with little risk.

4. **Medium** Compute expected yards: a run gains 5 yards 60% of the time, 0 yards 30% of the time and –3 yards 10% of the time.

Show answer

$$0.6(5) + 0.3(0) + 0.1(-3) = 3 - 0.3 = 2.7 \text{ yards.}$$

5. **Medium** How did the T formation use deception?

Show answer

The quarterback took the snap directly from the center and could hand off, fake or pass so quickly that defenders could not see who had the ball.

6. **Medium** Why did Walsh mix deep passes into a short-passing offense?

Show answer

So that defenses could not crowd the short routes; the threat of the deep pass kept the high-percentage plays working.

7. **Medium** Which formation in this lesson is most like Alexander's oblique attack, and why?

Show answer

The single wing: it massed blockers on one side (the strong wing) while holding the other side lightly, and forced the defense to shift.

8. **Medium** On fourth-and-1, would you rather have a play that gains at least 1 yard 72% of the time or one that gains 20 yards 30% of the time? Explain.

Show answer

The 72% play: the objective is 1 yard to keep the drive alive, and it succeeds far more often.

9. **Hard** Trailing by 6 points with 8 seconds left at the opponent's 30, you have time for one play. A short pass gains 8 yards 75% of the time; a pass to the end zone scores 20% of the time. Which do you call, and why?

Show answer

The pass to the end zone. A short pass cannot win the game with no time left; only a touchdown wins. The objective decides: the 20% play is the only one that achieves it.

10. **Hard** A short pass is completed 68% of the time for 6.5 yards; interceptions happen 1.5% of the time and cost 45 yards. Compute expected yards.

Show answer

$$0.68(6.5) + 0.015(-45) = 4.42 - 0.675 = 3.745 \text{ yards.}$$

11. **Challenge** You need 10 yards in 3 plays. Option A gains 4 yards with probability 0.75 (else 0); option B gains 10 yards with probability 0.35 (else 0). Find the best plan if you may switch options after each play. (Hint: after an A success you need 6 yards in 2 plays; consider the cases.)

Show answer

Work backward. With 1 play left: needing 4 or fewer, use A (0.75); needing 5–10, use B (0.35). With 2 plays needing 6: A first gives $0.75(0.75) + 0.25(0.35) = 0.65$, B first gives $0.35 + 0.65(0.35) = 0.5775$, so A (0.65). With 2 plays needing 10: A first gives $0.75(0.35) + 0.25(0.35) = 0.35$, B first gives 0.5775, so B. With 3 plays needing 10: A first gives $0.75(0.65) + 0.25(0.5775) \approx 0.632$; B first gives $0.35 + 0.65(0.5775) \approx 0.725$. Best plan: throw B first, keep throwing B while you still need 10, and switch to A once a short gain would finish the job; success about 72.5%. When the distance is long, the bolder play is the percentage play.

COMMON MISTAKES

- Choosing the play with the highest success rate without checking whether it reaches the objective.
- Choosing the play with the highest expected yards without considering the risk of a turnover.
- Thinking formations are only about offense; each one also changes how the defense must line up.

Make it a game • Whose Offense?. Write five clues for the single wing, the T formation or the West Coast offense, naming its coach or era. Your parent guesses the offense before you finish. Fewer clues used earns more points. Then switch. Sketch the backfield for each offense on paper and explain what each was designed to do at its point of attack.

5.3 BASKETBALL: MAN, ZONE, SPACING AND JOHN WOODEN

OBJECTIVES

- Explain man-to-man and zone defense and the strengths and weaknesses of each.
- Explain spacing on offense and compute distances and areas on a basketball court.
- Describe John Wooden's record at UCLA and his Pyramid of Success, and connect his teaching to character and preparation.

Warm-up. On a sheet of paper draw a half court (about 50 feet wide and 47 feet deep). Place five offensive players bunched near the basket, then spread them out. In each case, how many could one defender guard at once? Write what you notice.

WATCH

The difference between winning and succeeding. | John Wooden | TED

TED • 17:36

<https://www.youtube.com/watch?v=0MM-psvqiG8>

WHEN TO WATCH

After “the principle” paragraph. John Wooden himself explains his definition of success and the Pyramid of Success, late in his life.

BACKUP VIDEO

Difference Between Zone Defense vs Man To Man Defense

Basketball Coach Allen • 8:39

<https://www.youtube.com/watch?v=iTI9SEOA1Aw>

Before worked example 1. A coach diagrams man-to-man and zone defense on a whiteboard court and explains when to use each.

KEY TERMS

man-to-man defense

Each defender guards one assigned opponent wherever he goes.

zone defense

Each defender guards an area of the court and whichever opponent enters it; for example, the 2-3 zone has two defenders up top and three near the basket.

spacing

Keeping offensive players far enough apart that one defender cannot guard two of them, opening driving and passing lanes.

points per possession

Points scored divided by the number of possessions; the best single measure of an offense or defense.

Pyramid of Success

John Wooden's chart of fifteen building blocks of character and skill, with industriousness and enthusiasm at the base and competitive greatness at the top.

CORE IDEAS

The story. John Wooden grew up on a farm in Indiana, was an All-American player at Purdue, and taught high school English before he came to the University of California, Los Angeles, in 1948. At UCLA he built the most successful program in the history of college basketball: ten national championships in twelve seasons from 1964 to 1975, including seven in a row, and an 88-game winning streak in the early 1970s. Wooden was a devout Christian who read his Bible daily and taught that success is “peace of mind” that comes from knowing you did your best. He spent years developing his Pyramid of Success, which he finished in the late 1940s.

The plan. Wooden's teams were famous for preparation. Practices were planned to the minute on index cards; he began each season by teaching players how to put on their socks to prevent blisters. His teams used a full-court zone press to speed up opponents, and a fast, simple offense built on spacing, quick passing and

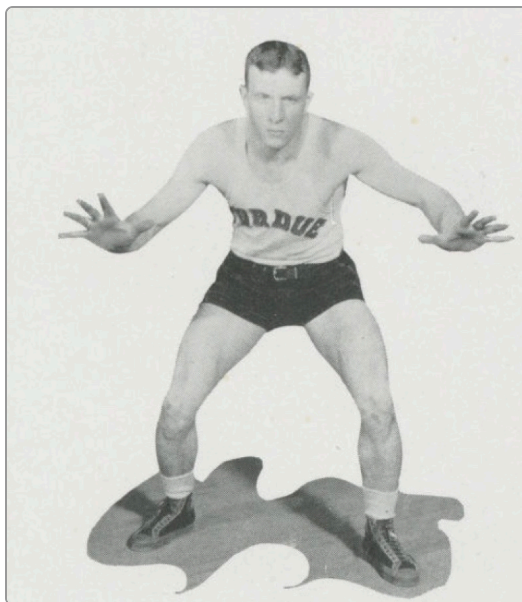
conditioning. “Be quick, but don’t hurry,” he told players. In every game his players knew their roles so well that they seldom needed a timeout to be told what to do.

The principle. Basketball defense shows the trade-off between **man-to-man** and **zone**. Man-to-man gives clear responsibility (unity of command for each matchup) but can be beaten by screens and by a player who is faster than his defender. A zone protects an area, usually the basket, and lets defenders help one another (mass near the hoop), but it can be beaten by passing quickly around it and by good outside shooting, because the gaps between zones are the zone’s weak points. On offense, **spacing** is economy of force for the defense’s worst enemy: if offensive players stand far enough apart, one defender cannot help on a drive without leaving a shooter open. The best offenses create a two-on-one somewhere on the floor on almost every possession.

On the board and the field. Points per possession is the honest measure: a team that scores 1.10 points per possession and allows 1.00 will win most games, however fast or slow it plays. Coaches choose defenses by comparing the points per possession they allow; analysts choose shots by comparing the points each shot is worth. Wooden’s teams also show that tactics rest on character. His Pyramid begins with industriousness and enthusiasm and includes self-control, alertness, initiative, team spirit, condition and skill; he later placed faith and patience at its peak. Colossians 3:23 describes the attitude he taught: “whatsoever ye do, do it heartily, as to the Lord.”

Think it through. Wooden said he never told his players to win. He told them to prepare and to play their best, and he trusted the results to follow. That is the difference between an objective and an obsession.

PICTURE STUDY



John Wooden at Purdue, Unknown photographer, about 1932 · Photograph · Purdue University yearbook (reproduction)

Image: [Wikimedia Commons](#), public domain

Long before his coaching championships, John Wooden was an All-American guard at Purdue, famous for his speed and for diving after loose balls. His college coach, Ward “Piggy” Lambert, taught a fast-breaking style that Wooden later used and improved at UCLA.

Look closely

- Look at Wooden’s stance: knees bent, hands wide. What is he ready to do?
- Look at his uniform and shoes. How has basketball equipment changed?
- Imagine him as the coach he became. What would he have learned as a player that helped him teach?

Talk about it

1. Wooden taught that success is the peace of mind of doing your best. How is that different from winning?
2. Which blocks of the Pyramid of Success do you think this young player already had?
3. Why might a great player not always become a great coach, and what made Wooden different?

Safety first. Warm up first. Use a soft ball, play on a clear, dry surface away from cars, windows and furniture, wear proper shoes, and keep contact light. A parent should supervise.

PROJECT

Defense Test with a Soft Ball

You will test man-to-man and zone defense in a small half-court game at home (or with a laundry basket as the goal), recording points per possession, and chart possessions in a real game.

You will need

- A soft ball and a basket, bucket or laundry basket
- Four to six players
- The scorebook
- A real basketball game to watch

Steps

1. Mark a half court in a driveway or room with cones or tape.
2. Play 3 on 3 (or 2 on 2) with a simple rule: a basket counts 1 point (2 points from beyond a line you mark).
3. Play 15 possessions with the defense in man-to-man, then 15 in a zone of your design. Record points per possession for each.
4. Switch teams and repeat.
5. Watch 10 minutes of a real game and record for one team: possessions, points, and whether the defense was man or zone.
6. Compute points per possession for your games and for the real game.
7. Draw the zone you used and mark its gaps.
8. Write a paragraph: which defense worked better in your game and why? Which block of Wooden's Pyramid mattered most in your team's play?

Tips

- Count a possession as ending when the offense scores, misses without an offensive rebound, or loses the ball.
- Keep contact light; this is a test of positioning, not strength.

Check your work

- ☐ I recorded at least 60 possessions in my home games with points per possession for man and zone.
- ☐ I charted 10 minutes of a real game.
- ☐ I explained the result and connected it to Wooden's teaching.

SCOREBOOK

1. Draw a half court with a 2-3 zone and shade the gaps between zones.
2. Copy Wooden's Pyramid of Success as best you can, and circle two blocks you want to build this season.
3. "What I would decide and why": the opponent has two great outside shooters and a weak center. Man or zone? Explain.

KEY FORMULAS

$$\text{points per possession} = \frac{\text{points}}{\text{possessions}}$$

From history. Wooden retired in 1975 after his tenth championship and lived to the age of 99. His Pyramid has been used by coaches, teachers and businesses ever since. He liked to give players his father's advice, including "Make each day your masterpiece."

WORKED EXAMPLES

Example 1. Against a man-to-man defense, a team scores 48 points on 50 possessions. Against a 2-3 zone, the same team scores 54 points on 50 possessions, mainly on open three-point shots. Compute points per possession for each and decide which defense the opponent should use against this team.

Show solution

1. Man: $48/50 = 0.96$.
2. Zone: $54/50 = 1.08$.
3. The zone allows 0.12 more points per possession, about 12 more points in a 100-possession game.

Answer: Man-to-man allows 0.96 and the zone 1.08 points per possession. Against this good outside-shooting team, the opponent should play man-to-man. (Illustrative numbers.)

Example 2. The NBA three-point line is 22 feet from the basket in the corners. Two offensive players stand in the two corners on opposite sides of a 50-foot-wide court, and one defender stands under the basket. Estimate how far apart the two corner shooters are and how far the defender must travel to reach either one.

Show solution

1. The corners are about 22 feet on each side of the basket, so the shooters are about $22 + 22 = 44$ feet apart.
2. The defender under the basket is about 22 feet from each.
3. If the defender helps toward one, he is about 44 feet from the other; no single defender can guard both.

Answer: About 44 feet apart, with the defender about 22 feet from each. Spacing to the corners forces the defense to choose; it cannot both protect the basket and cover both corners.

Example 3. UCLA won 10 national championships in the 12 seasons from 1963–64 through 1974–75. What percent of those seasons ended in a title? If a team had a 40% chance of winning the title each year, independently, what is the probability of winning at least 10 in 12 years?

Show solution

1. $10/12 \approx 83\%$.
2. At least 10 of 12 with $p = 0.4$: $\binom{12}{10}0.4^{10}0.6^2 + \binom{12}{11}0.4^{11}0.6 + 0.4^{12}$.
3. $66(0.000105)(0.36) + 12(0.0000419)(0.6) + 0.0000168 \approx 0.00249 + 0.00030 + 0.$

Answer: 83% of seasons. Even a team with a strong 40% chance each year would win 10 of 12 only about 0.3% of the time. Wooden's record was not luck; it reflected a sustained edge built by preparation and teaching.

PRACTICE

1. Easy What is the difference between man-to-man and zone defense?

Show answer

In man-to-man each defender guards one player; in zone each defender guards an area and whichever opponent enters it.

2. **Easy** How many national championships did Wooden's UCLA teams win, and in what span?

Show answer

Ten, in twelve seasons from 1964 to 1975.

3. **Easy** Compute points per possession: 72 points on 68 possessions.

Show answer

$72/68 \approx 1.06$.

4. **Medium** How is a zone defense beaten, and why?

Show answer

By quick ball movement and good outside shooting, and by placing players in the gaps between zones; the gaps are where responsibility is shared and slow to cover.

5. **Medium** Which principle of war does spacing on offense serve, and how?

Show answer

Mass and maneuver: spreading the defense makes it impossible for one defender to cover two attackers, so the offense can create a two-on-one at the point of attack.

6. **Medium** Name four blocks of Wooden's Pyramid of Success.

Show answer

Sample: industriousness, enthusiasm, friendship, loyalty, cooperation, self-control, alertness, initiative, intentness, condition, skill, team spirit, poise, confidence, competitive greatness.

7. **Medium** Team A scores 1.12 points per possession and allows 1.03. In a 70-possession game, what is its expected margin?

Show answer

$(1.12 - 1.03) \times 70 = 6.3$ points.

8. **Medium** What did Wooden mean by "Be quick, but don't hurry"?

Show answer

Act fast but under control; speed without hurry keeps execution accurate. Haste causes mistakes.

9. **Hard** A defense allows 0.94 points per possession in man-to-man but gets tired after 15 minutes; then it allows 1.08. A zone allows 1.00 throughout. In a 40-minute game with possessions spread evenly, which plan allows fewer points: all man, all zone, or man for 15 minutes and zone for 25?

Show answer

Per 40 minutes with 70 possessions (1.75 per minute): All man: 15 min at 0.94 and 25 at 1.08: $26.25(0.94) + 43.75(1.08) \approx 24.7 + 47.3 = 72.0$. All zone: $70(1.00) = 70.0$. Mixed: $26.25(0.94) + 43.75(1.00) \approx 24.7 + 43.75 = 68.4$. Mixed is best.

10. **Hard** Explain how Wooden's preparation (planned practices, socks) relates to Clausewitz's friction.

Show answer

Friction is made of small things going wrong. Wooden removed as many small causes of failure as possible before games, so that under pressure his players had fewer things to think about and fewer things that could break down.

11. **Challenge** Model a two-on-one fast break: the ball handler shoots a layup 60% of the time if not guarded; his teammate makes a layup 65% of the time if open. The defender must choose whom to guard. If he guards the ball handler, the ball handler passes and the teammate shoots open; if he guards the teammate, the ball handler shoots open. What should the defender do, and what is the expected number of points (2 per make)?

Show answer

If he guards the ball handler, the teammate shoots: $2(0.65) = 1.30$. If he guards the teammate, the ball handler shoots: $2(0.60) = 1.20$. He should guard the teammate (the better finisher), allowing 1.20 expected points. A two-on-one cannot be fully defended; the offense is guaranteed at least 1.20.

COMMON MISTAKES

- Thinking zone defense is lazy; a good zone requires constant movement and communication.
- Judging offense by points instead of points per possession.
- Treating the Pyramid of Success as a slogan rather than a plan for daily habits.

Make it a game • Pyramid of Success Cups. Build a small paper-cup pyramid. For each cup you place, name one block from John Wooden's Pyramid of Success. Then use the pyramid as a game board: your parent names an offense, you say whether man-to-man or zone defense is better against it. Your parent adds spacing and points per possession. A correct answer lets you add another cup.

Scripture. “And whatsoever ye do, do it heartily, as to the Lord, and not unto men;” (Colossians 3:23, KJV)

Wooden taught players to do their best for its own sake, not for applause or the scoreboard. That attitude made his teams prepared, calm and unselfish.

5.4 HOCKEY AND LACROSSE: THE POWER PLAY AND THE FORECHECK

OBJECTIVES

- Explain the power play, the penalty kill and the forecheck in hockey, and the man-up offense and the ride in lacrosse.
- Tell the story of the 1956 power-play rule change and compute power-play percentages and local ratios.
- Connect pressure and numerical advantage to the principles of mass, offensive and security.

Warm-up. In a game of keep-away with three players against two in a small space, how long can the three keep the ball? Try it for one minute (or imagine it), then try two against two. Write what changed.

WATCH

Hockey Power Play: Umbrella

Jeremy Weiss (Weiss Tech Hockey) • 4:54

<https://www.youtube.com/watch?v=y63cHxYIMRw>

WHEN TO WATCH

After “the plan” paragraph. A hockey coach diagrams the umbrella power play on a rink board; count the attackers and defenders in each area.

BACKUP VIDEO

Hockey Insights from Coach Eaves - Forechecking

PBS Wisconsin • 2:42

https://www.youtube.com/watch?v=qQrhu_uxLZ0

Optional, before the project. A college hockey coach explains the forecheck at a whiteboard.

KEY TERMS

power play

A period when one team has more players on the ice (usually 5 against 4) because an opponent is serving a penalty.

penalty kill

The short-handed team’s defense during an opponent’s power play.

forecheck

Pressuring the opponent in its own defensive zone to win the puck back before it can attack.

man-up offense

The lacrosse equivalent of a power play, when a penalty leaves the opponent a player short.

ride

In lacrosse, the attackers' effort to stop the defense from clearing the ball upfield, like a hockey forecheck.

CORE IDEAS

The story. On November 5, 1955, the Montreal Canadiens were playing the Boston Bruins when a Boston player was sent to the penalty box. In those years a player served his whole two-minute penalty no matter how many goals were scored. Montreal's power play, with Jean Béliveau, Maurice Richard, Bernard Geoffrion and Doug Harvey, was so strong that Béliveau scored three goals in 44 seconds during that single penalty. The next season the National Hockey League changed the rule: a minor penalty now ends as soon as the team with the advantage scores. The rule still stands.

The plan. A power play turns a numerical advantage into a local superiority near the goal. With five attackers against four, the offense spreads into a shape such as the "umbrella" (one player at the blue line, two on the points, two near the net) or an overload on one side, and moves the puck quickly until the four defenders cannot cover everyone. The penalty-killing team stays compact in a box or diamond in front of its own net, protects the most dangerous area, and clears the puck down the ice whenever possible. When teams are even, the **forecheck** is the offensive tool: one, two or three forwards chase the puck into the opponent's corner to win it back before the opponent can break out. In lacrosse, the same ideas appear as the man-up offense and the ride.

The principle. The power play is **mass** made easy by the rules, and the 1956 rule change shows how rules limit a too-great advantage. The forecheck is the **offensive**: taking the initiative to win the puck in the opponent's territory, where a turnover leads straight to a scoring chance. But an aggressive forecheck sacrifices **security**: if the opponent escapes the pressure, it may attack against fewer defenders. Coaches

therefore choose forechecks by situation: aggressive (two or three forwards in deep) when trailing, conservative (one forward in, others back) when protecting a lead.

On the board and the field. In chess, when you are a piece up, you try to bring every piece into the attack and trade the opponent's defenders: a power play. In soccer, a pressing team behaves like a forecheck, chasing the ball in the opponent's half. In basketball, a full-court press is a forecheck. The wise question is always the same: is the extra pressure worth the risk to security in this situation?

Think it through. Penalties give the opponent a power play. The cleanest way to defend against a power play is not to take a needless penalty: self-control is a tactic as well as a virtue.

PICTURE STUDY



Varsity Lacrosse Practice, Columbia University, Bain News Service, 1908 · Glass negative photograph · Library of Congress, Washington, D.C.
Image: [Wikimedia Commons](#), public domain

Lacrosse was first played by Native peoples of North America, and Canadians and Americans adopted and organized it in the 1800s. By 1908, when the Bain News Service took this photograph, colleges such as Columbia fielded teams. Here four players practice with long, hand-made wooden sticks in front of the university's domed library.

Look closely

- Look at the sticks. How long are they, and how do the heads differ from modern ones?
- Look at the spacing of the four players. Why do passers spread out?
- Look at the players' clothing. What protection do they have, and what is missing compared with today?

Talk about it

1. A man-up offense uses an extra player to create a two-on-one. How would these four players have to move to create one?
2. How might the long sticks change the tactics of riding and clearing compared with hockey?

3. Why do so many different sports end up with similar tactics, such as pressing and power plays?

Safety first. Warm up first. Use a soft ball and pass with hands or gentle kicks, play on level ground away from streets and windows, wear proper shoes, and avoid rough contact. A parent should supervise.

PROJECT

Advantage and Pressure Drill

You will measure how much a numerical advantage helps in a keep-away drill, and how pressure (a forecheck) affects the time to win the ball back, then chart the power plays in a real hockey or lacrosse game.

You will need

- A soft ball and four cones or shoes to mark a 6 m square
- Five or more players
- A stopwatch and the scorebook
- A hockey or lacrosse game to watch

Steps

1. Keep-away, even: 2 against 2 in the square. Time how long the passing team keeps the ball (count passes until the defenders touch it). Do 5 trials.
2. Keep-away, advantage: 3 against 2. Repeat 5 trials.
3. Compute the average number of passes in each case and the ratio.
4. Forecheck test: the defenders try to win the ball (a) with one chaser and one staying back, and (b) with both chasing. Record passes until a touch and how often the passing team “escapes” by reaching a line you mark.
5. Watch a hockey or lacrosse game and record every power play or man-up: time, result, and the shape the attacking team used.
6. Compute the power-play percentage for each team in the game.
7. Make a table of all your results.
8. Write a paragraph: how much did a one-player advantage help? When was pressure worth the risk?

Tips

- Use passes with hands for safety indoors; no rough contact.
- Rotate roles so everyone attacks and defends.

Check your work

- ☐ I recorded at least 20 keep-away trials across the four setups.

- ☐ I charted every power play or man-up in a real game and computed percentages.
- ☐ I explained the trade-off between pressure and security in writing.

SCOREBOOK

1. Draw a hockey power-play umbrella and a penalty-kill box on a rink diagram.
2. Draw a 1-2-2 forecheck and a 2-1-2 forecheck, and mark which is safer.
3. “What I would decide and why”: you lead by one goal with three minutes left. Which forecheck do you use, and why?

From history. The Montreal Canadiens of the late 1950s won five Stanley Cups in a row, from 1956 to 1960, the longest run in NHL history. Béliveau, their captain for many years, was admired as much for his sportsmanship as for his skill.

WORKED EXAMPLES

Example 1. A hockey team had 250 power-play opportunities in a season and scored 55 power-play goals. Compute its power-play percentage. If its penalty kill allowed 42 goals on 230 times short-handed, compute its penalty-kill percentage.

Show solution

1. Power play: $55/250 = 0.22 = 22\%$.
2. Penalty kill: $(230 - 42)/230 = 188/230 \approx 0.817 = 81.7\%$.

Answer: Power play 22%, penalty kill about 81.7%. Both numbers are measured per opportunity; a team that takes many penalties can have a good penalty-kill percentage and still allow many goals.

Example 2. Compute the ratio of skaters in a 5-on-4 power play and a 5-on-3. Using the square law of Lesson 1.5 as a rough model of strength, compare each with even strength (5 on 5).

Show solution

1. 5 on 4: ratio 1.25; square-law strength ratio $1.25^2 \approx 1.56$.
2. 5 on 3: ratio $5/3 \approx 1.67$; strength ratio $1.67^2 \approx 2.78$.
3. Even strength: 1.0.

Answer: A one-player advantage gives about 1.56 times the “strength” by the model; a two-player advantage about 2.78. The model is rough, but it explains why 5-on-3 power plays score so often and why referees’ calls matter so much.

Example 3. Before 1956, a team could score several goals on one minor penalty. Suppose a strong power play scored on average one goal every 2.5 minutes of 5-on-4 play. Under the old rule (the full 2 minutes are served), what is the expected number of goals per penalty? Under the new rule (the penalty ends at the first goal), what is the maximum? (Use the expected rate as a simple model.)

Show solution

1. Old rule: $2/2.5 = 0.8$ expected goals per penalty, and sometimes 2 or 3.
2. New rule: at most 1 goal per minor penalty.
3. The new rule cuts off the long tail of multi-goal penalties like Béliveau’s 44 seconds.

Answer: About 0.8 expected goals under the old rule (with some penalties producing two or three); never more than one under the new rule. Rules can limit an advantage that becomes too large.

PRACTICE

1. Easy What is a power play?

Show answer

A period when one team has more players because an opponent is serving a penalty.

2. **Easy** What rule did the NHL change after the 1955–56 season, and why?

Show answer

A minor penalty now ends when the team with the advantage scores; Montreal's power play (Béliveau's three goals in 44 seconds) had shown how one penalty could decide a game.

3. **Easy** Compute the power-play percentage: 18 goals on 90 opportunities.

Show answer

$$18/90 = 20\%.$$

4. **Medium** What is a forecheck, and what risk does an aggressive forecheck carry?

Show answer

Pressuring the opponent in its own zone to win the puck back. If the opponent escapes, it can attack against fewer defenders: a risk to security.

5. **Medium** Compute the penalty-kill percentage: 35 goals allowed on 200 times short-handed.

Show answer

$$165/200 = 82.5\%.$$

6. **Medium** What are the lacrosse equivalents of the power play and the forecheck?

Show answer

The man-up offense and the ride.

7. **Medium** When would a coach choose a conservative forecheck, and why?

Show answer

When protecting a lead late in a game: security matters more than winning the puck deep, so he keeps more players back.

8. **Medium** Explain why taking fewer penalties is a tactic.

Show answer

Every penalty gives the opponent a power play with a much higher chance of scoring; self-control reduces the opponent's best opportunities.

9. **Hard** Team A has a 24% power play and draws 3.2 power plays per game; it takes 3.8 penalties per game and kills 78% of them. Compute expected power-play goals for and against per game, and the net.

Show answer

For: $3.2 \times 0.24 = 0.768$. Against: $3.8 \times 0.22 = 0.836$. Net about -0.07 goals per game: its strong power play is more than offset by its penalties.

10. **Hard** How is a full-court press in basketball like a hockey forecheck? Give one similarity and one difference.

Show answer

Similar: both pressure the opponent far from its goal to win the ball back where a turnover leads straight to a scoring chance. Different: a press must deal with a time limit to cross half-court (backcourt rules), while a hockey forecheck has no such clock but relies on the boards and corners to trap the puck.

11. **Challenge** A power play scores at a rate of 1 goal per 2.5 minutes (so the chance of no goal in t minutes is $e^{-t/2.5}$). What is the probability of scoring at least once in a full 2-minute power play? In a 5-on-3 that lasts 1 minute at a rate of 1 goal per 1.2 minutes?

Show answer

$1 - e^{-2/2.5} = 1 - e^{-0.8} \approx 1 - 0.449 = 0.551$. 5-on-3:

$1 - e^{-1/1.2} \approx 1 - 0.435 = 0.565$. A one-minute 5-on-3 is about as dangerous as a full two-minute 5-on-4. (Rates are illustrative.)

COMMON MISTAKES

- Thinking a power play guarantees a goal; most power plays fail.
- Judging a penalty kill by percentage only, without counting how many penalties a team takes.
- Forechecking aggressively when protecting a lead.

Make it a game • Man-Up Keep-Away. Three players pass a soft ball in a room while one defender in the middle tries to touch it. This is the man-up offense. Add a fourth defender and say whether it is a penalty kill. Count the passes you complete in sixty seconds, then switch. Call out the forecheck or ride when the defender presses. Beat your own count.

5.5 THE SCOUTING REPORT

OBJECTIVES

- Tell the story of the 1946 Boudreau shift against Ted Williams and the 2023 rule limiting shifts.
- Build an honest scouting report from public data: tendencies, strengths, weaknesses and a plan.
- Use percentages and spray charts to decide where to position defenders, and distinguish honest scouting from cheating.

Warm-up. Think of a friend or sibling you play a game with often. Write three things he or she almost always does. How sure are you of each? How could you check?

WATCH

DO MLB DEFENSIVE SHIFTS WORK?

Simple Sabermetrics · 10:15

<https://www.youtube.com/watch?v=bodtuX4Pf2E>

WHEN TO WATCH

After “the plan” paragraph. A whiteboard explanation of how teams use spray charts to shift and what the data say about whether it works.

BACKUP VIDEO

Scully on the history of the defensive shift

MLB · 2:42

<https://www.youtube.com/watch?v=hyBsVs5Y4a4>

Optional, after the story. During a broadcast, the veteran announcer Vin Scully tells the history of the shift, beginning with Boudreau and Ted Williams.

KEY TERMS

scouting report

A written study of an opponent’s tendencies, strengths and weaknesses, with a plan to use them.

tendency

A choice an opponent makes more often than chance would predict, such as a hitter pulling the ball or a team running on first down.

spray chart

A diagram showing where a batter's batted balls landed, used to position fielders.

shift

Moving fielders away from their normal positions toward where a hitter usually hits the ball.

sample size

The number of observations a percentage is based on; small samples can mislead.

CORE IDEAS

The story. On July 14, 1946, Lou Boudreau, the young player-manager of the Cleveland Indians, faced a problem named Ted Williams. The Boston slugger had hit three home runs in the first game of a doubleheader that day. In the second game, when Williams came up, Boudreau moved his fielders: the shortstop and third baseman shifted toward the right side, leaving the left side almost empty. Boudreau knew from experience that Williams pulled nearly everything to right field. Williams, a proud hitter, kept pulling the ball into the shift rather than poking it the other way. The “Boudreau shift” (or “Williams shift”) was copied by other teams, and much later, with modern data, shifts became so common that Major League Baseball limited them starting in 2023, requiring two infielders on each side of second base.

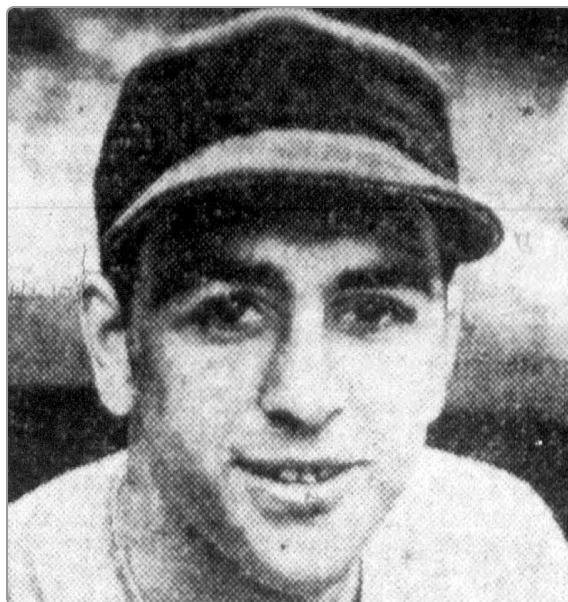
The plan. A scouting report turns observation into a plan. It asks: what does this opponent do most often, how sure are we, and how can we take it away or use it? A baseball report might say a hitter pulls 70% of his ground balls; a football report that a team runs on first down 65% of the time; a basketball report that a player drives left four times out of five. From these come the plan: shift the infield, load the box on first down, force the player right. A good report also notes the opponent's counter: Williams could have bunted or hit to left, and later hitters learned to.

The principle. Scouting is Sun Tzu's “know the enemy” turned into numbers. But two cautions apply. First, **sample size**: a tendency seen in 10 plays may be chance; one seen in 200 is more trustworthy. Second, the opponent adapts: the more you exploit a tendency, the more reason he has to change it, as the guessing games of Lesson 3.2 showed. A shift is like Napoleon's thin right wing at Austerlitz: it gives up one area to be strong in another, and a clever opponent will aim for the empty space.

On the board and the field. Honest scouting uses what anyone may see: game film, public statistics, notes from games you watched. It never uses stolen signals, hidden cameras, or plans obtained dishonestly. Chess players prepare by studying an opponent's published games; that is honest. Paul writes that an athlete "is not crowned, except he strive lawfully" (2 Timothy 2:5), a theme for Lesson 6.4. A scouting report is only as good as its honesty about the evidence: what we know, how sure we are, and what we are guessing.

Think it through. Scouting yourself is as important as scouting the opponent. Your own tendencies are on film too, and a good opponent will read them.

PICTURE STUDY



Lou Boudreau, Unknown photographer, 1944 · Photograph · Wikimedia Commons (reproduction of a press photograph)

Image: [Wikimedia Commons](#), public domain

Lou Boudreau became Cleveland's player-manager in 1942, when he was only twenty-four. He was a fine shortstop who managed the team while playing in it, which meant he studied opposing hitters from the field itself. In 1948 he led Cleveland to the World Series title and was named the American League's Most Valuable Player.

Look closely

- Look at Boudreau's face and uniform. How old does he look?
- Think about his position, shortstop. What could he see of each hitter from there?
- Imagine him moving his fielders for the first time against Williams. How might the crowd have reacted?

Talk about it

1. Why might a player-manager be especially good at scouting hitters?
2. Boudreau's shift used what he had seen with his own eyes. How is that different from modern data, and how is it the same?
3. Williams refused to change his swing to beat the shift. Was that stubbornness, confidence or wisdom? Explain.

PROJECT

Write a Scouting Report

You will write a two-page scouting report on a real team or player from public information and your own observation, with data, tendencies, a confidence rating for each, and a plan.

You will need

- Two or more games of one team or player to watch (live, television or free replays) and its public statistics
- The scorebook and a calculator

Steps

1. Choose a team or player in any sport.
2. Decide on three to five tendencies to chart (for example, run or pass on first down; where a hitter's balls go; which hand a player drives with).
3. Watch at least two games and tally each tendency.
4. Add public statistics if available (season totals give larger samples).
5. Compute percentages and estimate the possible error with $1/\sqrt{n}$ for each.
6. Rate each tendency as strong, moderate or weak evidence.
7. Write a plan to take away the opponent's top tendency, and note how the opponent might adjust.
8. Self-scout: list two tendencies of your own team or yourself that an opponent could exploit.
9. Write the report in two pages, with a chart, a short summary of strengths and weaknesses, and the plan.

Tips

- Use only information anyone may see. Never record or share an opponent's signals or plans obtained improperly.
- Be honest about uncertainty; a good report says what it does not know.

Check your work

- ☐ My report charts at least three tendencies with counts and percentages.

- ☐ Each tendency has an error estimate and an evidence rating.
- ☐ My plan includes the opponent's likely adjustment and a self-scouting note.

SCOREBOOK

1. Draw a baseball spray chart for an imaginary pull hitter, and draw the shift that would answer it.
2. Make a table of sample sizes (10, 25, 100, 400) and the rough error $1/\sqrt{n}$.
3. "What I would decide and why": your scouting shows the opponent's star drives left 75% of the time in 12 drives. How much do you trust it, and what do you do?

From history. Ted Williams batted .406 in 1941, the last major-league season in which a player hit over .400. In his book *The Science of Hitting* (1971) he explained his approach: wait for a good pitch in your best zone. He chose to beat the shift by hitting the ball hard and over it rather than around it.

WORKED EXAMPLES

Example 1. A hitter's ground balls in a season (illustrative): 140 to the right side of second base, 45 up the middle, 15 to the left side. Compute the percent to each zone. With a standard infield, two fielders cover the left side; with a shift, one fielder moves to the right side. Explain the trade.

Show solution

1. Total: $140 + 45 + 15 = 200$.
2. Right: $140/200 = 70\%$; middle: 22.5% ; left: 7.5% .
3. The shift moves a fielder from the area that sees 7.5% of grounders to the area that sees 70% .

Answer: 70% right, 22.5% middle, 7.5% left. The shift puts strength where the ball goes and accepts weakness where it rarely goes: economy of force guided by data.

Example 2. On first down, an opponent ran the ball 13 times in 20 plays in one game. In its last five games, it ran 64 times in 100 first-down plays. Compute both percentages and say which you would trust more for a scouting report.

Show solution

1. One game: $13/20 = 65\%$.
2. Five games: $64/100 = 64\%$.
3. The percentages are almost the same, but 100 plays give a much more reliable estimate than 20.

Answer: 65% and 64%. The five-game figure is more trustworthy because it rests on five times as much evidence. A rough rule: a percentage from n observations can easily be off by about $1/\sqrt{n}$, about 22 points for 20 plays and 10 points for 100.

Example 3. Model the shift as a choice for the hitter. Against a normal infield, his ground balls become hits 25% of the time. Against the shift, if he keeps pulling, they become hits 18% of the time; if he hits to the empty left side, they become hits 45% of the time, but he can do that successfully only on 30% of his swings (the rest are pulled as usual). What is his hit rate on grounders if he tries to go the other way on every swing?

Show solution

1. 30% of grounders go left: hit rate 0.45.
2. 70% are pulled into the shift: hit rate 0.18.
3. Overall: $0.30(0.45) + 0.70(0.18) = 0.135 + 0.126 = 0.261$.

Answer: About 26.1%, slightly better than 25% against a normal infield. If a hitter can learn to use the empty side even a little, the shift loses most of its value. Every tactic based on a tendency invites an adjustment. (Numbers are illustrative.)

PRACTICE

1. Easy Who invented the shift against Ted Williams, and when?

Show answer

Lou Boudreau, player-manager of Cleveland, on July 14, 1946.

2. Easy What rule did Major League Baseball adopt in 2023?

Show answer

It limited shifts by requiring two infielders on each side of second base (and all four infielders on the infield dirt) when the pitch is thrown.

3. Easy What is a tendency?

Show answer

A choice an opponent makes more often than chance would predict.

4. Medium A batter hit 52 of 80 fly balls to left field. What percent is that? How would you position the outfield?

Show answer

$52/80 = 65\%$. Shade the outfielders toward left, keeping some protection in right.

5. Medium Why is a tendency seen in 10 plays less reliable than one seen in 100?

Show answer

With few observations, chance can easily create an apparent pattern; more observations average out chance and give a more reliable estimate.

6. Medium List three honest sources and two dishonest methods for scouting an opponent.

Show answer

Honest: game film, public statistics, notes from games watched in person.
Dishonest: stealing signals by forbidden means (such as hidden cameras), obtaining an opponent's playbook or game plan by deceit.

7. Medium How is a shift like Napoleon's thin right wing at Austerlitz?

Show answer

Both give up strength in one area to be strong in another; both invite a clever opponent to attack the weakened area.

8. Medium Use the rough rule $1/\sqrt{n}$ to estimate the possible error of a percentage based on 400 observations.

Show answer

$1/\sqrt{400} = 1/20 = 5\%$.

9. **Hard** In worked example 3, what fraction of swings must the hitter successfully send to the left side for his hit rate to match the 25% he had against a normal infield?

Show answer

Solve $0.45f + 0.18(1 - f) = 0.25 \Rightarrow 0.27f = 0.07 \Rightarrow f \approx 0.26$. About 26% of the time.

10. **Hard** Why should a team scout itself? Give an example.

Show answer

Opponents study your tendencies too. If a team runs to its right on 80% of goal-line plays, a good opponent will know it. Self-scouting reveals predictable habits so the team can break them.

11. **Challenge** An opponent passes on third down 85% of the time. You may play a pass defense (allows a first down 30% of the time against passes and 70% against runs) or a run defense (allows 60% against passes and 25% against runs). Which should you play, and what is the conversion rate allowed? At what pass percentage would the two defenses be equal?

Show answer

Pass defense: $0.85(0.30) + 0.15(0.70) = 0.255 + 0.105 = 0.36$. Run defense:

$0.85(0.60) + 0.15(0.25) = 0.51 + 0.0375 = 0.5475$. Play pass defense (36%).

Equal when $0.30q + 0.70(1 - q) = 0.60q + 0.25(1 - q)$: $0.70 - 0.40q = 0.25 + 0.35q$, so $q = 0.45/0.75 = 0.6$. Above 60% passing, the pass defense is better.

COMMON MISTAKES

- Trusting a tendency from a small sample.
- Forgetting that the opponent will adjust to your plan.
- Using scouting methods that break the rules or the spirit of the game.

Make it a game • Spray Chart Scout. Your parent flicks fifteen beans toward a paper target without saying where. You record each landing on a spray chart. After the fifth flick, decide where to place your shift, then after ten, again. Count how many land inside your shift. Say what the 1946 Boudreau shift and the 2023 rule mean for sample size.

UNIT 5

TACTICS IN TEAM SPORTS

The principles that won at Cannae and Trafalgar are at work every weekend on fields, courts and rinks. This unit studies how coaches arrange eleven, five or six players to gain local superiority, protect against counterattacks and give every player a clear role: soccer formations from the 2-3-5 to Total Football, football's single wing, T formation and West Coast offense, man and zone defense and John Wooden's UCLA, the power play and the forecheck in hockey and lacrosse, and the honest scouting report.

Every lesson asks you to draw formations, count players in each zone, compute points per possession or expected yards, and run a small drill or game in the yard to test an idea. You will also watch real games and chart what you see. The unit ends with a scouting report on a real team, the kind of document coaches prepare every week.

PREREQUISITES

- The principles of war (Lesson 1.2), especially mass, economy of force and security
- Local superiority and the oblique attack (Lessons 1.2 and 3.3)
- Percents, averages and expected value as a weighted average

MASTERY CHECKLIST

- ☐ I can draw the 2-3-5, WM, 4-4-2 and Total Football shapes and explain why formations changed.
- ☐ I can explain the single wing, T formation and West Coast offense and compute expected yards for short and long passing.
- ☐ I can explain man and zone defense and spacing, and describe John Wooden's Pyramid of Success.
- ☐ I can explain the power play and the forecheck and compute power-play percentages and local ratios.
- ☐ I can write an honest scouting report with data and a plan.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **U.S. Soccer Learning Center (free coaching resources)**: Free resources from U.S. Soccer on small-sided games and team shape, useful for the drills in Lessons 5.1 and 5.5. Ages 12+.
- **The Official Site of Coach John Wooden**: Free. Wooden's Pyramid of Success and his maxims, for Lesson 5.3. All ages.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

5.1 Soccer Formations: From the Pyramid to Total Football	3 sessions of 50 minutes
5.2 Football Formations: Single Wing, T and West Coast	3 sessions of 50 minutes
5.3 Basketball: Man, Zone, Spacing and John Wooden	3 sessions of 50 minutes
5.4 Hockey and Lacrosse: The Power Play and the Forecheck	3 sessions of 50 minutes
5.5 The Scouting Report	3 sessions of 50 minutes

UNIT 5 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Draw diagrams where asked. Answer the concept questions in complete sentences. The test has 15 problems worth a total of 100 points.

1. **7 pts**
Explain how the 1925 offside change led to Herbert Chapman's WM formation.
2. **6 pts**
Compute the percent of field players in attack for the 2-3-5 and the 4-4-2, and explain the trend.

3. (6 pts)

A back four spreads across 68 m; a compact back four covers 40 m. Find the channel width in each case and the uncovered width when compact.

4. (8 pts)

A short pass: 72% complete, 6 yards, 1% interception (−45). A deep pass: 38% complete, 24 yards, 4% interception (−45). Compute expected yards for each.

5. (6 pts)

On third-and-2, which pass in problem 4 would you call? On fourth down trailing by 4 with 5 seconds left at the opponent's 24? Explain each.

6. (6 pts)

Describe the single wing and the T formation and one advantage of each.

7. (7 pts)

A team scores 63 points on 60 possessions against man-to-man and 57 on 60 against zone. Compute points per possession and recommend a defense to its opponent.

8. (6 pts)

State John Wooden's record at UCLA and name three blocks of the Pyramid of Success.

9. (7 pts)

A team had 240 power plays and scored 48 goals; it was short-handed 260 times and allowed 52 goals. Compute both percentages.

10. (6 pts)

Tell the story behind the NHL's 1956 power-play rule change.

11. (6 pts)

Explain the trade-off of an aggressive forecheck, and when a coach should choose a conservative one.

12. (7 pts)

A hitter's grounders: 126 right, 54 middle, 20 left. Compute percentages and explain the shift a team might use (under the pre-2023 rules).

13. (6 pts)

Use $1/\sqrt{n}$ to estimate the error of a percentage from 25 observations and from 225. Which would you trust?

14. (7 pts)

Distinguish honest scouting from cheating, with two examples of each.

15. (9 pts)

Short essay (6–8 sentences): Choose one tactic from this unit and one battle from Units 3–4 that use the same principle. Explain the shared principle and one important difference.

ANSWER KEY

1. With attackers needing only two opponents between them and the goal line, a single full-back could no longer safely step up, and goals rose. Chapman added a center-back to mark the center-forward, creating the 3-2-2-3 WM.
2. 50% and 20%. Coaches shifted strength from attack to security and midfield control as passing and counterattacks improved.
3. 17 m and 10 m; 28 m uncovered (14 m each wing).
4. Short: $4.32 - 0.45 = 3.87$; deep: $9.12 - 1.8 = 7.32$.
5. Third-and-2: the short pass, which converts about 72% of the time. Final play needing a touchdown: the deep pass to the end zone; only it achieves the objective.
6. Single wing: unbalanced line, tailback taking a deep snap, mass of blockers to one side (local superiority). T: quarterback under center with backs in a T, quick handoffs and fakes (deception and speed).
7. Man 1.05, zone 0.95. The opponent should play zone.
8. Ten national titles in twelve seasons (1964–1975), including seven straight, and an 88-game winning streak. Blocks: for example, industriousness, enthusiasm, self-control, team spirit, competitive greatness.
9. Power play 20%; penalty kill $208/260 = 80\%$.
10. On November 5, 1955, Jean Béliveau of Montreal scored three power-play goals in 44 seconds against Boston during one minor penalty. The NHL then ruled that a minor penalty ends when the team with the advantage scores.
11. It wins the puck deep and creates chances (offensive) but risks odd-man rushes against if beaten (security). Choose a conservative forecheck when protecting a lead.
12. 63%, 27%, 10%. Move an infielder from the left side to the right side, accepting weakness where only 10% of grounders go.
13. 20% and about 6.7%. Trust the 225-observation estimate.
14. Honest: game film, public statistics, notes from games watched. Cheating: stealing signals with hidden cameras or other forbidden means, obtaining an opponent's plans by deceit.
15. Answers will vary. A full-credit essay accurately describes both, names a shared principle (for example, the single wing and Gaugamela both mass on one wing), and identifies a real difference (rules, scale, the possibility of adjustment).

PORTFOLIO PIECE: A COACH'S PLAYBOOK

Create a six-page playbook for one team sport you play or follow. It must include (1) your team's formation in attack and defense, drawn and explained with the principles of war it uses; (2) three set plays, each with a diagram, the principle behind it, and an expected-value or success-rate calculation from real or carefully measured data; (3) a defensive plan comparing two defenses with points per possession or a similar measure; (4) a one-page scouting report on a real opponent with tendencies, sample sizes and a plan; and (5) a closing page on the character you want your team to show, drawing on Wooden's Pyramid of Success.

LOOK FOR	WHAT IT MEANS
Formations and plays	Formations and plays are clearly diagrammed and correctly tied to principles of war.
Calculations	Each play and the defensive comparison is supported by correct, clearly shown calculations with stated assumptions.
Scouting	The scouting report uses honest sources, reports sample sizes and confidence, and anticipates adjustments.
Character	The closing page thoughtfully connects tactics to character, with specific habits drawn from Wooden's teaching.

UNIT 6

THE STRATEGIST'S CHARACTER

Every plan in this course was carried out by people, and in the end the quality of a strategy depends on the character of those who make and carry it out. This unit studies five qualities of a good strategist: the clarity to state an intent that others can follow, the diligence to supply and sustain a plan, the humility to adapt when the plan fails, the honor to win only by lawful means, and the creativity to design something new and test it honestly.

The stories come from Gettysburg, from Napoleon's march to Moscow as drawn on Charles Minard's famous chart, from the Prussian staff of Helmuth von Moltke, and from the golfer Bobby Jones and the lawyer Francis Lieber. The unit ends with a capstone in which you design and test an original strategy for a game or sport, or write an analysis comparing a historical battle with a game, and present it.

PREREQUISITES

- All of Units 1–5, especially the principles of war, friction, Sun Tzu's rule of knowing the enemy, and the scouting report
- Reading charts and maps; percents and rates
- Expected value as a weighted average

MASTERY CHECKLIST

- ☐ I can write a clear commander's intent (purpose, key tasks, end state) and explain why unclear orders fail.
- ☐ I can read Minard's chart of 1812 and explain why supply decides campaigns.
- ☐ I can explain Moltke's view that no plan survives first contact, and plan with branches and reserves.
- ☐ I can explain why honor and lawful striving are part of strategy, with examples from sport and history.
- ☐ I can design, test and present an original strategy with honest data.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **The Lieber Code (Avalon Project, Yale Law School)**: Free. The full text of General Orders No. 100 (1863) for Lesson 6.4. Read Articles 14–16 on military necessity and its limits. Ages 15+ with a parent previewing.
- **Edward Tufte on Minard’s chart**: Free resources from the statistician who made Minard’s 1869 chart famous, for Lesson 6.2. Ages 14+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

6.1	Commander’s Intent	3 sessions of 50 minutes
6.2	Supply: Minard’s Map of 1812	3 sessions of 50 minutes
6.3	When the Plan Fails	3 sessions of 50 minutes
6.4	Honor and Lawful Striving	3 sessions of 50 minutes
6.5	Capstone: Your Strategy Report	3 sessions of 50 minutes

UNIT 6 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Answer the concept questions in complete sentences, with specific examples. The test has 15 problems worth a total of 100 points.

1. **6 pts**

Define commander’s intent and its three parts.

2. **7 pts**

Compare Lee’s order to Ewell on July 1, 1863, with Vincent’s order to Chamberlain on July 2.

3. **6 pts**
An order passes through 5 relays, each 92% accurate. What is the chance it arrives exactly?
4. **7 pts**
Using Minard's figures (422,000; 100,000; 10,000), compute the percent who reached Moscow and the percent who returned.
5. **6 pts**
An army of 80,000 needs 1 kg of food per man per day; wagons carry 500 kg and take 6 days for a round trip. How many wagons are needed?
6. **6 pts**
What is the culminating point, and how does Minard's chart show it?
7. **6 pts**
Paraphrase Moltke's saying about plans and explain his answer to it.
8. **7 pts**
A plan gives +8 with probability 0.55 and -7 with probability 0.45. A branch plan changes the bad case to +1 and the good case to +6. Compare expected values.
9. **6 pts**
Explain the difference between steadiness and stubbornness, with an example.
10. **6 pts**
Tell the story of Bobby Jones's penalty in 1925 and what it cost him.
11. **6 pts**
What was the Lieber Code, and why does it matter for a course on strategy?
12. **7 pts**
Classify as fair deception or cheating, and explain: (a) a disguised serve; (b) faking a foul; (c) a feigned retreat in a war game; (d) moving a chess piece when the opponent is not looking.

13. **6 pts**

A strategy scores 13.5 points in 20 games against a control of 10 points in 20. Compute both percentages and the rough uncertainty.

14. **6 pts**

What rating difference predicts a 75% score?

15. **12 pts**

Essay (10–12 sentences): Which quality of a strategist from this unit (clear intent, attention to supply, adaptability, honor) do you think matters most? Defend your answer with one historical example and one example from a game or sport, and connect it to a verse of Scripture from the course.

ANSWER KEY

1. A short statement of what a plan must achieve and why, clear enough for subordinates to act when circumstances change: purpose, key tasks and end state.
2. Lee's order ("if practicable," while avoiding a general engagement) gave discretion without a clear priority, and Ewell did not attack. Vincent's order stated the purpose (the left of the line) and the task (hold at all hazards); Chamberlain understood it and invented a charge that achieved it.
3. $0.92^5 \approx 0.659$.
4. About 23.7% and about 2.4%.
5. $80000/500 = 160$ loads per day; $160 \times 6 = 960$ wagons.
6. The point beyond which an attacker is too weakened to succeed. The chart shows the army shrinking steadily as it advanced, so that by Moscow it was too weak to force a decision or hold its position.
7. No plan extends with certainty beyond the first encounter with the enemy's main strength. His answer: plan anyway, train officers in the purpose, give short directives, and let them act on their judgment (mission tactics).
8. Without: $4.4 - 3.15 = 1.25$. With: $3.3 + 0.45 = 3.75$. The branch plan is better.
9. Steadiness keeps the objective and changes the method; stubbornness keeps a failing method. Example: a team that keeps trying to win (objective) but switches from a long-passing game to a short one when the wind changes.
10. His ball moved at address in the rough; no one else saw it, but he called a one-stroke penalty on himself. He tied after 72 holes and lost the playoff, so the stroke cost him the championship.
11. General Orders No. 100 (1863), the first written code of the laws of war for an army in the field. It shows that even in war strategy operates within rules, and that lawful limits are part of honorable conduct.
12. (a) Fair, within the rules. (b) Cheating, deceives the official. (c) Fair, part of the game. (d) Cheating, breaks the rules.
13. 67.5% and 50%; about $1/\sqrt{20} \approx 22$ points each, so the difference is suggestive but not proven.
14. $10^{-D/400} = 1/0.75 - 1 = 1/3$, $D = 400 \log_{10} 3 \approx 191$.
15. Answers will vary. A full-credit essay chooses a quality, defends it with accurate, specific historical and game examples, addresses at least one objection, and

connects it thoughtfully to a verse such as 1 Corinthians 14:8, Proverbs 6:6-8, Proverbs 16:9, 2 Timothy 2:5 or Proverbs 16:32.

PORTFOLIO PIECE: A STRATEGIST'S HANDBOOK, FINAL EDITION

Complete your strategist's handbook. Add (1) a page on commander's intent with a three-part intent for a real game or project; (2) a Minard-style chart of a resource from your own experience; (3) a decision tree with a branch plan for a game you play; (4) your family or team code of honor; and (5) your capstone report and presentation notes. Finish with a two-page reflection on the whole course: the three ideas that changed how you play or plan, one battle or game that you will remember, and how Scripture has shaped your view of competition, planning and providence.

LOOK FOR	WHAT IT MEANS
Completeness	All five additions and the reflection are present, neat and labeled.
Capstone quality	The capstone has a clear objective, a fair test or specific comparison, correct calculations and honest limitations.
Application	Intent, supply, branch plans and the code of honor are applied to real situations from the student's life.
Reflection	The reflection is thoughtful, specific and honest, connecting strategy, character and Scripture without preaching.

6.1 COMMANDER'S INTENT

OBJECTIVES

- Define commander's intent and its three parts: purpose, key tasks and end state.
- Compare an unclear order (Lee to Ewell, July 1, 1863) with a clear one (Vincent to Chamberlain, July 2, 1863) at Gettysburg.
- Write intent statements for games and sports, and compute how clarity survives a chain of messengers.

Warm-up. Play “telephone” with three or four family members: whisper a ten-word instruction from one to the next and compare the last version with the first. Then try again with a five-word instruction that states its purpose (“Get the ball to Sam”). Which survived better?

WATCH

Little Round Top Battle | Gettysburg | Mapping History | July 2, 1863 | Joshua Lawrence Chamberlain

Jeffrey the Librarian · 13:39

<https://www.youtube.com/watch?v=nAMReh79NeY>

WHEN TO WATCH

After “the story” paragraph. The fight for Little Round Top is shown on satellite maps with moving unit markers; watch the left end of the Union line.

Note: The battle is shown only with maps, photographs and markers.

BACKUP VIDEO

Mission Command Episode #1: Origins of Mission Command

Lopez on Leadership · 5:48

<https://www.youtube.com/watch?v=JIDNvnmQ05c>

Optional, after “the principle.” An Army officer explains the origins of mission command and commander's intent at a whiteboard.

KEY TERMS

commander's intent

A short statement of what a plan must achieve and why, clear enough that subordinates can act rightly when circumstances change and no new orders come.

purpose

The reason for an action: why it matters to the larger goal.

end state

What the situation should look like when the task is complete.

discretionary order

An order that leaves the decision to the subordinate ("if practicable"). Useful only if he understands the purpose and the risk.

flank

The end or side of a line, where it can be attacked from the side.

CORE IDEAS

The story. On the afternoon of July 1, 1863, at Gettysburg, Pennsylvania, Confederate forces had driven two Union corps back through the town to Cemetery Hill. Robert E. Lee, seeing the beaten Union troops gathering on the hill, sent word to his corps commander Richard Ewell to take the hill "if practicable," while also not wanting to bring on a general engagement before the rest of his army arrived. Ewell, with tired troops and uncertain information, judged it not practicable and did not attack. That night Union troops fortified Cemetery Hill and nearby Culp's Hill. The next afternoon, July 2, the far left of the Union line was a rocky hill called Little Round Top. Colonel Strong Vincent rushed his brigade onto it just in time and placed the 20th Maine Regiment, under Colonel Joshua Lawrence Chamberlain, at the very end of the line. According to Chamberlain, Vincent told him that this was the left of the Union line and that he was to hold that ground at all hazards.

The plan. Chamberlain knew exactly what was wanted and why: if his regiment gave way, the whole Union line could be turned from the flank. When attackers tried to go around his left, he stretched his line and bent back its end. After repeated attacks his men were nearly out of ammunition. Rather than retreat, which his orders forbade,

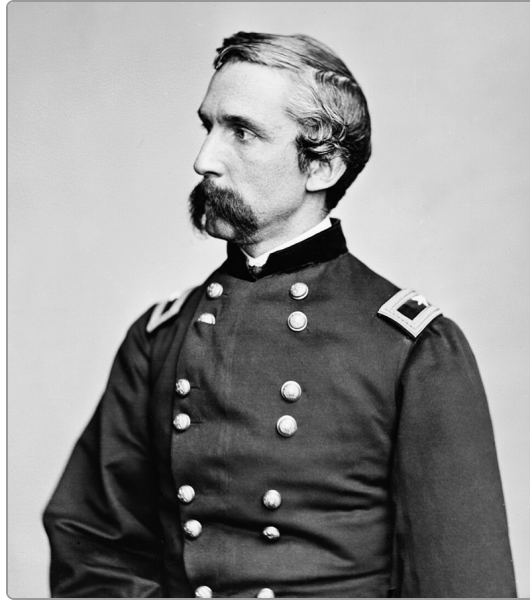
or stand without ammunition, he ordered a charge down the hill with fixed bayonets, the left of the line swinging like a door. The charge swept the attackers from the slope and took many prisoners, and the Union left held. Chamberlain, who before the war had been a professor of rhetoric at Bowdoin College and had studied for the ministry, later received the Medal of Honor.

The principle. The two moments show the power of **commander's intent**. Lee's order gave Ewell discretion but not a clear purpose or priority: take the hill, but avoid a general battle. Historians still argue over whether Ewell judged rightly, but the order left him to resolve a conflict Lee had not resolved. Vincent's order to Chamberlain was short and complete: the **purpose** (you are the left of the line), the **key task** (hold this ground) and the **end state** (the line is not turned). Because Chamberlain understood it, he could invent a new tactic, the charge, that served it. Paul wrote, "if the trumpet give an uncertain sound, who shall prepare himself to the battle?"

On the board and the field. Good coaches give intent, not just plays: "we want the ball in the middle of the floor, attacking the rim, every possession." A quarterback who knows the intent of a play can adjust when the defense does something new. A chess player's plan ("attack the weak pawn on d5") is his intent; it tells him which moves are good even in positions he never studied. A captain on a soccer field with a clear intent can lead without waiting for the bench. In a family or a team project, the same rule holds: explain why, and people will find a way.

Think it through. Clear intent is not the same as rigid orders. Chamberlain was not told to charge; he was told what mattered. The clearer the purpose, the more freedom a good subordinate can be given.

PICTURE STUDY



Joshua Lawrence Chamberlain, Brady–Handy studio, 1860s · Photograph · Library of Congress, Washington, D.C.

Image: [Wikimedia Commons](#), public domain

Joshua Lawrence Chamberlain was a scholar who taught rhetoric and languages at Bowdoin College in Maine before he volunteered for the army in 1862. He had no military training. What he had was a habit of careful thought and clear words, and a deep sense of duty; he wrote movingly afterward about why he fought and how he tried to lead.

Look closely

- Look at Chamberlain's face. What qualities does it suggest?
- Look at the uniform. What does it tell you about his rank?
- Compare this photograph with the portraits of Clausewitz and Nelson earlier in the course. What do these leaders have in common?

Talk about it

1. How might a teacher of rhetoric (clear speaking and writing) be especially good at understanding and giving intent?
2. Chamberlain had to decide in minutes. What helped him decide well?
3. What would you want a leader to tell you before a hard task?

PROJECT

Orders versus Intent

You will run a team task twice, once with detailed step-by-step orders and once with a short commander's intent, and introduce an unexpected change partway through to see which version adapts better.

You will need

- Three to five people
- A task such as building a structure from blocks or cups, setting a table, or finding hidden objects in a room
- A stopwatch and the scorebook

Steps

1. Write a detailed set of ten step-by-step orders for the task.
2. Write a commander's intent for the same task in three sentences: purpose, key tasks, end state.
3. Secretly prepare a change to spring halfway (for example, remove some blocks, move an object, add a new goal).
4. Run 1: give only the detailed orders. Spring the change. Time the task and count mistakes and questions asked.
5. Run 2 (with different helpers if possible, or a different but similar task): give only the intent. Spring a similar change. Time and count again.
6. Repeat both versions once more.
7. Make a table of times, mistakes and questions.
8. Write a paragraph comparing the two versions, especially after the change, and connect it to Ewell and Chamberlain.

Tips

- Keep the change fair and safe; the point is adaptation, not frustration.
- Ask helpers afterward what they understood the goal to be.

Check your work

- ☐ I wrote both detailed orders and a three-part intent for the same task.

- ☐ I recorded four runs with an unexpected change in each.
- ☐ My paragraph connects my results to Gettysburg.

SCOREBOOK

1. Draw a sketch map of Gettysburg with Cemetery Hill, Culp's Hill and Little Round Top, and mark July 1 and July 2.
2. Write a three-part intent for a game you will play this week.
3. "What I would decide and why": you are Ewell on the evening of July 1, with tired troops and an order to attack "if practicable." What would you want to know, and what would you decide?

KEY FORMULAS

$$P(\text{message intact after } n \text{ relays}) = p^n$$

From history. Later Chamberlain was chosen to receive the formal surrender of the Confederate infantry at Appomattox in April 1865. He ordered his men to salute the defeated soldiers as they passed, an act of honor remembered on both sides. He later served as president of Bowdoin College.

WORKED EXAMPLES

Example 1. An order passes through 4 people before reaching the soldiers. Each passes it on accurately 90% of the time. What is the chance it arrives intact? If the order includes a clear purpose, suppose each person who receives a slightly garbled order can still recover the intent 70% of the time. What is the chance that each relay preserves the intent?

Show solution

1. Exact message: $0.9^4 \approx 0.656$.
2. With intent, a relay preserves the meaning if it is accurate (0.9) or garbled but recovered ($0.1 \times 0.7 = 0.07$): 0.97.
3. Over 4 relays: $0.97^4 \approx 0.885$.

Answer: About 66% for the exact words, but about 89% for the meaning when the purpose is clear. Intent is a form of redundancy: it lets people repair the message. (The percentages are illustrative.)

Example 2. Rewrite Lee's order to Ewell as a clear commander's intent with purpose, key task, end state and priority. (Assume Lee's real wish was to take the high ground if it could be done before Union reinforcements arrived, even at the risk of a larger battle.)

Show solution

1. Purpose: deny the Union army the high ground south of town, where it could defend strongly.
2. Key task: attack Cemetery Hill before dark with the troops available.
3. End state: Confederate troops hold Cemetery Hill tonight.
4. Priority: taking the hill matters more than avoiding a general engagement.

Answer: "Take Cemetery Hill before dark so the enemy cannot defend the heights; this matters more than avoiding a larger battle." Whether Lee would have chosen that priority is a question historians debate; the point is that a clear intent resolves the conflict for the subordinate.

Example 3. The 20th Maine had about 386 men at Little Round Top. If each man began with 60 rounds of ammunition and the regiment fired an average of 2 rounds per man per minute, how many minutes of firing did it have? (Use these as illustrative numbers.)

Show solution

1. Rounds per man: 60. Rate: 2 per minute.
2. Minutes: $60/2 = 30$.

Answer: About 30 minutes of steady firing. Ammunition is supply, and supply limits every plan (Lesson 6.2). When it ran out, Chamberlain's understanding of his intent led him to a new solution rather than retreat.

PRACTICE

1. Easy What are the three parts of commander's intent?

Show answer

Purpose, key tasks and end state.

2. Easy What did Lee's order to Ewell say about Cemetery Hill?

Show answer

To take it "if practicable," while avoiding a general engagement until the rest of the army arrived.

3. Easy What was Chamberlain told, according to his own account?

Show answer

That his regiment was the left of the Union line and that he must hold the ground at all hazards.

4. Medium Why did Chamberlain's charge fit his orders even though no one ordered a charge?

Show answer

His intent was to hold the ground; with no ammunition, standing still or retreating would lose it, so a charge was the action most likely to achieve the purpose.

5. Medium Write a commander's intent for a basketball team's last possession, down by 1 with 20 seconds left.

Show answer

Sample: "Purpose: score to win. Key task: get a shot at the rim or an open three, not a contested jumper, with time for a rebound. End state: we lead or are fouled with under 5 seconds left."

6. Medium An order passes through 3 relays, each 85% accurate. What is the chance it arrives exact?

Show answer

$0.85^3 \approx 0.614$.

7. Medium Explain 1 Corinthians 14:8 in your own words and connect it to commander's intent.

Show answer

If a trumpet signal is unclear, no one knows to prepare for battle. An unclear order leaves people unprepared; a clear intent prepares them.

8. **Medium** Give a chess example of a plan acting as intent.

Show answer

Sample: “Attack the isolated pawn on d5.” Even in a position you have never seen, moves that add pressure on d5 or stop its defense serve the plan.

9. **Hard** Why can a discretionary order like “if practicable” be wise, and what must accompany it to work?

Show answer

The commander cannot see everything; the man on the spot may know better. It works only if he also knows the purpose and the commander’s priorities, so he can judge what “practicable” means.

10. **Hard** In worked example 1, how high must the recovery rate be for the meaning to arrive intact 95% of the time over 4 relays?

Show answer

Need per-relay $q^4 = 0.95 \Rightarrow q \approx 0.9873$. Since $q = 0.9 + 0.1r$, $r \approx 0.873$: about 87% recovery.

11. **Challenge** Write intents for two levels of the same game: a coach’s intent for a whole soccer match and a captain’s intent for the last ten minutes when leading 1–0. Show how the second serves the first, and name the principle of war each emphasizes.

Show answer

Sample: Coach: “Win by controlling the middle and attacking quickly when we win the ball; end state: we create more good chances than they do.”

(Offensive, mass.) Captain: “Protect the lead: stay compact, keep the ball in their half when we can, and give away no free kicks near our goal; end state: we finish ahead.” (Security, economy of force.) The second serves the first’s purpose, winning, by changing the method for the situation.

COMMON MISTAKES

- Confusing intent with detailed instructions; intent says what and why, not every how.
- Giving discretion without priorities, which leaves subordinates to resolve conflicts the leader should have resolved.

- Thinking clear intent removes the need for judgment; it makes good judgment possible.

Make it a game • Intent Instructions. Give your parent a task, such as tidying the family room, using only three parts: the purpose, the key tasks, and the end state. No step-by-step orders. Then change one condition, like a closed door, and see if your parent can still finish. Score the clarity of your intent from one to five. Swap roles.

Scripture. “For if the trumpet give an uncertain sound, who shall prepare himself to the battle?” (1 Corinthians 14:8, KJV)

Paul used a military picture to teach the church to speak clearly. Clear words are a kindness to those who must act on them.

6.2 SUPPLY: MINARD'S MAP OF 1812

OBJECTIVES

- Read Charles Minard's 1869 chart of Napoleon's Russian campaign and extract its numbers.
- Explain why supply, distance and weather can decide a campaign, and why logistics is part of strategy.
- Compute rates of loss and supply requirements, and apply the idea of supply to sports, games and family life.

Warm-up. Plan the food and water for a family day hike of 10 miles. List what you need and estimate the weight. Now imagine you had to carry food for 100 people for a week. What changes?

WATCH

The Greatest Ever Infographic - Numberphile

Numberphile · 6:19

<https://www.youtube.com/watch?v=3T7jMcstxY0>

WHEN TO WATCH

After “the story” paragraph. A mathematician walks through Minard's chart line by line; have the chart in front of you and follow along.

Note: Paintings of the retreat from Moscow appear briefly; nothing graphic is shown.

BACKUP VIDEO

Minard's Famous "Napoleon's March" Chart – What It Shows, What It Doesn't

eagereyes – Robert Kosara · 11:24

https://www.youtube.com/watch?v=hlb1uM_SOcE

Optional, before the project. A data-visualization researcher explains what the chart shows, what it leaves out, and how Minard drew it.

KEY TERMS

logistics

The planning and carrying out of supply, transport, maintenance and movement for a force.

line of communication

The route connecting an army with its sources of supply and reinforcement.

attrition

Gradual loss of strength through casualties, sickness, desertion and exhaustion.

culminating point

The point beyond which an advancing force grows weaker than its opponent because of distance and losses; a term from Clausewitz.

CORE IDEAS

The story. In June 1812 Napoleon led the largest army Europe had seen across the Niemen River into Russia. In 1869 a retired French civil engineer, Charles Joseph Minard, drew the whole campaign as a single chart. A broad tan band, its width proportional to the number of men, runs from the Niemen to Moscow; a thin black band returns. Minard's figures show 422,000 men crossing the Niemen, about 100,000 reaching Moscow, and about 10,000 coming back across the river. Beneath the return route he drew a line of temperatures, falling to -30 degrees on the Réaumur scale in December. Statisticians have called it one of the best charts ever made.

The plan. Napoleon expected a short campaign: the Russians would stand and fight near the border, and he would win as he had at Austerlitz. He gathered supply wagons and depots for a few weeks of advance. But the Russian armies retreated, and every week the army marched farther from its depots. Horses died by the thousands in the summer heat and from lack of fodder; without horses, supply wagons could not move, and men went hungry. Disease, desertion and detachments to guard the long road cut the army down far more than battle did. After Borodino and the council at Fili (Lesson 1.5), Napoleon entered Moscow, waited five weeks for a peace that never came, and began the long retreat in October as winter closed in.

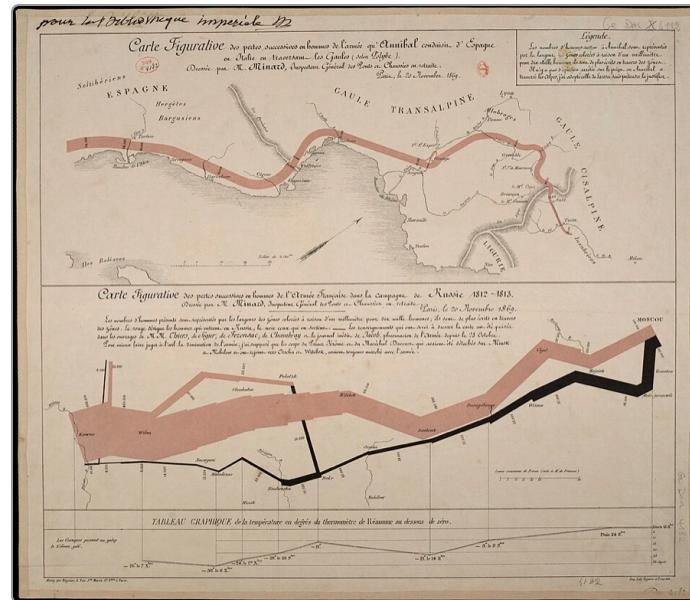
The principle. Minard's chart teaches the most neglected truth of strategy: **supply decides campaigns**. Soldiers say that amateurs talk tactics and professionals talk logistics. Clausewitz wrote of the **culminating point**: an attacker grows weaker the farther he advances, until he can go no farther without being outmatched. Napoleon

passed that point long before Moscow. The lesson is not only military. Proverbs points to the ant, which “provideth her meat in the summer, and gathereth her food in the harvest.” A plan without supply is a wish.

On the board and the field. In sport, supply is fitness, sleep, food, water, a deep bench and a travel schedule. A team that plays three games in four days is fighting its own logistics. A marathoner who does not drink early cannot catch up later. In chess, the clock is supply: a player who spends too much time early may have a winning position and lose on time. Wise strategists plan their supply first and their tactics second.

Think it through. The worst losses on Minard’s chart came not in battle but on the march. The quiet, unglamorous work of supply is where most campaigns, seasons and projects are won or lost.

PICTURE STUDY



Figurative Map of the Successive Losses of the French Army in the Russian Campaign, 1812–1813, Charles Joseph Minard, 1869 · Lithograph chart · École nationale des ponts et chaussées, Paris (original); many reproductions

Image: [Wikimedia Commons](#), public domain

Minard was an engineer who loved to show numbers as pictures. This sheet holds both of the charts he published together: Hannibal's march above and Napoleon's campaign of 1812 below. In the lower chart he shows six things at once: the size of the army, its location, its direction, the dates, the temperatures on the retreat, and the rivers it crossed. Read it slowly, from left to right and back again.

Look closely

- Find the start of the tan band at the Niemen. How wide is it compared with the band at Moscow?
- Find places where the band suddenly narrows or splits. What happened there?
- Follow the black band back. Find the river crossing where it narrows sharply.
- Read the temperature line along the bottom. When did the cold become severe?
- Compare the upper chart of Hannibal's march with the lower one. What do the two armies have in common?

Talk about it

1. What does this chart show that a list of numbers would not?
2. Where on the chart would you mark the culminating point of the campaign, and why?
3. If you were Napoleon's supply officer in May 1812 and saw this chart in advance, what would you have recommended?

Safety first. If you track sprint times or a hike, warm up first, drink water, stop if anything hurts, and have a parent present. Hike only on safe, familiar trails.

PROJECT

Draw a Minard Chart

You will collect data on a resource that is used up over time, in a game, a sport or family life, and draw it in Minard's style, with band width showing the amount left.

You will need

- Graph paper, colored pencils and a ruler
- A stopwatch or a way to measure something that runs down (energy, time, resources)
- The scorebook

Steps

1. Choose a resource to track. Examples: your chess clock time remaining after every five moves in three games; your sprint times over ten repeated runs (energy); the money of each player in a board game such as Monopoly by turn (counted in points, not real money); water in a bottle during a long hike.
2. Record the resource at regular intervals, with one or two other variables (for example, temperature, score or position).
3. On graph paper, draw a path (a route, a timeline or a board) and make a band along it whose width is proportional to the resource at each point.
4. Add a second line beneath, as Minard did with temperature, for one other variable.
5. Label the moments where the band narrows sharply and say why.
6. Compute the percent remaining at three points and the average loss per interval.
7. Write a paragraph: where was your culminating point, and how could better supply have changed the result?

Tips

- Choose a scale so that the widest band is about 3 cm.
- If you track a board game, keep score in points only.

Check your work

- ☐ I recorded real data at regular intervals.
- ☐ My chart shows band width proportional to the resource and a second variable beneath.
- ☐ I computed percents and explained my culminating point.

SCOREBOOK

1. Sketch Minard's chart from memory, then compare with the original and correct it.
2. Make a table of 422,000, 100,000 and 10,000 with percents of the starting force.
3. "What I would decide and why": your team has three games in four days. Plan your players' rest and supply.

KEY FORMULAS

$$\text{percent remaining} = \frac{\text{current}}{\text{start}} \times 100\%$$

From history. Minard was in his late eighties when he drew the chart. He drew it as a pair, with a chart of Hannibal's march over the Alps, which also shows an army melting away on a long road. The statistician Edward Tufte made the 1812 chart famous in the 1980s.

WORKED EXAMPLES

Example 1. Using Minard's figures (422,000 crossed the Niemen, about 100,000 reached Moscow, about 10,000 recrossed the Niemen), compute the percent that reached Moscow, the percent that returned, and the percent of those who reached Moscow who returned.

Show solution

1. Reached Moscow: $100000/422000 \approx 23.7\%$.
2. Returned: $10000/422000 \approx 2.4\%$.
3. Of those at Moscow: $10000/100000 = 10\%$.

Answer: About 23.7% reached Moscow and about 2.4% returned across the Niemen. (Minard's main column numbers do not include all detachments; historians' totals differ, but the proportions tell the story.)

Example 2. Suppose (illustrative) each soldier needs about 1 kg of food per day and a supply wagon carries about 600 kg. How many wagonloads per day does an army of 100,000 need? If each wagon takes 5 days to make a round trip from a depot, how many wagons are needed to keep the flow going?

Show solution

1. Food per day: $100000 \times 1 = 100000$ kg.
2. Wagonloads per day: $100000/600 \approx 167$.
3. Each wagon delivers once every 5 days, so wagons needed: $167 \times 5 = 835$.

Answer: About 167 wagonloads a day and about 835 wagons, and every wagon needs horses that also eat. As the army advances, the round trip grows longer and the number of wagons needed grows with it. This is why the army weakened as it went forward.

Example 3. Model attrition as a steady loss of a fixed percent each week. If the main column fell from 422,000 to 100,000 in about 12 weeks, what weekly retention rate r would produce that loss? (Solve $422000 r^{12} = 100000$.)

Show solution

1. $r^{12} = 100000/422000 \approx 0.237$.
2. $r = 0.237^{1/12} = e^{\ln(0.237)/12} = e^{-1.440/12} = e^{-0.120} \approx 0.887$.
3. So the army lost about 11.3% of its remaining strength each week, mostly without battle.

Answer: About 88.7% retained per week, an 11.3% weekly loss. A steady loss that seems modest week by week compounds into disaster, exactly like the friction calculations of Lesson 1.4.

PRACTICE

1. Easy Who drew the famous chart of 1812, and when?

Show answer

Charles Joseph Minard, in 1869.

2. Easy What does the width of the band on Minard's chart represent?

Show answer

The number of men in the army at each point.

3. Easy What is logistics?

Show answer

The planning and carrying out of supply, transport, maintenance and movement for a force.

4. Medium Name three causes of loss in the 1812 campaign besides battle.

Show answer

Hunger from supply failure, disease, desertion, heat and then cold, detachments left to guard the road, loss of horses.

5. Medium An army of 60,000 needs 1.2 kg of food per man per day. How many kilograms per day? How many 500 kg wagonloads?

Show answer

72000 kg; $72000/500 = 144$ wagonloads.

6. Medium What is the culminating point of an attack?

Show answer

The point beyond which the attacker, weakened by distance and losses, becomes weaker than the defender and can no longer advance successfully.

7. Medium Give two examples of supply in sport.

Show answer

Sample: fitness and rest that last a whole game; water and food during a long event; a deep bench for a crowded schedule.

8. Medium In chess, how is the clock like supply?

Show answer

Time is a limited resource; spending too much early leaves too little later, and a player can lose a winning position on time.

9. **Hard** If an army loses 8% of its remaining strength each week, what fraction remains after 10 weeks?

Show answer

$0.92^{10} \approx 0.434$, about 43%.

10. **Hard** In worked example 2, if the round trip grows to 8 days as the army advances, how many wagons are needed? What does this show?

Show answer

$167 \times 8 \approx 1336$ wagons. The farther the army advances, the more transport it needs to deliver the same food, while its strength is falling.

11. **Challenge** A team plays a 10-game tournament. Its starters' effectiveness falls 6% per game without rest (multiplicative), but resting them for one game restores full effectiveness and costs that game's result. Compare the average effectiveness of the starters over the games they play if they (a) play all 10, (b) rest in game 6.

Show answer

(a) Effectiveness: $1, 0.94, 0.94^2, \dots, 0.94^9$; sum $= (1 - 0.94^{10})/0.06 \approx (1 - 0.539)/0.06 \approx 7.68$, average 0.768. (b) Games 1–5: sum $(1 - 0.94^5)/0.06 \approx 4.43$; games 7–10 (fresh again): $(1 - 0.94^4)/0.06 \approx 3.65$; total 8.08 over 9 games, average about 0.898. Rest raises their average effectiveness from about 77% to about 90%, at the cost of one game.

COMMON MISTAKES

- Thinking the army was destroyed mainly by the Russian winter. The chart shows most losses happened on the advance, in summer and autumn.
- Treating supply as a minor detail; it limits every plan.
- Reading Minard's numbers as exact; they are his estimates from the sources he had.

Make it a game • Shrinking Army Beans. Start with a pile of 100 beans. Your parent calls out the stages of the march in order with losses to remove at each. Lay a paper strip beside the beans for each stage and cut its width to match. You then have the shape of a Minard chart. Name the culminating point, the line of communication, and the attrition. Compare.

Scripture. “Go to the ant, thou sluggard; consider her ways, and be wise: Which having no guide, overseer, or ruler, Provideth her meat in the summer, and gathereth her food in the harvest.” (Proverbs 6:6-8, KJV)

The ant plans its supply in advance without being told. Wisdom prepares for the long road before the road begins.

6.3 WHEN THE PLAN FAILS

OBJECTIVES

- Explain Helmuth von Moltke's view that no plan survives first contact with the enemy, and his method of mission tactics.
- Describe how Moltke adapted at Königgrätz (1866), and how coaches and players adjust in games.
- Build a decision tree with branches and compute the value of a flexible reserve.

Warm-up. Think of a time your plan for a game or a day fell apart. Write what you did next. Did you have a plan B, or did you invent one on the spot?

WATCH

Moltke the Elder: The Prussian Mastermind Who Rewrote the Rules of War

PastPerfect History • 9:26

<https://www.youtube.com/watch?v=tu-rHIM-zmk>

WHEN TO WATCH

After “the plan” paragraph. A short biography of Moltke covering the general staff, his campaigns and mission tactics; listen for his saying about plans.

BACKUP VIDEO

Who was Helmuth von Moltke -the elder? (English)

German History w/ a German accent • 4:56

<https://www.youtube.com/watch?v=2wc0rzxp8o>

Optional, after the story. A shorter biography of Moltke, told with portraits and paintings.

KEY TERMS

mission tactics (Auftragstaktik)

The Prussian method of telling subordinates what to achieve and why, and leaving how to them, so that they can act quickly when the situation changes.

branch plan

A prepared alternative for a situation that might arise during an operation.

reserve

A force kept back from the first fighting, available to be sent wherever it is most needed.

adaptation

Changing a plan in response to what actually happens, while keeping the objective.

decision tree

A diagram of choices and chance events with their probabilities and results, used to compare plans.

CORE IDEAS

The story. Helmuth von Moltke, called “the Elder” to distinguish him from his nephew, was chief of the Prussian General Staff from 1857 to 1888. A quiet, scholarly officer who rarely raised his voice, he planned the campaigns that won Prussia’s wars of 1864, 1866 and 1870–71. In 1866, against Austria, he sent three Prussian armies into Bohemia by separate routes, planning to unite them on the battlefield. On July 3, 1866, at Königgrätz (also called Sadowa), the battle began before his armies were together. All morning the First and Elbe Armies attacked and were held. The Second Army, under the Crown Prince, was marching from the north and arrived in the early afternoon, striking the Austrian flank. The Austrians retreated, and the war was decided within weeks.

The plan. Moltke expected his plans to be disrupted. In an 1871 essay he wrote that no plan of operations extends with any certainty beyond the first encounter with the enemy’s main strength; strategy, he said, is a system of expedients. His answer was not to stop planning but to plan differently. He trained his officers to understand the purpose of every operation, gave them short directives instead of detailed orders, and expected them to act on their own judgment when circumstances changed. At Königgrätz the separated armies could have been beaten one at a time; instead the plan’s purpose, to unite on the battlefield, guided each commander, and the Crown Prince marched to the sound of the guns.

The principle. Plans fail because of friction (Lesson 1.4) and because the opponent is also thinking. The wise strategist plans for failure: he keeps the **objective** fixed while letting the **method** change, prepares **branch plans** for the likely surprises, keeps a **reserve**, and trains people to act on intent (Lesson 6.1). Dwight Eisenhower, who planned the D-Day landings, liked to repeat an old army saying: plans are worthless,

but planning is everything. The planning itself teaches you the ground, the options and the risks, so you can adapt quickly when the plan breaks. Scripture adds humility: “A man’s heart deviseth his way: but the LORD directeth his steps.”

On the board and the field. Halftime is a team’s chance to adapt. Good coaches come to halftime with branch plans already in mind (“if they press, we use our long passing; if they sit back, we move the ball quickly”). In chess, a player’s prepared opening often meets a surprise move; strong players then return to principles and the position’s needs rather than forcing their memorized plan. A tennis player who is losing changes her pattern of play. In each case the objective stays the same and the method adapts.

Think it through. Stubbornness and steadiness look alike from a distance. The difference is that steadiness keeps the objective, while stubbornness keeps the method.

PICTURE STUDY



Helmuth von Moltke the Elder, Carl Günther, about 1860s–1870s · Photograph · Bibliothèque nationale de France (Gallica)

Image: [Wikimedia Commons](#), public domain

Moltke was known as “the great silent one.” He spoke little, wrote clearly, and kept calm when things went wrong. Those who worked with him said that his quiet confidence spread through the staff, so that surprises did not become panics.

Look closely

- Look at Moltke’s face. What does his expression suggest about how he handled bad news?
- Notice the simple dress. How is this portrait different from the grand paintings of Napoleon and Nelson?
- Imagine him reading a report that his plan has gone wrong. What would he do first?

Talk about it

1. Why is calm leadership especially important when a plan fails?
2. Moltke trusted his subordinates to act on their judgment. What must a leader do first to deserve and build that trust?
3. How is a quiet, steady leader like the steadiness described in this lesson?

PROJECT

Plan B Tournament

You will play a series of games in which an opponent is secretly told to change his strategy partway through, and you will compare your results when you have a written branch plan and when you do not.

You will need

- A strategy game (chess, checkers, a card or board game) and one opponent
- A referee (a third person) to hand the opponent secret instructions
- The scorebook

Steps

1. Before each game, write your main plan in one sentence.
2. For games 1–3, write nothing else. For games 4–6, also write two branch plans: what you will do if the opponent suddenly becomes very aggressive, and what you will do if he becomes very defensive.
3. The referee secretly tells the opponent, partway through each game, to switch to an aggressive or defensive style.
4. Record each game, marking the moment of the switch and how long it took you to notice and respond.
5. Record the results.
6. Make a table comparing games with and without branch plans: time to respond, result, and whether you kept your objective.
7. Draw a decision tree for one of your games with the branches you prepared.
8. Write a paragraph: did branch plans help? How does your experience compare with Moltke's?

Tips

- The opponent must stay within the rules of the game; the switch is a change of style, not of rules.
- Six games are a small sample; note what you learned beyond the score.

Check your work

- ☐ I played six games, three with branch plans, and recorded the switches.
- ☐ My table compares response times and results.
- ☐ My decision tree and paragraph connect my games to the lesson.

SCOREBOOK

1. Draw a sketch of Königgrätz: the Austrian position, the First and Elbe Armies attacking from the west, and the Second Army arriving from the north.
2. Draw a decision tree with two choices and two chance events for a game you play.
3. “What I would decide and why”: your opening plan has failed by move 10. Write your next three steps.

From history. Moltke’s staff system, with officers trained to think alike about purposes while acting independently, was copied by armies around the world. He also used railways and the telegraph to move and direct armies on a scale no one had before, while warning that the telegraph tempted commanders to interfere too much with those on the spot.

WORKED EXAMPLES

Example 1. A coach prepares a game plan that works well (expected margin +8 points) if the opponent plays man-to-man, but badly (−6) if it plays zone. He thinks there is a 60% chance of man-to-man. He can also prepare a branch plan for zone, which would make the result against zone +2, at the cost of less practice on the main plan (reducing the man-to-man result to +6). Compute expected margins with and without the branch plan.

Show solution

1. Without branch: $0.6(8) + 0.4(-6) = 4.8 - 2.4 = 2.4$.
2. With branch: $0.6(6) + 0.4(2) = 3.6 + 0.8 = 4.4$.

Answer: Without a branch plan, +2.4; with it, +4.4. Preparing for the likely surprise is worth more than perfecting the main plan, because it removes the disaster. (Illustrative numbers.)

Example 2. A commander keeps a reserve. Without a reserve, his line breaks with probability 0.25 at one of two points (each equally likely), and a break means defeat. With a reserve of one-fifth of his force, the line breaks with probability 0.35 (it is thinner), but the reserve can repair a break 80% of the time. Compare the probability of defeat.

Show solution

1. Without reserve: defeat probability 0.25.
2. With reserve: a break occurs with probability 0.35, and the reserve fails to repair it 20% of the time: $0.35 \times 0.2 = 0.07$.

Answer: Defeat probability falls from 25% to 7%. A reserve makes the line slightly weaker everywhere but much harder to defeat, because it can go where the plan fails. (Illustrative numbers.)

Example 3. At Königgrätz, suppose (illustrative) the Crown Prince's army was 25 km from the battlefield at dawn and marched at 4 km/h over muddy roads. If the battle began at 8 a.m. and he started at 6 a.m., when would his leading troops arrive? Why did the outcome depend on the First Army holding until then?

Show solution

1. Time: $25/4 = 6.25$ h = 6 h 15 min.
2. Arrival: about 12:15 p.m.
3. The First and Elbe Armies had to hold the Austrians for more than four hours without being broken.

Answer: About 12:15 p.m., early afternoon, which is about when the Second Army began to arrive in the real battle. The plan worked because one part held while another marched: a combination of security and maneuver across time.

PRACTICE

1. Easy Paraphrase Moltke's saying about plans.

Show answer

No plan of operations extends with certainty beyond the first encounter with the enemy's main strength.

2. Easy What is mission tactics?

Show answer

Telling subordinates what to achieve and why, and leaving how to them, so they can act on their own judgment as things change.

3. Easy When and where did Moltke's armies defeat Austria?

Show answer

At Königgrätz (Sadowa), on July 3, 1866.

4. Medium Why didn't Moltke stop planning, if plans fail?

Show answer

Planning teaches the ground, the options and the risks, and prepares branch plans and reserves; it makes quick adaptation possible.

5. Medium Explain the difference between steadiness and stubbornness.

Show answer

Steadiness holds on to the objective while changing methods; stubbornness holds on to the method even when it is failing.

6. Medium Compute: a plan gives +5 with probability 0.7 and -10 with probability 0.3. What is its expected value?

Show answer

$$3.5 - 3 = 0.5.$$

7. Medium Give a chess example of adapting when your plan fails.

Show answer

Sample: your prepared opening meets an unexpected move; instead of forcing the memorized plan, you return to principles (develop, control the center, castle) and make a new plan from the position.

8. Medium How does Proverbs 16:9 relate to planning?

Show answer

We should plan (the heart devises its way), but we hold our plans humbly, knowing that God directs our steps and that circumstances will change.

9. **Hard** In worked example 1, for what probability of man-to-man would the two choices (with and without the branch plan) be equal?

Show answer

Without: $8p - 6(1 - p) = 14p - 6$. With: $6p + 2(1 - p) = 4p + 2$. Equal when $10p = 8$, $p = 0.8$. Only if man-to-man is more than 80% likely is the branch plan not worth preparing.

10. **Hard** In worked example 2, what repair rate would the reserve need for the two choices to be equal?

Show answer

$0.35(1 - r) = 0.25 \Rightarrow 1 - r \approx 0.714 \Rightarrow r \approx 0.286$. Even a reserve that repairs only about 29% of breaks breaks even; anything better makes it worthwhile.

11. **Challenge** Draw (in words) a decision tree for a soccer team leading 1-0 at halftime: choices “keep pressing” and “sit deep,” chance events “opponent scores” or not, and payoffs (win 3 points, draw 1, loss 0). Suppose: keep pressing gives $P(\text{opponent scores}) = 0.30$ and $P(\text{we score again}) = 0.35$; sit deep gives 0.20 and 0.10. Assume a goal by us makes it a win regardless, and an opponent’s goal without ours makes it a draw. Compute expected points for each choice (treat the events as independent and ignore further goals).

Show answer

Pressing: win if we score (0.35) $\rightarrow$ 3; if we don’t (0.65): opponent scores (0.30) $\rightarrow$ draw 1, else win 3. Expected:

$$0.35(3) + 0.65[0.30(1) + 0.70(3)] = 1.05 + 0.65(2.4) = 1.05 + 1.56 = 2.61.$$

Sitting deep:

$$0.10(3) + 0.90[0.20(1) + 0.80(3)] = 0.30 + 0.90(2.6) = 0.30 + 2.34 = 2.64.$$

Nearly equal, slightly favoring sitting deep under these assumptions; small changes in the probabilities would flip it, which is why coaches watch the game before deciding.

COMMON MISTAKES

- Concluding that planning is useless because plans fail.
- Changing the objective when only the method needed to change.
- Keeping no reserve of time, players or resources to respond to surprises.

Make it a game • Move the Obstacles. Plan a route across the living room with a branch plan in case of a blocked path. Walk it once. Then your parent moves two obstacles while you look away. Adapt quickly, using a reserve if you need one. Score a point for each obstacle handled. Explain what Moltke meant by no plan surviving first contact, and what mission tactics change.

Scripture. “A man’s heart deviseth his way: but the LORD directeth his steps.” (Proverbs 16:9, KJV)

Plan carefully, and hold your plans humbly. The strategist who expects surprises adapts calmly; the one who expects control is shaken.

6.4 HONOR AND LAWFUL STRIVING

OBJECTIVES

- Explain 2 Timothy 2:5 and why winning lawfully is part of a Christian view of competition.
- Tell the story of Bobby Jones's self-called penalty in the 1925 U.S. Open and of Francis Lieber's code of 1863.
- Distinguish fair deception within the rules from cheating, and compute what honesty can cost and what it gains.

Warm-up. Write down one rule in a game you play that no referee could ever enforce (because no one else would see it broken). Who enforces it?

WATCH

The Long Shadow of Bobby Jones | GPB Documentaries

GPB • 29:30

<https://www.youtube.com/watch?v=7bOMmA0we90>

WHEN TO WATCH

After “the story” paragraph. A public-television documentary on Bobby Jones's life and character; watch for the 1925 U.S. Open.

BACKUP VIDEO

The Lieber Code

International Humanitarian Law MOOC • 3:09

<https://www.youtube.com/watch?v=FEnS5Xs4v7E>

After “the plan” paragraph. A short university lecture clip on Francis Lieber and the code of 1863.

KEY TERMS

lawful striving

Competing to win within the rules and the spirit of the game; Paul's phrase in 2 Timothy 2:5.

sportsmanship

Fairness, respect and grace toward opponents, officials and teammates, in winning and in losing.

self-reported penalty

A penalty a player calls on himself when only he knows the rule was broken, as golfers are expected to do.

laws of war

Rules that limit how wars may be fought, protecting prisoners, the wounded and civilians; first written as a code for an army by Francis Lieber in 1863.

CORE IDEAS

The story. In the first round of the 1925 U.S. Open at Worcester Country Club in Massachusetts, the young amateur Bobby Jones was preparing to hit from the rough when his ball moved slightly as he addressed it. No one else saw it. Jones called a one-stroke penalty on himself. At the end of 72 holes he was tied with Willie Macfarlane, and he lost the playoff. The penalty stroke had cost him the championship. When people praised him for his honesty, he is reported to have said that one might as well praise a man for not robbing a bank. Sixty years earlier, in April 1863, President Lincoln's War Department issued General Orders No. 100, written by the Columbia College professor Francis Lieber: the first code of the laws of war written for an army in the field, setting rules for the treatment of prisoners, the wounded and civilians.

The plan. Both stories set limits on how a contest may be won. Jones accepted that the rules of golf bound him even when no one could enforce them. Lieber's code taught soldiers that even in war, "military necessity" does not allow cruelty for its own sake, revenge, or the abuse of prisoners. It was copied by other nations and helped shape the international Hague Conventions of 1899 and 1907. In every game and contest, strategy works inside a frame of rules, and the best strategists accept that frame rather than looking for ways around it.

The principle. Paul wrote, "if a man also strive for masteries, yet is he not crowned, except he strive lawfully." Winning by breaking the rules is not winning; the crown is not real. This course has praised deception many times: Gideon's trumpets, Joshua's feigned retreat, Napoleon's bait, the play-action pass. All of these stay inside the rules of their contest. Lying to an official, faking an injury, stealing signals by forbidden means, or moving a chess piece when the opponent is not looking are different in kind: they deceive the game itself. Honor is also good strategy over the long run: officials, opponents and teammates trust an honest player, and a team that never cheats never has to fear being caught.

On the board and the field. Golfers call penalties on themselves; chess players follow the touch-move rule (a piece touched must be moved) without being reminded; a soccer player kicks the ball out of play when an opponent is hurt, and the opponent gives it back. These customs make games possible. The United States Golf Association names its highest sportsmanship award, given since 1955, after Bobby Jones. Proverbs 16:32 gives the root of it: “he that ruleth his spirit” is better “than he that taketh a city.” Self-control is the strategist’s first victory.

Think it through. Honesty sometimes costs a game, as it cost Jones a championship. Count that cost honestly too, and then pay it gladly.

PICTURE STUDY



Bobby Jones on the Cover of Time, Time magazine, August 31, 1925 · Magazine cover with a drawn portrait · Reproduction

Image: [Wikimedia Commons](#), public domain

A few weeks after the 1925 U.S. Open, *Time* put Bobby Jones on its cover. He was twenty-three, an amateur with degrees from Georgia Tech and Harvard, and already famous both for his skill and for his conduct. In 1930 he won all four of the major championships of his day in one year, then retired from competition at twenty-eight.

Look closely

- Look at Jones's face. How old does he look?
- Notice that a news magazine chose a golfer for its cover. What does that tell you about his fame?
- Imagine the moment in the rough when his ball moved. What would have tempted him to say nothing?

Talk about it

1. Jones lost a championship by one stroke because of his own honesty. Was it worth it? Explain.
2. Why might people remember Jones's penalty longer than many of his victories?

3. What does 2 Timothy 2:5 add to the reasons for honesty that a non-Christian might also give?

Safety first. If you build a backyard golf or putting course, use soft or plastic practice balls, swing only in a clear space with an adult watching, and keep everyone well behind the person swinging.

PROJECT

The Honor Experiment

You will play a game that depends on self-reporting, track how often players report their own faults, and then write a code of honor for your family's games.

You will need

- A game or drill where players must judge their own faults (for example, a backyard golf or putting course where players count their own strokes, or a tag game where the tagged player must admit it)
- The scorebook
- Three or more players

Steps

1. Set up the game with clear rules, including at least one rule that only the player himself can see broken (for example, a ball that moves when addressed costs one stroke).
2. Play several rounds without referees. At the end of each round, each player privately records any fault he committed and whether he reported it.
3. Discuss together (without blame) how the self-reporting went.
4. Play again after reading 2 Timothy 2:5 and the Bobby Jones story aloud. Record the same information.
5. Write a five-rule code of honor for your family's games, each with a reason.
6. Have everyone sign it, and keep it in the front of your scorebook.
7. Write a paragraph: what made honest reporting easier or harder? How does trust change a game?

Tips

- This project is about building trust, not catching anyone. Keep it gracious.
- Your own honesty is the only part you control; record it truthfully.

Check your work

- ☐ I set up a game with at least one self-reported rule and recorded results for two sessions.

- ☐ My family code of honor has five rules with reasons.
- ☐ My paragraph reflects honestly on trust and self-control.

SCOREBOOK

1. Make a two-column chart: fair deception and cheating, with five examples of each from this course and from sport.
2. Copy 2 Timothy 2:5 and Proverbs 16:32, and write one sentence on how each applies to your games.
3. “What I would decide and why”: you notice your opponent miscounted his score in your favor. What do you do?

From history. Francis Lieber was a German-born scholar who had fought against Napoleon as a teenager in the Waterloo campaign of 1815 and later taught in South Carolina and New York. He had sons who served on both sides of the Civil War. The Bob Jones Award of the USGA is given each year to a golfer who shows the spirit of the game.

WORKED EXAMPLES

Example 1. Jones and Macfarlane tied after 72 holes, and Jones’s score included his one-stroke self-called penalty. What would Jones’s margin have been without the penalty? The playoff went 36 holes; Macfarlane won by one stroke. How many total strokes separated them over 108 holes?

Show solution

1. Without the penalty, Jones would have finished 72 holes one stroke ahead and won outright.
2. After 108 holes (72 plus a 36-hole playoff), Macfarlane was one stroke better.
3. Over the whole contest the penalty stroke was the entire margin.

Answer: One stroke either way. Jones’s honesty cost him the title by the smallest possible margin, which is why the story is remembered.

Example 2. A team considers a dishonest trick (for example, faking an injury to stop the clock) that would raise its chance of winning one game from 40% to 46%. If the trick is caught (suppose 20% of the time), the team forfeits the game and suffers penalties worth losing two future games. Compute the expected number of wins from the trick over this game and the next two, compared with not cheating (assume a 50% chance in each of the next two games).

Show solution

1. Honest: $0.40 + 0.5 + 0.5 = 1.40$ expected wins.
2. Cheat, not caught (0.8): $0.46 + 1.0 = 1.46$.
3. Cheat, caught (0.2): 0 wins in all three games.
4. Expected: $0.8(1.46) + 0.2(0) = 1.168$.

Answer: Honest play: 1.40 expected wins; cheating: about 1.17. Even counted coldly, the cheat loses. But the deeper reason not to cheat is not the arithmetic: it is that the win would not be a real win. (Illustrative numbers.)

Example 3. Sort these as fair deception within the rules or cheating: (a) a disguised tennis serve; (b) a chess player who quietly prepares a trap; (c) a basketball player who falls down without being touched to draw a foul; (d) a football team using a hidden camera to record the opponent's signals in violation of league rules; (e) a soccer team that runs a set play with a decoy runner.

Show solution

1. (a) Fair: the opponent can read it if he can.
2. (b) Fair: the opponent can see the board.
3. (c) Cheating: it deceives the official about what happened.
4. (d) Cheating: it breaks the rules to gain information.
5. (e) Fair: the decoy is part of the play.

Answer: Fair: (a), (b), (e). Cheating: (c), (d). The test: does the deception target the opponent's judgment within the game, or does it deceive the officials or break the rules?

PRACTICE

1. Easy Quote 2 Timothy 2:5.

Show answer

“And if a man also strive for masteries, yet is he not crowned, except he strive lawfully.”

2. Easy What did Bobby Jones do in the 1925 U.S. Open?

Show answer

He called a one-stroke penalty on himself when his ball moved at address, though no one else saw it; he tied and then lost the playoff.

3. Easy What was the Lieber Code, and when was it issued?

Show answer

General Orders No. 100, issued in April 1863 by the Union army: the first written code of the laws of war for an army in the field, by Francis Lieber.

4. Medium Explain the difference between fair deception and cheating, with one example of each.

Show answer

Fair deception misleads the opponent within the rules (a play-action fake); cheating breaks the rules or deceives officials (faking a foul).

5. Medium Name two customs of sportsmanship that no referee enforces.

Show answer

Golfers calling penalties on themselves; soccer players returning the ball after it was kicked out for an injury; chess players following touch-move; shaking hands after a game.

6. Medium How did the Lieber Code influence later history?

Show answer

Other nations copied it, and it helped shape the Hague Conventions of 1899 and 1907 on the laws of war.

7. **Medium** Why is honor good strategy over the long run?

Show answer

Officials, opponents and teammates trust an honest player; he never risks being caught, and his victories are real.

8. **Medium** How does Proverbs 16:32 connect self-control and victory?

Show answer

It says that ruling one's own spirit is greater than taking a city: mastery of oneself is the first and greatest victory, and makes honest competition possible.

9. **Hard** In worked example 2, what chance of being caught would make the cheat exactly equal to honest play in expected wins?

Show answer

$(1 - c)(1.46) = 1.40 \Rightarrow c \approx 0.041$. Only if the chance of being caught were below about 4% would the cheat “pay” in the cold arithmetic, and even then it would not be a real win.

10. **Hard** This course has praised deception in battle and games. Explain why that is consistent with 2 Timothy 2:5.

Show answer

Deception within the rules of a contest (feints, traps, disguised plays) is part of the game both sides agree to; it is lawful striving. Paul condemns winning by breaking the rules. In war, the laws of war set the limits; within them, stratagems such as Joshua's ambush were lawful.

11. **Challenge** Write a short code of honor (five rules) for a team or club you belong to, in the style of Lieber's code: each rule states a limit and the reason for it. Then explain how one rule might cost your team a game and why you would keep it anyway.

Show answer

Answers will vary. A full answer gives five clear rules with reasons (for example, “We do not argue calls, because officials must be able to do their work without pressure”), and honestly describes a case where a rule could cost a game and why it is still right.

COMMON MISTAKES

- Thinking that any deception is dishonest. Deception within the rules of a contest is lawful.
- Thinking that something is allowed if no referee can see it.
- Treating honor as a weakness. Over time it builds trust and makes every victory real.

Make it a game • Honor Court. Your parent describes six game situations: a missed foul nobody saw, a score disputed, a rule broken by mistake. Decide in ten seconds what a lawful competitor would do and why, using 2 Timothy 2:5. Earn a bean for each answer that includes a reason. Then name a self-reported penalty from any sport. First to six beans wins.

Scripture. “And if a man also strive for masteries, yet is he not crowned, except he strive lawfully.” (2 Timothy 2:5, KJV)

Paul knew the athletic games of his day, where a victor who broke the rules lost his crown. The rule still holds, in games and in life.

6.5 CAPSTONE: YOUR STRATEGY REPORT

OBJECTIVES

- Design an original strategy for a game or sport, or analyse a historical battle alongside a game situation.
- Test the strategy honestly over many trials, with records, and analyse the results with the tools of the course.
- Present the work clearly in writing and aloud, naming the principles used and the limits of the evidence.

Warm-up. List the five ideas from this course that you think are most useful for a game you play. Rank them. Keep the list; your capstone should use at least three of them.

WATCH

My 5.25 Best Board Game Playtesting Tips

Board Game Design Lab • 7:52

<https://www.youtube.com/watch?v=Alb9jjNwGCg>

WHEN TO WATCH

At the start of session 2, before you begin testing. A game designer gives practical advice on testing a game or strategy with real players.

BACKUP VIDEO

Playtesting Board Games 101

Pam Walls Game Design • 12:28

<https://www.youtube.com/watch?v=WKd4WJi5VBI>

Optional, for students choosing Option A. Another designer's introduction to running fair, useful playtests.

KEY TERMS

hypothesis

A specific claim that can be tested:
“Opening with a pawn to the center wins more often than opening on the side against this opponent.”

control

A comparison condition: games played without the new strategy, so that its effect can be measured.

playtesting

Testing a game or strategy by playing it many times with real players and recording what happens.

limitation

An honest statement of what the evidence cannot show, such as a small sample or a biased opponent.

CORE IDEAS

The story. In 1824 a Prussian officer named Georg von Reisswitz showed the Prussian general staff a game played on maps with blocks for troops and dice for chance. He called it *Kriegsspiel*, the war game. The chief of staff is said to have exclaimed that it was not a game but a training for war, and Prussian officers played versions of it for decades to test plans and train judgment; Moltke's generation learned on it. The idea that strategy can be designed, tested and learned by playing many games is the idea behind this whole course. Sofonisba Anguissola's painting of her sisters playing chess, made in 1555, shows the same truth in a quieter way: a game is a small world where judgment is learned.

The plan. Choose one of two capstones. **Option A, design and test a strategy:** choose a game or sport, state a hypothesis about a new strategy (an opening plan, a defensive shape, a set play, a rule for when to attack), test it against a control over at least 20 games or trials, and analyse the results with percentages, expected value and, if possible, Elo ratings. **Option B, a battle-and-game analysis:** choose one battle from Units 3–4 and one game situation (a chess opening, a sports play), show with maps, diagrams and calculations how the same principles appear in both, replay the battle at least five times on a grid with your own rules, and explain what the game version teaches and what it leaves out.

The principle. A good strategy report has the virtues this course has praised: a clear **objective** (Lesson 1.2), honest **assessment** of yourself and the opponent (Lesson 1.3), awareness of **friction** and chance (Lesson 1.4), a counted **cost** (Lesson 1.5), clear **intent** (Lesson 6.1), adequate **supply** of time and data (Lesson 6.2), **adaptation** when the first plan fails (Lesson 6.3), and complete **honesty** about the evidence (Lesson 6.4). Its conclusion is only as strong as its data, and it says so.

On the board and the field. Coaches, chess players and military planners all write reports like this: a scouting report, an opening study, an after-action review. They share a structure: what we wanted, what we did, what happened, why, and what we will do next time. Your capstone follows the same structure, and it will be useful to

you long after this course, whenever you must plan, test and decide. Do your best work, and present it with a humble confidence: “he that ruleth his spirit” is better “than he that taketh a city.”

Think it through. A capstone is not judged by whether the strategy won. A failed strategy honestly tested and clearly explained is a successful capstone.

PICTURE STUDY



The Chess Game, Sofonisba Anguissola, 1555 · Oil on canvas · National Museum, Poznań, Poland

Image: [Wikimedia Commons](#), public domain

Sofonisba Anguissola was one of the first women painters of the Renaissance to become famous across Europe. She painted three of her sisters playing chess, with a servant looking on. The eldest has just made a move and looks out at us; the second raises her hand in surprise or objection; the youngest smiles. The whole drama of a game is in their faces.

Look closely

- Find the sister who seems to have just made a strong move. How can you tell?
- Look at the second sister's raised hand. What do you think she is feeling?
- Look at the youngest sister and the servant. What are they watching?
- Look at the chessboard. Can you tell who is winning?

Talk about it

1. A game can teach judgment, patience and grace. Which of these do you see in the painting?
2. How does this quiet family scene connect with the generals and admirals you have studied?

3. If you painted a scene from your own capstone, what moment would you choose?

Safety first. If your capstone uses a sport, warm up, use soft balls where possible, play in a clear space with proper shoes, and have a parent supervise any physical testing.

PROJECT

The Capstone Report

This project is the capstone itself. Choose Option A (design and test a strategy) or Option B (battle-and-game analysis), complete it over the three sessions of this lesson and any extra time you need, and present it to your family or class.

You will need

- The game or sport you choose, and opponents
- The scorebook, graph paper, colored pencils and a calculator
- Counters, a grid and dice (Option B)

Steps

1. Choose your option and write a one-paragraph proposal: the game or battle, your objective, and your hypothesis or comparison.
2. Plan your test or analysis: number of games or replays, the control, the records you will keep.
3. Option A: play at least 20 games or trials with the new strategy and at least 20 without, recording every game. Option B: draw the battle map, design grid rules, replay at least five times, and set up and analyse the matching game situation.
4. Compute your results: percentages, expected values, uncertainty estimates and, for games, Elo differences.
5. Make at least two clear charts or maps.
6. Write a report of four to six pages: objective, method, results, analysis (naming at least three principles from the course), limitations, and conclusion.
7. Prepare a five-minute presentation with your charts or maps.
8. Present it, answer questions, and write a short reflection on what you would do differently.

Tips

- Start testing early; 40 games take time.
- Record results in order, so you can see if anything changed during the test.

- Keep score in points only in any game you test.

Check your work

- ☐ My report states a clear objective and hypothesis or comparison.
- ☐ My data are complete, recorded in order, and analysed with correct calculations.
- ☐ I named at least three principles from the course and stated the limitations honestly.
- ☐ I presented my work and reflected on it.

SCOREBOOK

1. Write your proposal paragraph and a list of the records you will keep.
2. Draw a draft of the main chart or map for your report.
3. “What I would decide and why”: after ten games your new strategy is losing. Do you stop, change it, or keep testing? Explain using Lesson 6.3.

From history. Kriegsspiel was rediscovered by hobbyists in the twentieth century, and modern board wargames and strategy games descend from it. Anguissola’s painting is one of the earliest European paintings of an everyday family scene, and the game she chose was chess.

WORKED EXAMPLES

Example 1. A student tests a new chess opening plan against a sibling: 20 games with the plan (13 wins, 2 draws, 5 losses) and 20 games without it (9 wins, 3 draws, 8 losses). Compute the score percentage in each condition and the difference. Estimate the uncertainty with $1/\sqrt{n}$.

Show solution

1. With plan: $(13 + 0.5 \times 2)/20 = 14/20 = 70\%$.
2. Without: $(9 + 1.5)/20 = 10.5/20 = 52.5\%$.
3. Difference: 17.5 percentage points.
4. Rough uncertainty for each: $1/\sqrt{20} \approx 0.22$, about 22 points.

Answer: 70% against 52.5%, a difference of 17.5 points. Because each estimate could be off by about 20 points, the result is encouraging but not proof. An honest report says: “the plan looks better, but more games are needed to be sure.”

Example 2. Convert the results of worked example 1 into Elo terms. What rating difference would predict a 70% score, and what would predict 52.5%?

Show solution

1. Solve $0.70 = 1/(1 + 10^{-D/400})$: $10^{-D/400} = 1/0.70 - 1 \approx 0.4286$, so
 $D = -400 \log_{10} 0.4286 \approx 147$.
2. For 52.5%: $10^{-D/400} = 1/0.525 - 1 \approx 0.905$, so $D \approx 17$.

Answer: About 147 rating points with the plan and about 17 without: the plan seems worth roughly 130 rating points against this opponent, within the large uncertainty of 20-game samples.

Example 3. Outline a battle-and-game analysis comparing Cannae with a chess plan, listing the sections and one calculation for each.

Show solution

1. 1. The battle: map, forces (ratios from Polybius), plan and result.
 2. 2. The game: a chess position where one side invites the opponent's center forward and attacks it from both sides; diagram and moves.
 3. 3. Shared principles: double envelopment, using the opponent's strength, timing. Calculation: Roman depth (Lesson 3.4) and the chess material and development count.
 4. 4. Replay: five grid replays with recorded results; win rate of the crescent versus a straight line.
 5. 5. Differences: what the game leaves out (morale, terrain, the human cost) and what it shows clearly.
 6. 6. Conclusion and limitations.
-

Answer: A clear six-part outline with at least one real calculation per part. The comparison should be specific (named positions and numbers), not just “both are like a trap.”

PRACTICE

1. Easy What is a hypothesis? Write one for a game you play.

Show answer

A specific, testable claim. Sample: “Castling before move 8 raises my score against my brother.”

2. Easy What is a control, and why is it needed?

Show answer

A comparison condition without the new strategy; it shows whether the strategy, rather than something else, caused the difference.

3. Easy Who invented Kriegsspiel, and when did he show it to the Prussian staff?

Show answer

Georg von Reisswitz, in 1824.

4. Medium Compute the score: 11 wins, 4 draws, 5 losses in 20 games.

Show answer

$$(11 + 4)/20 = 65\%.$$

5. Medium Estimate the uncertainty of a percentage from 50 games with $1/\sqrt{n}$.

Show answer

$$1/\sqrt{50} \approx 0.14, \text{ about 14 points.}$$

6. Medium Name four limitations a game-testing report should consider.

Show answer

Small sample; one opponent who may adapt or tire; changes in your own skill during the test; unequal conditions (time of day, mood); bias in recording.

7. Medium Why is a failed strategy, honestly reported, still a good capstone?

Show answer

Because the purpose is to learn to plan, test and judge evidence honestly; an honest negative result teaches as much as a positive one.

8. Medium What rating difference predicts a 60% score?

Show answer

$$10^{-D/400} = 1/0.6 - 1 = 0.667, D = -400 \log_{10} 0.667 \approx 70.$$

9. **Hard** How many games would you need for the rough uncertainty $1/\sqrt{n}$ to be 10 percentage points? 5 points?

Show answer

$$1/\sqrt{n} = 0.10 \Rightarrow n = 100; 0.05 \Rightarrow n = 400.$$

10. **Hard** Explain how your capstone uses at least four lessons from the course.

Show answer

Answers will vary; a full answer names four lessons and shows specifically where each idea appears in the plan, test or analysis.

11. **Challenge** In worked example 1, suppose the opponent learned to answer your new plan after game 10, so that you scored 85% in games 1–10 and 55% in games 11–20 with the plan. What is the overall score, and what does the pattern suggest? How would you redesign the test?

Show answer

Overall $(8.5 + 5.5)/20 = 70\%$. The drop suggests the opponent adapted, so the plan's advantage may be a surprise effect rather than a lasting edge. Redesign: test against several opponents, alternate conditions game by game, and report results in time order.

COMMON MISTAKES

- Testing without a control, so that improvement cannot be measured.
- Stopping too early or reporting only the games that went well.
- Claiming more certainty than the data allow.
- Making the comparison in Option B vague instead of specific.

Make it a game • Playtest Pit Stop. Run a three-minute playtest of your strategy with your parent in a simple game. Note two limitations and one possible control. Then state your hypothesis in one sentence. Your parent asks what you would change next time. Earn a point for each limitation named honestly. Rewrite your hypothesis and play again to see if it holds.

Scripture. “He that is slow to anger is better than the mighty; and he that ruleth his spirit than he that taketh a city.” (Proverbs 16:32, KJV)

The final lesson of strategy is self-mastery. A calm, honest strategist who rules his own spirit is ready for any contest, and for losing well as well as winning.

UNIT 6

THE STRATEGIST'S CHARACTER

Every plan in this course was carried out by people, and in the end the quality of a strategy depends on the character of those who make and carry it out. This unit studies five qualities of a good strategist: the clarity to state an intent that others can follow, the diligence to supply and sustain a plan, the humility to adapt when the plan fails, the honor to win only by lawful means, and the creativity to design something new and test it honestly.

The stories come from Gettysburg, from Napoleon's march to Moscow as drawn on Charles Minard's famous chart, from the Prussian staff of Helmuth von Moltke, and from the golfer Bobby Jones and the lawyer Francis Lieber. The unit ends with a capstone in which you design and test an original strategy for a game or sport, or write an analysis comparing a historical battle with a game, and present it.

PREREQUISITES

- All of Units 1–5, especially the principles of war, friction, Sun Tzu's rule of knowing the enemy, and the scouting report
- Reading charts and maps; percents and rates
- Expected value as a weighted average

MASTERY CHECKLIST

- ☐ I can write a clear commander's intent (purpose, key tasks, end state) and explain why unclear orders fail.
- ☐ I can read Minard's chart of 1812 and explain why supply decides campaigns.
- ☐ I can explain Moltke's view that no plan survives first contact, and plan with branches and reserves.
- ☐ I can explain why honor and lawful striving are part of strategy, with examples from sport and history.
- ☐ I can design, test and present an original strategy with honest data.

OPTIONAL BOOKS AND GAMES FOR THIS UNIT

- **The Lieber Code (Avalon Project, Yale Law School)**: Free. The full text of General Orders No. 100 (1863) for Lesson 6.4. Read Articles 14–16 on military necessity and its limits. Ages 15+ with a parent previewing.
- **Edward Tufte on Minard’s chart**: Free resources from the statistician who made Minard’s 1869 chart famous, for Lesson 6.2. Ages 14+.

Not required. Every project in this unit works without them. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

6.1	Commander’s Intent	3 sessions of 50 minutes
6.2	Supply: Minard’s Map of 1812	3 sessions of 50 minutes
6.3	When the Plan Fails	3 sessions of 50 minutes
6.4	Honor and Lawful Striving	3 sessions of 50 minutes
6.5	Capstone: Your Strategy Report	3 sessions of 50 minutes

UNIT 6 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means. Answer the concept questions in complete sentences, with specific examples. The test has 15 problems worth a total of 100 points.

1. **6 pts**

Define commander’s intent and its three parts.

2. **7 pts**

Compare Lee’s order to Ewell on July 1, 1863, with Vincent’s order to Chamberlain on July 2.

3. **6 pts**
An order passes through 5 relays, each 92% accurate. What is the chance it arrives exactly?
4. **7 pts**
Using Minard's figures (422,000; 100,000; 10,000), compute the percent who reached Moscow and the percent who returned.
5. **6 pts**
An army of 80,000 needs 1 kg of food per man per day; wagons carry 500 kg and take 6 days for a round trip. How many wagons are needed?
6. **6 pts**
What is the culminating point, and how does Minard's chart show it?
7. **6 pts**
Paraphrase Moltke's saying about plans and explain his answer to it.
8. **7 pts**
A plan gives +8 with probability 0.55 and -7 with probability 0.45. A branch plan changes the bad case to +1 and the good case to +6. Compare expected values.
9. **6 pts**
Explain the difference between steadiness and stubbornness, with an example.
10. **6 pts**
Tell the story of Bobby Jones's penalty in 1925 and what it cost him.
11. **6 pts**
What was the Lieber Code, and why does it matter for a course on strategy?
12. **7 pts**
Classify as fair deception or cheating, and explain: (a) a disguised serve; (b) faking a foul; (c) a feigned retreat in a war game; (d) moving a chess piece when the opponent is not looking.

13. **6 pts**

A strategy scores 13.5 points in 20 games against a control of 10 points in 20. Compute both percentages and the rough uncertainty.

14. **6 pts**

What rating difference predicts a 75% score?

15. **12 pts**

Essay (10–12 sentences): Which quality of a strategist from this unit (clear intent, attention to supply, adaptability, honor) do you think matters most? Defend your answer with one historical example and one example from a game or sport, and connect it to a verse of Scripture from the course.

ANSWER KEY

1. A short statement of what a plan must achieve and why, clear enough for subordinates to act when circumstances change: purpose, key tasks and end state.
2. Lee's order ("if practicable," while avoiding a general engagement) gave discretion without a clear priority, and Ewell did not attack. Vincent's order stated the purpose (the left of the line) and the task (hold at all hazards); Chamberlain understood it and invented a charge that achieved it.
3. $0.92^5 \approx 0.659$.
4. About 23.7% and about 2.4%.
5. $80000/500 = 160$ loads per day; $160 \times 6 = 960$ wagons.
6. The point beyond which an attacker is too weakened to succeed. The chart shows the army shrinking steadily as it advanced, so that by Moscow it was too weak to force a decision or hold its position.
7. No plan extends with certainty beyond the first encounter with the enemy's main strength. His answer: plan anyway, train officers in the purpose, give short directives, and let them act on their judgment (mission tactics).
8. Without: $4.4 - 3.15 = 1.25$. With: $3.3 + 0.45 = 3.75$. The branch plan is better.
9. Steadiness keeps the objective and changes the method; stubbornness keeps a failing method. Example: a team that keeps trying to win (objective) but switches from a long-passing game to a short one when the wind changes.
10. His ball moved at address in the rough; no one else saw it, but he called a one-stroke penalty on himself. He tied after 72 holes and lost the playoff, so the stroke cost him the championship.
11. General Orders No. 100 (1863), the first written code of the laws of war for an army in the field. It shows that even in war strategy operates within rules, and that lawful limits are part of honorable conduct.
12. (a) Fair, within the rules. (b) Cheating, deceives the official. (c) Fair, part of the game. (d) Cheating, breaks the rules.
13. 67.5% and 50%; about $1/\sqrt{20} \approx 22$ points each, so the difference is suggestive but not proven.
14. $10^{-D/400} = 1/0.75 - 1 = 1/3$, $D = 400 \log_{10} 3 \approx 191$.
15. Answers will vary. A full-credit essay chooses a quality, defends it with accurate, specific historical and game examples, addresses at least one objection, and

connects it thoughtfully to a verse such as 1 Corinthians 14:8, Proverbs 6:6-8, Proverbs 16:9, 2 Timothy 2:5 or Proverbs 16:32.

PORTFOLIO PIECE: A STRATEGIST'S HANDBOOK, FINAL EDITION

Complete your strategist's handbook. Add (1) a page on commander's intent with a three-part intent for a real game or project; (2) a Minard-style chart of a resource from your own experience; (3) a decision tree with a branch plan for a game you play; (4) your family or team code of honor; and (5) your capstone report and presentation notes. Finish with a two-page reflection on the whole course: the three ideas that changed how you play or plan, one battle or game that you will remember, and how Scripture has shaped your view of competition, planning and providence.

LOOK FOR	WHAT IT MEANS
Completeness	All five additions and the reflection are present, neat and labeled.
Capstone quality	The capstone has a clear objective, a fair test or specific comparison, correct calculations and honest limitations.
Application	Intent, supply, branch plans and the code of honor are applied to real situations from the student's life.
Reflection	The reflection is thoughtful, specific and honest, connecting strategy, character and Scripture without preaching.

MIDTERM EXAM

Covers Units 1–3. Time: 100 minutes.

You have 100 minutes. A calculator is allowed; no notes. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means; correct work earns partial credit even if the final number slips. Draw sketch maps or chess diagrams where asked. Answer the concept questions in complete sentences. The exam has 24 problems worth a total of 100 points.

1. **3 pts** Lesson 1.1

Define strategy, operations and tactics in one sentence each.

2. **4 pts** Lesson 1.1

Name the two parts of Scott's Anaconda Plan and the event of July 4, 1863, that completed the second part (with the surrender of Port Hudson five days later).

3. **4 pts** Lesson 1.1

About 3,500 miles of coast and about 42 ships in commission: compute miles per ship. How many ships would give one ship per 25 miles?

4. **4 pts** Lesson 1.2

List the nine principles of war.

5. **4 pts** Lesson 1.2

A team of 8 field players places 5 on its left and 3 on its right; the opponent places 4 on each side. Find both local ratios and name the two principles involved.

6. **4 pts** Lesson 1.3

State Sun Tzu's three cases of knowing the enemy and yourself, and the five factors of assessment.

7. **4 pts** Lesson 1.3

Sun Bin's fires fell from 100,000 to 50,000 to 20,000. Compute the overall percent drop and explain why Pang Juan should not have trusted it.

8. **4 pts** Lesson 1.4

A plan has 7 independent steps, each 93% reliable. What is the chance the whole plan works?

9. **4 pts** Lesson 1.4

Two messengers by separate roads each arrive 75% of the time. What is the chance at least one arrives? What assumption does this require?

10. **4 pts** Lesson 1.5

Under the square law with equal quality, 20,000 meet 12,000. How many of the larger force remain?

11. **4 pts** Lesson 1.5

Explain Kutuzov's decision at Fili and connect it to Luke 14:31-32.

12. **4 pts** Lesson 2.1

State the four opening principles and explain why Black lost the Opera Game despite having more material at the end.

13. **4 pts** Lesson 2.2

Define a fork and a skewer, and give the move that forks a king on e8 and a rook on a8 from a knight on b5.

14. **5 pts** Lesson 2.2

A Black knight on e5 is defended by a pawn and a queen. White attacks e5 with a knight, a bishop and a rook. Count the exchange if White starts with the knight and Black recaptures only when it gains.

15. **5 pts** Lesson 2.3

Find the expected score of a 1720 player against a 1520 player, and his rating change for a loss with $K = 32$.

16. **4 pts** Lesson 2.3

State Steinitz's rule about which side must attack, and describe Capablanca's three-step method of planning.

17. **4 pts** Lesson 2.4

Compute the points per stone for enclosing a 3×3 area in a corner and in the center of a Go board, and state the proverb they explain.

18. **4 pts** Lesson 2.5

White pawn on b4, Black king on f4. Using the rule of the square, does the king catch the pawn (a) with Black to move, (b) with White to move?

19. **4 pts** Lesson 3.1

Describe Gideon's plan of attack and the reason Judges 7:2 gives for reducing his army.

20. **4 pts** Lesson 3.2

Explain how Joshua's second attack on Ai used the first defeat, citing Joshua 8:6.

21. **4 pts** Lesson 3.3

Explain the oblique attack at Gaugamela and the purpose of Alexander's second line.

22. **5 pts** Lesson 3.4

Using Polybius's figures, compute the ratio of Roman to Carthaginian infantry and of Carthaginian to Roman cavalry at Cannae, and explain how Hannibal used his advantage.

23. **4 pts** Lesson 3.5

List Scipio's answers to Hannibal's elephants and cavalry at Zama.

24. **6 pts** Lesson 1-3

Short essay (6-8 sentences): Choose one battle from Unit 3 and one game from Unit 2. Show how one principle of war appears in both, with specific evidence.

ANSWER KEY

1. Strategy: the overall plan for using all contests and resources toward the final goal. Operations: a campaign or connected series of actions serving the strategy. Tactics: the arrangement and conduct of a single fight, game or play.
2. A naval blockade of the Southern coast and control of the Mississippi; Vicksburg surrendered on July 4, 1863.
3. $3500/42 \approx 83$ miles per ship; $3500/25 = 140$ ships.
4. Objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, simplicity.
5. Left 5:4, right 3:4. Mass on the left and economy of force on the right.
6. Know both: no fear of a hundred battles; know yourself only: a defeat for every victory; know neither: defeat in every battle. Factors: the Moral Law, Heaven, Earth, the Commander, Method and discipline.
7. 80%. The evidence was controlled by the enemy; he should have checked it against evidence the enemy could not easily fake.
8. $0.93^7 \approx 0.602$, about 60%.
9. $1 - 0.25^2 = 0.9375$. That the messengers fail independently.
10. $\sqrt{400 - 144} \times 1000 = 16,000$.
11. He gave up Moscow without another battle to preserve Russia's only army. Like the king who counts whether he can meet twenty thousand with ten, he counted the cost and chose not to fight a battle he might lose with everything at stake.
12. Center, development, king safety, not wasting time. Black neglected development and king safety; White's few active pieces checkmated a king whose own pieces blocked it.
13. Fork: one piece attacks two or more at once. Skewer: a valuable piece is attacked and must move, exposing a piece behind it. 1.Nc7+.
14. $Nxe5 +3$; pawn takes, -3 (0); $Bxe5 +1$ (+1). Black should not recapture with the queen ($Qxe5 Rxe5$ would cost 9 for 3). White wins a pawn: +1.
15. $E = 1/(1 + 10^{-0.5}) \approx 0.760$; loss: $32(0 - 0.760) \approx -24.3$.
16. The side with the advantage must attack or lose it; the other should defend economically. Evaluate, plan, then calculate.
17. Corner $9/6 = 1.5$; center $9/12 = 0.75$. "Corners, then sides, then center."

18. Square b4–b8–f8–f4: (a) the king is already inside, so it catches the pawn. (b) After 1.b5 the square is b5–b8–e8–e5; the king can reach e5, which is inside: it still catches the pawn.
19. Three companies of 100 with trumpets, pitchers and lamps, surrounding the camp at the beginning of the middle watch and signaling together. So that Israel could not boast that its own hand had saved it.
20. Joshua expected the men of Ai to say, “They flee before us, as at the first,” so his main body fled again; Ai’s men pursued and left the city open to the ambush.
21. Alexander advanced at an angle to his right with his strong wing, drawing Persian cavalry sideways and opening a gap he attacked toward Darius; his left was held back. The second line guarded against enemy cavalry riding around the flanks.
22. Infantry $80,000 : 40,000 = 2$; cavalry $10,000 : 6,000 \approx 1.67$. His cavalry drove off the Roman horse and closed the back of the pocket, while his bending center and inward-turning African infantry surrounded the Romans.
23. Lanes through his formation, trumpets and velites for the elephants; an alliance with Masinissa that gave Rome superior cavalry, which later attacked Hannibal’s rear.
24. Answers will vary. A full-credit essay names a principle correctly, gives specific, accurate evidence from both the battle and the game, and explains how the principle decided the result in each.

FINAL EXAM

Covers Units 1–6. Time: 120 minutes.

You have 120 minutes. A calculator is allowed; no notes. Show your work for every calculation: write the formula, substitute the numbers, and give the answer with a sentence explaining what it means; correct work earns partial credit even if the final number slips. Draw diagrams where asked. Answer the concept questions in complete sentences. About a third of the exam reviews Units 1–3 and the rest covers Units 4–6. The exam has 26 problems worth a total of 100 points.

1. **3 pts** Lesson 1.2

Match each to a principle of war: (a) a double-team; (b) a safety who always stays deep; (c) an onside kick; (d) a playbook of only a few plays.

2. **3 pts** Lesson 1.4

Quote Clausewitz on friction and compute the chance that 8 steps, each 95% reliable, all succeed.

3. **3 pts** Lesson 1.5

Under the square law with equal quality, how much stronger is a force of 15,000 than one of 5,000?

4. **3 pts** Lesson 2.3

What rating difference predicts a 64% score?

5. **3 pts** Lesson 2.4

Black has 42 points of territory and 6 prisoners; White has 40 points and 3 prisoners; komi 6.5. Who wins, and by how much?

6. **3 pts** Lesson 2.5

Define the opposition, and explain why the king should usually lead its pawn in a king-and-pawn ending.

7. **4 pts** Lesson 3.1–3.2

Compare Gideon's night attack and Joshua's ambush at Ai: name one principle they share and one difference in how each used deception.

8. (4 pts) Lesson 3.4–3.5

Explain how Scipio learned from Hannibal, using Cannae and Zama.

9. (4 pts) Lesson 4.1

Washington's army marched about 9 miles from about 4 a.m. to 8 a.m. Compute its speed and name two sources of friction that night.

10. (4 pts) Lesson 4.2

Explain Napoleon's feigned weakness at Austerlitz and Davout's role.

11. (4 pts) Lesson 4.3

If the British had engaged 22 enemy ships with 27, find the local ratio and the square-law strength ratio. Explain shared intent at Trafalgar.

12. (4 pts) Lesson 4.4

Define interior lines and explain how they let Jackson defeat separated forces in 1862.

13. (4 pts) Lesson 4.5

Starting belief 50% that AF is Midway; the report follows with probability 0.95 if true and 0.03 if false. Compute the updated probability.

14. (4 pts) Lesson 4.5

Why did the agreement of many reports mislead the Germans in Operation Fortitude?

15. (4 pts) Lesson 5.1

Explain how the 1925 offside change led to the WM, and compute the channel width for a back four across 68 m.

16. (4 pts) Lesson 5.2

A short pass: 70% complete for 7 yards, 1% interception (–45). A deep pass: 35% for 28 yards, 5% interception (–45). Compute expected yards for each.

17. (4 pts) Lesson 5.2

On fourth-and-1 with the game tied in the first quarter, which pass in problem 16 is the better call, and why might that differ from the expected-yards answer?

18. (4 pts) Lesson 5.3

A team scores 1.09 points per possession and allows 1.01. In a 72-possession game, what is its expected margin? Name two blocks of Wooden's Pyramid.

19. (3 pts) Lesson 5.4

A power play scores 44 times in 220 chances. Compute the percentage, and explain the 1956 rule change.

20. (4 pts) Lesson 5.5

A hitter's grounders: 150 right, 40 middle, 10 left. Compute percentages and the rough error of the right-side figure with $1/\sqrt{n}$.

21. (4 pts) Lesson 6.1

Write a three-part commander's intent for a team protecting a one-goal lead with five minutes left.

22. (4 pts) Lesson 6.2

An army falls from 300,000 to 120,000 in 10 weeks at a steady weekly rate. Find the weekly retention rate.

23. (4 pts) Lesson 6.3

A plan gives +6 with probability 0.6 and -8 with probability 0.4. A branch plan changes the bad case to 0 and the good case to +5. Compare expected values.

24. (4 pts) Lesson 6.4

Tell the Bobby Jones story of 1925 and explain 2 Timothy 2:5 in your own words.

25. (4 pts) Lesson 6.5

A new strategy scores 15 of 20 against a control of 11 of 20. Compute both percentages, the rough uncertainty, and write one honest sentence of conclusion.

26. (7 pts) Lesson 1-6

Essay (8-10 sentences): Choose one commander or coach from this course whose character you most admire. Describe his plan, the principle it used, how he handled friction or failure, and what his example teaches about competing well. Include one verse of Scripture from the course.

ANSWER KEY

1. (a) Mass, (b) security, (c) surprise, (d) simplicity.
2. "Everything is very simple in War, but the simplest thing is difficult."
 $0.95^8 \approx 0.663$.
3. $(15/5)^2 = 9$ times.
4. $10^{-D/400} = 1/0.64 - 1 = 0.5625$; $D = -400 \log_{10} 0.5625 \approx 100$.
5. Black 48; White 49.5. White by 1.5.
6. Kings on the same file or rank with one square between; the side not to move has the opposition. The king must control the squares in front of the pawn; if the pawn goes first, the defending king blocks it and draws.
7. Shared: surprise and deception. Gideon made a small force seem huge with trumpets and lights; Joshua made a strong force seem weak by a feigned retreat.
8. At Cannae Hannibal won with superior cavalry and an attack on the rear. At Zama Scipio gained superior cavalry through Masinissa, answered the elephants with lanes, and won when his cavalry attacked Hannibal's rear.
9. 2.25 mph. River ice, the storm, a three-hour crossing delay, supporting forces unable to cross.
10. Napoleon gave up the Pratzen Heights and left his right weak so the Allies would descend to attack it; Davout's forced march from Vienna reinforced the right in time, while Soult seized the emptied heights.
11. $27/22 \approx 1.23$; $1.23^2 \approx 1.51$. Nelson explained his plan in advance so captains could act without signals: none would do very wrong placing his ship alongside an enemy.
12. Shorter routes between one's own forces than the enemy has. Between separated Union forces, Jackson marched fast to mass against each in turn before they could combine.
13. $0.475/(0.475 + 0.015) = 0.475/0.490 \approx 0.969$.
14. They treated the sources as independent, but all were controlled by the Allies, so their agreement added no real evidence.
15. Attackers needed only two opponents, so a single full-back stepping up became risky and goals rose; Chapman added a center-back. $68/4 = 17$ m.
16. Short: $4.9 - 0.45 = 4.45$; deep: $9.8 - 2.25 = 7.55$.
17. The short pass: the objective is a first down, which it achieves about 70% of the time against about 35%. Expected yards do not measure whether the objective is

reached.

18. $0.08 \times 72 = 5.76$ points. For example, industriousness and enthusiasm (also self-control, team spirit, competitive greatness).
19. 20%. After Béliveau scored three power-play goals in 44 seconds in 1955, the NHL ruled that a minor penalty ends when the team with the advantage scores.
20. 75%, 20%, 5%. $1/\sqrt{200} \approx 7\%$.
21. Sample: Purpose: win the game. Key tasks: stay compact, keep the ball in their half, avoid fouls near our goal. End state: we finish ahead.
22. $r = 0.4^{1/10} = e^{\ln 0.4/10} = e^{-0.0916} \approx 0.912$, about 8.8% lost per week.
23. Without: $3.6 - 3.2 = 0.4$. With: $3.0 + 0 = 3.0$. The branch plan is much better.
24. His ball moved at address; no one else saw it, but he called a penalty on himself, tied, and lost the playoff. Paul says the athlete is not crowned unless he competes by the rules: a victory won by breaking the rules is not a real victory.
25. 75% and 55%; about 22 points each. “The strategy looks better, but 20 games each are too few to be sure; more testing is needed.”
26. Answers will vary. A full-credit essay accurately describes the plan and principle, explains how the person dealt with friction or failure, draws a thoughtful lesson about character, and uses a verse from the course appropriately.