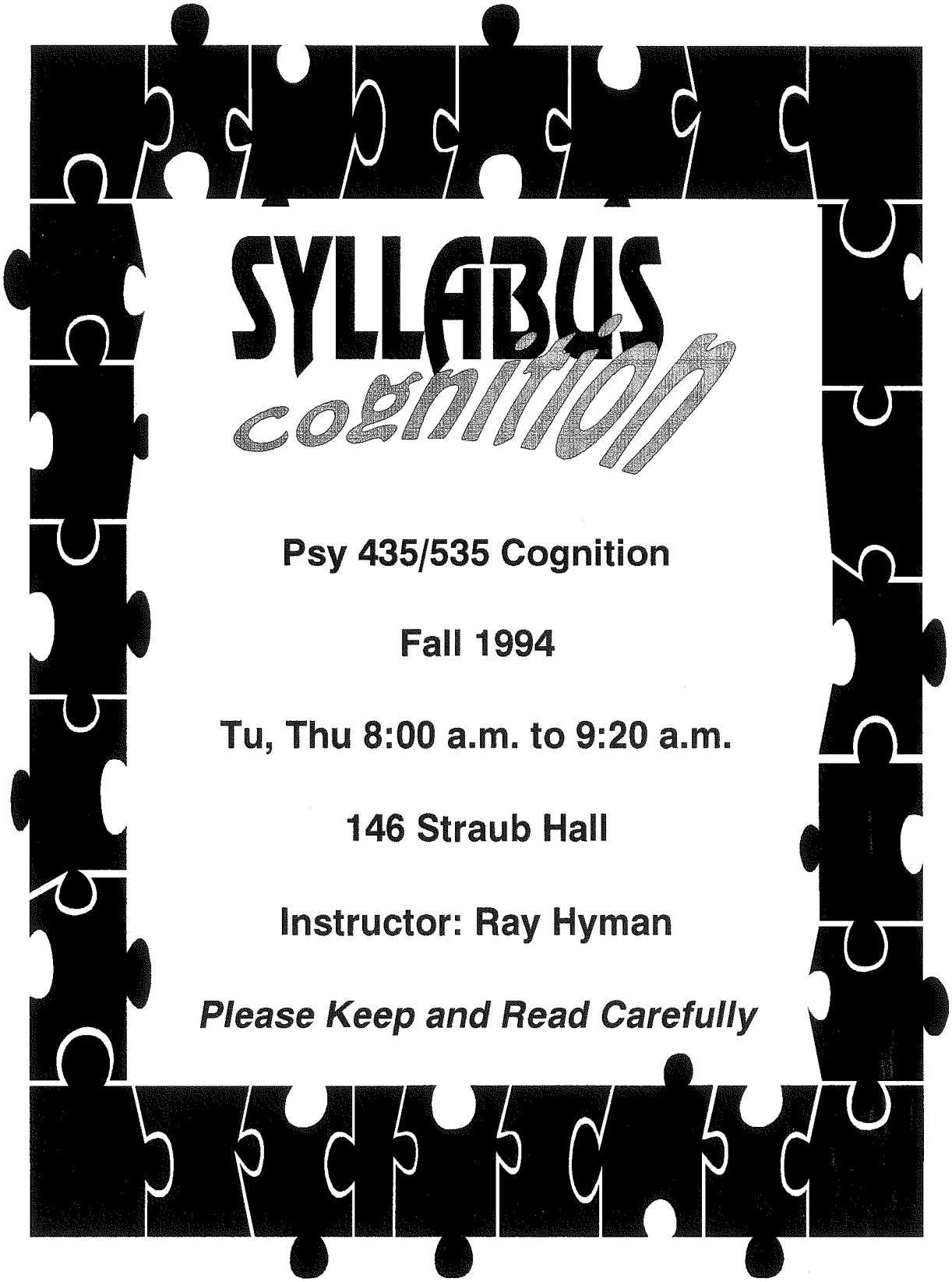


Psy 435/535 Cognition

Fall 1994

Tu, Thu 8:00 a.m. to 9:20 a.m.

146 Straub Hall

Instructor: Ray Hyman

Please Keep and Read Carefully

General Information

1.1. Catalog Details:	Psy 435 CRN 14660/ Psy 535 CRN 14673 UH 8:00- 9:20 a.m. 146 Straub Hall[1] 4 Credit Hours
1.2 Instructor:	Ray Hyman 323 Straub Hall, 346-4910 Office Hours: M 2:00-3:30 p.m./ F 10:00-12:00 p.m.
1.3 Textbook:	Medin, D.L., & Ross, B. H. (1992). *Cognitive Psychology*. NY: Harcourt Brace Jovanovich.
1.4. Examinations:	**MIDTERM: October 27, 1994** **FINAL: December 9, 1994 @ 8:00 a. m.**
1.5. Term Paper:	The term paper is due on ***Tuesday, November 29, 1994***. Papers handed in after this deadline will either be marked down or not accepted.

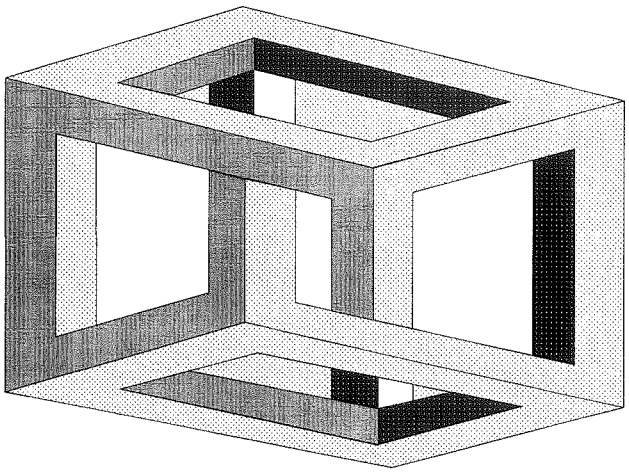
PLEASE CONSIDER THE FOLLOWING BEFORE YOU DECIDE TO REMAIN IN THIS COURSE:

1. Look carefully at the dates for the Midterm and the Final Examations. If you anticipate that you may have to miss one or both of these dates, do not take this course. We do not have the time or resources to give makeup examinations. It is against university regulations to give examinations to anyone for any purpose before the scheduled date.
2. If you anticipate any possibility of not completing the term paper by the assigned date, please do not take this course. You can obtain an incomplete only under the most exceptional conditions. Failure to complete the work in time almost certainly will result in a failing mark.

[1] The examinations will be held in another room.

Topics & Assignments

DATES	TOPICS	ASSIGNMENTS
	OVERVIEW	
Sept 27, 29	Basic Themes, Overview, History	Preface, Ch1, Ch 2
	ACQUIRING INFORMATION	
Oct 4, 6	Learning, Attention	Ch 3, Ch 4
Oct 11, 13	Perception, Imagery, Mnemonics	Ch 5, Ch 6
	MEMORY	
Oct 18, 20	The Standard Model, Signal Detection	Ch 7, Ch8
Oct 25	Review	
Oct 27	***MIDTERM***	Bring #2 pencils!
Nov 1, 3	Language, The Psychic Reading	Ch 9, Ch 10
Nov 8, 10	Comprehension, Inference, Concepts	Ch 11, Ch 12
	THINKING	
Nov 15, 17	Judgment, Decision Making, Reasoning	Ch 13, Ch14
Nov 22	Problem Solving	Ch 15
Nov 29, Dec 1	Expertise, Creativity	Ch 16, 17 **Term paper due Nov 29**
Dec 9 @8:00 a. m.	***FINAL EXAMINATION. Please bring #2 pencils and show up on time.***	



YOU AND YOUR GRADE

1. Points and Letter Grades

You can earn a total of 250 points in this course. The Midterm is worth up to 50 points; the Final Examination is worth up to 100 points; and the term paper is worth up to 100 points.

I do not grade on a curve. Instead, I try to set standards which a student has to meet to get a letter grade. As a rough guideline, you would need to get 212 or more points to earn an A; 188 to 211 points to earn a B; 162 to 187 points to earn a C; and 138 to 161 points to earn a D. These are approximate guidelines because I make adjustments based on the difficulty of the examinations and other unanticipated factors.

2. The Term Paper

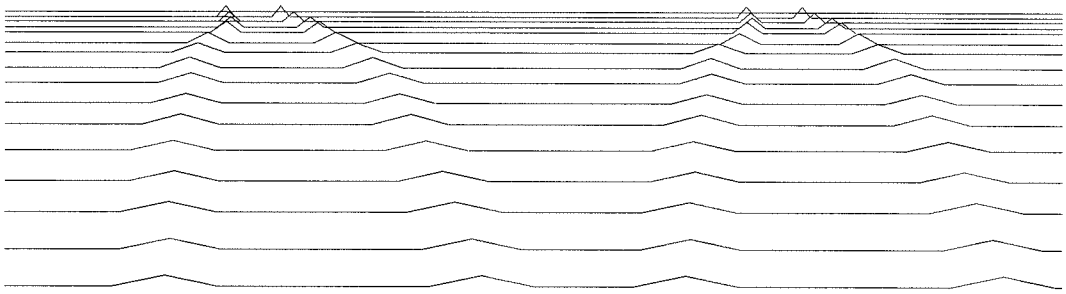
The term paper is necessary to pass the course. The term paper provides you another opportunity to show what you have learned in *this course*. For your term paper, choose 6 pointers from the course. Use these pointers to write an integrative essay on cognitive psychology emphasizing the unifying themes and materials used in this course. The integration refers not only to tying the themes together but also to putting the lectures and the textbook together into a unified story. Your paper will be graded on comprehensiveness, integration, importance of the themes, and evidence that you have understood and can sensibly discuss the key issues of this course. *Warning! Each year, students turn in otherwise excellent papers that show no explicit connection with the key themes and issues of this course. Make sure that you explicitly use*

topics, pointers and themes from the textbook and lectures in this course or you will receive no credit for your paper.

How long should your paper be? Over the past three years, the typical paper has averaged 8 to 9 pages in length. The range has been from four to 20 pages.

3. The Examinations

The examinations will be half multiple-choice and half essay in format. The coverage is equally on the text and the lectures.



Topics, Pointers, & Themes: A Study Guide

If you have looked at your textbook or if you have skimmed the subjects listed on page 3 of this syllabus, some questions might occur to you. The topics--attention, perception, memory, language, decision making, and problem solving, etc.--were covered in your introductory psychology course. Moreover, the Psychology Department offers separate courses in perception, learning, memory, psycholinguistics, decision making, and thinking. So what's the point of covering these topics in a separate course called `cognition'?

In fact, many cognition textbooks are little more than glorified introductory psychology

books. They begin with the obligatory chapter on the history of psychology and its methods. Then they cover attention, perception, memory, language, reasoning, and thinking at a level and detail that differs little from the coverage of the same topics in the typical introductory psychology text.

In my opinion, the justification for covering these topics again in a course on cognition is to show how they can be integrated by a few central and important themes. We do not want to simply review what we have already learned about perception, memory, and thinking. Rather, we want to understand these topics in a new way. We want to focus on those themes that explain both the achievements and failures of human intelligence. What is it about the way we acquire, store, understand, and use information that makes us the cognitive marvels (according to some) or the abject blunderers (according to others) that we are?

Your textbook focuses on ambiguity and how we cope with it as the integrating motif. Medin and Ross define cognitive psychology as "the study of the human mind; its domain includes questions concerning how people perceive the world, remember information, use knowledge, understand language, learn, reason, and solve problems. ***In each area one can show that an intelligent organism that objectively considers all possibilities is doomed to failure. It will not be able to learn a language, solve complex problems or understand events in the world as meaningful...any visual perception is consistent with an unlimited number of interpretations. The challenging question is how the perceptual system functions such that we are normally unaware of any ambiguity...*** " [Emphasis added].

Pay careful attention to the italicized portion of the preceding quotation. Do you fully understand what the authors are saying? Why should the consideration of all the possibilities doom us to failure? Your task in this course is to grasp fully the meaning of this quotation.

Medin and Ross go on to say that "we have organized this entire book around challenges posed by ambiguity. ***The world continually confronts us with situations that offer too little information about what is going on and too many possibilities about what to do. Rather than try to consider all the possibilities, we come prepared with certain biases or expectations that greatly influence what we consider and how we act. We may not experience ambiguity because we do not consider alternative possibilities. These `constraints' occur in all facets of cognition and, we believe, are responsible for the successful performance of the cognitive system Finally, one should note that constraints represent an adaptation to our world and therefore, should be thought of more as `guiding principles' rather than limitations.***"
[Emphasis added]

This last quotation captures the heart of Medin and Ross's story. You will find it useful to spend some time before you get into the course thinking about this statement. As an interesting and helpful exercise, write down your thoughts (in a page or so) about this statement. Date your thoughts and put them aside. When studying for the midterm, make another attempt to write down your understanding of this statement. Finally, do it again when studying for the final examination. Hopefully, when you compare your three responses, you will see some big gains in your grasp of these principles. [This exercise is for your personal benefit. It is not an assignment. However, I would be interested in reading your three responses if you are willing to share them with me.] Why should our biases help us in dealing with an ambiguous world? Can you explain how biases and constraints on what we experience can be considered as useful adaptations? Medin and Ross do not explicitly discuss consciousness. Yet, one implication of their motif is that we experience *consciously* only one of the many possible interpretations in a given situation. Does this suggest a role for consciousness in cognition?

Your task in this course is demonstrate that you can integrate the material in the lectures and the textbook around the central theme in the preceding quotations as well as a few additional major themes. As we proceed through the course you will encounter a number of what I will call *topics, pointers, and themes*. *Topics* are broad subdivisions of the content we will be dealing with. Your text, for example, divides cognitive psychology into the topics of *Acquiring Information, Memory, Language and Understanding,* and *Thinking*. These broad topics are, in turn, broken down into somewhat narrower topics. The broad topic of *Acquiring Information* includes the subtopics of *Learning, Attention,* and *Visual Attention*.

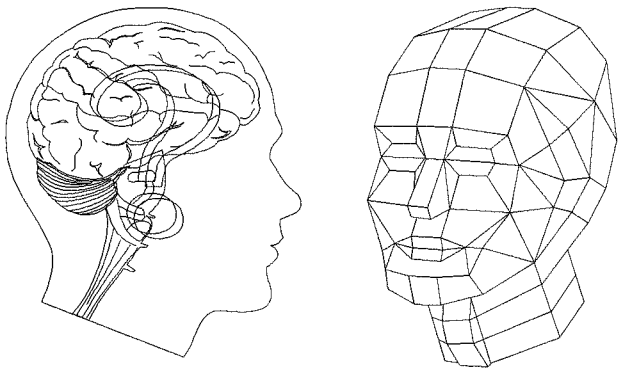
Pointers are demonstrations, experiments, or other concrete models that illustrate (point to) one or more important principles or themes. *Themes* are general principles or theoretical generalizations about how cognition operates or what problems cognition has to cope with. For your term paper, you will select a set of pointers and use the themes to which they point as the basis for an integrated statement of what cognitive psychology is.

The following table lists some of the topics, pointers and themes that we will encounter in each week of the course. This is just a sample. Think of the table as a starter kit. You can add additional terms to the list as the course progresses. The items in bold print are especially important.

Some Key Terms

Dates	Topics	Pointers	Themes
Sept 27, 29	Cognitive Psychology Cognitive Science Information	7C/7S/ Shape Constancy Illusion/ Boomerangs Invisible Rectangle Domino/ Fs Filtered Speech Policeman	**Ambiguity**, AI, **Computational complexity**, **Constraints**, **Contributions (O,E)**, **GPS**, Information Processing, Introspection, Less/More, **Limits**, **Metacognition**, Perception/Imagination, **Top Down/Bottom Up**/ Satisficing
Oct 4, 6	Acquiring Information, Learning, Attention	Dichotic Listening Partial Report Mental Paper Folding The Standard Model THE CAT	Availability, Anchoring, **Automaticity**, Chunks, Conditioning, Illusory Correlation, Instrumental learning, Mental models, **Parallel/ Serial,** Superstitious behavior, Unusualness Heuristic, What/where
Oct 11, 13	Perception Imagery Representation	Mental Rotation Mnemonics Hecht, Shlaer, & Pirenne	**Allocation of resources**, Assimilation/Contrast, Features/Templates, Figure/ground, **Data limits, Resource limits**, Dual coding, Signal detection
Oct 18, 20	Memory, Representation	ACT Amnesia	Chunking, Declarative memory, Encoding Specificity, Episodic memory, Explicit Memory, Implicit memory, Incidental learning, Intentional learning, LTM, Levels of processing, PDP, Procedural memory, Propositions, Semantic memory, Serial position effect, Spreading activation, STM, Typicality effect
Nov 1, 3	Language Language Acquistion	The Psychic Reading Christian Dion Forer Connectionism	Categorical perception, Garden path, McGurk Effect, Modularity, Morpheme, Motor Theory, Personal Validation, Surface/Deep structure Less-is-more, Linguisitic universals, productivity, whole-object assumption
Nov 8, 10	Comprehension Inference Concepts	Eliza Garfinkel	Ad hoc categories, Basic level, Category, Concept, Conversational maxims, Default assumptions, Frame, Given-new, Intuitive theories, Invited inference, Mental models, Presupposition & assertion, Prototype, Psychological Essentialism, Similarity, Slots, Schema, Typicality

Dates	Topics	Pointers	Themes
Nov 15, 17	Thinking Decision Making Reasoning	Wason Selection Task Von Restorff	Anchoring & adjustment, Availability, Base rate, Bayes' Theorem, Bounded rationality, certainty effect, Cognitive heuristics, Confirmation bias, Conjunction fallacy, Framing effects, Gambler's Fallacy, Hindsight Bias, Overconfidence, Representativeness, Satisficing, Utility
Nov 22	Problem Solving	GPS, Monty Hall, Mountain Climber Problem, Candle Problem, X-Ray Problem, Thorndike, Köhler Chess Silveira Water Jugs	Algorithm, Case-based reasoning, Functional fixedness, Heuristic, Ill-defined, Means-end, Operators, Problem Space, Protocols,Einstellung, Productions, Pragmatic Schemas, Deontic Logic
Nov 29, Dec 1	Expertise Creativity	Chess, Expert/ Novice, Silveira	Expert System, Incubation,
Dec 9, 1994 @ 8:00 a. m.	**Final Examination**	The final examination will focus mainly on the topics and pointers that were covered after the midterm examination. The themes that were covered before the midterm are also relevant to the topics and issues that occurred after the midterm.	



SOME POINTERS AND PROBLEMS TO COGITATE UPON

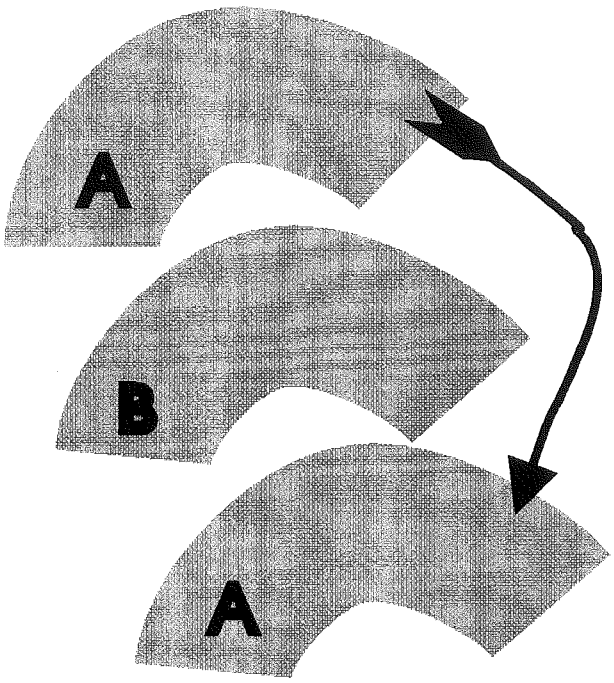
The following pointers and problems bring out various issues and themes that are important for understanding cognition. Most of them will play a central role in this course. You should find it helpful, and I hope interesting, to consider these problems before and during the course. For each pointer, try to list what important ideas about cognition are involved. What does each pointer tell us about how our minds both succeed and fail in coping with various challenges?

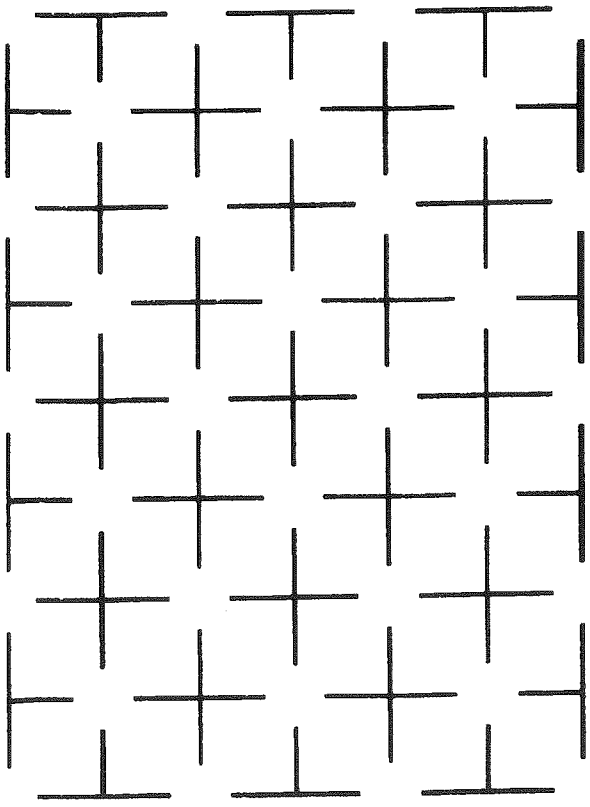
1. **MENTAL PAPER FOLDING**: Assume that I am holding a sheet of paper that is .004 inches thick. If I fold it half, the thickness doubles and becomes .008 inches. If I fold the paper in half a second time, the thickness will double again and become .016 inches thick.. I can continue folding the paper and doubling its previous thickness with each new fold. However, physical reality will soon get in the way, and I will be unable to continue doubling the thickness after I have folded the paper a few times. Your imagination, however, is not constrained by such physical limitations. You can continue folding the paper in your imagination for as long as you have the patience to do so. I want to use this pointer to teach us an important lession about our imagination and our intuition. Do not try to calculate an answer. Instead, I want you to imagine that I could continue doubling the paper (folding it in half) until I have done so 50 times. Now use your intuition to estimate how thick you believe the final result will be.

2. **THE GARDEN**: John, who lives in a big city, has a little square garden plot that measures 16 feet on a side. One day he discovers that a green mold that is covering one square foot of his garden. The next day, he observes that the area covered by the mold has doubled to two square feet. On the third day, the area covered by the mold doubles again, and continues doubling each successive day until, by the ninth day, it exactly covers the entire plot. On what day did the mold cover 50% of the plot?

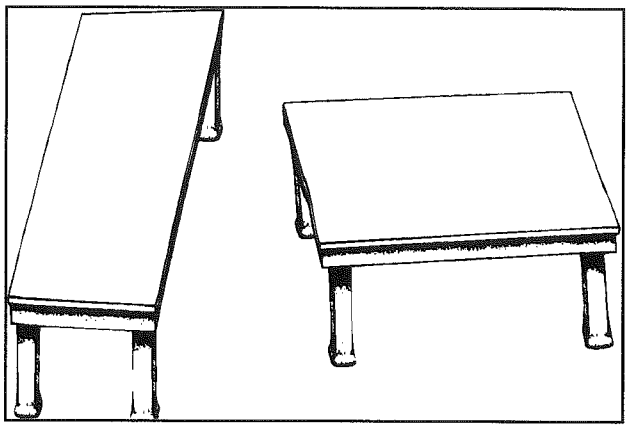
3. **THE CAT**: You probably have no difficulty in reading the sentence in the box on the right as *THE CAT*. Yet, if you look at the middle letter in each of the two words you will note that they are identifical in shape. Despite this, you had no trouble in treating the first occurrence of this pattern as *H* and the second occurrence of the identical pattern as *A*. Does this tell us something about how we recognize patterns and read words? Although this task is easy for us, it has been an almost insuperable barrier for computer scientists who want to create programs to read and understand natural language. What makes this task so easy for us and so difficult for artifical intelligence systems?

4. **BOOMERANGS**: Look at the three arcs or "boomerangs" on the right. To most observers the top boomerang (A) appears smaller than the middle boomerang (B). Yet, as you can verify by physically measuring them, Boomerangs A and B are of identifical size and shape. If we move Boomerang A, as indicated by the arrow, so that it is below B, then A now appears larger than B. Yet, all three shapes are identical in shape and size. How can you explain the apparent change in size of A as it is moved from the top position to the bottom position? Does this tell us something about perception and cognition? Does it reveal a limitation or constraint on the accurracy of normal percpetion and cognition?





5. **STREETS**:Look at the figure on the left. It can be perceived as a grid, but none of the lines of this grid touch each other. The empty spaces where the lines would intersect if they did touch each other are not seen as empty. Instead, we tend to perceive the interesections as covered by illusory circles. [Some people see illusory squares instead of illusory circles]. In addition to seeing illusory squares, observers also tend to see the circles connected by illusory "streets". Both the circles and the `streets' do not exist. Yet, we perceive them. Where do they come from? And why do we see circles instead of some other shape? What does this teach us about cognition?



.6. The box on the right shows another version of the **SHAPE CONSTANCY ILLUSION** that is depicted in your textbook on page 5. The version in the text was created and published by the Stanford psychologist Roger Shepard in 1981. Shepard created this interesting variation for his fascinating book of original visual illusions and other anomalous illustrations *Mind Sights* (1990). The tops of the two tables are of identical size and shape in the plane of the picture. This seems to contrary to our perception that you will have to trace one of the table tops and superimpose it upon the other one to convince yourself that they are, in fact, the same size and shape. The fact that your authors beging their textbook on cognitive psychology with Shepard's illusion should alert you that they believe this illusion is telling us something important about cognition. Can you figure out what this important point is? Why is this illusion so compelling even after we know that the two table tops are identical in shape and size?

7. A statistician gave mathematical tests to everyone who lived in a village of 6,000 people and at the same time measured the lengths of their feet. He found a strong correlation between mathematical ability and foot size. Explain.

8. A hotel detective was making his rounds through the corridors of the hotel. As he passed by a room, he heard a voice behind the closed door. The voice yelled, "Don't shoot, John!" Immediately afterwards, the detective heard a gun discharge. He immediately broke into the room and encountered this scene. A dead woman was lying on the floor. Next to her was a gun. Three people were standing around her. They were a judge, a soldier, and a postman. The detective immediately arrested the postman for murder. How come?

9. How many animals of each kind did Moses take upon the ark?

10. In 1944, the psychologist Crider published a study of a psychic or character reader[2]. Margarita S. was 30 years old and had been a character analyst for 15 years. Her clients gave her excellent testimonials. To test her abilities, Crider conducted the following experiment. Margarita saw each

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[2] Crider, B. (1944). A study of a character analyst. Journal of Social Psychology, 20, 315-318.

of the 16 female college students from Crider's class in the author's office. Each student was seen individually. The analyst made a series of statements about each student. The statements were made one at a time and written down. The subjects had been instructed not to react to the statements. Margarita made from 19 to 25 separate statements about each student. After the 19 or more statements were written down they were handed to the student who checked those with which she agreed.

Crider reported that in seven of the analyses there was no disagreement at all. In only one of the analyses were there as many as three disagreements. All told, for the 16 analyses, Margarita made a total of 364 statements. Of these statements, the students disagreed with only 22. In other words the students agreed with 96% of the statements made by Margarita. Crider provided two sample analyses. We give one of these below:

1. Does not like to take chances.
2. Very-very sensitive.
3. Very self-conscious.
4. Gets along well with boys.
5. Above-average student.
6. Worries about her studies.
7. Introvert.
8. Over-emotional, tries to conceal it.
9. General health good.
10. Love life not in settled stage.
11. Has had broken love affair.
12. Should not be in business world.
13. Appreciates good music.
14. Must always have feeling of security or else is uneasy.
15. Is of generous and cooperative nature.
16. Digestive organs normal.
17. Heart normal.
18. Kidneys normal.
19. Finds it hard to ask favors.
20. Should not be given technical work.
21. Does not like routine either.
22. Very stubborn.
23. Bad temper when aroused, yet she doesn't display it often.
24. This girl would be happiest when being supported.
25. Has <u>many big</u> dreams.

Crider states that, "Psychologists may say that the statements are mostly complimentary, that they are too general, that they will apply to anyone. However, from what I knew of the students, I was in substantial agreement with the analyses as presented. More interesting is the fact that the students were satisfied, and in their discussion with each other following the analyses they were of the opinion that the analyses were surprisingly accurate."

Crider also supplies a statement from Margarita:

> I believe we can and do absorb and register in our feeling worlds, the emotions and feelings of those we contact. Some people are more sensitive and can do this at will. I have been able to analyze personality, emotions, and temperament just by the impressions I receive while looking at an individual. I do not read the features or contours of the face. My findings are determined by thought vibrations which emanate from the individual. Those vibrations enter my emotional world and caused the same vibratory frequency to occur in my feelings. Thus, I feel what the individual feels.

Crider concludes: "Since she is one of several who are doing similar work I believe it is of considerable interest to psychologists to know how our competitors work; much better, in fact, to try to understand them than to scoff at them."

Think about Crider's test of this psychic and his conclusions. How would you evaluate this evidence and what further evidence would you require before you were willing to accept this psychic's powers?

11. **LINDA**: Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations. What is the probability that

___ Linda is a bank teller.
___ Linda is a bank teller who is active in the feminist movement?
___ Linda is active in the feminist movement?

[Estimate your probabilities on a scale from 0 to 100--with 100 indicating certainty and 0 indicating impossibility.]

12. **THREE CUPS**: Imagine that you have been hired to conduct the following experiment. The experiment uses three cups and a penny. Before your subject enters the experimental room, you randomly place the penny under one of the three overturned cups. When the subject enters the room, you tell her that there is a penny under one of the cups. You ask the subject to choose the cup which she thinks the coin might be under. When the subject has made her choice, you do not immediately turn up her chosen cup to show her if she has chosen the correct cup. Instead, you deliberately turn over one of the two remaining cups, making sure to turn over a cup that you know is empty, and show the subject that the coin is not under the upturned cup. You then remove the empty cup from the table leaving two cups--the chosen one and the remaining unchosen cup.

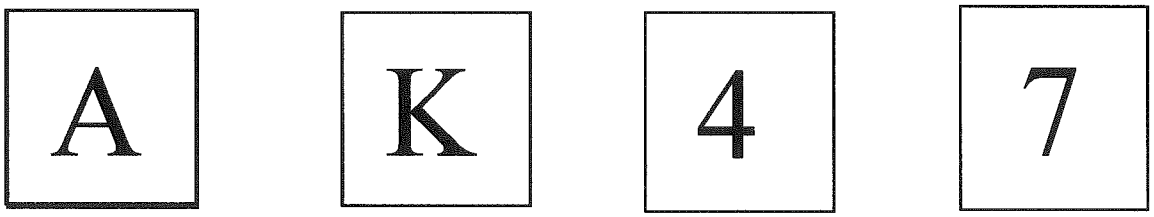
You now give the subject the following option. She can stick with her original first choice *or* she can switch her choice to the other remaining cup. Will the subject's probability of winning be better if she sticks with her first choice or will it be better if she switches? Or does it make no difference? Please explain.

13. A reader sent this question to Marilyn vos Savant who has the weekly column in *Parade Magazine*:

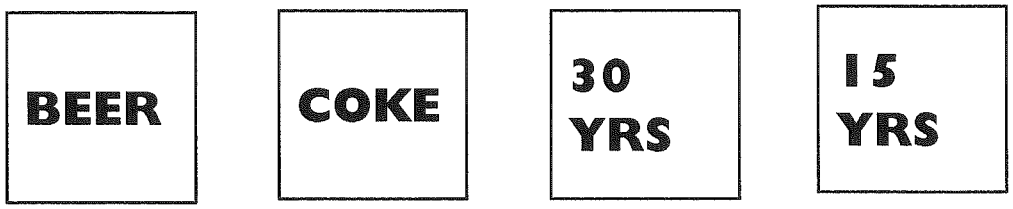
> A shopkeeper says she has two new baby beagles to show you, but she doesn't know whether they're male, female, or a pair. You tell her that you want only a male, and she telephones the fellow who's giving them a bath. "Is at least one a male?" she asks him. "Yes!" she informs you with a smile. What is the probability that the *other* one is a male?

14. Suppose that you intend to have four children. There are three possibilities: They may all be of one sex, or there may be three of one sex and one of the other sex, or the sexes may be balanced two and two. Which possibility is most likely?

15. **SELECTION TASK**: Assume that the four boxes which are presented below are actually cards which each have a *letter* on one side and a *number* on the other side. Your task is to test the hypothesis that-- *for these four cards*--if a vowel appears on one side, then an even number will appear on the other side. To test this hypothesis you will have to turn over one or more of the cards below. In other words, *list those cards, and only those cards, which need to be turned over to determine decisively whether the hypothesis is true or false*.



16. The four boxes below represent cards that contain information about four individuals who were recently reported to have been in Joe's bar. On one side of each card is information about the person's age. On the other side of each card is information about what the person was observed drinking while in Joe's bar.

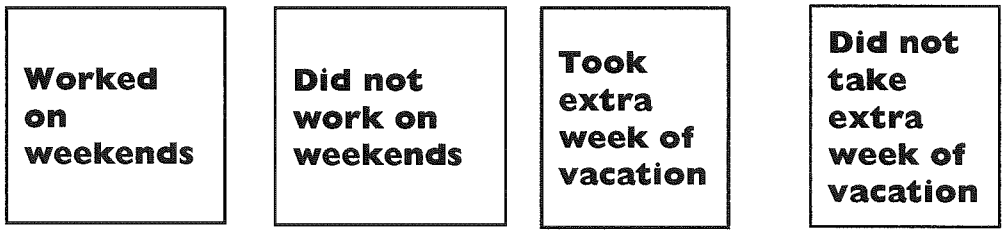


17. Imagine that you are the owner of a small business that manufactures a speciality item. You have discovered that your business if more efficient and profitable if you have employees working on the machines during weekends as well as on weekdays. Unfortunately, your employees do not like to work on weekends because it deprives them of quality time with their families. To entice some workers to work on weekends you have established the following policy or rule:

If an employee works on the weekend, then that person gets an extra week of paid

vacation.

You have heard rumors that some of your employees have been taking the extra week of paid vacation without actually working on weekends. You decide to see if the rule holds or is being violated on a sample of four employees. Each box below represents a card with information about each of these four employees. On one side of each card is the information of whether they have worked on weekends or not. On the other side of each card is the information about whether they took the extra week of vacation or not. To see if the rule is being maintained with these four workers, list those cards you would need to turn over. List only those cards that you need to see if the policy or rule is satisfied with these four employees.



18. There are three missionaries, three cannibals, and a boat at the bank of a river. Your task is transport all six people and the boat to the opposite bank. There are two constraints: (1) the boat will hold a maximum of two people; and (2) the cannibals must never outnumber missionaries on either bank.

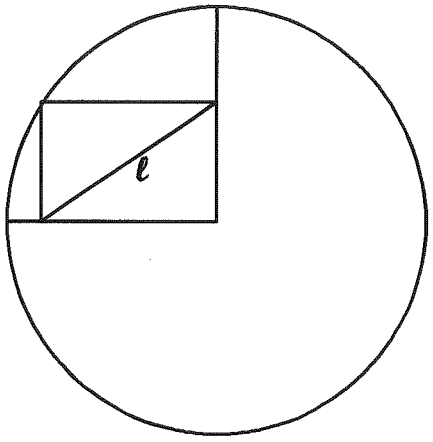
[Your solution will require several steps. Keep a written record of each step, showing the number of missionaries and cannibals on each bank and the position of the boat after each move.]

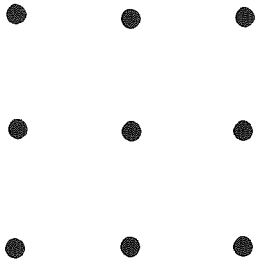
19. In his classic monograph *On Problem Solving* {originally published in German in 1935), Karl Duncker wrote:

> On a mountain trip, on which descent was by the same path as had been the ascent of the previous day, I asked myself whether there must be a spot en route at which I must find myself at exactly the same time on the descent as on the ascent. It was of course assumed that ascent and descent took place at about the same time of day, say from five to twelve o'clock.

How would you answer Duncker's question? How sure are you that your answer is correct?

20. Consider a situation in elementary geometry. There is a circle with the radius r, and in this circle I construct a rectangle. [See the diagram below]. The problem is the following.: If I now draw the line ℓ within the rectangle, what is the length of this line? For simplicity, assume that the radius is one inch long.





21. The figure on the left is for the nine-dot problem. Using no more than four straight lines and without lifting your pencil from the paper, draw a line through all nine dots.[This is favorite of many introductory text books on psychology. You may have encountered it previously.]

22. Consider the two figures below. For the figure on the left, imagine that the curved tube is on a table top, and a ball or marble is tossed in (see arrow). Draw the path of the ball when it exits the tube. For the figure on the right, imagine that the ball is being twirled around and that the string breaks. Draw the path the ball will take once the string breaks.