Thinking Syllabus

Psy 330 Winter 1996

Please keep and read this syllabus carefully. You are responsible for everything in this document. Beyond the course calendar, examination dates, assignments, and due dates this syllabus also contains:

1) Information about how you will be graded
2) Explanation of the course requirements
3) A list of the pointers and themes you should know to pass this course
4) The framework [set of questions] you must use for each of the four required exercises
5) A sample analysis to illustrate how to use this framework
6) Additional tools or aids for thinking
7) Problems to ponder

1. Goals

The major goal is to improve your thinking skills. We do not aspire to teach you how to think. You already can think. Instead, we try to teach you how to use your thinking more effectively. We do this by 1) informing you about what psychologists have learned about thinking--how it succeeds and how it fails; 2) we acquaint you with techniques based on this knowledge; 3) we provide you with a framework for systematically evaluating claims that you encounter in your daily life; 4) we illustrate the application of this framework to several case histories; and 5) we assign four cases for you to write up as exercises using the framework.

Although we intend the framework to apply to almost any type of claim, we focus mostly on claims of the paranormal. In previous occurrences of this course, some students have objected to this emphasis upon paranormal claims. Some have objected because they believe in one or more paranormal systems. Other have complained that paranormal issues are not as important as other controversial topics such as the environment, abortion, aids, homelessness, racism, etc.

On the other hand, paranormal claims provide good examples because the issues are sufficiently clear that they enable us to focus on learning the framework. Once you have mastered the framework, you will be better able to cope with the more complex social and environmental matters. In addition, it just is not true that the paranormal claims are less important than other claims. Surveys consistently show that a majority of our population--including the college educated--believes in one or more of the paranormal systems. Many respondents believe that they have had one or more paranormal experiences. This is important because if even one paranormal claim were true it would contradict the laws of science.

We live in an age of unprecedented scientific progress and technological achievements. Simultaneously a majority of our population believes in systems that contradict the very foundations of this scientific and technological age. Surely this raises important questions. Is science fatally flawed or is most our population--including college-trained--badly deluded?

2.0 Class Meetings

The lectures are an essential component of the course. The lectures deal with cases and applications of the framework that you will not find in the textbook. My records show that those students who fail to attend lectures regularly get much lower grades than those who do attend. Just about all the students who have failed in this course were ones who rarely appeared in class. If you cannot attend classes regularly, do yourself and me a favor by not enrolling. The class meetings are from *8:00 to 9:20 A.M., Tuesday and Thursday, in 150 Columbia.*

3.0 Instructors

Instructor: Ray Hyman
323 Straub, 346-4910
Office Hours: M 2:30-3:30 pm, F 10:00-12:00 pm

TA: Ellen Peters
312 Straub, 346-4927
Office Hours: Tues 9:30-10:30 A.M. or by appointment.

4.0 Text

Halpern, D.F. (1989, Second Edition). *Thought and Knowledge: an Introduction to Critical Thinking*. Hillsdale, NJ: Lawrence Erlbaum. [The third edition of this text has just been published. We will use the Second Edition. About 97% of the material is the same in both textbooks.]

5.0 Requirements

Examinations: Both the Midterm [*February 8, 1996*] and the Final Examination [*Wednesday, March 20, 1996 @ 8:00 a.m.*] will consist of multiple choice items. Approximately half the items will be based on the text and the remainder on the lectures and exercises. The Midterm will contain 50 multiple choice items and the final will contain 100 items. Because of the class size, *no makeup examinations will be given*.

Exercises: The exercises consist of four short papers. The first three papers should be three to four pages in length. The last paper should be 5-6 pages long. Each paper will deal with an assigned example that you will evaluate according to the framework given at the end of this syllabus.

IMPORTANT!

The exercises make up the heart of the course. Although they can contribute a maximum of 25% to the total number of points in this course, *you cannot pass the course unless you complete all four exercises on time.* Please keep this in mind when considering to remain in this course. The goal of the course is to provide you training in systematically thinking about issues and problems. You cannot benefit from the course without doing the exercises on time. You cannot get an incomplete for failure to complete one or more of the exercises. Not completing the exercises shows that you did not complete the course requirements and have failed the course.

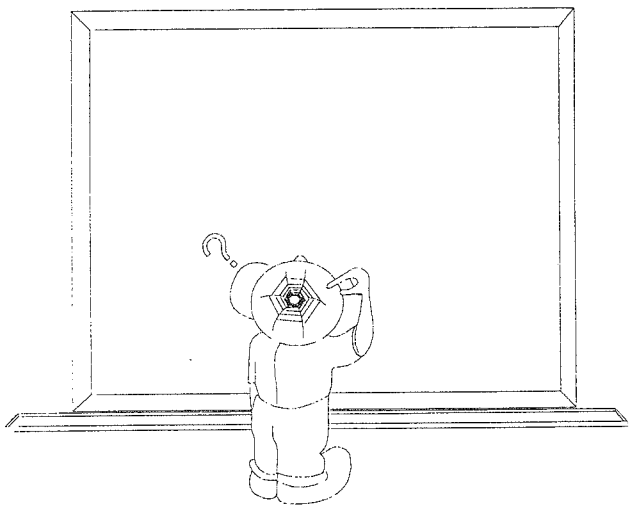
Research Participation: The Psychology Department requires students in this course to serve as subjects in three hours of psychology experiments. However, if you complete your four exercises you do not have to meet this research requirement. Instead, those of you who do complete your research participation can use it to bring your lowest grade on the first three exercises up to the maximum 10 points. To qualify for such a bonus you must submit your slips for three hours of experimental participation along with a one-page summary of your experiences in the experiments [the one page summary covers your three hours of participation].

6. Grading

You can achieve a total of 200 points in the course. Your grade will be based on the total number of points you earn from the examinations and the exercises. In addition bonus points can be given for research participation and for marked improvement from midterm to final examination performance. To pass the course you need to *both* complete the four exercises on time and achieve a total of at least 100 points. You can earn your points in the following ways:

Exercises: You can earn up to 50 points for the set of four exercises. Each of the first three exercises is worth up to 10 points each. [If you complete the research participation, we will increase the lowest score you got on one of these exercises up to the maximum of 10 points.][1] The fourth exercise is worth up to 20 points. *Remember that you must complete the four exercises by their due dates to pass this course.*

Examinations: The midterm is worth up to 50 points [one point for each correct answer]. The final examination is worth up to 100 points. In special cases where your final examination score shows marked improvement over an unsatisfactory midterm score, we will ignore the midterm score and pro-rate your total score based on your final examination.



[1] You can also earn bonus points on exercises by applying tools in the textbook or syllabus in addition to the conditional format and framework that is required.

Course Calendar and Assignments

Dates	Topics	Assignment	Pointers	Themes
Jan 9, 11	The Framework/ Critical Thinking, Intelligence	Begin Exercise 1 Ch 1	***Key Bending***, Geller, PK Parties	*Conditional Reasoning/ As-reported: as-happened/ Garbage-in: Garbage-out/* Falsifiability/ Metacognition/ Transfer
Jan 16, 18	Thought & Language, Comprehension	Ch 3	Penny/Washing Clothes/Peace March, /**PQ3R**/Graphic Organizers/ Communication Rules/ Dowsing	Surface structure/ Meaning/ Framing/ Inference, Ideomotor Action
Jan 23, 25	Reasoning, Logic, Rationality	***Exercise 1 due on Jan 23*** Bégin Exercise 2 Ch 4	Mulholland/ *Sherlock Holmes/ Doyle & Houdini/ Wason 4 Card Problem/* Circle Diagrams, *The Psychic Reading*	Deduction-induction/ Observation/ Belief Bias/ Content Effects/ Illicit Conversions/ Confirmation Bias/
Jan 30, Feb 1	Analyzing Arguments	Ch 5	*Hasted et al/ Alternative Healing*	Retrospective Falsification/ *Illusory Correlation* Credibility/ Fallacies/Diagraming
Feb 6 ***Feb 8***	Review ***MIDTERM EXAMINATION***	***Exercise 2 due on Feb 6*** ***Bring <u>sharpened</u> #2 pencils!***		

Dates	Topics	Assignment	Pointers	Themes
Feb 13,15	Hypothesis Testing/ Probability/ Statistics/ **Scientists & Psychics**	Begin Exercise 3 Chs 6, 7	*Zöllner & Slade/* **Gambling/ Linda/** *Thinking as an intuitive scientist*	*Data & Resource Limits/ Expertise/ Misdirection/ Symbiosis/ Causal Models/ Incrementalism/ Independent & Dependent Variables/ Correlation and Cause/ Placebo/ Illusory Correlation/ Reliability/ Validity/ Self-fulfilling Prophecies/* Double-Blind/ Conjunction Error/ Gambler's Fallacy/ Base-rate Neglect/ Regression toward the Mean/ Psychic Fallacy
Feb 20,22	Decision Making, **Pathological Science**	Ch 8	*Piltdown Man/* Mental Paper Folding/	Contributions (O,E)/ Constraints/ Paleontological Model/ Schema/ Availability/ Representativeness/ Entrapment/ Psychological Reactance/ Liking/ Cognitive Dissonance/ Hindsight
Feb 27,29	**Problem Solving**	*Exercise 3 due on Feb 27* Begin Exercise 4 Ch 9	Birthday Problem/ Parallelogram/ Monk/ Radius Problem/ Tower of Hanoi/ Two-string Problem/ Nine-dot Problem/ The Three Cups/ Shape Constancy/ Two-coin problem, Beagles, and other problems from the Syllabus	*Representation/* Heuristics/ Effortless-Effortful Retrieval/ Insight/ Incubation/ Well-defined & Ill-defined problems/ Diagraming & Representation/ Functional Fixedness/ Mental Set

Dates	Topics	Assignment	Pointers	Themes
Mar 5, 7	Creativity/ Clever Hans	Ch 10	*Clever Hans/ Lady/ Wife and Mother-In-Law*	Brainstorming/ Idea Checklists/ Redefining/Strategies
Mar 12, 14	Creative & Critical Thinking/ Leverrier	***Exercise 4 due on Mar12*** Ch 11	Leverrier	Redefining the Problem/ Beyond the Framework/ *Information Pollution/* Alternatives
Mar 20	*FINAL EXAMINATION*	***8:00 TO 10:00 A.M.***	***Please be on time!***	***BRING NO. 2 PENCILS!***

INSTRUCTIONS FOR DOING THE EXERCISES

Evaluate the cases for your report by answering each of the following questions. Repeat the questions in your report so that we know which answers go with each question. Keep in mind that no general set of questions applies exactly to every situation. Some modifications may be necessary depending upon the context. Also, remember that your goals may differ from those of the narrator. ***Use these eight questions as the framework for doing the four exercises. Remember to number and repeat each question in your reports.*** Also remember to rephrase *the claim in the conditional format*.

1. What is the issue or question?

"The issue is a question which specifies the controversy and makes clear why the argument even takes place."[2] For our purposes, no actual controversy is necessary. An issue exists whenever we want to critically evaluate a claim, happening, performance, system or anything else. The issue should always be stated as question whose answer we are interested in. Many issues can be raised about claims or happenings we encounter. Try to identify one that seems to matter or is most dominant. In this course we will treat each claim as a *theoretical hypothesis*. We will assume that each claim implies a *theory* of some sort. Most such theories will be vague and not clearly formulated. A theory, for our purposes, is an idealization about a system of some sort. The theory itself is neither true nor false. A *theoretical hypothesis*, for our purposes, is an assertion or claim that some natural system in the real world is an example or realization of the theory.

2. What is the claim [what is the proponent arguing for]?

The first step in thinking about an issue is to identify the claim or problem. Sometimes the claim is explicit. Other times the claim is implicit and you will have to supply it in your analysis. Often both explicit and implied claims are involved. You will also have to decide whether you are dealing with a specific claim about one concrete instance or a general claim involving an entire system. The claim is essentially an answer to the question raised by the issue. We ask you to phrase the claim in an *IF...THEN or conditional format*. The portion that follows the *IF* is called the antecedent and corresponds to the theoretical hypothesis that is in question. The portion that follows the *THEN* is called the consequent. In this course, we will treat the consequent as the outcome of a specific test of the theoretical hypothesis. See below for more extensive discussion of the conditional format. We will also discuss and illustrate the conditional format in the early lectures.

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[2] Moore, K.D. (1986). *Inductive arguments: a field guide*. Dubuque, IA: Kenall Hunt.

3. What reasons are offered to support the claim?

Is evidence cited to support the claim? What sort of support is offered? Hearsay, testimonials, anecdotes, experimental results, analogies, etc. In the conditional format, the evidence usually is what follows after *THEN* . The evidence is contained in the consequent.

4. How strong is the support?

Here you try to evaluate the support. Is it relevant? Is it trustworthy? The strength of the argument supporting the claim depends upon 1) the relevance of the consequent or evidence to the theoretical hypothesis and 2) the quality of the evidence. Some sorts of evidence such as testimony are untrustworthy whereas evidence collected under double-blind, controlled conditions is of high quality.

5. What would be adequate support?

What kinds of arguments and evidence would adequately support the claim? How could you find or get such support? Hopefully you will learn why good evidence must meet criteria such as operational definition, controlled conditions, double-blind, etc.

6. What reasons might create (false) beliefs in the claim by the proponent and followers?

For a psychologist, this is the most important question. It focuses on how people can believe what isn't so. As you read the text and listen to the lectures, try to generate a master checklist of the various biases, fallacies, and other factors that can trick us into believing false claims[3].

7. What did you notice or learn while doing this exercise that can be useful in dealing with the sort of problems that you face in your daily life?

This question is included to enhance the possibilities of transferring what you learn in this course to issues and problems you encounter outside the classroom. The idea is that if you consciously attend to ways of using this framework and the results of your exercises in other domains what you learn in this course will be much more useful to you.

8. What thoughts or actions on your part, while doing this exercise, were most helpful? What was not so helpful?

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[3] Here is another means for getting extra credit or adding points to your grade on an exercise. Submit your checklist along with your final exercise. If we deem it a good one, we will add a few points to your total.

This question deals with *metacognition.* It is designed to get you to monitor your thought processes as you perform the exercises. If you make such self-monitoring of your thought processes habitual then you are more likely to find out what works and what does not work for you when you apply your thinking to new problems.

[9. Application of an additional tool

As already mentioned, you can earn bonus points by applying one of the other tools mentioned in syllabus or the text.]

Comments on the Framework

No framework for thinking can be completely general without being vacuous. The preceding framework is oriented towards evaluating claims or arguments. We would want to modify the questions if we were applying it to finding the solutions to problems. Still other modifications would be desirable if we were using it to create new products or to generate novel ideas.

Many books and frameworks are available that promise to make you a better thinker. Most of them probably can be helpful if you systematically apply their suggestions. They help because they force you to tackle problems systematically. Studies show that good thinkers, as contrasted with poor thinkers, spend relatively more time trying to understand the problem and its requirements. Poor thinkers waste little time on trying to understand problem and jump right into possible solutions. Once a problem solver has formulated a possible solution it blinds him or her to other alternatives. The framework is designed, among other things, to make you `look before you leap.'

Much thinking, no matter how systematic and logical, is wasted effort if the problem is wrongly understood or if the relevant `facts' are erroneous or incomplete. This is the problem of `garbage in/garbage out.' So the framework is designed to help you focus on the adequacy of the relevant evidence as well as to ensure that you are coping with the right problem.

At the end of this syllabus, I supply a few examples of other possible frameworks.

A SAMPLE CASE

We present a case for analysis by the framework. The case is followed by a possible analysis using the framework. *Before you look at our analysis, try doing your analysis using the framework.* Thinking is a matter of doing. The more practice you have in applying the framework, the better you will do. We strongly urge you to do your own analysis before looking at ours. When you compare your analysis with ours, remember that many different analyses can be done. No one analysis is necessarily the best. You might find it worthwhile to discuss your analysis with Professor Hyman or Ellen Peters.

The Sample Exercise

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 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 many big dreams.

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

Crider stated 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."

Please try doing your own analysis before reading the sample analysis that follows.

1. What is the issue or question?

Can this character reader, or any fortune teller, accurately assess a client's personality just from mysterious vibrations or thought emanations? In other words, is there something beyond normal science taking place? [Note that the issue can be stated in many ways. You can focus on the abilities of this character reader. Or you can focus on the abilities of fortune tellers in general.]

2. What is the claim [what is the proponent arguing for]?

Crider is arguing that Margarita can accurately assess character. He suggests that she can do so by means unrecognized by psychology or science. We want to phrase this question in the *conditional format*. To do this we need to identify the following components: 1) *The Theory; 2) The Theoretical Hypothesis; 3) The Initial Conditions; 4) Any Auxiliary Conditions; 5) The Prediction* about the outcome of a test of the hypothesis. Here the theory is something like the following: there are individuals, called psychics, who can pick up information by means unknown to science. The *theoretical hypothesis* is that Margarita is just such a person. If the hypothesis is true then we should be able to successfully predict certain outcomes. One outcome is that Margarita can successfully describe the personality of people using nothing more than impressions she gets just by looking at the person. We need to add and refine this information before we can put it into a useful conditional form. We need to state *Initial Conditions*--these are whatever we have to arrange to conduct the test. Here they could be something like the following: Margarita writes down statements with no other information than seeing the client sitting in front of her. Presumably, according to Crider, the client does not provide any feedback during the reading. We may also need to specify *Auxiliary Conditions*. Here such conditions could be that Margarita is doing her thing under conditions that do not interfere with her powers. Finally, we also have to make sure that the possible outcomes of the test are specified in advance and are *operationally defined*. Crider has failed to specify clearly the possible outcomes and which ones would be considered as evidence for and which as evidence against the hypothesis. We can infer that his Prediction involves the acceptability of Margarita's statements by the client. The outcome cited by Crider is that the students agreed with 96% of the statements that Margarita made about them. We do not know, but presumably Crider was assuming that if the students agreed with something like more than 50% of the statements he would have concluded that outcome of the test of the hypothesis about Margarita was positive. If, on the other hand, if the students rejected more than 50% of the statements, he might have concluded that the outcome was negative. Already, we can see a serious weakness in Crider's claim. He did not clearly specify in advance just what would be a successful outcome for testing the hypothesis. From what we have said so far, however, the conditional form of the test can be phrased as follows:

> *If Margarita is a psychic (Hypothesis) AND if we have her make statements about students just by seeing them (Initial Condition) AND if the conditions do not interfere with her powers (Auxiliary Condions THEN the students will accept at least 50% of her statements as true of themselves (Prediction).*

Because the students accepted 96% of her statements as true, Crider concluded that the hypothesis of Margarita being a psychic was confirmed or supported.

2. What reasons are offered to support the claim?

Crider offers three reasons to support his claim. 1) 96% of Margarita's statements were judged accurate by the students; 2) the combined opinion of the students; 3) his own agreement with the assessments. Each of these, in turn, could be used as the prediction or outcome of the prediction in the conditional format. The second two reasons, as you should learn in this course if you do not already realize, are not useful as evidence. This is because the opinions are subjective, made after the fact, and are easily influenced by factors other than the actual accuracy of the statements. On the surface, the first reason is quantitative and seemingly objective.

3. How strong is the support?

Several points could be made. Margarita sees each student as she makes her analysis. She can gain clues from dress, jewelry, posture, etc. For example, if the student had a major health problem, this could be obvious just from observation. Although Crider instructed the students not to react to the statements, we do not know if the students gave unintentional bodily or other cues. Consider, as well, that this study was conducted in the early 1940s when females traditionally did not go to college. The few who did came from upper class families and would obviously be healthy, well-off, etc. However, even if Margarita did not pick up clues from the students, the evidence cannot be considered as supporting the hypothesis.

We could also question the use of the student's own self-evaluation as a suitable criterion. But the most serious limitation is the lack of a control baseline. What percentage of female college students in 1944 would accept these statements as true of themselves under the same circumstances? In the sample analysis we find statements such as: *Digestive organs normal. Heart normal. Kidneys normal.* How many young, female college students from upper-class families are going to have abnormal digestive, heart, and kidney problems?

[Later in the course we will learn many reasons why the use of the students' self-assessment is fallacious.]

When you read about conditional reasoning in Halpern, you will learn that the use of a successful outcome of the prediction (consequent) to justify the hypothesis (antecedent) is a logical fallacy. This is because the conditional statement does not rule out the possibility of a successful outcome due to reasons other than the truth of the hypothesis. This is known as the fallacy of affirming the consequent. Yet, hypothesis testing in science relies on just this form of argument. The scientist derives a prediction form the theoretical hypothesis and then looks to see if the prediction is true. If so, this is taken as support or confirmation of the hypothesis. How can science succeed so well when its major form of testing hypotheses rests on a logical fallacy?

The answer is that the scientist makes sure to formulate the conditional statement in such a way as to rule out other plausible alternatives that would make the prediction true. Strong support comes only from tests in which other plausible reasons for a successful predic tion have been ruled out (or made highly unlikely). As we will see, Crider's implied conditional statement does not rule out other likely reasons for the successful outcome.

4. What would be adequate support?

The answer to this question is implicit in the answer to question 3. One possibility is to use objective personality assessments as a criterion against which to correlate Margarita's statements. [This is trickier than it seems as we will discuss in class]. Ideally, we would want a control baseline against which to evaluate her apparent rate of success. For example, later studies had some students evaluate those statements actually made about them. Other students evaluated statements made for someone else that they believed were made for them. Under these circumstances both groups accept the same proportion of statements as accurate self-descriptions.

In terms of the conditional format, adequate support would be in the form of a test where 1) the predicted outcome is operationally specified in advance and 2) the predicted outcome is very unlikely to occur in the hypothesis is true. In other words, if Margarita is not a true psychic we would want a test that would fail. Crider's test is inconclusive on its face just because it does not provide us data on what proportion of these statements would be accepted by a student even if no psychic powers were operative.

6. What reasons might create (false) beliefs in the claim by the proponent and followers?

Both the textbook and the lectures will supply you with many reasons why an experiment such as

Crider's seems to give positive results. Subjective or Personal Validation turns out to be untrustworthy. Language is ambiguous. Everyone possesses all traits. We differ from one another in terms of the degree to which we exhibit such traits. Am I introvert or extrovert? This depends both on the circumstances and whom I am being compared with. Other principles that apply here, and that you will learn about in the course, are illusory correlation, the power of the situation, and conversational maxims.

OTHER FRAMEWORKS

In this course we require you to write you exercises using the framework (the eight questions) previously described in this syllabus. Besides this framework, we also ask you to use the conditional form for stating the claim being evaluated. Many other frameworks have been suggested. Most of them probably aid your thinking because they force you to systematically consider various aspects of the problem and several alternatives. Also, as I have already said, no single framework is ideal for every situation. You may find it helpful, even when using the course framework, to supplement your considerations with other frameworks. Here is a very select and brief listing of some other frameworks:

1. Halpern's Framework

Halpern, the author of your textbook, provides a framework on pages 34-37 that she uses throughout the book. In this course, her framework is best viewed as a *Meta-framework*. Her questions force you to consider your goal(s) in dealing with the problem and the best ways of reaching that goal. She also forces you to decide if you have reached your goal. These are important questions and they are worth considering before you apply one of the other frameworks. Let's apply her framework to our sample case:

1. What is the Goal?

Halpern says that, "Goals can include deciding among a set of possible alternative solutions, generating a solution where there is none, synthesizing information, evaluating the validity of evidence, determining the probable cause of some event, considering the credibility of an information source, and quantifying uncertainty." She also points out that the "way you identify the goal should help you plan the time and effort required by the situation." In the present case, you may have no interest in whether Margarita is or is not psychic. At a higher level, your goal is to do well in this course. One way to increase your chances of doing well is to learn how to apply the framework to the exercises. Working your way through this sample exercise might get you started on this path.

At another level, you could put yourself in the place of someone who sincerely wants to evaluate Crider's claim. Your goal would be to decide whether the arguments and evidence

that he has provided are enough to support the claim that Margarita has psychic powers.

2. What Is Known?

This is always an important element of good thinking. Typically not much is really "known." In such cases it is a waste of time to work on the problem. This question is handled in the course framework by questions 2 and 3. We know that Crider instructed the students not to react to the statements while Margarita was making them. But we do not know if the students fully complied with this instruction. Did they say anything at all during the reading? Did they make facial expressions, change their posture, etc.? We do not know. Nor does it appear that Crider used any checks or safeguards to make sure. We do not know exactly what outcomes would have made Crider decide that Margarita had failed the test. He did not specify in advance his criteria for deciding if the test succeeded or failed. This is a serious failing as we will discover during the course.

3. Which Thinking Skill or Skills Will Get You to Your Goal?

Knowing what will help you deal with a given problem depends upon experience and adequately categorizing the problem. A knowledge of statistics, experimental design, the fallacy of personal validation, control groups, and double-blind procedures all could help you in evaluating Crider's claim. However, you do not have to be an expert in the area to recognize weak arguments. Hopefully, this course will teach you how.

4. Have You Reached Your Goal?

Although this seems like an obvious question, I am amazed at how frequently people get into trouble because they fail to check their answers to see if they make sense. As Halpern emphasizes, it is wise to continually ask yourself if you have been pursuing the correct goals. Also, this question emphasizes the important point that you should set up clear criteria to tell you when you have arrived at your destination. When do you stop? For example, you may decide that the evidence that Crider offers does not support his claim. Is this enough? Or do you want to pursue the question further and gather other data which may help you decide if Margarita or any other person can obtain information through psychic channels.

2. Thinking As an Intuitive Scientist

On page 246, Halpern provides an excellent checklist of questions for "evaluating the research claims of others or when you are asserting your own claims." This framework brings up new questions to ask about our sample case such as the nature of the sample, how it was selected, and if it is large enough. It gets you to focus on the relevant variables and if they were properly operationalized. Questions of reliability, validity, control, correlation,

falsifiability and bias are brought into the picture.

3. Identify Relevant Variables and How they might be Related

This can be construed as a special case of the previous framework. A variable is simply a set of mutually exclusive categories for classifying things. The categories can be ordered or unordered. The ordered categories can form a continuum or consist of discrete levels. Variables can be considered as Independent, Dependent, or Concomitant. Variables can also be controlled, randomized, or uncontrolled. All scientific and normal inquiry can be viewed as an attempt to decide if two or more variables are related. We will expand upon variables later in the course. Meanwhile, consider some possible variables in Crider's report. An obvious variable is the status of Margarita {Psychic, Non-Psychic}. Another variable is the percentage of statements she makes that are accepted by a student. This is a continuous variable that can range fro 0 to 100%. Crider is implicitly assuming a relationship between these two variables. The relationship should show itself, if the theoretical hypothesis is true, by producing a high score on the second variable for a Psychic and a low-score on that variable for a Non-Psychic. Stating the matter in this way, we observe that, assuming Margarita is a psychic, we observe a score of 96%. But we do not know what score a non-Psychic would get in the same circumstances. If a non-Psychic got a score of,. say, 50%, this would suggest a relationship in favor of Margarita. However, if a non-Psychic got a score of 96% this would indicate no-relationship between psychic powers and number of statements accepted as true. As you will learn, every experiment that has included this complete variable has found no relationship between psychic claims and acceptability of personality statements.

4. Perkins' Framework

The educational psychologist D.N. Perkins[1] proposed a series of four design questions that he claimed could help a person grasp the key elements of any problem.

1. What is its purpose (or purposes)?

Crider's purpose is to convince his readers that Margarita has some special powers that are worth further consideration. Presumably, the purpose of his study was first to see for himself if she had special powers. Apparently he was convinced. The purpose of his report is to argue to the psychological community that his evidence supports his conviction.

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[1] Perkins, D.N. (1986). *Knowledge as design.* Hillsdale, NJ: Lawrence Erlbaum.

2. What is its structure?

"In general, the term structure is used loosely and broadly to mean whatever components, materials, properties, relations, and so on, characterize the object in question." As with the other questions in the framework there is no one correct way to answer this. We could focus on the structure of Crider's experiment: the arrangement of client and "psychic"; the task of listing statements in writing without overt reactions from the client; the use of a classroom setting; the use of female college students in 1944; etc. We could focus on the structure and components of the sample analysis that Crider provides. We might note that none of the statements can be unambiguously verified as true or false. We might also note that none of the statements refer to concrete, observable behaviors, etc. We could focus on the structure of his argument: since 96% of the statements were accepted as true by the clients this, along with Crider's own intuitive assessments, somehow imply special powers.

3. What are some model cases?

"In general, a model exemplifies in some concrete way the design or how it works." One possibility here is to imagine how a psychic with perfect abilities might operate in this situation.
She could make statements a) that could be objectively verified and b) that would be unlikely to apply to people in general. For example, instead of "Does not like to take chances", she could write something like, "Did not enjoy the poker game her boyfriend talked her into playing last Friday." Instead of "Gets along well with boys.", she could write something like "Agreed to go steady with Axel last June."

4. What are arguments that explain and evaluate it?

This question is partially captured by questions 2 and 4 in the course framework.

5. The *IDEAL* Framework

I will briefly introduce a few other frameworks. Many, many others exist and all can be useful. The *IDEAL* framework is the basis of a book by Bransford and Stein[2] . *IDEAL* is an acronym standing for: *I*dentify, *D*efine, *A*nticipate and *A*ct, *L*ook and *L*earn. In their book, Bransford and Stein show how to apply this framework to problem solving, creativity, the evaluation of arguments, communication, memory, and learning.

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[2] Bransford, J.D., & Stein, B.S. (1993). *The ideal problem solver* (second edition). Salt Lake City, UT: Freeman.

1. Identify Problems and Opportunities

"Most books on problem solving begin with the assumption that you have already experienced problems rather than stress the importance of actively trying to locate them." The *IDEAL* framework makes us aware that the finding and formulating of problems are just as important, if not more so, than finding solutions once the problem has been stated. Even when you are given a problem you will find it helpful to try to reformulate or redefine the problem. Indeed, some psychologists believe that the secret to creative problem solving is to find a better way to redefine a given problem.

In considering our sample case, how would you identify the problem? Can you find other ways to state the problem? A problem is generally believed to exist when we are dissatisfied with a current state of affairs and do not have an automatic or obvious way of changing that state into a more satisfactory one. In this context, what is the problem in the sample case? You might see nothing wrong with Crider's report and feel perfectly content with his study and its conclusions. If so, the case does not present you with a problem. However, you may be a well-trained, experimental psychologist who is familiar with the research on personality testing. You know how difficult it is to validate any personality test. You may also know of the previous attempts by some psychologists to find any evidence to support the claims of fortune-telling. In this latter case, Crider's report creates a problem because his conclusions differ from what your training and knowledge have taught you. The problem for you is to decide if your prior beliefs about fortune-telling are wrong or if something is wrong with Crider's conclusion.

2. Define Goals

"This is different from identifying the problem. For example, a group of people could identify the *existence* of a general problem and agree that it represents an opportunity but still disagree about their *goals* should be. Different goals often reflect differences in how people understand a problem."

Most readers might agree that the general problem in the sample case is whether conventional scientific psychology is wrong or whether there is a flaw in Crider's findings. Some may want to repeat the study with Margarita using better controls to prevent her picking up clues from the students. They might place a barrier between Margarita and the students or present Margarita with a photograph of the student with all obvious clues such as dress and jewelry removed. For these people, the goal is to see if Margarita can still succeed without the possibility of feedback from the student. Others may want to focus on the specificity of her statements. They might test Margarita by having her give readings to a set of students. Some students would get the actual reading Margarita generated for them. Others would, without knowing it, get a reading that Margarita generated for another student. The goal here would be to see what percentage of the statements would be accepted by clients in each condition. [

Psychologists, in fact, have run several experiments of this kind. They typically find that the clients accept the same proportion of statements as self-descriptive regardless if they are given the reading actually intended for them or a control reading.]

Still others might focus on the goal of understanding why Margarita and other psychics succeed in convincing clients that they can tune into their personalities. They might compare her success in convincing clients under various conditions.

3. Explore Possible Strategies

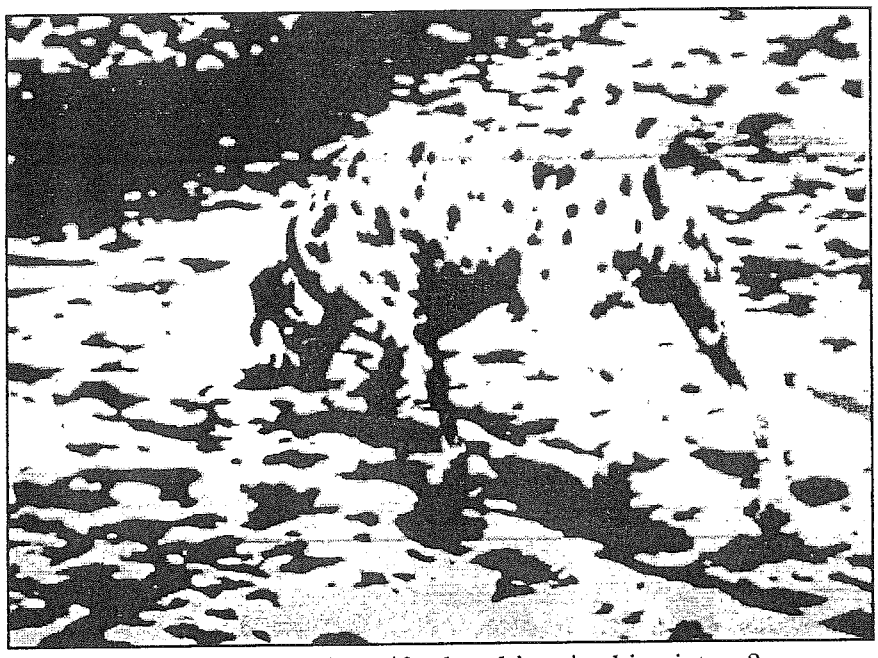
"This often involves a reanalysis of your goals plus a consideration of options or strategies that might be employed to achieve those goals." The course framework, the several chapters in Halpern, and some of the lecture material can be seen as providing several possible strategies for dealing with problems. Bransford and Stein point to two categories of strategies. General strategies consist of techniques that can be applied to almost any problem. Specific strategies apply only to limited domains and depend upon specialized knowledge. The frameworks we have discussed are general strategies. The advice to try to use diagrams whenever possible would also be a general strategy. Generalized strategies, when systematically applied, will often help with situations such as our sample case. However, if you know statistics and psychometrics, you can evaluate the sample case with potent, specialized tools that bring up such ideas as reliability, validity, double-blind, sampling, etc.

4. Anticipate Outcomes and Act

Crider could have saved himself some embarrassment if he had anticipated how his colleagues would react to his report. If he thought about it from the perspective of potential critics, he might have realized that his critics would focus on the lack of a control comparison to see how clients, other than the intended ones, would respond to a reading if they believed it was meant for them. He also should have realized that potential critics would point to the obvious clues that were available to Margarita as the student sat before her. These anticipations could have lead him to design the study to preclude such weaknesses.

5. Look and Learn

This is a step that is often neglected in other frameworks. I share Bransford and Stein's sentiment when they state, "We have been surprised many times by the degree to which students fail to look and learn from their attempts at problem solving." One dismaying example is how seldom students in this and my other courses fail to learn from the mistakes in the midterm. Indeed, the only time many students ever bother to find out why they failed to get a good grade is after the final examination. By then, clearly it is too late to do anything about their grade in that course.



Can you identify the object in this picture?

7. Generic Questions

King has provided a list of generic questions. According to Halpern[3] "These question stems can be used in almost any context. Research has shown that comprehension and memory are improved when students learn to ask and answer thoughtful questions based on these stems. More important, students use these generic questions in novel contexts, showing that transfer of critical thinking skills occurs when students understand that transfer is the goal of activities that improve thinking."

What is a new example of....?
How could...be used to...?
What would happen if...?
What are the implications of...?
What are the strengths and weaknesses of...?
What is...analogous to?
What do we already know about...?
How does...affect...?
How does...tie in with what we learned before?
Explain why...
Explain how...
What is the meaning of...?

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[3] Halpern, D.F. (1996, Third Edition). *Thought & Knowledge*. Page 104.

Why is...important?
What is the difference between...and...?
How are... and...similar?
How does...apply to everyday life?
What is the counterargument for...?
What is the best...and why?
What are some possible solutions to the problem of...?
Compare...and... with regard to...
What do you think causes...?Why?
Do you agree or disagree with this statement:...?
What evidence is there to support your answer?
How do you think...would see the issue of...?

You might try some of these stems on the Crider example to see if it leads to new insights. For example you could consider the question "What are some possible solutions the problem of allowing Margarita to see the student and at the same time precluding her from gaining non-psychic clues from this observation?" Or, how about, "What do you think causes the students to accept almost all of Margarita's statements? Why?"

8. Graphic Organizers

Your textbook discusses and illustrates the use of *graphic organizers*. These are also called *concept maps* or *mind maps*. A variety of systems to make such graphic patterns exist. There is no unique or correct way to diagram a problem, text, or claim. Typically, you identify key concepts or points and place them on a blank sheet of paper. You then use lines and arrows to connect concepts that relate to one another. Don't worry if your resulting diagram is correct, complete, or neat. The very effort to construct the graphic representation often brings out ideas and thoughts that you may have overlooked. At its best, the graphic organizer can clarify the underlying structure of the problem and can open new ways to think about the issues.

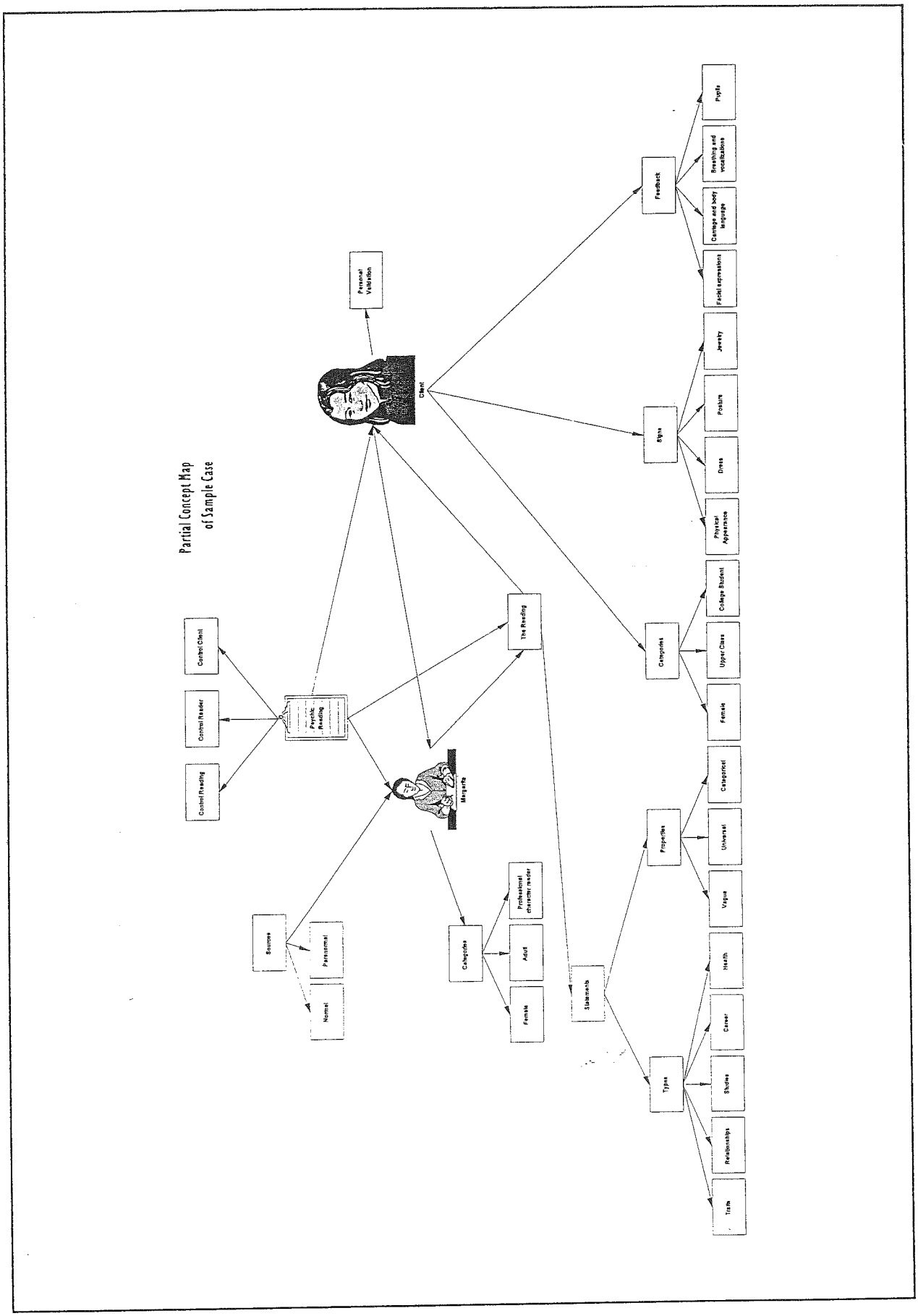
The next page illustrates one attempt to construct a conceptual map or graphic organizer of the sample case. Although the map is far from complete, you can see that it is already rather cluttered. You probably need a magnifying glass to read the items in the individual boxes. However, it provides you with one idea about how to apply this technique. The graph is organized around one central concept *The Psychic Reading*. The arrows from this central concept point to the such objects: *Margarita (the psychic reader); The Client (or student who receives the reading); The Reading itself (the set of statements uttered by Margarita for this client)*, and three control items: *A Control Reading, A Control Reader, A Control Client*. Because of space considerations I did not elaborate upon these latter three items, but I will say something about their significance later.

Consider first the subtopic *The Reading*. The Reading consists of the set of statements

Margarita makes about each client. The arrow going from Margarita to the Reading indicates that Margarita is the source or immediate creator of the Reading. The arrow going from the Reading to the Client shows that the Client is the recipient of the Reading. The arrow from the Client to Margarita indicates that the Client provides input to Margarita that may form the basis for her reading. Another arrow shows that the Reading consists of Statements. The Statements, in turn, are classified according to Types (or content) and Properties. We can classify the Types of statements into Traits, Relationships (with boys, etc.), Studies (concern about tests, etc.), Career, and Health. Some Properties of these statements are that they are Vague, Universal, and Categorical. By *Universal* I mean that the statements apply to any client just because they are human. For example, the statement *Must always have feeling of security or else is uneasy* applies to any human. Almost by definition someone feels uneasy if they do not feel secure. By *Categorical* I mean that certain statements will be true of the client just because she belongs to certain categories. Being a college student, for example, automatically insures that she will be concerned about grades. All the statements are vague in one way or another.

Presumably the Reading is about the Client. To the extent the statements correctly apply to the client, they presumably are based upon information that Margarita gets from the Client. One source of information, which I have labeled as *Normal* comes from the Client through *Categories, Signs,* and *Feedback*. Among other things, Margarita knows that her Client in Crider's study is a young female, belongs to the upper class, and is college student. She might also detect other categories to which her client belongs (e.g., she may be wearing a Phi Beta Kappa pin). By having the Client in her possession Margarita obtains *signs* such as physical appearance (size, body type, weight), posture and carriage, dress, hair style, jewelry, and the like that can provide useful information about the client's personality, confidence, taste, wealth, etc.

Although the clients had been told not to react to the statements the possibility of unwitting feedback from facial expression, pupil dilation, body language, breathing, and the like still existed.


Partial Concept Map
of Sample Case
Personal Validation
Client
Feedback
Pupils
Breathing and vocalizations
Carriage and body language
Facial expressions
Signs
Jewelry
Posture
Dress
Physical Appearance
Categories
College Student
Upper Class
Female
Properties
Categorical
Universal
Vague
Statements
Types
Health
Career
Studies
Relationships
Traits
The Reading
Psychic Reading
Control Client
Control Reader
Control Reading
Margarita
Sources
Paranormal
Normal
Categories
Professional character reader
Adult
Female

To the extent that Margarita's Reading was affected by such *Normal* inputs, there would be no reason for psychologists to take further interest. Crider's report implies, however, that Margarita goes beyond normal sources of information. She claims, and he implies, that her sources of information are occult or *Paranormal*. That is, she supposedly has access to information that goes beyond what contemporary psychology and science recognizes as possible.

One can focus on trying to decide if, indeed, she has access to occult information. To do this, you would want to block her access to the normal sources. However, before going to such trouble, you would first want to make sure that her readings do contain information that accurately discriminates the Client from other people. That could be the function of the boxes labeled *Control Reading, Control Client, Control Reader*. The box *Personal Validation* is a reminder that the case for Margarita's accuracy relies on the number of statements that the Client accepts as true of herself. We might consider other ways of assess the accuracy of Margarita's readings.

Using Graphic Organizers

The best way to use graphic organizers in this course is *before* you apply the framework to the exercises. If you construct a conceptual map of the exercise, this will help you insure that you are not overlooking some important points. The activity of making the map will also stimulate new ideas and associations and help you grasp the underlying issues, structures, and questions.

Read Chapter 3 of your text to get ideas about different types of graphic organizers and how to construct them. One way to begin is to start with one central organizing theme and make this the first box or symbol of your graph. Then make lines or arrows leading from this central theme to organizing sub-themes. Buzan and Buzan[4] suggest the following categories for making these organizing sub-themes: *Basic Questions (how, when, where, why, what, who, which), Divisions (chapters,lessons ,themes), Properties (characteristics of things), History (chronological sequence of events), Structure (forms of things), Function (what things do), Process (how things work), Evaluation (how good/worthwhile/beneficial things are), Classification (how things are related to each other), Definitions (what things mean), Personalities (what roles/characters people have)*. They also suggest that you keep the number of lines or arrows coming from any concept to seven or fewer.

9. Additional Tools and Frameworks in Halpern

a) If,Then Statements (pp. 154-162)
b) Diagramming arguments (pp. 183-198)
c) Operational Definitions (pp. 226-227)
d) Thinking as an Intutivive Sciencist (Checklist on p. 246)
e) Representing Problems (356-390)
f) Idea Checklists (pp. 423-424)
g) Attribute Listing (pp. 424-425)
h) Crovitz's Relational Algorithm (pp. 425-426)
I) PMI (p 426)

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[4] Buzan, T., & Buzan, B. (1994). *The Mind Map Book*. New York, NY: Dutton.

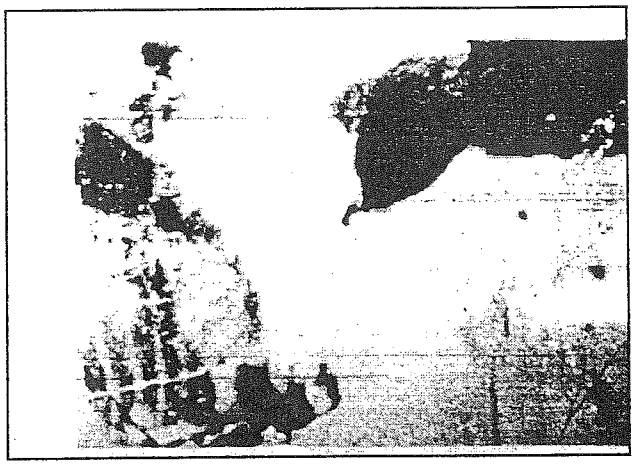
Some Problems To Ponder

Your textbook contains many problems and puzzles worth thinking about. A sampling of these would be:

1. The candle problem (Page 14)
2. The story about the young boy who is rushed to the hospital for surgery (Page 15)
3. Cutting the cake into 8 equal pieces (Page 18)
4. Outbreak of disease (Page 98)
5. The Wason Four Card Problem (Pages 160-162)
6. The Linda problem (Page 274)
7. The birthday problem (Page 278)
8. The Wason Induction Task (P 312)
9. Multiplying 8x7x6...x1 vs 1x2x3x...x8 (Page 317)
10. Parallelogram (Page 354)
11. The bear problem (P 358)
12. The monk problem (Pages 358-360)
13. The radius problem (Page 361)
14. The tumor problem (Page 365)
15. The Two Strings (Page 283)
16 The nine dot problem (Page 391)
17 The bus driver (Page 392)
18 The ping pong problem (P 394)
19. The set of problems on pages 399-402.
20. Problem 12 (Page 402)
21. Problem 14 (Page 402)
22. Problem 15 (Page 402)
23. The pebble problem (Page 408)

Here are a few other problems worth pondering:

1. Try to identify the object (which can be a living or non-living thing) in the picture on the page 21.



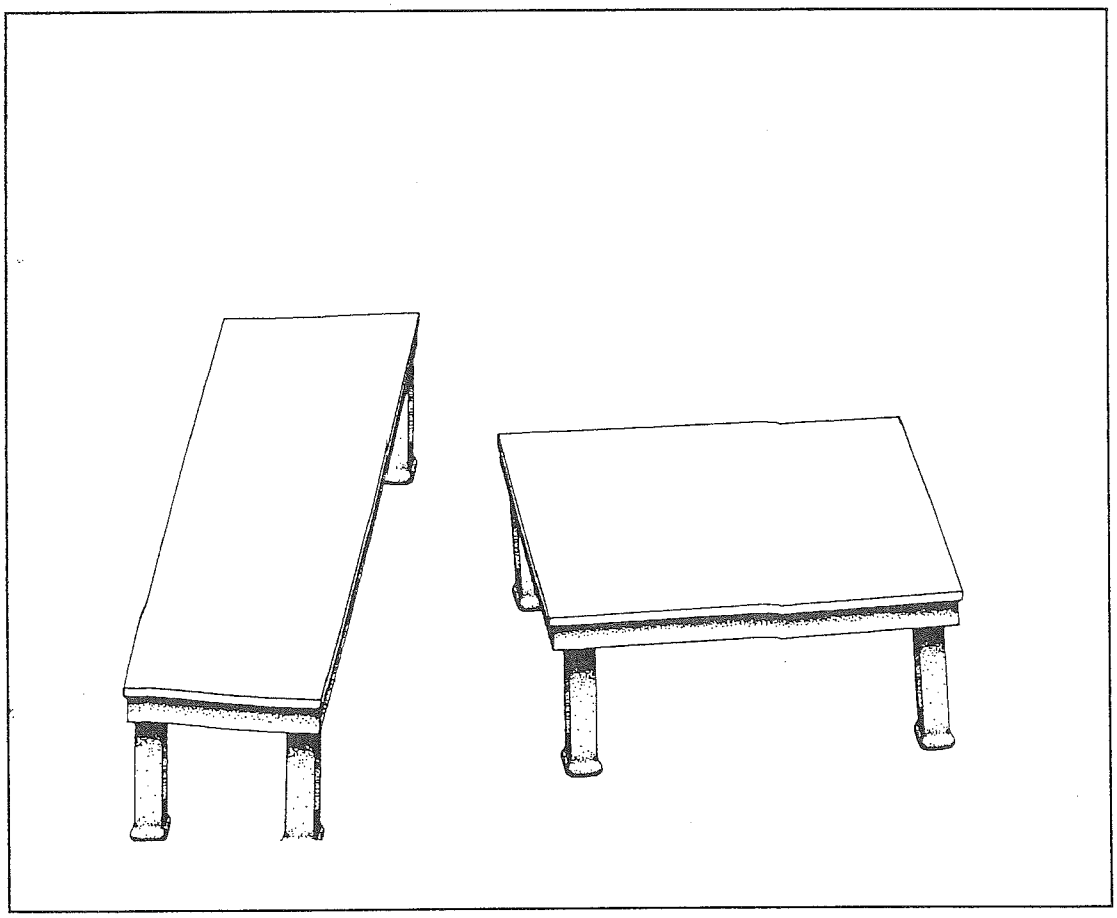
2. Can you identify the object in the box on the right? What do problems 1 and 2 teach us about perception and thinking?

3. Mrs. Jones works on the assembly line at a local factory while her husband stays home and does the housekeeping. Each day Mr.

Jones packs the same lunch for his wife. This lunch consists of six sandwiches. He packs two cheese sandwiches in one sandwich bag (each bag holds two sandwiches). He packs two peanut butter sandwiches in another sandwich bag. In a third bag, he packs one cheese and one peanut butter sandwich. He then puts the three sandwich bags into a larger bag that Mrs. Jones takes to work. One day, well before lunch time, Mrs. Jones stomach begins growling with hunger. While using one hand to continue with her demanding assembly routine, she reaches under her seat with the other hand, opens her large lunch bag, reaches into the bag and opens one of the three sandwich bags. She then removes a sandwich from this opened bag and begins eating the sandwich while still focussing on her assembly duties. The sandwich turns out to be a cheese sandwich. What is the probability that the remaining sandwich in the sandwich bag from which she obtained the cheese sandwich is also a cheese sandwich?

4. A soldier is lying in a hospital bed. A nurse enters the room and asks, "Are you better today?" The soldier replies, "I think not." He then vanishes. Who was the soldier?

5. The following figure was created by the Stanford psychologist Roger Shepard [See his book *Mind Sights* for more examples of his ingenious perceptual/artistic creations]:



Look carefully at the two table tops. Each is created by a rectangle drawn upon the flat surface of the paper. Do these rectangles look like they coincide? That is, if you cut out the rectangle that represents the top of the left table, would it exactly cover the rectangle that represents the top of the right table? Check your impressions by tracing the rectangle of one table top and superimpose it on the rectangle of the other table top. How do you account for the result?

6. 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 mail carrier. The detective immediately arrested the mail carrier for murder. How come?

[Does this problem remind you of one you encountered in the text? Which one?]

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

8. Julius Caesar was assassinated on March 15, 44 BC. As he was dying, he saw his friend, Brutus, among the assassins. With his last breath, he uttered, "Et tu Brutte!" With his last breath he also exhaled molecules into the atmosphere. How probable is it that the next time you inhale, you will inhale at least one of the molecules exhaled by Julius Caesar over 2,000 years ago?

9. I purchased a watch along with the watch band. Together, the watch and the band cost a total of $110. The watch cost $100 *more* than the band. How much did the band cost?

10. I wear only brown or blue socks. I keep them all mixed up in my dresser drawer. One morning I get up when it is still dark and reach into the drawer to get a pair of socks. What is the least number of socks that I must remove from the drawer to insure that I have at least one pair of the same color?

11. The psychologist Max Wertheimer related this story in his book *Productive Thinking* [1945]:

> Two boys were playing badminton in the garden. I could hear as well as see them from my window, although they did not see me. One boy was twelve, the other ten years old. They played several sets. The younger boy was by far poorer; he was being beaten in all the games.
> I heard some of their conversation. The loser--let us call him *B*-- became more and more unhappy. He had no chance. *A* often served him so cleverly that he could not possibly return the bird. The situation grew worse. Finally *B* threw down his racket, sat on a tree trunk, and said, "I won't play anymore." *A* tried to persuade him to continue. No answer from *B*. *A* sat down beside him. Both looked unhappy.
> I interrupt the story here to put a question to the reader: "What do you suggest? What

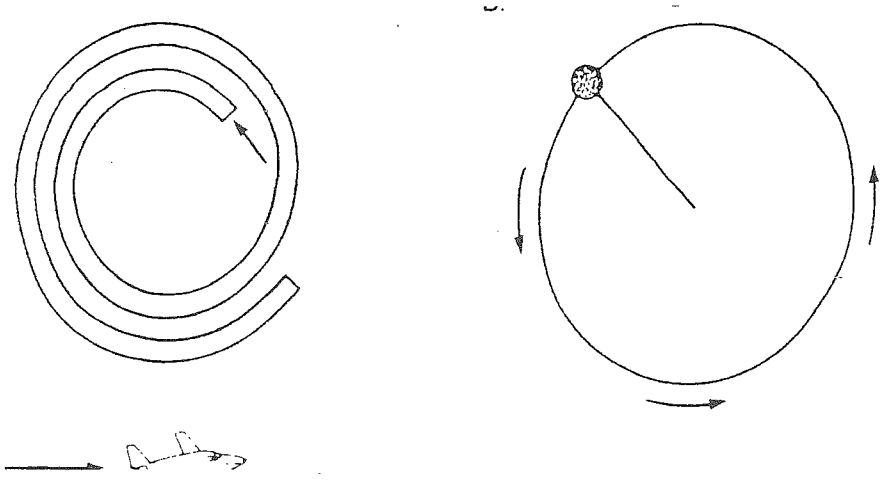
would you do if you were the older boy? Do you have a productive proposal.?"

12. 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?
>
> What if the shopkeeper asked the fellow who's giving them a bath, "Is the older beagle a male?" and he replied "Yes." Does this change your answer? Explain.

13. 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?

14. 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.



15. "I am your long-lost sister," says Amy to the man, who indeed has one (but only one) missing sibling. "She's lying--*I'm* your long lost-sister," Barbara insists at the family reunion. "At least two of us always lie," smirks a third woman, Carol. Assuming one of these women really is his long-lost sister, which one is it?