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Heuristics across contexts: An examination of pediatricians' reasoning

Heller, Rachael F., Ph.D.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

HEURISTICS ACROSS CONTEXTS:
An Examination of Pediatricians' Reasoning

by

RACHAEL F. HELLER

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Date

Herbert D. Salzstein
Chair of Examining Committee

Nov. 14, 1988
Date

Herbert D. Salzstein
Executive Officer

Delmos Jones, Ph.D.
Suzanne Ouellette Kobasa, Ph.D.
Kay Deaux, Ph.D.
Florence Denmark, Ph.D.
Supervisory Committee

The City University of New York

Abstract

HEURISTICS ACROSS CONTEXTS:
AN EXAMINATION OF PEDIATRICIANS' REASONING

by

Rachael F. Heller

Adviser: Professor Herbert D. Saltzstein

The purpose of this research was to study the use of heuristics, i.e., strategies or shortcuts in decision making, by physicians in work and non-work contexts.

A questionnaire, comprised of paired hypothetical vignettes, was presented to physician-subjects. Each vignette was designed to test for the use of a particular heuristic in either medical or non-medical decision making contexts.

Responses to vignette-based questions within medical and non-medical contexts were analyzed and served as a basis of comparison. For each heuristic, the data were analyzed to determine the frequency of heuristic use and differences between contexts.

Physician-subjects were grouped according to level of hospital experience, i.e., first, second and third year residence. Responses were analyzed for differences related to experience level as well as in relation to context.

Heuristic use was found in all areas studied: redundancy, disregard of base-rate, discounting and augmentation, as well as evidence of confusion of prospective and retrospective probabilities. Analysis of the influence of context and/or experience on heuristic use revealed that the use of augmentation, confusion of prospective and retrospective probability, and use of redundant data were not influenced by either context or experience. Contextual differences were observed in the use of discounting and disregard of base-rate data. Interaction effects of context and experience were observed in the use of discounting and the disregard of base-rate information. In addition, some subjects perceived contextually presented data as if it provided more information than listed data. Differences in perception were related to an interaction of context and experience.

Published critiques of Tversky and

Kahneman's work have asserted that heuristic use cannot be generalized across contexts. This research provides support for the hypothesis that the use of some heuristics differs across contexts. A model of prototype matching is presented to explain observed differences.

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Introduction

Heuristic principles help the decision maker reduce the complexity of assessing probabilities and predicting outcomes. Heuristics may be understood as strategies which guide the decision making process. Heuristics may prove to be helpful and, at times, lead to accurate assessments. They may also lead to error. Tversky and Kahneman (1974) drew an analogy between the use of heuristics and the subjective assessment of physical qualities such as distance or size. Like heuristics, assessment of distance or size may be based on data of limited validity. An example may be seen in the judging of the distance of an object, in part, by its clarity. The more sharply the object appears, the closer to us we judge it to be. This rule for judging distance has some validity. Most objects appear clearer to us, the closer they are. Likewise, most distant objects appear less sharp in comparison. If one relies on this rule, however, errors in distance judgment are invevitable and predictable. When visibility is poor, and the contours of objects appear blurred, distances will be overestimated. When visibility is unusually good and objects appear quite sharp, distances will be underestimated. Common biases can be expected if

the individual relies on the rule of visual clarity as an indication of distance. While this rule intuitively appears to be correct, it may lead to errors of judgment.

In the same way, rules of judgment related to non-physical assessments, i.e., to probability or frequency assessments, may likewise intuitively appear to be correct. Yet, according to Tversky and Kahneman, these rules may lead to erroroneous as well as to correct judgments.

"In making predictions and judgments under uncertainty, people do not appear to follow the calculus of chance or statistical theory of prediction. Instead, they rely on a limited number of rules in order to make judgments when making decisions. When these rules reduce the complex task of assessing probabilities and predicting values into simpler judgmental operations', we term them 'heuristics'. (Tversky and Kahneman, 1974) "Heuristics sometimes yield reasonable judgments and sometimes lead to severe and systematic errors." (Kahneman, Slovic and Tversky, 1982, p. 48.)

The above assertion, and others, typical

quotes of Tversky and Kahneman, have set off a controversy within the cognitive psychology community. This controversy remains open for debate and examination. While the work of Tversky and Kahneman seemed striking at first, other cognitive psychologists have since taken issue with it, specifically, its generalizability.

"Consider first the picture that is emerging from the laboratory simulations currently being used in decision making research, in particular the work of Tversky and Kahneman. Humans are portrayed as intellectual cripples, limited in their capacity to think, and biased by cognitive processes that interfere with rational decision making." (Ebbesen and Konecni, 1980).

Critics of the Tversky and Kahneman approach, such as L. Johnathon Cohen (1981), take issue with several points. Cohen (1981) took issue with Tversky and Kahneman's work on three specific points. The first line of argument holds that what is rational should be determined by the average person and that findings that statisticians or experiments choose to impose on laypersons are irrelevant. I will not address this issue in this research.

Cohen's second line of argument maintains that it is unreasonable to expect ordinary individuals to be aware of laws of probability and other statistical regularities. Cohen's argument challenges the relevance of laws of statistics like Bayes' theorem altogether, saying that "chance distributions [may] have no causal efficacy in individual events." (p. 329). Cohen makes a strong argument in his suggestion that the factors affecting the promulgators of a statistical law are not identical to those influencing a solitary individual making a decision about his or her own life. He adds that acting in one's own adjudged self-interest is not necessarily the same as making a judgment about which outcome is more likely to happen in some hypothetical event. Yet Tversky and Kahneman appear to treat personal judgments as indicative of larger understandings of probability, and the workings of the world at large. Again, this research will have only some relevance to this issue.

The third point and main criticism of Tversky and Kahneman's work lies in the realm of the validity and generalizability of their findings. Questions of contextual generalizability have been

addressed by some critics in the field (Ebbesen and Konecni, 1980). "One would not be surprised to find that features of tasks such as context, might affect the decisions of the subjects" (page 25). Ebbesen and Konecni go on to state that "one might think of people as continually shifting their strategies to meet the demands placed on them by contrived decision tasks." These tasks may be seen to be influenced by the context of the task. Similar issues have been raised in relation to the work of Piaget (e.g., Donaldson, 1978).

This research addresses the effect of context on decision making*. It takes as a starting point the assumption that physicians, like others, formulate heuristics in order to assist them in the simplification of decision-making tasks.

*Context is defined as the "match" between the way in which the vignettes were presented and the way in which subjects were used to gathering, "decomposing" and transmitting informative cues. When the match was close, as in medical vignettes, the "context" was considered to be "realistic". When the match was not close, as in non-medical vignettes, the "context" was considered to be "hypothetical". Responses to vignettes were related to this definition of context.

Assumptions

We start with following assumptions:

1. Medical diagnosis involves cognitive processes such as those involved in non-medical forms of problem solving.

2. Medical diagnosis is a process comprised of (a series of) choices, as is non-medical decision making. While protocols may guide some of the decision making, a great latitude of choice is afforded the physician (Weinstein and Fineberg, et al, (1982).

3. The process of diagnosis is a complex set of decision-making tasks in which a symptom, or pattern of symptoms, may point to several causes (diseases). In general, the physician does not find the tasks involved to be solved by referring to a "dictionary" consisting of a list of matching pairs with one member consisting of symptoms and the other consisting of diseases. Usually, the same symptom may indicate different disease conditions, and the same disease may exhibit varying symptoms in different patients, and at

different times.

4. In the interest of cognitive economy and in order to permit rapid decision making, physicians may use heuristics. Heuristics allow an abbreviating of the steps involved in the decision making process.

5. The diagnostic process may, at times, rely on subjective estimations of base-rate probability which can be seen to be open to errors. Probability estimates can be influenced by the physicians' use of heuristics (e.g., subjective base-rate probabilities influenced by representativeness or availability considerations). In this way, heuristics could influence the diagnostic process by direct and indirect means.

6. Confusion may exist in the physician's understanding of the use, meaning and accuracy of the conditional probability. In particular, confusion between prospective and retrospective probability could take place in diagnostic decision making. I am defining this probability confusion as a heuristic based on Hogarth's (1985) definition of a heuristic, i.e.,: (1) heuristics stem from [cognitive]

limitations of decision-makers to process great amounts of information, and (2) heuristics are strategies which saves the decision-maker's time and effort.

The focus of this investigation is the cognitive processes used by physicians in decision making, in particular the use of heuristics and probability statistics. It takes as its starting point (a) the heuristics studied by Tversky and Kahneman (e. g., 1974) and (b) the heuristics noted in causal attribution theory (e. g., Ross, 1977). We go beyond Tversky and Kahneman, however, to compare the use of heuristics across medical and non-medical contexts. In addition, physicians' confusion of probability statistics as noted by Eddy's study (1982) on predictive and retrospective accuracy is explored.

Background

The study of decision making has evolved through several stages. Each of these stages branched into different areas of investigation which have differed, paralleled and, at times,

complemented one another.

Early work was dominated by a formal model approach which employed statistical decision making theory (Slovic and Lichtenstein, 1971). This approach is still evident in the Bayesian Theorem. For a time, Bayes' Theorem became the model of judgment against which other methods of probability assessment were measured. Decision Analysis was a natural outgrowth Bayes' Theorem. It combined Bayes' statistical formula with predetermined decision-making rules. These rules were laid out in the form of flowcharts. Decision Analysis is advocated currently in clinical settings to assist in decision making under uncertainty. Weinstein and Fineberg (1980) provide clinical decision making flowcharts which incorporate those points at which a physician is required to make a diagnostic or treatment choice or at which feedback from the situation reaches the physician. Advocates of Decision Analysis (Schwartz, Gorry, Kassirer, et al., 1973) claim that all decisions can be described in terms of answers to two questions: (1) What are the consequences of alternative actions (i.e., what is "at stake"), and, (2) What are the uncertainties (in

the environment) relevant to the decision. These questions relate to both the evaluative and predictive dimensions of judgment, i.e., how much the decision maker "likes" the consequences of different alternatives and what is expected to happen. Decision Analysis now provides a tool which physicians, as well as others, may use to make crucial choices when expensive and potentially dangerous diagnostic and therapeutic interventions must be weighed against the high cost of possible medical errors (Weinstein and Fineberg, et al., 1980, p. 9).

The formal model, Bayes' Theorem, and Decision Analysis provide prescriptive approaches to decision making. They instruct and channel the decision maker's choices. These statistical approaches have proven, however, to be cumbersome, time consuming, and too abstract for the average decision maker. Generally, people have not been comfortable or willing to using them. After repeated failures in attempts to motivate decision makers to use these statistical aids, researchers addressed the issue of describing, rather than prescribing, the decision-making process. Several

questions had not been addressed by the prescriptive aids, and researchers in the field (Wallstein, 1980) proposed alternative approaches in order to investigate, what was perceived of, as the formal model's lack of concern for the intervening processes underlying the decision making task. The resulting development of the Information Processing Theory contained a unified general approach which was descriptive rather than prescriptive. It addressed the issues related to what actually did take place in the process of decision making, rather than what ought to occur.

Continuing in the descriptive tradition, and arising out of Information Processing Theory, more recent work has examined decision makers' underlying cognitive processes. In particular, researchers have addressed the simplifying rules or heuristic principles that allow for decision making under limitiations of time and certainty. Observing physicians' diagnostic practices, Elstein, Shulman, and Sparfka (1978) found that the most frequently observed error was in the treating of a finding which was, in fact, noncontributory, as if it had relevance for a particular diagnosis.

Supportive findings regarding the physician's overuse or misuse of diagnostic procedures have been reported by Abrams (1979) and Kaplan et al., (1985).

Some studies have focused on the way in which probability theory is misunderstood and misapplied in medical diagnosis. A study by Eddy (1982) focused on the use of mammography in the diagnosis of breast cancer. Researchers found that mam- mography was used as a routine diagnostic tool even though it provided redundant information while exposing patients to attendant risks. The decision to use this test may not have been based on carelessness or indifference, but on a faulty understanding of probability statistics. Eddy interpreted the overuse of mammography as possibly due to a confusion in the diagnostician's mind between prospective probability of a disease given a symptom, P(D/S+) with the retrospective probability of the occurrence of a symptom given the presence of a disease, P(S+/D). Eddy postulated that "many physicians sense the value of information on the prior probability of a disease but that the formal lessons of probability theory are not well understood." Further, he concluded

that "without a formal theory, physicians tend to make the same kinds of errors in probabilistic reasoning that have been made in other contexts." (p. 259).

In non-medical settings, Causal Attribution Theory paralled, and later contributed to, the emergence of the study of heuristics. Observations by Heider (1958) led to the original formulation regarding the importance of the observer's attribution of causality. Using these observations, Kelley (1967) went on to produce a formal model describing the process of assignment of causality where causation might be multiple.

Kelley's study of causal attribution led to the identification of two heuristics or principles, the Discounting Principle and the Augmentation Principle.

1. The Discounting Principle:

This strategy is used in making causal inferences and involves the discounting or disre-

garding of one cause of an event to the extent that other potential causes are available. Discounting is a function of the Multiple Sufficient Causal Schema, in which one of several causes is deemed sufficient to explain the event (Kelley, 1972).

Fiske and Taylor (1984) offer an example of the Discounting Principle in the following example: "If I wreck my car at 2:00 a.m., you may be less inclined to conclude that I was tired and not paying careful enough attention if you learn that it was raining. If you then find out that my brakes malfunctioned, you may be less likely to blame the rain" (1984, p. 33).

Within the medical community, use of the Discounting Principle can be combined with use "Occam's Razor", an extension of a doctrine taught by the medieval scholastic, William of Occam. Occam instructed his young students that "entities should not be multiplied beyond necessity". This theoretical statement evolved into the instruction that students should not suppose more forces or causes than are necessary to account for the phenomena observed. Because Occam's principle pares down causes or explanations to bare essentials, it is often referrred to as Occam's

Razor. (Hardin and Bajema, 1978, p. 328). Occam's Razor is an accepted educational guide for diagnosis that is taught to the young physician. When applied to diagnosis, it encourages a physician to seek the most parsimonious cause to explain symptoms presented by a patient, rather than seeking a more complicated explanation.

While the above strategies may allow for accurate causal attribution at times, in cases where more than one cause is needed to explain the presenting problem(s), the Discounting Principle may disallow correct causal assignment.

An example may be seen in the case of a teenage girl presenting symptoms of vomiting, fever, pain in the abdomen and loss of weight. Guided by the Discounting Principle the physician seeks one cause to explain these symptoms. A series of involved, costly and time-consuming tests are ordered to confirm a diagnosis of cancer of the gastro-intestinal tract. While fever would not typically be expected to be part of the symptom profile, the physician might conclude that the cancer may have caused peritonitis, an inflammation of the peritoneum (the lining of the

abdominal cavity). This has been seen in advanced cancers, which would be concomitant with the girl's wasted state. In this case, however, the correct diagnosis is two separate diseases: appendicitis and Anorexia nervosa. The physician using the Discounting Principle in diagnosing this patient would probably order an x-ray series of the upper and lower gastro-intestinal tracts and a sonogram of the abdomen in order to locate any mass(es). These tests could delay surgery that is critical to the safe removal of an inflammed appendix. If a physician was made aware that symptoms might be related to two different disorders in the same patient, the physician would be likely to quickly order tests to confirm appendicitis and make a decision about surgery based on the patient's weakened condition caused by, what appeared to be, Anorexia. Without awareness of that possibility and in treating this patient, the use of the Discounting Principle could be fatal.

The probability of correct diagnosis when using the Discounting Principle may vary depending on the patient population. When dealing with very young children, who have a very low incidence of

chronic disease, the use of Discounting may be an appropriate tool in diagnosis. According to the Chief of Pediatrics at a major metropolitan hospital, the odds against two acute illnesses in very young children are very high. When dealing with older children, adolescents and adults, where chronic disease is more probable and the probability of two disease states becomes more likely, Discounting is more likely to lead to error. In Geriatric medicine, the use of Discounting may lead to the greatest incidence of error. The probability for the occurrence of chronic disease is greatest in the elderly, and the probability of chronic disease found in combination with acute illness is greatest.

It should be noted, also, that without such a heuristic, there may be no formal way to terminate the causal search. The probability of using the Discounting Principle to lead to a correct diagnosis may be highest when Discounting is used at the end of the diagnostic investigation, rather than at the beginning of the process.

2. The Augmentation Principle:

This strategey is used in making causal

inferences and involves differentially weighing causes depending on whether they are judged to inhibit or facilitate the likelihood of that occurrence.

Kelley (1972) noted that when asked to explain an event which occurs in the presence of an inhibitory cause, people require an exceptionally strong cause to explain the event because they reason that it had to be strong enough to overcome the inhibitory cause.

For example, if you find out that I visited my aunt you may conclude that I have a moderate desire to see her. If, however, you learn that I took off from work at the risk of my job and traveled 800 miles to see her, you might conclude my desire to visit was greater than it appeared at first. The validity of this conclusion is in question for what were judged as inhibitory factors, i.e., the long drive and risk of job loss. These factors, however, may have no relevance to me or may not have been experienced as inhibiting. Therefore, they may not have been involved in my decision to see her. My desire to visit may have been the same in both cases. Therefore, while this strategy may

at times lead to correct causal assignment, in some cases it may lead to incorrect judgments of causal attribution. This heuristic also leads to the attribution of exceptionally strong internal causes to account for counternormative behaviors.

In medical diagnosis, the Augmentation Principle may be seen in the requiring of an exceptionally strong symptom profile when confronted with an inhibitory statistical probability. The physician, confronted with a 14-year-old female exhibiting a weight equal to twenty percent below the normal curve for her age and height, might suspect Anorexia nervosa. Examination and request for diagnostic tests would serve as confirmation of this diagnosis. Imagine the same physician confronted with a 14-year-old male who exhibits the same deviation in weight as the female patient. In this case, the physician might order a more exhaustive diagnostic workup, seeking to reveal a disorder other than Anorexia nervosa (e.g., leukemia). Upon questioning, this physician might explain that Anorexia nervosa is rare in males and that he/she would need to observe a more extreme weight loss in a male in to

order to suspect this disorder. In using the Augmentation Principle, this physician seeks to compensate for a low statistical probability or base-rate (inhibitory factor) with a more extreme presentation of symptoms. The symptom profile should be the same in both cases. The incidence of the disorder in males versus females in unrelated to the degree of weight deviation, i.e., if a weight of twenty percent below the norm is indicative of Anorexia nervosa in females, it is also indicative of Anorexia nervosa in males. It does not need to be higher because the incidence of Anorexia nervosa is lower in males.

In 1982, Tversky and Kahneman clarified and further documented the use of heuristics. Their comprehensive examination of the work to date in the field, in addition to their own experimental investigations, are drawn upon in this study of the use of the following heuristics:

3. The Representativeness Heuristic:

This heuristic may be described as the probability judgment that an object belongs to a

class, or that an event originates from a process, based on the extent to which it represents the essential features of the parent class or process.

The individual using this heuristic may disregard important information, such as sample size, and prior probability of outcomes in favor of attention to intuitive similarities based on appearances and expectations.

Kahneman and Tversky (1982a) presented a classic illustration of the Representativeness Heuristic in which subjects were shown personality descriptions of several individuals and asked to offer a probability estimate that each description was of either a lawyer or engineer. In two conditions, subjects had been informed that the population from which the descriptions were drawn consisted of a ratio of engineers/lawyers of either 70/30 base-rate or 30/70 base-rate. Reversing the ratio of engineers/lawyers essentially had no effect on the subjects' probability estimates. Subjects appeared to disregard this statistical information completely, basing their evaluations of the likelihood of

professional assignment solely on sterotypical personality expectations, despite the unreliability of such personality assessments.

Like the subjects observed by Tversky and Kahneman, the physician is also required to make probability estimates. The probability estimate that the physician makes is in the form of a diagnosis. Instead of being given a personality profile, the physician is presented with a symptom profile. If the physician is presented with a patient's symptom profile which is highly representative of a rare disease, the physician might disregard the low probability of occurrence favoring, instead, highly salient representativeness.

An example of use of the Representativeness Heuristic may be seen in the following hypothetical case. A physician is presented with a patient complaining of fever, weakness, and shivering. The patient reports that the fevers come on suddenly and without warning. The symptoms are severe for several days to a week and then disappear completely. This cycle repeats at six-month to

one-year intervals. The physician strongly suspects Malaria because the symptom profile presented by the patient matches the "classic" Malaria symptom profile in every way. Although the patient denies foreign travel, which would make the contraction of Malaria more probable, the physician still concludes that Malaria is the cause. He orders confirming blood tests and is quite puzzled when laboratory testing for the Malarial organism is reported to be negative. The physician questions the reliability of the laboratory but not his own reliance on Representativeness and his failure to take into account the base-rate probability of this disease. Had the physician not relied on Representativeness alone, he might have formulated a second diagnosis, perhaps recurrent influenza attacks, a much more common phenomenon and one which be in agreement with the laboratory findings.

Reliance on Representativeness can lead to errors resulting from overconfidence in redundant information as the "match" appears more perfect although no new information is given. Oskamp (1965) found psychologists, presented with

increasing amounts of redundant information, reported greater confidence in their judgments. As would be expected, given that the information was redundant, there was no corresponding increase in predictive accuracy. Yet the psychologists, relying on what they perceived of as greater Representativeness, i.e., a closer "match", were more confident in their judgments.

The physician, relying on the Representativeness Heuristic, might be found to perceive redundant data as increasingly informative. The physician listening to a patient who describes the symptoms which can be expected to accompany a very high fever in an almost 100% coincidence, i.e., alternating sweating and chills, glassy eyes, weakness, headache and disorientation, might feel more confident in his/her diagnosis than in the diagnosis of the patient who simply reports a thermometer reading of a very high fever. Reliance on the Representativeness Heuristic may influence the physician's judgments and subsequent decision making when dealing with highly verbal and confident patients.

Judgements based on Representativeness, itself, may not lead to errors. Rather, it may be the disregarding of base-rate information or over-confidence in redundant information, which are the result of reliance on Representativeness. which may in turn lead to error.

The heuristics examined in this study included: (a) The Discounting Principle; (b) The Augmentation Principle; and (c) The Representativeness Heuristic; as illustrated by the use of redundant data as informative and the disregarding of base-rate information. Physicians were also tested for (d) confusion between prospective and retrospective probability in medical and non-medical situation (Eddy, 1982; Weinstein, 1980).

The general research stategy was to offer physician-subjects questionnaires, comprised of hypothetical vignette pairs. Each vignette pair was designed to test for the presence of, and differences in, the use of a particular heuristic. One vignette within each heuristic pair tested for the use of the heuristic within a non-medical context. Non-medical vignettes included decision-making tasks found in "everyday" life. They

included those decision-making choices which have been, or could be, asked of non-physicians. Whenever appropriate, non-medical vignettes were constructed from decision-making tasks already found in the literature of the field, i.e., Tversky and Kahneman, and Oskamp. The second vignette within the heuristic vignette "pair", duplicated (as much as possible) the structure of the non-medical vignette of the same heuristic but it provided the subject with information appropriate to medical decision making. The data from the responses were analyzed to determine the type of heuristic used and its frequency. Comparison of the frequency of general heuristic used in medical and non-medical situations were made. The impact of context (i.e., medical versus non-medical differences) on the use of individual heuristics was examined. For purposes of comparison, physicians were divided into levels of hospital experience, i.e., first, second and third year residence. All heuristic comparisons and analyses were performed to detect the effects of context and experience differences.

With this as the general framework, the objectives of the research have been:

1. To detect the kinds of problem-solving heuristics evident in physicians' decision making in medical and non-medical situations;

2. To test whether physicians' use of heuristics varies with context as evidenced in non-medical versus medical situations.

3. To test the relationship between the frequency, types, and contextual variations in the use of heuristics as related to physicians' hospital experience.

Method

Subjects

Subjects were first, second and third year pediatric residents at two metropolitan hospitals. Twenty-six of the 29 residents at Hospital A completed questionnaires. Three of the residents were away from the hospital and were not available. Two of the 26 subjects presented incomplete responses so as to be unusable (i.e., fewer than two heuristics had completed answers for analysis). Twenty-two of the 27 residents at

Hospital B completed questionnaires. Three of the residents were away from the hospital and two, though at the hospital, were unavailable. All questionnaires completed by subjects at Hospital B were completed and usable.

Instrument

The instrument was comprised of paired hypothetical vignettes (Appendix A). Each pair of vignettes tested for the use of the same heuristic in both medical and non-medical situations. In all, nine pairs of vignettes tested for evidence of heuristic use.* Single pairs of vignettes compared use of discounting and augmentation respectively.

Two pairs of vignettes compared prospective and retrospective probabilities as well as disregard of data in 70% and 30% base-rate

* It should be noted that it is noted that questionnaire may have limitations in the testing of heuristic use. Concerns related to patient's rights, the controlling of variables found in natural situations and concerns related to reliability of physicians' responses in relation to staged diagnostic situtations appear to have made it the best choice, however. Content used in questionnaires was taken from real and common situations and, as much as possible, duplicated the usual mode that physicians use to communicate to other physicians and to themselves at a later date.

situations. Three paired vignettes compared use of redundant data in simple, listed and contextual formats. (These formats will be explained in more detail in the text which follows.) Additional questions designed to identify tacit information were included. Vignette pairs were designed to test for the use of: 1) The Discounting Principle, 2) The Augmentation Principle, and 3) Representativeness. Subjects' use of Representativeness was to be measured (a) by subjects' use of probability statistics, and (b) by subjects' use of redundant data as useful information. In addition, physicians were to be tested for evidence of 4) Confusion between prospective and retrospective probability. Simple responses in the form of circled probability or probability estimates were requested (Appendix A).

Non-medical vignettes were taken directly from the literature in the field, (Oskamp, 1965; Chapman and Chapman, 1969; Tversky and Kahneman, 1974, 1982; Eddy, 1982) whenever possible. Medical vignettes were taken from the following three methods by which physicians acquire and transmit information about patients.

The three methods which formed the basis for the medical vignettes were:

a) formal presentation during rounds,
b) communications about patients, during, and after patient intakes, and
c) informal discussions about cases, which took place between physicians during lunch, in lounges, around nursing stations, etc.

Vignettes duplicated the detail and order of data found in each of these three modes, as far as possible. Communications about patients, during and after patient intakes, (b, above), were based on interviews with physicians at Hospital A during a pilot study in 1986-1987 as well as on discussions observed among physicians and between physicians and other staff members at Hospital B. Formal presentations during rounds, (a, above), and informal discussions about cases, (c), were based on presentations and discussions at Hospital B. The two modes, "communications about patients", (b), and "discussions about cases, (c), should not be confused. They differed in that "communications about patients", (b), took place during, or immediately following, the diagnostic task. These

communications related to a specific patient only.

"Communications about patients" centered around gaining or giving information regarding a particular patient. They often took place at the nurses' station or outside the patient's room, in the hall. They usually followed immediately the examination of a patient. In contrast, "discussions about cases", (c), took place some time after the diagnostic situation, or were hypothetical situations. They usually took place in an informal setting, away from patient areas, such as in Residents' Lounges or in the cafeteria. "Discussions about cases" appeared to be used to assist the physician in comparing his/her choices with others, i.e., reinforcing or clarifying physicians' skills in general, using specific cases as examples.

Medical and non-medical vignettes were ordered randomly throughout the testing instrument. To assure randomized positioning of the eighteen questions within the testing instrument, the following method was designed: One container held eighteen identical three by five inch index cards each bearing a single nonrepeated position number, from "1" through "18". A second

container held eighteen identical three by five inch index cards each bearing the name of one of the eighteen test questions. One index card from each container was randomly selected simultaneously thereby matching a position number to a test question. The only constraint in randomness was that no two heuristics appeared adjacent to one another. Card selection was repeated six times, until all eighteen cards in each container were matched. The selection process was then begun anew as described above. After the sixth draw, all eighteen questions were randomly positioned in such a way as to have no two versions of a test question adjacent to one another. All subjects received the same random order questionnaire.

Procedure

Tests were administered to all residents attending the weekly staff conference at Hospital B's Department of Pediatric Medicine. The following day, additional questionnaires were administered before the Grand Rounds presentation at Hospital B. To insure that all potential subjects were recruited, individual residents, who had not yet completed the questionnaire, were approached during floor duty. Tests were administered to all

residents attending staff meeting at Hospital A. Individual residents, who had not attended the staff meeting, were approached during, or before, their computer assignments or during floor duty.

A brief statement was made defining the purpose of the study and stressing the maintenance of subjects' anonymity. Subjects had been encouraged by their respective Department Chiefs to participate in the study. Subjects were informed that participation was voluntary. None refuse. The researcher was available to answer questions before, during, and after the administration of the test.

Scoring and Analysis:

The testing instrument resulted in scores of both nominal and non-nominal data. The nominal data indicated the presence or absence of the use of each heuristic in both medical and non-medical situations. Data regarding subject identification numbers, hospital, year of residency, and evidence of use of each heuristic in medical and non-medical contexts for each subject were compiled. Comparisons of use of heuristics were made between levels of experience and context. Possible interactions between both variables were

examined. It should be noted here that the choice of statistical test for analysis of results was not prescribed by the existing literature. Optimally the statistical choice should allow comparison with past experiments. In this case, however, there was a lack of specific information regarding research design needed in order to design comparative research. Tversky and Kahneman's "Judgment under uncertainty: Heur- istics and biases" appears to offer no statistical data at all (1974) and uses terms "most subjects" and "subjects" when describing responses to base- rate while implying that disregard was quite evident. In Tversky and Kahneman's "Belief in the law of small numbers" (1971) 9 out of 84 subjects are reported to have given "correct" responses but no other information is given. Data regarding the variation of error and the numbers of subjects in relation to errors are not offered. In the same article the reader is informed that 66 out of 75 respondents answer in a particular way but little or no information appears on the subjects or the instrument. In place of statistical information the reader is supplied with terms such as "most popular response" and the "majority of our respondents" (p. 105-110). Similar difficulties

present themselves in Tversky and Kahneman's "Evidential impact of base-rates" (1980). Eddy (1980) offers a percent- age of respondents (95 out of 100) who confuse prospective and retrospective probability but he includes very little additional information.

Due to what appears to be a lack of statistical detail in the literature, comparisons with previous work is difficult if not impossible. Therefore, having few prior and consistent statistical parameters, the significance of findings of nominal data was tested using hierarchical log-linear procedure models, i.e., multi-way contingencies based on the multinominal response model. Significance was reported when results were found to have a probability of occurrence by chance of less than .05, two-tailed test. Item analysis was applied to the non-nominal data. Frequency of occurrences, means and categorical frequencies (when appropriate) were compared between the three redundancy formats and the two base-rate questions in each context, respectively. By inspection, non-nominal data was examined for evidence of tacit information used in the decision-making process. The forty-four completed

questionnaires were distributed as follows:

	1st year resident	2nd year resident	3rd year resident	unknown
MT. SINAI	9	7	7	1
BRONX LEBANON	7	7	7	1

The "residency level - unknown" responses were unusable for this study. By examination, subjects' responses were found to be consistent across hospitals.

Protection of Subjects

All questionnaires were filled out without any identification of subject. Responses related to level of experience and hospital of residence were optional, and were indicated by the subject on the cover page. This information was requested for coding purposes only. Clear instructions on the cover sheet requested that no identifying marks be made. Approval of the Committee for The Protection of Human Subjects was obtained.

Results

Redundancy

Use of Redundant Data as Information

Subjects' use of redundant data as information was analyzed by comparing the confidence levels assigned to each of three portrayals of a case study. In one portrayal (simple), seven symptoms, signs or behaviors were listed. A second portrayal (listed), included twelve additional, pretested synonyms for these signs, symptoms and behaviors along with the original seven. They were presented in a listed form. The third portrayal (context), contained the same items as those in the listed vignette, placed in sentence form. While this type of portrayal contained no additional information, it was this investigators belief that it would more closely duplicate the format of a contextually imbedded vignette.

As per Oskamp's work (1965), evidence of the use of redundant data as information was indicated by a lower level of confidence in response to the "simple" version of the vignette versus the "listed" or the "contextual" vignettes [Appendices B and C]. Questions were completed by all subjects.

Responses to medical and non-medical vignettes were as follows:

USE OF REDUNDANT DATA AS INFORMATIVE, BOTH HOSPITALS

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	16	0	14	0	14	0
Non-Med.	16	0	13	1	14	0

Over 98% of the responses showed evidence of use of redundant data as information (87/88). Use of redundant data as information was compared across contexts and experience levels. Neither contextual nor experience effects were seen.

Hypotheses and results are summarized below:

Use of Redundant Data as Information

Hypothesis 1A: Use of redundant data as information differs between contexts.	Not Supported*
Hypothesis 1B: Use of redundant data as information differs between experience levels.	Not Supported*
Hypothesis 1C: Use of redundant data as information differs in relation to an interaction between contexts and experience levels.	Not Supported*

* at the Log-linear z-score= $p<.05$, two-tailed test level

Contextual Data As More Informative than Listed Data

Subjects' use of contextual data as more informative than listed data was analyzed by comparing the confidence levels they assigned. The same nineteen synonyms for signs, symptoms and behaviors were included in both the listed and the contextual portrayals. In the listed form, the items were simply listed, separated by commas or periods. In the contextual form, the items were presented in sentence form.

The purpose of this examination was to clarify the previous finding, i.e., that redundant data, per se, was being used as information as opposed to unidentified tacit knowledge. In order to support this claim, it was necessary to provide the redundant information in two different forms, i.e., within a listed and a contextual format. In this way, the probability that contextually presented data, rather than redundancy, impacted on subjects use of redundant data was examined.

Evidence of the use of contextual data as

more informative than listed data was indicated by a higher level of confidence in response to the contextual version of the vignette versus the listed vignettes [Appendices B and C]. Questions were completed by all subjects.

Responses to medical and non-medical vignettes were as follows:

USE OF CONTEXTUAL DATA AS MORE INFORMATIVE THAN LISTED DATA, BOTH HOSPITALS

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	8	8	1	13	0	14
Non-Med.	1	15	3	11	0	14

Fourteen percent of the responses showed evidence of use of contextual data as more informative than listed (13/88). Use of contextual data versus redundant listed data was compared across contexts and experience levels. There was a significant effect of level and training (experience) on subjects' perception of contextually presented data as more informative than listed data. First year residents viewed contextual

data as more informative than the same contextually presented data significantly more than did third year residents. But this was superseded by an interaction of context and experience effect which revealed that a significantly greater number of first year residents viewed contextual data as more informative than listed data in medical vignettes but not in response to non-medical questions. This did not hold true for second and third year residents. Hypotheses and results are summarized below:

Use of Contextual Data as More Informative than Listed Data

Hypothesis 1D:					
Use of contextual data as more informative than listed data differs between contexts.	Not Supported*				
Hypothesis 1E:					
Use of contextual data as more informative than listed data differs between experience levels.	Supported*	df=2	Z=2.05	p<.05	[a]

* at the Log-linear z-score= p<.05, two-tailed test level

[a] Significant difference between 1st & 2nd and 1st & 3rd experience levels.

Hypothesis 1F:			
Use of contextual data as more informative than listed data differs by context in interaction with experience levels.	Supported*	df=7	Z=3.02 p<.01[b]

Disregard of Base-Rate Information

Subjects' disregard of base-rate was assessed by comparing probability estimates that subjects assigned to each of two portrayals of a case study, in both medical and non-medical contexts. In the medical portrayal, subjects were presented with symptoms and clinical findings related to a young adolescent who might be pregnant. Subjects were asked to assign a probability of the patient being pregnant in two clinics; one in which the rate of preganancy was 30%, another in which it was 70%.

In the non-medical portrayal, subjects were presented with a description of a protagonist's interpersonal behavior at a conference. Subjects were

* at the Log-linear z-score= p<.05, two-tailed test level

[b]Significant differences across context increased inversely with first experience level, i.e., within medical context, greater use of contextual data as more informative than listed data was found in first year only.
Pairwise comparison: Use of contextual data as more informative than listed data differed significantly by context only at first year level, df=1, z=3.18, p<.05.

asked to assign a probability of the protagonist being a salesman at two conferences; one in which the percentage of salesmen present was 30%, another in which it was 70%. Subjects' use of base-rate data was compared.

According to Kahneman and Tversky (1973), disregard of base-rate data would be indicated by the manipulation of base-rates having no effect on subjects' predictions. Subjects were presented with the same event in high and low base-rate situations. Evidence of the disregard of base-rate was indicated by a lower or equal probability estimate of the event in the presence of the higher base-rate, as compared with the probability estimate related to the same occurrence in the presence of the lower base-rate. [Appendices D and E]. Questions were completed by forty of the forty-four subjects.

Responses to medical and non-medical vignettes were as follows:

**DISREGARD OF BASE-RATE,
BOTH HOSPITALS**

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	1	13	5	7	10	4
Non-Med.	0	14	0	12	0	14

Twenty percent of the responses showed evidence of disregard of base-rate information (16/80). Disregard of base-rate information was compared across contexts and experience levels. Disregard of base-rate was seen in a significantly greater number of responses to medical rather than non-medical questions. But it was the interaction of context and experience differences which provided the basis for these differences. Disregard of base-rate information occurred in a far greater number of third year residents' responses to medical vignettes as compared to non-medical questions but this did not hold true for first and second year residents. Hypotheses and results are summarized below:

Disregard of Base-Rate Information

Hypothesis 2A: Disregard of base-rate information differs between contexts.	Supported*	df=1	Z=2.49	p<.05 [a]
Hypothesis 2B: Disregard of base-rate information differs between experience levels.	Supported*	df=2	Z=2.05	p<.05 [b]
Hypothesis 2C: Disregard of base-rate information differs by context in interaction with experience levels.	Supported*	df=7	Z=3.12	p<.01 [c]

*at the Log linear z-score = p<.05, two-tailed test level

[a] Significant difference between medical and non-medical contexts.

[b] Trend toward increase disregard of base-rate information with greater level of experience. Difference found to be significant at first versus third year level of experience, i.e., third year residents showed signficantly greater disregard of base-rate than first year residents.

[c] Differences across context increased directly with level of experience, i.e., within medical contexts, third year subjects showed significantly greater evidence of disregard of base-rate data as compared with first-year residents. This was not found to be true in the non-medical contexts.

Confusion of Prospective and Retrospective Probability

Confusion of prospective and retrospective probability was assessed by comparing probability estimates assigned to each of two questions, in both medical and non-medical contexts. In each of the contexts, one question provided the sign and asked the subject to estimate the probability of the occurrence of an event (prospective probability). In the second question, the event was provided and the subject was asked to estimate the probability of the occurrence of the sign (retrospective probability). The medical vignettes compared probability estimates of Kawaski's Disease related to a symptom profile. The non-medical vignette compared probability estimates of education related to earning potential.

According to Eddy (1982), confusion of the two probability estimates would be indicated when these two events have differing probabilities of occurrence, but are assigned the same probability estimate. Medical advisors, in pretesting, had indicated that the two probabilities differed greatly. Having a vast background of experience with all levels of residents, they indicated that they believed

that beginning residents, as well as more experienced subjects, would be aware of the probability differences, if they understood that the probability assessments themselves were different processes. Subjects' selections of the same probability estimates were, therefore, assumed to be related to subjects' confusion of probabilities and not responses based on perceived similarities of probability or on lack of knowledge. [Appendices F and G]. Questions were completed by all residents.

Responses to medical and non-medical vignettes were as follows:

CONFUSION OF PROSPECTIVE AND RETROSPECTIVE PROBABILITY BOTH HOSPITALS

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	6	10	5	9	6	8
Non-Med.	5	11	5	9	5	9

Thirty-six percent of the responses showed evidence of confusion of prospective and retrospective probability (32/88). Confusion of probability was compared across contexts and experience levels. No evidence of either effect was seen.

Hypotheses and results are summarized below:

Confusion of Prospective and Retrospective Probability

Hypothesis 3A:
Confusion of Prospective and Retrospective Probability differs between contexts. — Not Supported*

Hypothesis 3B:
Confusion of Prospective and Retrospective Probability differs between experience levels. — Not Supported*

Hypothesis 3C:
Confusion of Prospective and Retrospective Probability differs between context and experience levels. — Not Supported*

* at the Log-linear z-score= $p<.05$, two-tailed test level.

Discounting

Subjects were given a description of a case study (in medical and non-medical contexts) containing descriptive items. Item lists of three "syndromes/ problems" were offered and subjects were asked to assign probabilities that the case-study was related to any, all, or any combination of the three. The medical vignette portrayed a hypothetical clinical case-study and offered three hypothetical diseases. The non-medical vignette portrayed a hypothetical automobile problem and offered three hypothetical mechanical causes. Each of the three "syndromes/ problems" were two items long, three items long and five items long, respectively. The two- and three-item lists contained the same items, in combination, as did the five item list. The five item list, or both shorter lists in combination, contained the same items as in the original case-study description.

Discounting was evidenced by subjects' failing to assign a probability of greater than zero that the case-study could be related to any (or all) of the "syndromes/problems" [Appendices H and J]. Questions were completed by all subjects.

Responses to medical and non-medical vignettes were as follows:

DISCOUNTING,
BOTH HOSPITALS

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	16	0	11	3	10	4
Non-Med.	9	7	9	5	7	7

Seventy percent of the responses showed evidence of discounting (62/88). Discounting was compared across contexts and experience levels. Discounting was used significantly more in medical rather than non-medical vignettes. The interaction of context and experience differences showed that discounting occurred in a significantly greater number of first year residents' responses to medical vignettes than to non-medical questions while this did not hold true for second and third year residents.

Hypotheses and results are summarized below:

Discounting

Hypothesis 4A:				
Discounting differs between contexts.	Supported*	df=1	Z=1.98	p<.05 [a]
Hypothesis 4B:				
Discounting differs between experience levels.	Not Supported*			
Hypothesis 4C:				
Discounting differs by context in interaction with experience levels.	Supported*	df=7	Z=2.12	p<.05 [b]

* at the Log-linear z-score= p<.05, two-tailed test level

[a] Significant difference between medical and non-medical contexts.

[b] Contextual differences in the use of discounting were found to be significant at the first year only, df=1, z=3.18, p<.01.

Augmentation

Augmentation was assessed by analyzing subjects' requirements for percentage of weight loss or number of witness' testimony required in decision-making in situations of increasing confidence levels. Subjects were told that the situation that they were assessing was strongly gender-associated. Within contexts, identical situations were postulated.

Previous base-rates related to gender were identified and subjects were asked to offer requirements for decision making.

Augmentation was evidenced by greater weight loss requirements or greater numbers of witness' testimony involving the unexpected gender (as compared with the expected gender). [Appendices K and L]. Questions were completed by all residents.

Responses to medical and non-medical vignettes were as follows:

AUGMENTATION, BOTH HOSPITALS

	1st yr.		2nd yr.		3rd yr.	
	Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Medical	12	4	10	4	11	3
Non-Med.	14	2	9	5	10	4

Seventy-five percent of the responses showed evidence of Augmentation (66/88). Augmentation was compared across contexts and experience levels. No evidence of either effect was seen.

Hypotheses and results are summarized below:

Augmentation

Hypothesis 5A:
Augmentation differs between contexts. — Not Supported*

Hypothesis 5B:
Augmentation differs between experience levels. — Not Supported*

* at the Log-linear z-score= p<.05, two-tailed test level

Hypothesis 5C:
Augmentation differs between context and experience levels. — Not Supported*

SUMMARY OF RESULTS

Heuristic	Context Effects	Experience Effects	Interaction of Context and Experience Effects
1. Redundancy			
Used as Information	ns*	ns*	ns*
Contextual vs. Listed	ns*	p<.05	p<.01
2. Disregard of Base-Rate	p<.05	p<.05	p<.01
3. Pro-/Retrospective Probability	ns*	ns*	ns*
4. Discounting	p<.05	ns*	p<.05
5. Augmentation	ns*	ns*	ns*

*at the Log-linear z-score= p<.05, two-tailed test level.

Tacit Knowledge

After completing the questionnaire and by means of a written instruction in the booklet, subjects were requested to respond to additional questions related to the vignettes that had appeared earlier.

Two tasks were requested. The first task was to circle items which were "important" in determining subjects' answers to questions on redundancy items (medical and non-medical). The second task was to check items which "crossed your mind" when subjects responded to base-rate vignettes (medical and non-medical).

The purpose of the first task was to determine if informational differences existed between the three redundancy vignettes (i.e., simple, listed, contextual) in each context. It was hypothesized that if such differences were found, they might provide tacit knowledge that the subject might be using and that would not, at first glance, be evident in the nominal data. In addition, if such differences existed, an exploration of experience level differences might offer additional understanding of "tacit information".

For both medical and non-medical vignettes, each of the circled items was counted and compared across formats (simple, listed and contextual). In addition, specific item selection was compared. Examination of the data revealed no identifiable differences within or across experience levels.

The purpose of the second task was to compare subjects' assumptions about the patient or person portrayed in the vignette in base-rate questions. It was proposed that same-context base-rates, differing between experience levels, might offer information about which subjects might gain tacit information which might influence the disregarding of base-rate data. Different base-rates might provide (tacit) information which could be diagnostic (e.g., inferences about patient's race and/or socio-economic status that would be relevant).

Requesting that subjects circle items in an adjective list about each of the protagonists in the vignettes allowed between experience-level comparison. Examination of the data revealed that within-subject consistency was quite high, at a rate of almost one-to-one. That is, the items chosen by a subject to describe a patient or person within a

vignette in the 30% base-rate question were almost always the same as those found in response to the 70% question. For both medical and non-medical vignettes, each of the number of circled items was counted and compared across base-rates. In addition, specific item selection was compared along with item groupings (physical features, socio-economic status, race and behavior). Examination of the data [Appendix M] revealed no identifiable differences within or across experience levels.

Evidence from these two tasks supports the hypothesis that no informational differences existed in tacit information provided by either the different redundancy types or by the different base-rate vignettes. Any differences in heuristic use found to occur across contexts and/or experience levels were, therefore, could be attributed to context and/or experience level differences rather than to differences in tacit information that subjects gained from the vignettes.

Discussion

The question of the impact of context on heuristic use has been a central issue in this study. In the past, researchers have challenged Tversky and Kahneman's findings. Supporters of task specificity claimed that pencil and paper tasks did not reflect "real life" decision-making strategies. Testing for differences between "real" and "simulated" decision-making tasks, Ebbesen, Parker and Konecni (1977) found significant differences in the ways in which automobile drivers responded to questionnaires related to driving strategies and their actual responses in road tests. Phelps and and Shanteau (1978) tested judges of livestock in two structurally different laboratory tests and found differences in strategies and approaches to judgments.

At this point the difficulty in defining context becomes apparent. In the Ebbesen's et al study, context refers to differences in mode (i.e., feature lists versus direct experience) and setting (i.e., laboratory versus road). The pencil and paper test taken in the laboratory was considered the "hypothetical" form of the test. The car on the road was considered the "realistic" form. Both constituted

different "contexts".

In the Phelps' and and Shanteau's study, however, modes (i.e., feature lists versus pictures replicating experience) differed but the setting remained constant. "Context" was defined as differences in mode which reflected "realistic" versus "hypothetical" situations. "Realistic" versus "hypothetical" situations are defined as to how well the cues that were being presented to the subject matched the cues that he/she typically used in "real life" decision making. Representative cues defined the situation as "realistic", non-representative cues defined the situation as "hypothetical". The matching of cues (test and real-life), rather than setting, defined "context". Hogarth (1980) supported this definition when he stated that he believed that differences in the representation of the cues in the mind of the subject would predict differences in decision-making behavior. I have chosen to define context in terms of representation rather than setting. I believe that this definition of context most closely parallels differences related to subjects' cognitive cue representation.

Based on this understanding, this research has

addressed the study of cross-contextual decision-making by contrasting "realistic" versus "hypothetical" situations related to closeness of subjective cue representation to that of "real-life decision making.

For this study, medical vignettes were drawn from "real life" situations. I have described (above) the manner in which the subjects typically communicated among or between themselves in notes for future use and with their colleagues. I utilized these observations to devise the medical vignettes. They were taken from cases presented in charts, grand rounds, and formal, as well as informal, communications. Cue representation was as closely matched as possible.

Non-medical vignettes, on the other hand, represented "hypothetical" contexts. Non-medical vignettes provided physicians with situations in which they had less experience in the use of short-cut, decomposed vignettes. The shorter descriptions were more typical of physicians' experiences in medical situations, e.g., chart notes, abbreviated rounds presentations.

The purpose of this research was to study the effect of context on the use of heuristics in decision making. Much of the work of Tversky and Kahneman appears to make global statements about decision making and the use of heuristics based on responses to single-context questions. The main concern of critics of Tversky and Kahneman's work appears to lie in the realm of context generalizability of their findings. Ebbesen and Konecni (1980) state that "One would not be surprised to find that features of tasks such as context, might affect the decision of the subjects". These researchers noted that people may shift their strategies to meet demands of the tasks at hand and that these tasks may be influenced by the context of the task, and they voiced concern that Tversky and Kahneman's conclusions had not taken this point into consideration.

In addition, the question remains unanswered as to what, within the context, may differentially influence heuristic use. Realizing that the meaning of contexts may vary depending on the subjects' experience with the context, comparisons of experience levels were included in combination with contextual differences (medical and non-medical). Experience levels, then, provided a second kind of contextual comparison, i.e.,

experience with the context. In combination, these comparisons provided a fuller analysis of cross-contextual heuristic use.

Contextual effects were seen in the use of discounting (which was used significantly more often in medical than non-medical vignettes) and disregard of base-rate (which occurred response to a significantly greater number of medical rather than non-medical questions).

Experience effects were seen in (1) the viewing contextual data as more informative than listed data (first year residents were more confident in making a probabilistic judgment from contextual data in significantly more instances than were third year residents). Experience effects were also seen in (2) the disregarding of base-rate data (third year residents showed significantly greater disregard of base-rate data as compared with first year residents).

The interaction of context and experience differences provided a basis for significant differences in (1) use of contextual data as more informative than listed data, (2) disregarding of base-rate information, and (3) use of discounting.

Disregard of base-rate information occurred in a significantly greater number of third year residents' responses to medical vignettes as compared to non-medical questions. This medical-non-medical difference did not hold true for first and second year residents. Discounting, as well as the use of contextual data as more informative than listed data, occurred in a significantly greater number of first-year residents' responses to medical vignettes than to non-medical questions. This did not hold true for second and third year residents. It is important to note that evidence of discounting cannot be explained by actual experience differences in relation to diseases presented, since these diseases were hypothetical rather than actual ones.

Findings of contextual differences either alone or interacting with experience differences provided a basis for confirming criticisms of Tversky and Kahneman's work. Experience differences, when viewed as differences in subjects' experience with the context, supported this view as well.

Given the confirmation of the impact of context and contextual experience on the use of heuristics, one must address the question: "What is it about

context and contextual experience that would explain the differences observed?".

Sherman and Corty (1984) have noted that the (general) study of heuristics is marked by the lack of a "framework within which to place the various heuristics and to understand, in general terms, their principles of operation and their characteristic errors" (p. 230). It is difficult, then, to conceive of the impact of context and contextual experience on the use of heuristics, when no general theoretical framework has been formulated.

Sherman and Corty do, however, offer an interesting model of category matching which they believe represents the two processes by which judgments are made and heuristics are used. They term the processes "prototype" and "exemplar matching". While they are differentiated for Sherman and Corty's discussion, they may treated as a singular process for our purposes. For both of these processes, I have used the term "prototype

matching"*.

In prototype matching, the subject abstracts a central tendency of a category and bases categorical judgments on the match between the item under consideration and this central tendency or prototype. Sherman and Corty reported that the more experience a subject has had with a matchingtask, the easier and quicker the match, or the believed match.

Using the model of prototype matching, it is hypothesized that residents with less experience within medical contexts would have fewer prototypes against which to compare new experiences. Increasing experience within a context would be expected to bring about change.

Context effects were seen in 1) the Disregard of Base-rate Information, and 2) Discounting. As might

* The prototype model describes the process as the matching of cues to a central tendency or prototype that has been abstracted previously from past cues. In the exemplar model a stimulus item acts as a retrieval cue to access information associated with similar stored exemplars. For our purposes, the second process, "exemplar", differs little from prototype matching and the term "prototype matching" will refer to both.

be expected, both base-rate considerations and discounting are part of medical education, i.e., they are taught to the student. This would predict contextual differences, as prototypes learned for each context, and against which new prototypes are compared, differ.

Discounting and Base-Rate considerations* are, however, taught at different levels which would predict differences in experience effects as follows.

Discounting, is taught during the early classes of medical school. Medical students are taught to seeka single cause for all signs and symptoms presented by a patient and "rule-out" others. This is often presented as the principle of Occam's Razor.

While experience itself did not significantly affect discounting, the interaction of experience and context was significant. Within medical contexts only, the use of discounting decreased as experience increased. This may be explained by the impact of of first-hand experience on the physician's use of discounting. It is

*Disregard of base-rate information may be the natural result of overemphasis of representative concerns.

hypothesized that, within medical contexts, discounting decreased over time as first-hand experience provided alternative exem- plars. Within medical contexts, opportunities for exposure to many new exemplars may occur with the resident's exposure to other physicians choosing exceptions to the prototype. New experiences allow the resident to incorporate examples that do not fit the prototypes formed and fostered in his/her early medical education, e.g., discounting. During residency, non-medical contexts may not provide an equivalent for the quantity and quality of experiences provided in medical situations. It is interesting to question whether the impact of experience on medical discounting is the result of the more experienced subject's accumulation of non-discounting examples or his/her formulation of a new non-discounting rule. Informal discussion with staff and faculty gives weight to the former. All non-subject physicians questioned stated the importance of being strongly guided by the discounting principle. It is therefore hypothesized that the new prototypes themselves have lessened subjects' discounting.

Regard for Base-Rate information is discussed at varying points in the education of physician, but

according to the staff noted above it is informal, erratic and sometimes non-existent. The inverse of this approach, disregard of base-rate information, may be construed as being instilled by the stressing of individual (or representative) prototype matching which operates at the expense of base-rate consideration. This comes later in the residents' career, is consistent, and is emphasized during teaching and presentation sessions.

Evidence of this matching may be seen in the interaction effect of increasing disregard of base-rate within the medical realm with increasing experience level. The more experienced, third level resident may have had from more exposure to individuating prototypes gathered from increased experience with patients and from working with other physicians. These prototypes, I have been told (by the staff), stress representative matching and, therefore, disregard of base-rate. These more experienced subjects would be expected to show greater between-context differences in the use of this heuristic than do first year residents. Third year residents should have greater discrepancies between accumulated medical and non-medical prototypes against which to match the vignette data

and would be expected to show greater cross-contextual differences in their regard (or disregard) of base-rate. The findings confirmed this expectation.

It is interesting to note here that lack of disregard of base-rate (except in medical contexts, second and third year) is in contrast to Tversky and Kahneman's accumulated findings of evidence of use of this heuristic (1971, 1973, 1974). In explan- ation, it is possible that procedural variables may have influenced the findings. Fischoff, Slovic and Lichtenstein (1979) showed that base-rate data have more impact when varying base-rates are presented to each subject than when different base-rates are presented to different subjects. In their "Judgment under uncertainty: Heuristics and biases", (1974), Tversky and Kahneman fail to specify whether both conditions of base-rate judgment were presented to each subject or whether subjects were presented with one or the other of the base-rate conditions. In their "Psychology of Prediction", (1973), Tversky and Kahneman clearly indicate that subjects were asked for information regarding one of two base-rate testing situations and were not exposed to multiple base-rates as were these subjects. According to

Fischoff, Slovic and Lichtenstein (1980), exposure to both base-rate conditions might well result in a greater consideration of base-rate information by these subjects than by subjects of Tversky and Kahneman.

As medical experience increases, however, and the number of exceptions to previously learned rules increases, differences in prototypic and exemplar matching can become strong enough to override the salience of the double-presentation within medical contexts. This might well produce resulting evidence of disregard of base-rate. It is unfortunate that lack of detail in the reported research does not allow for further examination and more specific comparison. An interesting note is seen in the pilot study to this research which revealed disregard of base-rate information in only two of the twelve physicians interviewed (Appendix N). Limitations of time, financial support and differences in research strategies precluded exploring the differences between the pilot and regular sets of findings.

Experience effects were seen in 1) the use of contextual data as more informative than listed data, and 2) discounting (discussed above). All residents

used redundant data as information, across contexts. In medical vignettes only first year students viewed the contextually presented redundant data as more informative than the same information presented in a listed format. Prototype matching may offer an explanation in the fact that at that point in their education, first year students have far less experience with medical charts, quick consultations, and multiple opinions. All of these methods of communication call upon a short-hand method of information transmission that requires a listed prototype. At this stage of hospital exper- ience, key terms and words, rather than full sentences, are used to transmit information. The first year student would be expected to have less experience in this method of communicating and thinking and fewer prototypes against which to match it within the medical context. All residents have equal experience in this type of prototype matching in non-medical situations, and the data reflect the similarity in treatment of data in that context.

The impact of heuristic use on medical decision making and on the patient has been only sporadically documented. While a large-scale study addressing this issue presents basic difficulties in design, it is

one I believe most worthy of study. Some work has been done and has proven quite revealing. Chapman and Chapman (1980) studied the psychologist-subjects' use of illusory correlation in interpreting the Draw-A-Person and Rorschach test. They found that the use of this heuristic resulted in patient psychological profiles that were more predictive of the clinician's attitudes and assumptions than the patients' personalities and psychopathology. Eddy (1980) documented that physician's confusion of prospective and retrospective probabilities led to great over- and under-estimations of probability of breast cancers and subsequent life-determining treatment choices. Eddy's findings led him to conclude that "the evidence presented shows that ... many physicians make major errors in probabilistic reasoning, and that these errors threaten the quality of medical care" (1980, p. 249).

Recommendations for further study are offered in the Conclusions section of this paper (below).

Conclusions

It is evident from the findings of this research that there are several kinds of problem solving heuristics used by physicians in medical and non-medical situations. Among the identified heuristics used are Discounting, Augmentation, the use of Redundant data as useful information, and the Disregarding of Base-Rate information.

According to the data presented, it is concluded that the use of heuristics may remain stable across contexts and experience levels, may show significant effects of either, or may be affected by both.*

The finding that differences exist in the use of the same heuristic in medical and non-medical contexts supports Ebbesen and Konecni's contention that

* The physicians studied here are in some ways a rather "typical" and in some ways a unique group. They were not self-selected, but constituted all available members of the group to be studied. They are unique in that they are pediatric residents and may be seen to be self-selected by virtue of their career goal. It is possible that factors influencing their choice of specialty might also influence the responses to the vignettes presented as part of this study. Any generalizations which may be made from this study should, therefore, keep these considerations in mind.

some of Tversky and Kahneman's findings may be context- sensitive and should not be generalized to a wide variety of decision-making tasks. Evidence is also offered that suggests that differences in the use of heuristics may be seen as a function of different experience levels. The incidence of heuristics seen in medical vignettes appears to increase as experience increases in some cases, (i.e., disregard of base-rate). In other instances, however, heuris- tics are more prominent with the less experienced resident (discounting). A prototypic matching model has been offered in partial explanation of these phenomena.

While Tversky and Kahneman have laid a groundwork for much of the current research in the area of heuristics, the research presented here supports the criticisms by their critics regarding contextual influences. Evidence of the influence of context, interacting with experience differences, puts into doubt the cross-contextual generalizability of some of Tversky and Kahneman's findings.

Specifically, further work regarding the formulation of prototypes, the impact of experience on prototype use and its relation to heuristic use is recommended. In the larger scheme of things,

however, it is important to note that the meaning of heuristic use may well go far beyond an exercise in interesting, albeit difficult, cognitive study. In the area of medical decision making, it may form the backbone of examining what has long been held by physicians to be sacrosanct, i.e., "art of diagnosis". It is my hope that this "art" may be turned into a scientific study, open to scrutiny, challenge, and feedback to the physician and the medical field at large, in the form of teaching optimal decision-making strategies. In this way, physicians may be taught not only content, but the cognitive processes by which they may best serve their patients.

SUMMARY

ALL HEURISTICS, ALL HOSPITALS

		1st yr.		2nd yr.		3rd yr.	
		Evid.	No evid.	Evid.	No evid.	Evid.	No evid.
Redundancy (Data Used As Information)	Med.	16	0	14	0	14	0
	Non-Med.	16	0	13	1	14	0
Redundancy (Contextual Data As More Informative Than Listed Data)	Med.	8	8	1	13	0	14
	Non-Med.	1	15	3	11	0	14
Disregard of Base-Rate	Med.	1	13	5	7	10	4
	Non-Med.	0	14	0	12	0	14
Confusion of Pro/Retro Prob.	Med.	6	10	5	9	6	8
	Non-Med.	5	11	5	9	5	9
Discounting	Med.	16	0	11	3	10	4
	Non-Med.	9	7	9	5	7	7
Augmentation	Med.	12	4	10	4	11	3
	Non-Med.	14	2	9	5	10	4

Appendix A

Instructions

All answers will be held in confidence. There will be no identifying marks on any page. Do not write your name on any sheet.

Please answer each of the following questions completely.

Do not leave any blank answers.

Please do not erase. If you want to change a response, cross out your previous answer.

Some of the questions may appear similar. Please read them carefully.

Do not go back and look for differences.

Answer all questions to the best of your ability. Do not worry about correctness or consistency.

Please circle one to indicate your status:

1st year resident 2nd year resident 3rd year resident

The following question is optional. Do not indicate your speciality (below) if this response may compromise your anonymity.

Anticipated specialty:

Pediatrics

Internal Medicine

Surgery

(indicate sub-specialty _____)

Cardiology

Geriatrics

Gastro-intestinal Disorders

Psychiatry

Neo-natal Care

Ob/GYN

Ear, Nose and Throat

Ophthamology

Neurology

Oncology

Other _____

Alan Green is highly intelligent. He learns quickly and is well able to repeat much of what he has read. Although he does not talk about it a great deal, he remembers much of what he is taught. While he is intelligent, his ability to produce original thought appears limited. Likewise, he does not produce much original work. He is relatively unimaginative. He is neat and likes to keep things tidy. He prefers orderly systems and arranges things around him in an organized manner. He is quiet and not prone to shows of emotion. He doesn't take part in much of the conversation around him and appears unemotional.

1. Circle the graduate program that Alan will be most likely to enroll in:

Business Administration
Computer Science
Engineering
Medicine
Humanities and Education
Physical and Life Sciences
Law
Library Sciences
Social Science and Social Work

2. What additional information, if any, would you like to have?

_____

_____

3. What is your level of confidence?
(If more than one choice, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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You are working in a walk-in pediatric clinic in which adolescents are seen to age 18.

A sixteen-year-old girl has been found to have an abnormal urinalysis. Bacteria and W.B.C.'s were seen on a clean-catch urinalysis. She has had a positive U.C.G. but states that she had a normal menstrual period about a week ago. She complains of a bit of nausea in the morning and states that she feels like throwing up. She denies sexual activity.

The pregnancy rate among adolescents at this clinic is seventy percent (70%).

1. What is the probability that this patient is pregnant?

0% 10% 20% 30% 40% 50%
60% 70% 80% 90% 100%

Please feel free to explain your answer or offer any additional information.

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What is the probability that a person who will earn $40,000 per year will have completed medical school?

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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A ten and a half-year-old female presents with loss of appetite, fatigue, abdominal pain, nausea, vomiting, fever 100.6° F and insomnia due to pain.

1. What is your tentative diagnosis(es)?

2. What additional information, if any, would you need from history and /or physical and/or diagnostic tests?

_____

_____

3. What is your level of confidence in this diagnosis at this time? (If more than one diagnosis, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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You are attending a conference and you enter a reception area in which you know that 30% of the people are salesmen and the remainder are accountants. A man approaches you and appears quite friendly. He attempts to involve you in conversation. You answer his question tersely but he appears to not notice. The only way you can stop the conversation is to leave the room.

1. What is the probability that this man is a salesman?

   0% 10% 20% 30% 40% 50%

   60% 70% 80% 90% 100%

Please feel free to explain your answer or offer any additional information.

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A 7-month-old is brought in by the mother who complains of the following symptoms: wheezing, a "cold" for two or three days, difficulty in breathing. He responds minimally to plain mist. He responds well to .1% epinephrine.

Three clinical syndromes called, A, B, and C, are listed with their attendent symptoms and responses to treatment.

Syndrome A	**Syndrome B**	**Syndrome C**
Wheezing	Wheezing	Cold (2-3 days)
Difficulty breathing	Cold (2-3 days)	Responds to .1% epin.
Min. resp. to plain mist	Responds to .1% epin.	
	Difficulty breathing	
	Min. resp. to plain mist	

1. List the probability that the above patient has syndrome A, B, or C, or any combination of syndromes (based on a total of 100%).

Please feel free to explain your answer or offer any additional information.

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An eleven-year-old female presents with nausea, vomiting, "regurgitation", "feeling like throwing up", "felt like she did when she was seasick", loss of appetite, "wasn't hungry", "fever 100.4° F, "feels hot", fatigue, "tiredness", "lack of energy", insomnia, "not sleeping well", abdominal pain, and "pain in stomach", "a belly ache".

1. What is your tentative diagnosis(es)?

2. What additional information, if any, would you need from history and /or physical and/or diagnostic tests?

_____

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3. What is your level of confidence in this diagnosis at this time? (If more than one diagnosis, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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A 3-year-old child is diagnosed as having Kawaski's Disease.

1. What is the probability that this child presented with a rash, red fissured lips and a fever?

0-10% 10-20% 20-30% 30-40% 40-50%
50-60% 60-70% 70-80% 80-90% 90-100%

Please feel free to explain your answer or offer any additional information.

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Males constitute 97% of those convicted of violent crimes.

You are a jurer judging the guilt or innocence of a male. He is accused of a violent crime. How many witnesses' testimony would you require to be convinced of his guilt?

1. How many witness(es)' testimony would you require to be convinced of his guilt (your confidence level=10%)? _____

2. How many witness(es)' testimony would you require to be convinced of his guilt (your confidence level=50%)? _____

3. How many witness(es)' testimony would you require to be convinced of his guilt (your confidence level=90%)? _____

Males constitute 97% of those convicted of violent crimes.

You are a jurer judging the guilt or innocence of a female. She is accused of a violent crime.

4. How many witness(es)' testimony would you require to be convinced of her guilt (your confidence level=10%)? _____

5. How many witness(es)' testimony would you require to be convinced of her guilt (your confidence level=50%)? _____

6. How many witness(es)' testimony would you require to be convinced of her guilt (your confidence level=90%)? _____

Please feel free to explain your answer or offer any additional information.

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Tom Wilson is of high intelligence although lacking true creativity. He is neat, organized, and prefers orderly systems. He is generally introverted and unemotional.

1. Circle the graduate program that Tom will be most likely to enroll in:

Business Administration
Computer Science
Engineering
Medicine
Humanities and Education
Physical and Life Sciences
Law
Library Sciences
Social Science and Social Work

2. What additional information, if any, would you like to have?

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3. What is your level of confidence?
(If more than one choice, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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What is the probability that a person who completes medical school will earn $40,000 per year?

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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Stan Thompson is highly intelligent, learns quickly, is well able to repeat much of what he has read, does not talk about it a great deal, remembers much of what he is taught, is intelligent, ability to produce original thought appears limited, does not produce much original work, is relatively unimaginative, is neat, likes to keep things tidy, prefers orderly systems, arranges things around him in an organized manner, is quiet, not pro . to shows of emotion, doesn't take part in much of the conversation around him and appears unemotional.

1. Circle the graduate program that Stan will be most likely to enroll in:

Business Administration
Computer Science
Engineering
Medicine
Humanities and Education
Physical and Life Sciences
Law
Library Sciences
Social Science and Social Work

2. What additional information, if any, would you like to have?

_____

_____

3. What is your level of confidence?
(If more than one choice, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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Females comprise about 97% of patients diagnosed with Anorexia nervosa.

A 14 year old female is seen.

1. What percentage of weight loss would she need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=10%)? _____

2. What percentage of weight loss would she need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=50%)? _____

3. What percentage of weight loss would she need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=90%)? _____

Females comprise about 97% of patients diagnosed with Anorexia nervosa.

A 14 year old male is seen.

4. What percentage of weight loss would he need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=10%)? _____

5. What percentage of weight loss would he need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=50%)? _____

6. What percentage of weight loss would he need to exhibit for a diagnosis of Anorexia nervosa (your confidence level=90%)? _____

Please feel free to explain your answer or offer any additional information.

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An 11-old female child is said to complain of nausea and vomiting. It is reported that she regurgitated. During examination, she requests to use the bathroom, stating that she feels like she is going to "throw up". She says that she hasn't wanted to eat because she "wasn't hungry" and "felt like she did when she was seasick". It is reported that she has had a fever of 100.4° F. Upon questioning, she reports that she feels "hot". She has complained of loss of appetite and lack of energy. She is exhibiting difficulty in performing activities due to tiredness. Upon examination she complains that she is "tired" and that she is not sleeping well. Besides insomnia and fatique, it is reported that she has complained of abdominal pain. Upon examination, she reports that she has pain in her "stomach". She confirms that she has a "belly ache".

1. What is your tentative diagnosis(es)?

2. What additional information, if any, would you need from history and /or physical and/or diagnostic tests?

_____

_____

3. What is your level of confidence in this diagnosis at this time? (If more than one diagnosis, indicate level of confidence for each)

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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You are attending a conference and you enter a reception area in which you know that 70% of the people are salesmen and the remainder are accountants. A man approaches you and appears quite friendly. He attempts to involve you in conversation. You answer his question tersely but he appears to not notice. The only way you can stop the conversation is to leave the room.

1. What is the probability that this man is a salesman?

0% 10% 20% 30% 40% 50%
60% 70% 80% 90% 100%

Please feel free to explain your answer or offer any additional information.

_____
_____
_____
_____

A 3-year-old child presents with a rash, red fissured lips and a fever.

1. What is the probability that this child has Kawaski's Disease?

0-10%	10-20%	20-30%	30-40%	40-50%
50-60%	60-70%	70-80%	80-90%	90-100%

Please feel free to explain your answer or offer any additional information.

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_____

You are working in a walk-in pediatric clinic in which adolescents are seen to age 18.

A sixteen-year-old girl has been found to have an abnormal urinalysis. Bacteria and W.B.C.'s were seen on a clean-catch urinalysis. She has had a positive U.C.G. but states that she had a normal menstrual period about a week ago. She complains of a bit of nausea in the morning and states that she feels like throwing up. She denies sexual activity.

The pregnancy rate among adolescents at this clinic is thirty percent (30%).

1. What is the probability that this patient is pregnant?

   0% 10% 20% 30% 40% 50%

   60% 70% 80% 90% 100%

Please feel free to explain your answer or offer any additional information.

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You have been driving your car on the highway for about an hour and a half. The temperature gauge indicates that the engine is overheated. You see steam coming from under the hood.You smell antifreeze. You get out of the car and notice that the radiator fluid is overflowing. Two fresh puddles are seen under the car: one under the radiator and one under the oil pan.

Three car problems called, 1, 2, and 3, are listed with their attendent signs.

Problem 1	**Problem 2**	**Problem 3**
Temp. gauge indicates engine is overheated	Steam coming from under hood	Smell of antifreeze
Radiator fluid overflow	Two fresh puddles: one under radiator, one under oil pan	Radiator fluid overflow
Smell of antifreeze		Temp. gauge indicates engine is overheated
Steam coming from under hood		
Two fresh puddles: one under radiator, one under oil pan		

1. List the probability that the above car has Problem 1, 2, 3, or any combination of problems (based on a total of 100%).

Please feel free to explain your answer or offer any additional information.

_____

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_____

The following questions have already appeared in the questionnaire.

We are now asking you different questions related to them. Please read the instructions at the top of each page.

Please feel free to explain any answer or offer any additional information.

Please circle the item(s) in the following question which were "important" in determining your answer:

A ten and a half-year-old female presents with loss of appetite, fatigue, abdominal pain, nausea, vomiting, fever 100.6° F and insomnia due to pain.

Please feel free to explain your answer or offer any additional information.

_____

_____

_____

_____

Please circle the item(s) below which give some information regarding how you pictured this person at the time you answered the question.

Do not describe how you would perceive the person now. Please check only those items which crossed your mind when you originally answered this question.

You are working in a walk-in pediatric clinic in which adolescents are seen to age 18.

A sixteen-year-old girl has been found to have an abnormal urinalysis. Bacteria and W.B.C.'s were seen on a clean-catch urinalysis. She has had a positive U.C.G. but states that she had a normal menstrual period about a week ago. She complains of a bit of nausea in the morning and states that she feels like throwing up. She denies sexual activity.

The pregnancy rate among adolescents at this clinic is seventy percent (70%).

Item Check List

shy	fat	
Asian	Black	thin
tall	average weight	upper socioecon. level
White	Hispanic	average height
lower socioecon. level	short	middle socioecon. level
outgoing	arrogant	loud

Please feel free to explain your answer, add items, or offer any additional information

_____

_____

_____

Please circle the item(s) in the following question which were "important" in determining your answer:

A ten and a half-year-old female presents with loss of appetite, fatigue, abdominal pain, nausea, vomiting, fever 100.6° F and insomnia due to pain.

Please feel free to explain your answer or offer any additional information.

_____

_____

_____

_____

Please circle the item(s) below which give some information regarding how you pictured this person at the time you answered the question.

Do not describe how you would perceive the person now. Please check only those items which crossed your mind when you originally answered this question.

You are attending a conference and you enter a reception area in which you know that 30% of the people are salesmen and the remainder are accountants. A man approaches you and appears quite friendly. He attempts to involve you in conversation. You answer his question tersely but he appears to not notice. The only way you can stop the conversation is to leave the room.

Item Check List

shy	fat	
Asian	Black	thin
tall	average weight	upper socioecon. level
White	Hispanic	average height
lower socioecon. level	short	middle socioecon. level
outgoing	arrogant	loud

Please feel free to explain your answer, add items, or offer any additional information

_____

_____

_____

_____

Please circle the item(s) in the following question which were "important" in determining your answer:

An eleven-year-old female presents with nausea, vomiting, "regurgitation", "feeling like throwing up", "felt like she did when she was seasick", loss of appetite, "wasn't hungry", "fever 100.4° F, "feels hot", fatigue, "tiredness", "lack of energy", insomnia, "not sleeping well", abdominal pain, and "pain in stomach", "a belly ache".

Please feel free to explain your answer or offer any additional information.

_____

_____

_____

_____

Please circle the item(s) in the following question which were "important" in determining your answer:

Tom Wilson is of high intelligence although lacking true creativity. He is neat, organized, and prefers orderly systems. He is generally introverted and unemotional.

Please feel free to explain your answer or offer any additional information.

_____

_____

_____

_____

Please circle the item(s) in the following question which were "important" in determining your answer:

An 11-old female child is said to complain of nausea and vomiting. It is reported that she regurgitated. During examination, she requests to use the bathroom, stating that she feels like she is going to "throw up". She says that she hasn't wanted to eat because she "wasn't hungry" and "felt like she did when she was seasick". It is reported that she has had a fever of 100.4° F. Upon questioning, she reports that she feels "hot". She has complained of loss of appetite and lack of energy. She is exhibiting difficulty in performing activities due to tiredness. Upon examination she complains that she is "tired" and that she is not sleeping well. Besides insomnia and fatique, it is reported that she has complained of abdominal pain. Upon examination, she reports that she has pain in her "stomach". She confirms that she has a "belly ache".

Please feel free to explain your answer or offer any additional information.

_____

_____

_____

_____

Please circle the item(s) below which give some information regarding how you pictured this person at the time you answered the question.

Do not describe how you would perceive the person now. Please check only those items which crossed your mind when you originally answered this question.

You are attending a conference and you enter a reception area in which you know that 70% of the people are salesmen and the remainder are accountants. A man approaches you and appears quite friendly. He attempts to involve you in conversation. You answer his question tersely but he appears to not notice. The only way you can stop the conversation is to leave the room.

Item Check List

shy	fat	
Asian	Black	thin
tall	average weight	upper socioecon. level
White	Hispanic	average height
lower socioecon. level	short	middle socioecon. level
outgoing	arrogant	loud

Please feel free to explain your answer, add items, or offer any additional information

_____

_____

_____

_____

Please circle the item(s) in the following question which were "important" in determining your answer:

Stan Thompson is highly intelligent, learns quickly, is well able to repeat much of what he has read, does not talk about it a great deal, remembers much of what he is taught, is intelligent, ability to produce original thought appears limited, does not produce much original work, is relatively unimaginative, is neat, likes to keep things tidy, prefers orderly systems, arranges things around him in an organized manner, is quiet, not prone to shows of emotion, doesn't take part in much of the conversation around him and appears unemotional.

Please feel free to explain your answer or offer any additional information.

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_____

_____

Please circle the item(s) below which give some information regarding how you pictured this person at the time you answered the question.

Do not describe how you would perceive the person now. Please check only those items which crossed your mind when you originally answered this question.

You are working in a walk-in pediatric clinic in which adolescents are seen to age 18.

A sixteen-year-old girl has been found to have an abnormal urinalysis. Bacteria and W.B.C.'s were seen on a clean-catch urinalysis. She has had a positive U.C.G but states that she had a normal menstrual period about a week ago. She complains of a bit of nausea in the morning and states that she feels like throwing up. She denies sexual activity.

The pregnancy rate among adolescents at this clinic is thirty percent (30%).

Item Check List

shy	fat	
Asian	Black	thin
tall	average weight	upper socioecon. level
White	Hispanic	average height
lower socioecon. level	short	middle socioecon. level
outgoing	arrogant	loud

Please feel free to explain your answer, add items, or offer any additional information

_____

_____

_____

_____

APPENDIX B

REDUNDANCY, MEDICAL*

1st year

Bronx Lebanon Hospital

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	20-30	10-20	10-20	20-30	M = 17.85 SD = 4.88
LISTED Confidence Level(s)	30-40	50-60	40-50	50-60	30-40	30-40	40-50	M = 43.57 SD = 8.99
CONTEXTUAL Confidence Level(s)	50-60	50-60	40-50	50-60	40-50	40-50	40-50	M = 49.28 SD = 5.34

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, MEDICAL*

1st year

Mt. Sinai Medical Center

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	20-30	20-30	10-20	10-20	10-20	10-20	M = 17.22 SD - 4.41
LISTED Confidence Level(s)	60-70	60-70	30-40	30-40	40-50	30-40	40-50	30-40	30-40	M = 43.89 SD = 12.69
CONTEXTUAL Confidence Level(s)	60-70	70-80	40-50	30-40	50-60	30-40	50-60	50-60	30-40	M = 50.56 DS = 14.24

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, MEDICAL*

2nd year

Bronx Lebanon Hospital

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	10-20	10-20	10-20	10-20	M = 15 00 SD = 0.00
LISTED Confidence Level(s)	30-40	30-40	30-40	30-40	30-40	30-40	40-50	M =36 43 SD = 3 78
CONTEXTUAL Confidence Level(s)	30-40	30-40	30-40	30-40	30-40	30-40	40-50	M = 36.43 DS = 7.56

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, MEDICAL*

2nd year

Mt. Sinai Medical Center

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	10-20	10-20	10-20	10-20	M = 15.00 SD = 0.00
LISTED Confidence Level(s)	30-40	30-40	30-40	30-40	40-50	30-40	30-40	M = 36.43 SD = 3.78
CONTEXTUAL Confidence Level(s)	30-40	30-40	30-40	30-40	50-60	30-40	30-40	M = 37.86 SD = 7.56

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, MEDICAL*

3rd year

Bronx Lebanon Hospital

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	10-20	10-20	10-20	10-20	M = 15.00 SD = 0.00
LISTED Confidence Level(s)	30-40	30-40	30-40	30-40	30-40	20-30	20-30	M = 32.14 SD = 4.88
CONTEXTUAL Confidence Level(s)	30-40	30-40	30-40	30-40	30-40	20-30	20-30	M = 32.14 SD = 4.88

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, MEDICAL*

3rd year

Mt. Sinai Medical Center

Redundancy, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	10-20	10-20	10-20	10-20	M = 15.00 SD = 0.00
LISTED Confidence Level(s)	30-40	20-30	30-40	30-40	30-40	30-40	20-30	M = 32.14 SD = 4.88
CONTEXTUAL Confidence Level(s)	30-40	20-30	30-40	30-40	30-40	30-40	20-30	M = 32.14 SD = 4.88

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

APPENDIX C

REDUNDANCY, NON-MEDICAL*

1st year

Bronx Lebanon Hospital

Redundancy, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	20-30	10-20	20-30	10-20	10-20	10-20	10-20	M = 17.86 SD = 4.98
LISTED Confidence Level(s)	60-70	60-70	20-30	30-40	30-40	30-40	40-50	M = 42.14 SD = 16.04
CONTEXTUAL Confidence Level(s)	60-70	60-70	30-40	30-40	30-40	30-40	40-50	M = 45.00 SD = 14.14

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, NON-MEDICAL*

1st year

Mt. Sinai Medical Center

Redundancy, Non-Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9	STATIST.
SIMPLE Confidence Level(s)	10-20	10-20	10-20	20-30	10-20	10-20	10-20	10-20	20-30	M = 17.22 SD = 4.41
LISTED Confidence Level(s)	30-40	40-50	50-60	50-60	30-40	30-40	50-60	30-40	50-60	M = 45.00 SD = 10.00
CONTEXTUAL Confidence Level(s)	30-40	40-50	50-60	50-60	30-40	30-40	50-60	30-40	50-60	M = 45.00 SD = 10.00

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, NON-MEDICAL*

2nd year

Bronx Lebanon Hospital

Redundancy, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	20-30	10-20	10-20	10-20	10-20	20-30	10-20	M = 17.15 SD = 3.94
LISTED Confidence Level(s)	60-70	60-70	20-30	40-50	30-40	30-40	30-40	M = 43.75 SD = 15.74
CONTEXTUAL Confidence Level(s)	60-70	60-70	20-30	40-50	30-40	40-50	30-40	M = 44.86 SD = 15.39

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, NON-MEDICAL*

2nd year

Mt. Sinai Medical Center

Redundancy, Non-Medical	•1	•2	•3	•4	•5	•6	•7	STATIST.
SIMPLE Confidence Level(s)	20-30	10-20	10-20	10-20	10-20	10-20	30-40	M = 19.29 SD = 7.87
LISTED Confidence Level(s)	30-40	50-60	50-60	20-30	20-30	10-20	60-70	M = 39.29 SD = 19.02
CONTEXTUAL Confidence Level(s)	30-40	50-60	50-60	30-40	30-40	10-20	60-70	M = 42.14 SD = 17.04

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY, NON-MEDICAL*

3rd year

Bronx Lebanon Hospital

Redundancy, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	20-30	10-20	10-20	10-20	10-20	10-20	10-20	M = 16.43 SD = 3.78
LISTED Confidence Level(s)	40-50	40-50	40-50	40-50	40-50	40-50	40-50	M = 45.00 SD = 0.00
CONTEXTUAL Confidence Level(s)	40-50	40-50	40-50	40-50	30-40	40-50	40-50	M = 43.57 SD = 3.78

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

REDUNDANCY. NON-MEDICAL*

3rd year

Mt Sinai Medical Center

Redundancy, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
SIMPLE Confidence Level(s)	20-30	20-30	20-30	10-20	10-20	10-20	10-20	M = 19.29 SD = 5.35
LISTED Confidence Level(s)	30-40	30-40	50-60	30-40	30-40	60-70	30-40	M = 42.14 SD = 12.54
CONTEXTUAL Confidence Level(s)	30-40	30-40	40-50	30-40	30-40	60-70	30-40	M = 40.71 SD = 11.34

* Use of redundant data as information was evidenced by higher confidence levels reported in response to listed or contextual vignettes as compared with simple data.
Viewing contextual data as more informative than listed data was evidenced by higher confidence levels reported in response to contextual vignettes as compared with listed vignettes.

APPENDIX D

BASE RATE, MEDICAL*

1st year,
Bronx Lebanon Hospital

Base Rate, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	30	50	30	20	40	30	30	M = 32.86 SD = 9.51
70% Probability	50	50	70	70	70	80	80	M = 67.14 SD = 12.54

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

BASE RATE, MEDICAL *

1st year,

Mt. Sinai Medical Center

Base Rate,* Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9	STATIST.
30% Probability	30	inc.**	40	20	inc.	30	20	30	50	M = 31.43 SD = 10.69
70% Probability	70	inc.	70	90	inc.	60	50	90	80	M = 72.86 SD = 14.96

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc indicates that this item was not completed by the subject.

BASE RATE, MEDICAL *

2nd year,

Bronx Lebanon Hospital

Base Rate, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	inc.**	40	80	30	40	90	30	M = 51.67 SD = 26.39
70% Probability	inc.	80	80	80	80	80	70	M = 78.33 SD = 4.08

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc. indicates that this item was not completed by the subject.

BASE RATE, MEDICAL *

2nd year,

Mt. Sinai Medical Center

Base Rate, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	30	30	80	90	inc.**	80	30	M = 56.67 SD = 29.44
70% Probability	80	80	80	90	inc.	80	70	M = 80.00 SD = 6.33

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc. indicates that this item was not completed by the subject.

BASE RATE, MEDICAL*

3rd year,

Bronx Lebanon Hospital

Base Rate, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	30	30	40	80	90	80	90	M = 62.86 SD = 28.12
70% Probability	80	70	90	80	90	70	90	M = 81.43 SD = 9.00

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

BASE RATE, MEDICAL *

3rd year,

Mt. Sinai Medical Center

Base Rate, Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	80	80	30	90	90	90	90	M = 78.57 SD = 21.93
70% Probability	80	80	70	90	90	90	90	M = 84.29 SD = 7.87

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

APPENDIX E

BASE RATE, NON-MEDICAL *

1st year,
Bronx Lebanon Hospital

Base Rate, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	30	30	20	30	40	30	30	M = 30.00 SD = 5.77
70% Probability	50	50	50	60	50	80	50	M = 55.71 SD = 11.34

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc indicates that this item was not completed by the subject.

BASE RATE, NON-MEDICAL *

1st year,

Mt. Sinai Medical Center

Base Rate, Non-Medical	•1	•2	•3	•4	•5	•6	•7	•8	•9	STATIST.
30% Probability	30	inc.**	inc.	30	30	20	30	40	30	M = 30.00 SD = 5.77
70% Probability	80	inc.	inc.	80	70	60	70	70	70	M = 71.43 SD = 6 90

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc. indicates that this item was not completed by the subject.

BASE RATE, NON-MEDICAL *

2nd year,

Bronx Lebanon Hospital

Base Rate, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	inc.**	30	30	30	30	30	20	M = 28.33 SD = 4.08
70% Probability	inc.	80	80	80	70	70	60	M = 76.67 SD = 5.16

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc. indicates that this item was not completed by the subject.

BASE RATE, NON-MEDICAL *

2nd year,
Mt. Sinai Medical Center

Base Rate, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	20	30	30	20	40	40	30	M = 30.00 SD = 8.167
70% Probability	70	80	80	80	80	80	80	M = 78.57 SD = 3.78

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

BASE RATE, NON-MEDICAL *

3rd year,

Bronx Lebanon Hospital

Base Rate, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	inc.**	30	30	30	20	20	20	M = 25.00 SD = 5.48
70% Probability	inc.	80	80	80	80	80	80	M = 80.00 SD = 0.00

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

** Inc. indicates that this item was not completed by the subject.

BASE RATE, NON-MEDICAL*

3rd year,

Mt. Sinai Medical Center

Base Rate, Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
30% Probability	30	30	20	30	20	30	20	M = 25.71 SD = 5.35
70% Probability	80	80	80	80	80	70	70	M = 77.14 SD = 4.88

* Disregard of base-rate information was evidenced by assignment of values to the 70% vignettes of values equal or less than those assigned to the 30% vignettes.

APPENDIX F

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,* MEDICAL

1st year,

Bronx Lebanon Hospital

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	30-40	10-20	50-60	30-40	30-40	10-20	30-40	M = 32.14 SD = 13.80
Retrospective Probability	80-90	80-90	50-60	30-40	70-80	80-90	30-40	M = 65.00 SD = 23.09

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

1st year,

Mt. Sinai Medical Center

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9	STATIST.
Prospective Probability	30-40	30-40	10-20	10-20	10-20	10-20	10-20	50-60	50-60	M = 28.33 SD = 17.32
Retrospective Probability	30-40	30-40	80-90	80-90	80-90	80-90	80-90	50-60	80-90	M = 70.56 SD = 22.42

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,* MEDICAL

2nd year,

Bronx Lebanon Hospital

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	30-40	50-60	10-20	10-20	50-60	50-60	30-40	M = 37.86 SD = 18.00
Retrospective Probability	80-90	60-70	80-90	80-90	50-60	80-90	30-40	M = 70.71 SD = 19.88

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

2nd year,

Mt. Sinai Medical Center

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	50-60	50-60	10-20	10-20	50-60	30-40	30-40	M = 37.86 SD = 18.00
Retrospective Probability	50-60	50-60	80-90	80-90	80-90	80-90	30-40	M = 69.29 SD = 20.70

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,* MEDICAL

3rd year,
Bronx Lebanon Hospital

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	30-40	10-20	40-50	50-60	50-60	30-40	30-40	M = 39.29 SD = 13.97
Retrospective Probability	80-90	10-20	80-90	50-60	40-50	80-90	70-80	M = 63.57 SD = 26.73

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES.*

MEDICAL

3rd year,

Mt. Sinai Medical Center

Pro. & Retro., Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	30-40	30-40	50-60	20-30	10-20	10-20	10-20	M = 28.86 SD = 14.96
Retrospective Probability	30-40	30-40	50-60	40-50	80-90	80-90	80-90	M = 60.71 SD = 23.71

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

APPENDIX G

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL

1st year,

Bronx Lebanon Hospital

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	10-20	30-40	10-20	50-60	10-20	10-20	10-20	M = 23 57 SD = 15.74
Retrospective Probability	80-90	30-40	10-20	80-90	10-20	70-80	70-80	M = 55.00 SD = 32.15

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL

1st year,

Mt. Sinai Medical Center

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9	STATIST.
Prospective Probability	30-40	30-40	70-80	50-60	10-20	10-20	10-20	30-40	80-90	M = 40.56 SD = 26.03
Retrospective Probability	70-80	70-80	70-80	70-80	50-60	60-70	50-60	60-70	10-20	M = 61.67 SD = 19.37

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL,

2nd year,

Bronx Lebanon Hospital

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	10-20	10-20	50-60	10-20	20-30	20-30	30-40	M = 26.43 SD = 14.64
Retrospective Probability	10-20	10-20	80-90	50-60	50-60	30-40	30-40	M = 42.14 SD = 24.98

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL

2nd year,

Mt. Sinai Medical Center

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	50-60	30-40	10-20	30-40	20-30	30-40	10-20	M = 30.00 SD = 15.00
Retrospective Probability	70-80	30-40	70-80	50-60	20-30	50-60	60-70	M = 55.00 SD = 19.15

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL

3rd year,
Bronx Lebanon Hospital

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	50-60	10-20	20-30	60-70	10-20	10-20	50-60	M = 35.00 SD = 22.36
Retrospective Probability	20-30	60-70	70-80	10-20	80-90	70-80	50-60	M = 56.43 SD = 26.73

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

PROSPECTIVE AND RETROSPECTIVE PROBABILITIES,*

NON-MEDICAL

3rd year,

Mt. Sinai Medical Center

Pro. & Retro., Non-Medical	#1	#2	#3	#4	#5	#6	#7	STATIST.
Prospective Probability	70-80	10-20	10-20	30-40	20-30	10-20	20-30	M = 29.29 SD = 21.49
Retrospective Probability	70-80	50-60	30-40	30-40	50-60	30-40	80-90	M = 53.57 SD = 20.35

* Confusion of prospective and retrospective probability was evidenced by assignment of the same values to both vignettes.

APPENDIX H

DISCOUNTING. MEDICAL*

1st year,

Bronx Lebanon Hospital

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	90	90	80	100	100	100	70
3 Item Prob.	10	5	10	0	0	0	25
2 Item Prob.	0	5	10	0	0	0	5
5+3 Item Prob.	0	0	0	0	0	0	0
5+2 Item Prob.	0	0	0	0	0	0	0
2+3 Item Prob.	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

* Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3 or 5,3,+2.

DISCOUNTING MEDICAL*

1st year,

Mt. Sinai Medical Center

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9
5 Item Prob.	100	100	85	100	100	95	100	90	90
3 Item Prob.	0	0	10	0	0	5	0	5	5
2 Item Prob.	0	0	5	0	0	0	0	5	5
5+3 Item Prob.	0	0	0	0	0	0	0	0	0
5+2 Item Prob.	0	0	0	0	0	0	0	0	0
2+3 Item Prob.	0	0	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0	0	0

* Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3 or 5,3,+2.

DISCOUNTING, MEDICAL*

2nd year,

Bronx Lebanon Hospital

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	100	100	100	70	100	80
3 Item Prob.	0	0	0	0	10	0	15
2 Item Prob.	0	0	0	0	10	0	5
5+3 Item Prob.	0	0	0	0	10	0	0
5+2 Item Prob.	0	0	0	0	0	0	0
2+3 Item Prob.	0	0	0	0	0	0	0
5,3+2 Item Prob	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3 or 5,3,+2.

DISCOUNTING, MEDICAL*

2nd year,

Mt. Sinai Medical Center

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	90	80	80	100	100	80	80
3 Item Prob.	5	0	5	0	0	10	10
2 Item Prob.	5	0	5	0	0	10	10
5+3 Item Prob.	0	10	0	0	0	0	0
5+2 Item Prob.	0	10	0	0	0	0	0
2+3 Item Prob.	0	0	10	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3 or 5,3,+2.

DISCOUNTING, MEDICAL*

3rd year,

Bronx Lebanon Hospital

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	100	90	90	90	90	80
3 Item Prob.	0	0	0	5	5	5	5
2 Item Prob.	0	0	0	5	5	5	5
5+3 Item Prob.	0	0	0	0	0	0	0
5+2 Item Prob.	0	0	0	0	0	0	5
2+3 Item Prob.	0	0	10	0	0	0	5
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5+3,+2.

DISCOUNTING, MEDICAL *

3rd year,

Mt. Sinai Medical Center

Discounting, Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	100	80	90	90	80	90
3 Item Prob.	0	0	0	10	10	0	10
2 Item Prob.	0	0	0	0	0	0	0
5+3 Item Prob.	0	0	20	0	0	10	0
5+2 Item Prob.	0	0	0	0	0	10	0
2+3 Item Prob.	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5+3,+2.

APPENDIX J

DISCOUNTING, NON-MEDICAL*

1st year.

Bronx Lebanon Hospital

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	80	100	90	100	80	60	70
3 Item Prob.	10	0	5	0	10	20	10
2 Item Prob.	10	0	5	0	5	5	10
5+3 Item Prob.	0	0	0	0	5	5	10 -or-
5+2 Item Prob.	0	0	0	0	0	5	10
2+3 Item Prob.	0	0	0	0	0	5	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

DISCOUNTING, NON-MEDICAL*

1st year,

Mt. Sinai Medical Center

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7	#8	#9
5 Item Prob.	90	90	75	100	80	75	80	80	100
3 Item Prob.	10	10	10	0	10	10	10	10	0
2 Item Prob.	0	0	5	0	10	10	5	0	0
5+3 Item Prob.	0	0	5	0	0	5	5	5	0
5+2 Item Prob.	0	0	5	0	0	0	0	5	0
2+3 Item Prob.	0	0	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

DISCOUNTING, NON-MEDICAL*

2nd year.

Bronx Lebanon Hospital

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	80	80	90	70	100	90
3 Item Prob.	0	0	10	10	10	0	10
2 Item Prob.	0	0	10	0	10	0	0
5+3 Item Prob.	0	10	0	0	10	0	0
5+2 Item Prob.	0	10	0	0	0	0	0
2+3 Item Prob.	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

DISCOUNTING, NON-MEDICAL *

2nd year,

Mt. Sinai Medical Center

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	100	80	80	80	60	70
3 Item Prob.	0	0	10	10	10	10	10
2 Item Prob.	0	0	10	5	10	10	10
5+3 Item Prob.	0	0	0	0	0	10	0
5+2 Item Prob.	0	0	0	0	0	0	0
2+3 Item Prob.	0	0	0	5	0	10	10
5,3+2 Item Prob	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

DISCOUNTING, NON-MEDICAL*

3rd year,

Bronx Lebanon Hospital

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	100	90	80	90	80	80	80
3 Item Prob.	0	0	10	0	10	10	10
2 Item Prob.	0	0	5	0	10	10	5
5+3 Item Prob.	0	0	0	0	0	0	5
5+2 Item Prob.	0	0	0	0	0	0	—or— 5
2+3 Item Prob.	0	10	5	10	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

DISCOUNTING, NON-MEDICAL*

3rd year,

Mt. Sinai Medical Center

Discounting, Non-Medical	#1	#2	#3	#4	#5	#6	#7
5 Item Prob.	90	80	80	80	80	90	80
3 Item Prob.	0	10	10	0	10	0	10
2 Item Prob.	0	10	10	0	10	0	10
5+3 Item Prob.	10	0	0	10	0	10	0
5+2 Item Prob.	or 10	0	0	10	0	or 10	0
2+3 Item Prob.	0	0	0	0	0	0	0
5,3+2 Item Prob.	0	0	0	0	0	0	0

*Discounting was evidenced by the failure to assign any probability to multiple items, i.e., 5+3, 5+2, 2+3, or 5,3,+2.

APPENDIX K

AUGMENTATION, MEDICAL*

1st year,

Bronx Lebanon Hospital

	#1	#2	#3	#4	#5	#6	#7
Expected/ Unexpected* at 10%	10/15	10/15	10/15	10/15	10/10	10/15	10/15
at 50%	20/25	20/25	20/25	15/15	15/15	15/20	15/20
at 90%	25/30	20/25	25/30	20/25	20/20	25/30	25/30 25/35

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, MEDICAL*

1st year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7	#8	#9
at 10%	less than 10/15	10/10	10/15	10/15	10/20	10/10	10/15	10/15	10/10
at 50%	15/20	15/15	15/20	15/20	15/20	15/15	15/20	15/20	15/10
at 90%	15/25	20/20	20/25	20/25	20/25	20/25	20/25	20/25	20/20

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, MEDICAL*

2nd year,

Bronx Lebanon Hospital

	#1	#2	#3	#4	#5	#6	#7
Expected/ Unexpected* at 10%	10/15	10/15	10/15	10/15	10/15	10/10	10/10
at 50%	20/25	20/25	20/25	20/25	20/25	15/15	15/15
at 90%	20/25	20/20	15/15	20/25	20/25	20/20	20/20

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, MEDICAL*

2nd year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7
at 10%	10/15	10/15	10/15	10/10	10/20	10/10	10/15
at 50%	15/20	15/20	15/20	10/10	15/20	15/15	15/20
at 90%	15/25	20/25	20/25	20/20	20/25	20/15	20/25

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, MEDICAL*

3rd year,

Bronx Lebanon Hospital

	#1	#2	#3	#4	#5	#6	#7
Expected/ Unexpected* at 10%	10/15	10/15	10/15	10/15	10/10	10/15	10/10
at 50%	20/25	20/25	20/25	20/25	15/15	20/25	20/25
at 90%	20/25	20/25	20/25	20/25	20/20	20/25	20/25

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, MEDICAL*

3rd year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7
at 10%	10/15	10/15	10/10	10/15	10/20	10/10	10/10
at 50%	15/20	15/20	15/15	10/10	15/20	15/20	15/15
at 90%	15/25	20/25	20/25	15/20	20/25	20/25	20/20

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

APPENDIX L

AUGMENTATION, NON-MEDICAL*

1st year,

Bronx Lebanon Hospital

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7
at 10%	1/2	0/1	1/2	1/2	0/0	1/2	1/2
at 50%	2/3	2/3	2/3	1/2	0/0	2/3	2/2
at 90%	2/3	3/5	2/4	2/3	1/1	3/4	3/4

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, NON-MEDICAL*

1st year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7	#8	#9
at 10%	1/2	0/0	1/2	1/2	1/2	1/2	1/2	0/0	1/1
at 50%	2/3	0/0	2/3	1/2	0/0	2/3	2/2	1/2	1/2
at 90%	2/3	1/1	2/4	2/3	3/4	3/4	3/4	2/3	2/3

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, NON-MEDICAL*

2nd year,

Bronx Lebanon Hospital

	#1	#2	#3	#4	#5	#6	#7
Expected/ Unexpected* at 10%	1/2	0/1	1/2	1/2	0/1	0/0	1/1
at 50%	2/3	2/3	2/3	1/2	1/2	0/0	2/2
at 90%	3/4	3/4	3/4	2/3	3/4	0/0	3/4

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, NON-MEDICAL*

2nd year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7
at 10%	0/0	0/0	1/2	1/1	1/2	1/1	1/1
at 50%	1/1	1/2	2/3	2/2	1/2	2/2	2/3
at 90%	2/3	2/3	2/3	3/3	3/4	3/3	3/4

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, NON-MEDICAL*

3rd year,

Bronx Lebanon Hospital

	#1	#2	#3	#4	#5	#6	#7
Expected/ Unexpected* at 10%	1/1	0/0	0/1	0/1	0/0	0/1	0/0
at 50%	1/2	2/3	1/2	1/2	0/0	0/1	1/2
at 90%	2/3	2/3	2/3	2/3	2/2	2/3	2/3

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

AUGMENTATION, NON-MEDICAL*

3rd year,

Mt. Sinai Medical Center

Expected/ Unexpected*	#1	#2	#3	#4	#5	#6	#7
at 10%	0/0	0/1	1/2	1/2	1/2	1/1	0/0
at 50%	1/1	1/2	2/3	2/3	1/2	2/2	1/1
at 90%	2/3	2/3	2/3	3/4	3/4	3/3	2/2

*Augmentation was evidenced by the assignment of higher weight losses for unexpected versus expected gender.

APPENDIX M

Pretesting

Pretests were administered to ten physicians at Mt. Sinai Medical School. Pretest physicians were excluded from the study by virtue of their having had more hospital and/or patient experience than test subjects. Their post-residency experience ranged from 1 to 26 years. After completing the test questionnaire, pretest subjects were given additional tasks.

1. Pretest subjects were asked to rate the degree to which the medical versions of the vignettes were believable portrayals of medical situations. Possible pretest ratings included 1) not believable, 2) somewhat believable, and 3) believable portrayal. All medical vignettes were rated "believable portrayals" by all physicians. This was not unexpected as the vignettes had been rewritten several times with advice from the Chiefs of Pediatrics of Bronx Lebanon Hospital and Mt. Sinai Medical School in addition to several other physician-consultants.

2. Pretest subjects were asked and encouraged

to make recommendations for change and to offer general suggestions. Changes were minimal at this point, in great part, it is believed, because of the repeated modifications made prior to pretesting. The major area of suggested change centered on maintenance of anonymity of the physician-subject (Appendix N).

3. Two pretest subjects requested that the phrase "3-D rash", found in the medical redundancy question be changed to "raised rash". The Chief of Pediatrics at Bronx Lebanon Hospital recommended the substitution of "red-fissured lips" for this symptom. The Chief Resident at Mt. Sinai Medical School concurred. This change was acceptable to all pretest subjects and was noted to be preferred in several instances. This suggestion was implemented.

4. Suggestions for change of the format of the presentation of qualitative questions were offered by pretest subjects. It was recommended that subjects be given duplicates of the same vignettes along with new, qualitative

questions. Up to that time, pretest subjects had been asked to turn back to the same questions they had answered before and answer qualitative questions. Pretest subjects found this process cumbersome and said that they would prefer duplicates, added at the end of the questionnaire for ease of answering. This suggestion was also implemented.

5. In order to insure that terms used in the questionnaire and thought to be redundant in medical and non-medical vignettes did not offer significant new information, five pretest subjects were given lists of the randomly placed terms used in these questions. These terms were used interchangably by Taber's Cyclopedic Dictionary (1977), New American Pocket Medical Dictionary (1978), The Merriam-Webster Dictionary (1974), and Roget's Pocket Thesaurus (1977). Additional terms were added to the list. In order to confirm that these terms were interchangable in colloquial use, pretest subjects were given twelve colored marking pens and asked to circle the terms that they considered "interchangable" with the same marking pen.

They were instructed to mark the same item more than once if it fit into more than one group. Terms circled confirmed that these terms were perceived as interchangable by these physicians. No changes were made on these items.

6. In order to insure that similarities in test subjects' prospective and retrospective probability estimates were a reflection of their confusion of these two kinds of conditional probabilities (rather than similarities in the actual probabilities), it was necessary to ascertain that differences in these probabilities did exist and that the probability differences were common knowledge among residents. Pretest subjects were, therefore, given questions related to prospective and retrospective medical and non-medical probability estimates. The difference between prospective and retrospective probabilities was stressed and clarification of the difference between the prospective and retrospective relationships was offered. In this way, it was believed that estimates given would reflect the pretest

subjects' estimates of probability rather than their possible confusion in the meaning of prospective and retrospective probability. This would allow probability confusion to be tested later in the main study, having confirmed that probability differences did exist and were common knowledge. It was found, with pretest clarification, that prospective medical and non-medical versions of this question were within ten percent of each other which we had established as an allowable difference. The same finding was observed in the retrospective medical and non-medical questions. No changes were made for this item.

7. In order to insure that the base-rate differences of 70% and 30% did not influence subjects' perceptions of the individuals depicted in respective vignettes, pretest subjects were asked to "describe the way you pictured this person when you first read the question." Subjects were cautioned not to add information at this point but to recollect the way they had perceived the person in the vignette. Subjects' responses did not include

racial or socio-economic descriptors. Personality descriptions such as "arrogant" and "shy" and physical qualities such as "fat", "chubby" and "red faced" were used by subjects across base-rates and did not appear to reflect a simple stereotypical view related to base-rate. Using this feedback, a list of randomly placed adjectives was added to the request for descriptive items.

APPENDIX N

Suggestions for change were as follows:

A. The pretest questionnaire contained the letters "o.p." in nine-point print. These letters were placed in the lower left hand corner of each page. This coding was meant to indicate that this was the ordered ("o") version of the pretest ("p") during data analysis. These letters appeared on all of the pretest questionnaires. Six of the ten pretest subjects asked what these letters meant and, during conversation, said that they had had concern or question that these letters might have identified the subject's questionnaire. Of these subjects, three said that they had wondered if different code letters appeared on different questionnaires. Upon questioning, all of these subjects said that they had also entertained the thought that the letters had nothing to do with the subject's particular test packet but was meant for some other identification. Of these three subjects, two indicated that it would be preferable to eliminate this type of coding. This suggestion was followed and code letters were eliminated.

B. The pretest questionnaire contained a request for (1) year of residency, and (2) expected area of area of specialization. Five subjects and one Chief of Pediatrics recommended that these items be eliminated or made optional. It was pointed out that the two questions, in combination, could compromise the anonymity of a subject who might be the only resident of that year entering that subspecialty. All physicians agreed that this concern could be met satisfactorily by making the second question, specialization, optional. It was recommended that a clear statement should be included in the questionnaire that explained to the subject that this question should not be answered at the cost of anonymity. This change was made and future testing instruments contained these statements.

APPENDIX O

MEDICAL DIAGNOSIS: Analysis of Interviews

Abstract

The purpose of this research was to study the ways in which physicians use heuristics., i.e., the cognitive shortcuts, strategies or rules of thumb which guide them when making medical diagnoses. All data was gathered in actual clinical situations.

Physicians were interviewed immediately following their examination of patients. The reasons they gave for the diagnostic procedures requested, the diagnoses they made, and the treatments they ordered were recorded. These reasons were analyzed for the underlying cognitive processes, in particular, the use of heuristics.

Analyses included the types of heuristics, heuristic frequency and the reasons physicians gave for their use of heuristics. In addition, possible correlations between physicians' use of heuristics, as well as the relationship of that correlation to the length of the interview and the stage of the interview, were explored.

Thirteen instances of heuristic use were noted as follows: Discounting, 8; Disregard of base-rate, 4; and Illusory Correlation, 1. Use of heuristics did not appear to be related to length of interview. Five of the 12 physicians interviewed showed evidence of some heuristic use. Second and third follow-up interviews did not reveal any additional heuristic use.

APPENDIX P

Comparison of Redundancy Items Considered "Important" to Subjects*

Medical:	Simple			Listed			Contextual		
Item	1st year	2nd year	3rd year	1st year	2nd year	3rd year	1st year	2nd year	3rd year
1. Age of child	85	85	83	84	82	84	83	83	83
2. Sex of child	0	0	0	0	0	0	0	0	0
3. Loss of appetite	0	1	0	1	1	0	1	0	0
4. Fatigue	0	0	0	0	0	0	0	0	0
5. Abdominal pain	100	100	100	100	100	100	100	100	100
6. Nausea	100	100	100	100	100	100	100	100	100
7. Vomiting	100	100	100	100	100	100	100	100	100
8. Fever, >100.° F	100	100	100	100	100	100	100	100	100
9. Insomnia due to pain	0	0	0	0	0	0	0	0	0
10. Regurgitation		n/a		100	100	100	100	100	100
11. "feeling like throwing up"		n/a		0	0	0	0	0	0
12. "felt like she when was seasick		n/a		0	0	0	0	0	0
13. "wasn't hungry"		n/a		0	0	0	0	0	0
14. "feels hot"		n/a		0	0	0	0	0	0
15. "tiredness"		n/a		0	0	0	0	0	0
16. "lack of energy"		n/a		0	0	0	0	0	0
17. "not sleeping well"		n/a		0	0	0	0	0	0
18. "pain in stomach"		n/a		0	0	0	0	0	0
19. "a belly ache"		n/a		0	0	0	0	0	0
Mean	4.9	4.9	4.8	5.8	5.8	5.8	5.8	5.8	5.8

n/a: Items 10-19 not available to subject in simple format.
* Numbers show percentages of responses which indicate that this item was considered important in determining answer, i.e., positive responses/possible responses .

Comparison of Redundancy Items Considered "Important" to Subjects*

Non-Medical:	Simple			Listed			Contextual		
Item	1st year	2nd	3rd	1st year	2nd	3rd	1st year	2nd	3rd
1. High intelligence	100	100	100	100	100	100	100	100	100
2. Lacking true creativity	50	50	45	50	50	45	50	50	57
3. Neat	25	25	30	30	25	30	25	25	25
4. Organized	25	30	25	25	25	25	30	25	25
5. Prefers orderly systems	5	0	0	0	0	0	0	0	0
6. Introverted	30	30	25	30	30	25	30	25	25
7. Learns quickly	34	30	25	30	30	25	30	25	25
8. Able to repeat what he has read	0	0	0	0	0	0	0	0	0
9. Doesn't talk a great deal	0	0	0	0	0	0	0	0	0
10. Remembers much of what he is taught	n/a			34	30	25	30	30	25
11. Intelligent	n/a			86	80	80	82	82	82
12. Ability to produce original thought limited	n/a			0	0	0	0	0	0
13. Does not produce much original work	n/a			0	0	0	0	0	0
14. Relatively unimaginative	n/a			41	36	41	41	41	45
15. Tidy	n/a			5	2	2	2	5	0
16. Quiet	n/a			9	5	0	0	0	0
17. Arranges things around him in organized manner	n/a			0	0	0	0	0	0
18. Not prone to emotion	n/a			0	0	0	0	0	0
19. Doesn't take part in conversation around him	n/a			0	0	0	0	0	0
Mean	2.6	2.6	2.5	4.4	4.1	4	4.3	4.1	4.1

n/a: Items 10-19 not available to subject in simple format.

* Numbers show percentages of responses which indicate that this item was considered important in determining answer, i.e., positive responses/possible responses .

Comparison of Base-Rate Items Pictured by Subjects*

Medical: Item	30% Base-Rate 1st year	2nd year	3rd year	70% Base-Rate 1st year	2nd year	3rd year
Category I: Behavior						
1. Shy	3	0	0	0	0	0
2. Outgoing	5	0	0	0	0	5
3. Arrogant	0	0	3	0	0	0
4. Loud	3	3	0	3	3	3
Category II: Race/Ethnicity						
5. Asian	0	0	0	0	0	0
6. White	5	5	5	5	8	5
7. Black	5	5	5	5	5	5
8. Hispanic	8	5	0	8	5	5
Category III: Physical Appearance						
9. Tall	3	3	3	3	5	5
10. Fat	5	0	0	5	0	3
11. Short	0	3	3	3	3	3
12. Thin	3	3	3	0	0	8
13. Average height	0	3	3	0	8	0
Category IV: Socio-economic level						
14. Lower	0	3	0	3	0	0
15. Upper	0	0	0	0	0	0
16. Middle	3	0	0	0	0	0

* Numbers show percentages of responses which indicate that this item was considered when the base-rate question was answered, i.e., positive responses/possible responses .

Comparison of Base-Rate Items Pictured by Subjects*

Non-Medical:	30% Base-Rate			70% Base-Rate		
Item	1st year	2nd year	3rd year	1st year	2nd year	3rd year
Category I: Behavior						
1. Shy	0	0	0	0	0	0
2. Outgoing	100	100	90	95	100	95
3. Arrogant	75	76	76	83	83	76
4. Loud	50	60	63	53	58	63
Category II: Race/Ethnicity						
5. Asian	0	0	0	0	0	0
6. White	0	0	0	0	0	0
7. Black	0	0	0	0	0	0
8. Hispanic	0	0	0	0	0	0
Category III: Physical Appearance						
9. Tall	3	3	3	3	5	5
10. Fat	5	0	0	3	0	3
11. Short	0	0	5	1	0	1
12. Thin	0	0	0	0	0	0
13. Average height	0	0	0	0	0	0
Category IV: Socio-economic level						
14. Lower	0	5	0	3	0	0
15. Upper	0	0	0	0	0	0
16. Middle	5	0	0	0	5	0

* Numbers show percentages of responses which indicate that this item was considered when the base-rate question was answered, i.e., positive responses/possible responses .

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