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Probability judgments about traits: A categorical perspective

Carnot, Catherine Grace, Ph.D.

The Ohio State University, 1990

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PROBABILITY JUDGMENTS ABOUT TRAITS: A CATEGORICAL PERSPECTIVE.

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of the Ohio State University

By

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1990

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To my parents who always provided encouragement
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CHAPTER I
INTRODUCTION

Research Problem. Inferences about probabilities or liklihood are important in many social decisions. In deciding who to hire, or who to accept to a graduate program the decision maker evaluates the liklihood of a variety of possibilities. Often these are liklihood judgments about traits, abilities, or specific categories of behaviors. Possible judgments about traits are based on a candidates record of past behaviors and accomplishments. Given these behaviors, the evaluator asks how likely is it that this candidate will be ambitious? creative? enthusiastic? intelligent? In addition, evaluators are often given letters of recommendation that include trait descriptions and these can be used to make predictions about the liklihood of specific behaviors such as "How likely is it that this person will interact successfully with others and be cooperative?" "How likely is it that this candidate will be successful in integrating information and developing innovative research ideas?" The resulting probability inferences or judgments of liklihood directly affect the final decision.
The present research examines the cognitive processes underlying probability judgments about traits when given behavioral information and judgments about behaviors when given trait information. Specifically, we are interested in the cognitive processes involved in communicating inferences about likelihood using a numerical rating scale. When people are asked to translate their implicit feelings of certainty or likelihood onto a numerical response scale, what knowledge structures are activated and how do people draw upon their prior knowledge and cognitive structures?

The study of the cognitive processes involved in responding to rating scales is an ongoing and growing area of research (See Hippler, Schwarz & Sudman, 1987). The present research will shed light on the psychological processes involved in making probability judgments.

The conceptual orientation of this research is derived from a series of recent papers by Ostrom and colleagues (Ostrom, 1981; Ostrom, 1987; Devine & Ostrom 1988; Ostrom, 1988) where it is argued that the current study of social cognition has moved social psychology beyond the earlier dimensional view of judgment. This dimensional approach is not a single theory but a theoretical and methodological approach that characterizes much of the early work in social judgment. Early theories of social judgment were rooted in psychophysics and ignored many of the intervening
processes that occur during judgment. In contrast, social cognition approaches adopt the representational and process models of the information processing approach. The information processing approach focuses on the role of attention, unitization, knowledge structures and retrieval strategies in the judgment process. The field of social cognition has used and developed methods that allow us to examine the relationship between cognitive processes and judgment.

**History of the Dimensional Approach.** In order to appreciate the implications of the dimensional approach it is necessary to briefly summarize its history. The earliest work in psychology by Wundt and later by Fechner explored how people make judgments about sensory stimuli. These researchers were interested in exploring the relationship between stimulus magnitude (e.g., length) and the subjective experience of magnitude (e.g., rating of length).

Guilford (1954) in his book on psychometric methods provided a formal description of how these early researchers in psychophysics defined the judgment task. He describes three parallel continua of theoretical interest. The stimulus continuum describes the physical magnitude of stimulus intensity. The response continuum is a psychological continuum that records the magnitude of
stimulus intensity. And the judgment continuum contains the location of the perceiver's overt response.

Theories were developed that examined the relationship between the stimulus and response continuum (e.g., Thurstone's law of comparative judgment). That is, how do people come to locate the stimulus on their mental subjective response continuum? Another category of theories focused on the relationship between the implicit mental response and the overt judgment made by the person (e.g., Helson's adaptation level theory, 1964). These theories focused on how people draw on their mental representations and translate their mental "point on a continuum" to the given response format.

The dimensional approach may well be appropriate for exploring how people make judgments about the sensory magnitude of properties of physical objects. The magnitudes of the stimuli used can be objectively measured and our sensory systems may be capable of detecting changes in stimulus magnitude. However, this dimensional approach may not be appropriate for studying social judgments. Social judgments differ from judgments about physical stimuli in that they often rely on retrieval of past experience, relevant knowledge structures, and inferences. Also, with social stimuli there is no basis for an independent stimulus continuum. For example, there is no
appropriate "yardstick" to objectively measure the likelihood of a person possessing a particular trait without relying on human judgment.

Early research on social judgment paralleled work in psychophysics where the judgments were sensory such as the brightness of a light, or the heaviness of a weight (Thurstone, 1927; 1931). It seemed appropriate to apply the same theoretical approach to social judgments. Researchers applied the same conceptual approach to study how people rate "how likable Jack is" as they did to study how people rate the brightness of a light or the heaviness of a weight. This social psychophysics still prevails in recent work (Wegener, 1982, Wedell & Parducci, 1988). For example, Wedell & Parducci (1988) have argued that a range-frequency model (which is a traditional dimensional approach) can account for how people make judgments of life satisfaction.

A prototypical example of a theory that takes a dimensional approach is N. Anderson's (1974; 1981) information integration theory. Information integration is a theory about how people combine different pieces of information to form an overall judgment. This theory examines the relationship between the stimulus continuum and the response continuum. Items of information are located on the stimulus continuum and the point on the
continuum is called the scale value of the information item. Some items carry more weight in determining the subjective impression than others, so the scale value of each item is multiplied by its weight.

Information integration theory investigates how people combine scale values to form an overall impression on the response continuum. Anderson proposed a weighted averaging model to account for how people arrive at a final judgment. In this model all aspects of the impression formation process are reduced to points-on-a-continuum. The meaning of the information is a point (i.e., its scale value). The importance of each piece of information is a point (i.e., its weight). And the final impression or response is also a point. (See Devine and Ostrom (1988) for a comparison of the dimensional versus information processing approach.)

Implications of the Dimensional Approach. Ostrom (1988) points out several metatheoretical implications of a dimensional formulation of human judgment. First, this approach assumes that people can subjectively dimensionalize all judgmental problems. Information about the world is physically coded as falling on the stimulus continuum, and people make finely graded overt reports of their responses on a judgment continuum.

A second assumption pertains to the manner in which stimulus events are represented by the cognitive system.
From the perspective of a dimensional approach, events exist only as points on the three continuua (i.e., stimulus, response and judgment continuua). For these theorists, a stimulus object or event has a physical magnitude, and that magnitude was thought of as a point on the stimulus continuum. The stimulus point evokes a psychological response that is represented as a point on the response continuum. The psychological representation of a response is a point on a subjective continuum.

The major drawback of the dimensional approach is that it is silent on the cognitive activity involved in arriving at a judgment. These theories have no basis for predicting differences in dependent variables used by social cognition researchers such as response time, prototypicality ratings, ease of generating exemplars and others. These theories ignore the many processes involved in deliberative decisions. Moreover, these theories do not address the possibility that different processes occur depending on the specific location of the stimulus item. On the other hand, social cognition researchers have examined the effects of the degree to which a stimulus item matches a concept in memory on a number of these dependent variables.

The Social Cognition Approach. Research in social cognition has made progress by borrowing and extending
models from cognitive psychology. The social cognition approach offers a drastically different conception of what cognitive elements are involved in making judgments. To the dimensional theorist, the cognitive element is a point on a subjective continuum. To the social cognition theorist, mental representations can take on a variety of forms such as categories (Rosch, 1978), scripts (Schank & Abelson, 1977), schemata, (Hastie, 1981; Taylor & Crocker, 1981; Fiske & Taylor, 1984; Brewer & Nakamura, 1984), linear orderings (Potts, 1972), and causal stories (Pennington & Hastie, 1986).

In terms of process, the dimensional approach also differs from the social cognition approach. For example, according to information integration theory, process consists of assigning scale values and weights to items and combining these values according to some algebraic function to produce a judgment. In addition, the process of assigning scale values is assumed to be identical at all points on the subjective continuum. This theory and other dimensional theories ignore the different processes that occur due to item location or scale value. On the other hand, social cognition researchers propose specific processing stages occur as people encode social information, retrieve relevant information in memory, make inferences and integrate relevant information to arrive at
The present research examines the effect of the location of the stimulus item (or in N. Anderson's terminology, the scale value) on the cognitive activity involved in making probability judgments about traits. Research on categorization processes will be reviewed as it offers a theoretical framework for understanding the cognitive activity that occurs as people make probability judgments. Specifically, it is argued that when people are asked to make probability judgments about traits like intelligence or kindness from behavioral information they use the categories "highly probable", "highly improbable" and "uncertain". However, the "probability categories" used are likely to be highly domain specific. For example, the three categories used for intelligence judgments might actually be intelligent, stupid and irrelevant. Using theories about the representation of category structures, predictions are derived about the effects of item location on the dependent variables judgment time, ease of generating category exemplars, goodness of those exemplars, and the content of explanations given for probability judgments.

At this point, it is important to distinguish the dimensional view discussed in Ostrom's writings with the dimensional view of category representations. For example,
the comparative distance model of category representation proposes that categories and instances of categories are represented in a multidimensional psychological space and people classify objects by computing the metric distance between the object and concepts (Reed, 1972; Palmer, 1978; Rosch, Simpson and Miller, 1976; Rips, Shoben and Smith, 1973). As dimensional approaches, the two views are similar in a number of ways. They both propose an internal psychological continuum where concepts are represented as points on this continuum. However, they also differ in substantial ways. Specifically, when Ostrom speaks of dimensional theories he is referring to a metatheoretical approach taken by social psychologists that developed out of accepting the assumptions of early psychophysical models.

Most theories in social psychology do not speak to recent issues of concept representation or underlying processes. Rather, they begin by proposing a dimension (e.g., the internal/external dimension in attribution, the pro/anti dimension in attitudes) and focus on the antecedents and consequences of location value. It seems that the dimensional tradition we are left with has had long lasting implications for how current theories are developed and new research avenues explored.
In contrast, the recent dimensional theories in the category literature are more specific theories about how category members are represented by the cognitive system. Specifically, categories and their members are represented psychologically as points in a multidimensional space. These theories can be criticized on similar grounds as traditional psychophysical theories. In addition there are a number of empirical findings that are problematic for the notion that concepts are represented as points along relevant dimensions. The dimensional view of concept representation and problematic research findings will be discussed in detail in the next chapter.

Implications for Social Psychology. The dimensional reasoning is evident in nearly every area of social psychology. For example, attribution theorists propose a dimension ranging from dispositional to situational causes. (See Ostrom, 1981 for a discussion of this dimensional view of attributions). Research is concerned with developing a model of how to explain how a person's attribution came to be located at a particular point on the continuum. Other research areas where the dimensional approach is apparent are studies of attitude, impression formation, decision making, survey research, attraction, and prejudice. In many of these areas, researchers begin with proposing a judgment continuum and then focusing on the factors that
would affect a person’s location on that continuum and the resulting consequences of the item location. Attributions, and attitudes will be briefly discussed. Decision making and its use of the probability concept will be explored in chapter four.

**Attributions.** Theories of attribution attempt to explain how people make judgments about causality. Early theories focused on how people combined information to make an overt judgment on the external-internal continuum. Although early researchers did not propose algebraic models, most of these early theories can be modeled by one of N. Anderson's (1974; 1981) cognitive rules. For example, Kelley’s (1967) ANOVA model is concerned with how people combine consensus, distinctiveness, and consistency information to make an attribution. Also, Jones and Davis (1965) proposed the theory of correspondent inferences which made predictions about what type of information was discounted or given less weight in the attribution process. The final attribution judgment was most often regarded by these theorists as a point on the subjective continuum of internality-externality. Recently, attribution researchers have begun to study attribution processes from a social cognition framework. They have begun to realize the importance of understanding the cognitive processes involved in making attributions. For example, social
cognition researchers have examined the relationship between the recall of inconsistent information and attributions (Crocker, Hannah & Weber, 1983), and the construction of causal stories (Pennington & Hastie, 1986).

**Attitudes.** Historically, attitudes have also been treated as points-on-a-continuum. The prevalence of combinatorial theories such as information integration theory (N. Anderson 1974; 1981), expectancy-value theories (Rosenberg, 1956; Fishbein & Ajzen, 1975) and probabiliological theories (McGuire, 1968; 1981 Wyer & Goldberg, 1970; Wyer & Carlson, 1979) are evidence of this dimensional approach to the study of attitudes. These early researchers regarded the evaluative property of attitudes as a point on a dimensional continuum. The attitude measurement task was to locate a person's attitude on the evaluative dimension.

The social cognition approach offers a new orientation to study attitudes. As argued by Ostrom (1988), the information processing approach suggests more of a categorical than a dimensional analysis of judgments. Evaluation has been viewed by some social cognition theorists as evaluative tags linked to the attitude object which is represented as a node in a network. These evaluative tags do not indicate extremity but only indicate whether the cognition is favorable or unfavorable (Bower,
Recent research has investigated the structure of attitude related knowledge using social cognition methodology such as recall, recognition and response time. For example, Judd and Kulik (1980) found that information items rated at the extremes of an attitude scale were recalled best. In their study, subjects were presented with Thurstone scaled attitude statements on the topics of women's rights, capital punishment, and majority rule in South Africa. Subjects rated their agreement with each statement and also rated each statement on the degree to which it reflected an extremely pro or extremely anti position. They found that items rated at the extremes of the continuum were recalled best. Also, subjects were fastest in providing their opinion for items at the extremes of the attitude continuum. These results were interpreted as support for a bipolar structure of attitudes. Attitudes may act as a bipolar schema that contain representations of very agreeable and very disagreeable points of view. Information that closely matches these expectations is more easily judged and recalled than information that does not match so well. These results have been replicated by Pratkanis (1989) who in addition found evidence that some attitudes (e.g. attitude toward sports) may have a unipolar structure.
Another line of research that has employed social cognition methods to investigate attitudes is the work by Fazio and colleagues (see Fazio, 1986 for a detailed review). Fazio has developed a process model of how attitudes guide behavior. The model begins by assuming that a person's attitude may influence the person's perception of an attitude object. However, this can only occur if the attitude is activated from memory when the individual encounters the attitude object. Once activated the attitude guides the processing and interpretation of further information. Fazio's research program has tested this model using response time as a measure of attitude accessibility. This research assumes that the speed with which people can respond to a question about their attitudes corresponds to the likelihood that the attitude is spontaneously activated when the person encounters the attitude object. This model and the related research provide a framework for understanding the moderators of the attitude-behavior relationship (e.g., attitudes based on past experience, repeated attitudinal expression). The use of social cognition theory and methodology have provided insight into the attitude-behavior relationship and the qualitative features of attitudes that would not have developed from a dimensional approach.
Bipolar Survey Responses. Ostrom (1987) argued that research should begin to examine the cognitive responses underlying responses to surveys. Specifically, researchers should examine how people give meaning to different response alternatives and how they decide which alternative corresponds to their belief.

The present research directly tests Ostrom's proposal that people's implicit responses are categorical. In particular, it is proposed that when people are asked to make probability judgments they develop and use the three categories "highly probable", "highly improbable" and "uncertain". These concepts are then used to give meaning to the endpoints and to the midpoint on the response scale. These locations on the response scale are unique in that they have clear conceptual meaning (unlike the other probability values). This leads these locations to be used as reference points and subjects compare their degree of belief with these concepts, and determine the degree of match before choosing a response alternative.

Overview of Literature Review. In the next chapter, the literature on categorization processes and concept representation will be discussed. The third chapter will discuss trait inferences and traits as categories. The fourth chapter will review traditional approaches to probability judgments and delineate the hypotheses derived from the categorical approach to probability judgments.
CHAPTER II
CATEGORIES AND CONCEPTS: REPRESENTATIONS AND PROCESS

Most of the research on categorization of natural objects has concentrated on the representation of physical and biological categories such as furniture, vehicles, fruit, birds and animals (Rosch and Lloyd, 1978) although recent work has used different types of concepts such as goal-derived or ad hoc categories (e.g., "things to eat on a diet", "things to take camping" (Barsalou, 1985)). In addition, social psychologists have begun to apply the notion of prototypes and categories to the domain of person perception (Lingle, Altom, and Medin, 1984; Cantor and Mischel, 1977; 1979a; 1979b; Skowronski and Carlston, 1987; 1989) and personality (Buss and Craik, 1980; 1981; 1985). In this chapter research on categorization processes will be discussed, focusing primarily on the literature that developed out of examining object categories. However, research in social cognition will also be discussed when relevant. The next chapter will focus exclusively on the trait inference process and research that has applied the categorical approach to person perception.
**Purposes of Categorization.** Rosch (1978) points to cognitive economy as the basis of category formation. This principle is based on the assumption that organisms want to gain a great deal of information from the environment while conserving cognitive resources. The categorization process leads to considering a stimulus as equivalent to other stimuli in the same category but also different from stimuli not in that category. The purpose of categorization is to "reduce the infinite differences among stimuli to behaviorally and cognitively usable proportions." (p. 29).

A second purpose of categories is their use in making inferences (Lingle, Altom and Medin, 1984). By classifying something as an instance of a category, we can draw inferences about related attributes. Classifying something as a truck, permits inferences about what it is made of, how to operate it, how it functions, and how to take care of it. These inferences are useful in making predictions about objects in our environment and help us to relate to them in appropriate ways. This inferential function of categories points to their usefulness in situations where people have limited information. If given a category, we can generate inferences about likely features of the instance, and this can provide us with useful information. This function of categories is in contrast to the
traditional view that knowledge structures develop as a way of dealing with information overload (i.e., Rosch's (1978) discussion of cognitive economy). Indeed, (Medin, 1989) argues that categories are most useful in situations where there is limited information, due to their aid in generating inferences.

Generation is another example where categories serve to provide useful information. Medin and Barsalou (1987) discuss the generation-purpose of categories. Generation involves going from concepts to instances of the concept. With general knowledge categories, generation occurs after the concept has been instantiated. For example, the concept "things to eat on a diet" may include carrots, grapefruit, diet soda, and lean meat or the concept "things to take on a camping trip" may include tools, clothing, food, a tent, a lantern and some matches. Generation is useful especially with goal-derived categories where the instances are used to meet the requirements necessary for achieving some goal (Barsalou, 1985).

A third purpose of categorization is understanding. Categorization into social roles or trait categories often serves the function of understanding the causes of a person's behavior (Lingle, Altom & Medin, 1984). Classifying someone as an extrovert, helps us to understand the reasons behind their actions and also allows us to
make predictions about the likelihood of future behaviors. Once a person is categorized as possessing a particular trait like honesty, kindness, or intelligence, a host of likely behaviors become available. This understanding purpose has been the focus of recent discussions of the role of theories in conceptual coherence (Medin, 1989; Murphy and Medin, 1985; Medin and Wattenmaker, 1987) where it is argued that categories are in part explanation based. This view departs from traditional feature/exemplar views of categories and focuses on how people explain the relationships between features of an object.

**Representation of Categories**

**The Classical View.** One view about how categories are represented dates back to Aristotle and is referred to as the classical view. This view proposes that each concept is represented as a summary representation that includes a set of independent features that are both necessary and sufficient for category membership. For example, for a person to be classified as a bachelor, the necessary and sufficient features are single, and male. This defining feature assumption implies that natural concepts are never disjunctive or even partially disjunctive. That is concepts can not be represented as a set of features where instances must have either feature a,b,c or x,y,z to be considered a member of the concept.
There are a number of research findings that are problematic for the classical view. First of all, it is often difficult to come up with the defining features of a concept (e.g. define a game). The second, more devastating blow to the classical view comes from research findings that indicate that categories have a graded structure where members of the category differ in the extent to which they are "good" or typical examples of the concept. For example, a robin is a more typical example of a bird than a penguin or a turkey. The typicality of an example has been found to be related to a host of dependent variables used in research to study cognitive processes. For example, the more typical an instance is as a member of a category, the faster it can be categorized. These research findings on the effects of typicality on cognitive processes provide the basis for the present research and will be examined in detail later in this discussion.

The Featural View. The featural approach to category representation assumes that concepts are the result of an abstraction process which results in a summary representation (often referred to as a prototype). This summary representation is a set of features that are salient ones that have a substantial probability of occurring in instances of the concept. For example, if the feature "has four legs" is represented with chair then it
must be a salient feature of chairs. Moreover, given that an object is a chair, there must be a high probability that it has four legs.

Although there are various models of concept representation based on the featural approach (Collins & Loftus, 1975; Smith, Shoben & Rips, 1974; Hampton, 1979; McCloskey & Glucksberg, 1979; Hayes-Roth & Hayes-Roth, 1977) only the spreading activation model (Collins & Loftus, 1975) and the feature comparison model (Smith, Shoben & Rips 1974) will be discussed here.

The spreading activation model is used to explain how people decide whether or not a test item is a member of a concept. Collins and Loftus (1975) proposed that concepts were represented as summary descriptions consisting of features that can be either necessary or nonnecessary. Each feature is weighted by its importance in determining concept membership. This weight is designated the criteriality of the feature. The proposed structure is a network structure where features are connected to concepts by labeled links that are weighted by their criteriality. These labeled links confer the type of relationship between features and concepts. For example, part relationships are labeled "has" (e.g. "has 2 arms"), global characteristics are labeled "is" (e.g. "is fierce") and activities or functional relationships are labeled "can" (e.g. "can
When subjects are asked to decide whether or not a test item is a member of a concept activation spreads through the network from both the test item and the concept. If two sources intersect then the paths are evaluated to determine if there is a shared feature. The cognitive system keeps track of the amount of positive evidence (i.e. number of shared features weighted by their criteriality) to determine if it exceeds a positive threshold. In addition, negative evidence is accumulated if two mutually exclusive features are activated (e.g. carnivorous and omnivorous) or if there are a number of features that do not overlap. This negative evidence is tested against a negative threshold.

The spreading activation model can account for graded structure in categories by proposing that typical instances share more features with their concepts than atypical instances and the features of typical concepts have higher criteriality weights. Therefore, they accumulate positive evidence at a more rapid rate than do atypical instances.

The feature comparison model (Smith, Shoben and Rips, 1974) is similar in that it also proposes that concepts and instances are represented as summary descriptions of their features. A distinction is made between defining features
which are necessary features for category membership and characteristic features which are not necessary but have a high occurrence in category members. For example, "can fly" would be a characteristic feature for birds since most, but not all, birds can fly. However, "has wings" would be a defining feature since all birds have wings. All features of an object, both defining and characteristic, are represented and weighted in terms of their importance in conferring concept membership. However, in this model categorization is based on a two stage process.

In the first stage, weights are ignored and subjects simply determine the number of shared features, both defining and characteristic, between test item and concept. If the number of matches exceeds an upper criterion then there is no need for the second stage to execute and the subject reports "yes". Similarly, if the number of matches is below some lower criterion, then there is no need for the second stage and the subject reports "no". However, if the number of matches is between these two criterion, then the second stage is executed.

In this second stage, processing is more deliberate and accurate as feature weights are evaluated. It is in this stage that only defining features (i.e., those necessary for category membership) are evaluated. This model can also account for typicality effects. Since
typical instances share more features with concepts, they can be evaluated more quickly, during first stage processing. For example, subjects can readily classify an apple as a fruit since apples and fruit have a number of shared features. However, tomato will take longer to classify as it may take second stage processing where only defining features are considered. This model has been extended to explain response times for judgments about implicit personality theory (Ebbesen and Allen, 1979).

The Dimensional View. The dimensional view of category representation assumes that concepts can be represented as points in multidimensional space. The dimensions used are ones that are salient and have a relatively high probability of occurring in members of the concept. An additional assumption is that the dimensional value of the concept is the average of the values of the concepts' instances on this dimension. That is, in a multidimensional space, the concept falls in the middle of its instances.

Particularly relevant to the present research is the dimensional view's assumption that the cognitive system is able to represent continuous dimensions such as size, and traits on a psychological continuum. Most theorists who have used the dimensional approach have assumed that psychological distances should display the same metric properties that physical distances do. One example of a
model that assumes metric distances, the comparative

In the comparative distance model (Reed, 1972; Palmer, 1978) both instances and concepts are represented as points in a multidimensional space. Often the representation is determined by using multidimensional scaling solutions for similarity ratings. The relationship or similarity between concepts and instances is assessed by computing the distance between any pair of concepts or instances taking into account the distance between the test item and contrast concepts. In order to classify an object as an instance of a category, the metric distance between them must be less than the distance between the instance and the contrast category. Also, the greater the difference between the distance from the instance to the target concept and the distance from the instance to the contrast concept the faster and more accurately the instance will be categorized as a member of the target concept.

According to the comparative distance model, all that is considered are the points representing the items and the metric distance between them. It isn't necessary to break down the summary representation and examine component features. This model has been used in studies of natural concepts (Rips, Shoben and Smith, 1973; Rosch, Simpson and Miller, 1976) and artificial concepts (Hyman and Frost, 1975) and discussed by Reed (1972) and Palmer (1978).
The comparative distance model can also account for typicality effects by including the following assumption. The less distance there is between the concept and the test item, the faster and more accurately the item can be categorized as a member of the concept. Since typical instances are more similar to the concept, and less similar to contrast categories they will be closer to the representation of the concept than atypical instances.

Problems with the Dimensional Approach. There are a number of criticisms of the dimensional approach to concept representation. First of all, experiments by Rosch and Mervis (1975) used an attribute listing task. In these experiments, subjects were much more likely to list features than dimensions for both natural concepts and artificial categories. That is, the properties generated by subjects were qualitative, discrete features that an instance either had or did not have (e.g., has four legs, can be sat on, has wings, can fly) rather than as some value on a dimensional continuum (e.g., is small).

A more damaging blow to the dimensional view was provided by Tversky (1977) who presented evidence that seriously questions the accuracy of models that include assumptions of metric distances. Moreover, Tversky argues that the featural approach is a more appropriate model of concept representation. Although dimensional
representations may be appropriate for certain physical stimuli such as color or tones, "it seems more appropriate to represent faces, countries, personalities in terms of many qualitative features than in terms of a few quantitative dimensions." (p.328).

Tversky (1977) provided evidence for asymmetry in similarity judgments. Asymmetry in similarity judgments is defined as occurring when the judged similarity of object A to object B does not equal to the judged similarity of B to A. For example, the similarity of an ellipse to a circle is greater than the similarity of a circle to an ellipse. Tversky's theoretical explanation for asymmetry includes reformulating the similarity judgment task as a feature comparison process. Objects are represented as collections of features and the similarity of object A to B is a matching function of the shared features of A and B, the distinctive features of A, and the distinctive features of B (although as we shall see, the distinctive features of B are used to a lesser extent).

A critical assumption of Tversky's analysis is that people naturally focus on the subject of comparison. This focusing hypothesis holds that the features of the subject are weighted more than the features of the referent. For example, when people are judging the similarity of a circle to an ellipse, people naturally give more weight to the
circle. This focusing hypothesis implies that similarity will be reduced more by distinctive features of the circle than the ellipse.

Asymmetric judgments occur when one object is more salient or prototypical than the other (e.g. A circle is a more prototypical shape than an ellipse). Asymmetry is due to the decrease in perceptions of similarity when the prototypical object is the subject. This is a result of the salience of its distinctive features as a prototype and its focus as the subject. This explains why an ellipse is seen as more similar to a circle than vice versa. The salience of the distinctive features of the circle decrease perceptions of its similarity to an ellipse when circle is the subject.

Tversky’s theory of similarity provides an in-depth proposal of how similarity judgments are made. This is important since most of the current categorization models are based on feature matching, prototype matching, exemplar matching all of which include assessments of similarity. A number of applications of Tversky’s theory have appeared in the social cognition literature. Self-other judgments of similarity were examined by Srull and Gaelick (1983). They manipulated whether or not the self was the object or reference of the comparison process. Subjects were asked to judge the similarity of the self to another. The
result was greater ratings of similarity when the other person was compared to the self than vice versa. This is consistent with the view that self knowledge contains greater amounts of unique information relative to knowledge of others. Also, Houston, Sherman and Baker (1989) have examined the effects of unique versus shared features and direction of comparison on preferences.

Social cognition researchers have also addressed the categorical versus dimensional representation issue. Brewer (1988) proposed a model of impression formation that emphasizes social categories as person types rather than as trait dimensions. Research that has compared multidimensional scaling representations of social stimuli to clustering representations of the same data (which is based on discrete categories) also challenges the assumption that similarity judgments among social objects can be mapped by geometric models (Powell and Juhnke, 1983; Tversky and Hutchinson, 1986). Multidimensional models are inadequate since humans may only process along a limited number of dimensions at one time. Prinz and Scheerer-Neumann (1974) found that when the number of relevant dimensions in a classification task exceeds two or three, subjects resort to a feature detection strategy rather than discriminating along dimensions. In summary, there are empirical findings that are problematic for the notion
that concepts and instances are represented as points in dimensional space.

**The Exemplar View.** The other major view of category representation is the exemplar view. This view differs from featural and dimensional views in that it does not include the assumption that categories are summary representations. Rather, the concept contains representations of instances of the category. There are a variety of exemplar views ranging from completely exemplar based models (Hintzman and Ludlam, 1980, Hintzman, 1986) to mixed models that contain both exemplars and abstractions. The major claim of these models is that exemplars play an important role in categorization and are often more accessible than summary information.

**Proximity Model.** The proximity model (Reed, 1972; Hintzman and Ludlam, 1980) is the most extreme example of the exemplar approach. In this model, each concept is represented by all of its instances that have been encountered. When a new test item is presented, the instance in memory that is most similar to it is retrieved. A test item will be categorized as an instance of a concept if and only if the item that is retrieved is a member of the target concept. The proximity model proposes that concept representation does not include abstraction and every exemplar encountered is represented.
Exemplar based models of social categories have also been proposed. Smith (1988) applied Hintzman's (1986) MINERVA model to trait categorizations and argued that exemplar based models could account for category accessibility effects which have traditionally been explained using prototype based approaches (Srull and Wyer, 1979). In Hintzman's model, each experience is encoded and represented in memory by a number of features. Every experience is stored in memory, including those which are similar to earlier experiences. A person's classification of a new instance is based on the similarity (defined as shared feature values) of the new instance to the stored traces.

Although exemplar models have received some support (Reed, 1972; Medin and Schaeffer, 1978; Hintzman and Lundlam, 1980) the major problem is the lack of restrictions on the number of exemplars represented. Since people could conceivably encounter a huge number of instances for some natural concepts it is unlikely that the representations of concepts would include them all. Yet this criticism is based on a view of memory storage as limited, a view that has been challenged by researchers who work with distributed memory models (Rumelhart and McClelland, 1986).
Another possible model that does restrict the type and number of exemplars is what Smith and Medin (1981) refer to as the best-examples model. This model is based on the work of Rosch and her colleagues and includes the proposal that the exemplars represented are the ones that are typical of the concept or what Rosch refers to as focal instances. Recent work has also focused on mixed representational models that include both exemplar information and summary information or a prototype abstraction process (Homa, Sterling and Trepel, 1981; Elio and Anderson, 1981; Busemeyer, Dewey and Medin, 1978; Medin, Altom and Murphy, 1984).

**Conceptual Coherence: The Role of Theories.** An important paper by Murphy and Medin (1985) (See also Medin, 1989) addressed the question "Why do we have the categories that we have and not others?". What is the "glue" that holds categories together? They argue that categories are more than just a collection of features, or exemplars. A similar argument was made by Armstrong, Gleitman and Gleitman (1983) who presented the example that even all the features of bird, "has wings, feathers, a beak, can fly" do not make the object a bird unless these properties are held together in a "bird-like structure". Thus, the representation of a concept has to include more than just a list of features. Rather, it must also include knowledge
about the relationship among features and the reasons for the collection of features.

Murphy and Medin (1985) further argue that similarity-based, feature matching approaches are inadequate to account for categorization processes. Instead, peoples' general knowledge and naive theories about the world affect the degree to which concepts are coherent. For example, there is more than a simple link in memory noting that "has wings" and "can fly" are often correlated. Rather, people deduce reasons for these correlations. These reasons or causal explanations for how features are related are essential components of the representation.

This approach is especially useful to social cognition researchers as it points to the relevance of the inference process, and the generation of explanations, possible causes and contexts for events. The notion that categorization is based on similarity alone or the number of attribute matches is indeed limiting, especially when dealing with more flexible, abstract concepts, such as trait categories, or social stereotypes. Murphy and Medin provide the following example of the use of inference processes in social categorization. Given the behavior, "jumped into the swimming pool with one's clothes on", a person may decide the person was intoxicated, even though this specific behavior is probably not associated with the
concept intoxicated. However, categorizing the person as intoxicated may be useful as an explanation for the behavior. In this case, the category label serves as an explanation for the event.

The inference process may also include generating a possible context for the behavior (e.g., perhaps the person was at a party on a warm summer’s night, people were drinking and getting rowdy). Another possible context to explain this behavior is that the person jumped into the pool to save someone from drowning. In contrast to this explanation based approach, similarity based approaches would argue that in order to categorize someone as intoxicated, the perceiver would match attributes from the concept intoxicated (e.g., performs silly behaviors, slurs words, staggers) to the behaviors of the person. Murphy and Medin’s (1985) discussion is enlightening and offers a useful critique of the current state of categorical models. Moreover, it appears useful in bridging the gap between research in social cognition where categories are more abstract and flexible than the object categories (like furniture, vehicles) used in early categorization research.

Typicality Effects. Rosch and her colleagues (Rosch, 1973; 1975; Rosch & Mervis, 1975; Rosch et. al. 1976a; Rosch et. al.1976b; 1978) provided the impetus for research on the internal structure of both perceptual and semantic
categories. Although philosophers had proposed the notion of fuzzy categories (Wittgenstein, 1953) Rosch (1973) was the first to collect empirical data to support this proposal. Rosch (1978) argued that natural categories are not well defined. Rather they are fuzzy and organized in terms of their prototypes or most typical or average examples. This contrasts with the classical view of category representation that proposed that categories were defined by necessary and sufficient attributes or "defining features." Rosch et al. (1976a) studied three different types of categories: i) superordinate semantic categories such as furniture or vehicles ii) basic level semantic categories such as chair and car and iii) artificial categories formed by letter strings.

Rosch (1978) proposed that the degree of typicality or degree of category membership depended on the number of commonly shared attributes. Rosch and Mervis (1975) devised a measure of attribute sharing which they called family resemblance. This is a measure of central tendency. The most typical chair is an average chair, made of wood with four legs.

In one experiment (Rosch and Mervis, 1975) subjects were asked to list the attributes possessed by one item from each of six categories. Groups of twenty subjects saw a different item from each of twenty items falling in each
of the categories furniture, fruit, weapons, vehicles, vegetables and clothing. Examples of the types of attributes written are: "you drive it", "has legs", "you can eat it". Next each attribute received a score from 1-20 representing the number of items in the category which had been credited with that attribute. The measure of family resemblance for an item was the sum of the scores for each of the attributes that had been listed for that item.

There are a number of results of Rosch and Mervis' (1975) research that are problematic for the "defining features" or classical view. For 4 of the categories only one attribute was listed as true of all items, for the other two categories, none. On 3 cases, the single common attribute was "you eat it" which is true of many other things. On the whole, attributes would be true of some, but not all members of the category. If subjects were indeed listing what they considered defining features, the results certainly don't support the "necessary and sufficient view".

Rosch (1975) also obtained ratings of prototypicality of the objects by having subjects rate on a 7 point scale the extent to which an item fitted their idea or image of the category names. The means of these ratings served as an index of prototypicality. It is important to point out
that subjects find this a natural task and there is considerable agreement across subjects as to which instances are most prototypical and which least. Moreover, the correlations between these prototypicality ratings and the rank orders of family resemblance scores ranged from .84 to .93. These results indicated that the degree of membership of the category is correlated with category structure as measured by the number of commonly-shared attributes.

Following this initial research, prototypicality of items within a category was shown to affect a host of major dependent variables used in psychological research to study cognitive processes.

Response Time. Response time is one of the most widely used dependent measures to study processing in semantic memory. Research in categorization found that subjects can judge true statements about category membership more quickly for items that are rated as more typical. In these experiments subjects are asked to respond true or false to statements of the form: X item is a member of category Y. This finding has been confirmed with natural taxonomic categories such as birds, and vehicles (Rosch, 1973, Rips, Shoben and Smith, 1973) and also with artificial perceptual categories such as letter strings (Rosch et. al. 1976).

Response time has also been used by social cognition researchers in a variety of domains. For example, Ebbesen
and Allen (1979) examined the cognitive processes in implicit personality trait inferences by measuring the time it took for subjects to decide whether or not two traits were likely to co-occur. Results indicated that subjects took less time to affirm and more time to deny that two traits co-occurred, the greater the semantic similarity of the two traits.

Cohen (1977) also found evidence for the relationship between response time and typicality using social information. Subjects decided whether particular attributes were characteristic of given occupations. "False" reaction times increased and "true" reaction times decreased as the rated typicality of the attribute to the occupation increased. Markus (1977) found similar results for decisions about the self. Reaction times for "like me" decisions about trait attributes decreased as the rated self-applicability of the trait terms increased.

Recent research in the attitude domain has also examined the response time for ratings on an agree/disagree response scale and found faster judgments for items that were extremely agreed or disagreed with than with items that elicited less extreme ratings (Judd and Kulik, 1980; Pratkanis, 1989). These researchers argued that attitudes are bipolar knowledge structures that contain representations of very agreeable and disagreeable points
of view. Information that is "typical" or closely matches one of these representations is more easily evaluated than information that does not match as well. Across these domains, the response time for classification is affected by the typicality or similarity of the item to the concept.

**Exemplar Generation.** Item output is used in cognitive research to reflect aspects of encoding, storage, retrieval or category search. Rosch (1975) found that typicality ratings were significantly correlated with the probability with which college students listed instances of superordinate categories. Moreover, this effect was also found with artificial categories (letter strings) where frequency of experience was controlled. (Rosch et. al. 1976b).

In his comparison of common and ad hoc categories (i.e., categories that form spontaneously and are goal derived) Barsalou (1983) also used the method of exemplar production. By examining the number of exemplars generated in a specific time period and the uniqueness of those exemplars, he found that exemplar production is more consistent for common than for ad hoc categories. Also, subjects generated more exemplars for common categories than for ad hoc categories.

The ease to which subjects can generate exemplars may also depend on the degree to which the category "is
anchored with content". In other words, some locations along a dimension may be rightfully considered to be concepts in that they contain exemplars, and prototypes while others do not. In a discussion of psychological perspective theory Ostrom and Upshaw (1968) reported an experiment where subjects read a list of 9 rating labels ranging from "very pro-fraternity" to "very anti-fraternity" and for a second issue "pro-church" to "anti-church". Subjects were then asked to generate a specific belief for each of the 9 rating categories. The ease of generating a statement for each of ratings was the major dependent variable. Results indicated that subjects found it easier to generate attitude statements for the end anchors and for the value that represents the midpoint of the attitude scale than for the other places along the continuum. This indicates that these locations on the rating scale are given conceptual meaning and serve as categories while other locations do not.

Linguistic Hedges. Natural language provides additional evidence that categories are fuzzy and membership is not all or none. English has developed linguistic properties for coping with the graded structure of category membership where some members are more typical than others. Lakoff (1973) further developed the logic of fuzzy set theory that was originally proposed by Zadeh
(1965) by examining linguistic structure. Lakoff proposed that certain words implicitly involved fuzziness. These words called hedges functioned as deintensifiers making assertions fuzzier. For example, a penguin is only "technically" a bird or a person may be described as "sort of" tall. There were also some words that function as intensifiers making assertions less fuzzy. For example, people might assert that a robin is a bird "par excellence", or describe a person as "extremely tall". However, the study of hedges in classification hasn't received much attention in the study of categories.

**Category Learning.** Anglin (1976; as cited by Rosch, 1978) found evidence that young children learn category membership of good examples of categories before less typical examples. Moreover, Rosch (1976) found that in learning of artificial categories, the prototypicality of the instance predicted speed of learning the categories.

To summarize, there is evidence that the prototypicality of category members is related to a number of dependent variables that have been used to measure psychological processes. Three of these, response time, exemplar generation and the use of statements to assert distance from categories in explanations for judgments will be examined in the present research.
Determinants of Graded Structure. The differential ease of classification of instances has been referred to as "typicality" "exemplar goodness" and "graded structure". The explanation for these effects centered on the notion that categories were fuzzy in nature and the instances varied in the extent to which they were good fits to the concept. Graded structure refers to this continuum of category representativeness, beginning with the most representative members and continuing through its atypical members to those nonmembers least similar to category members (and more similar to contrast categories). The more similar a category member is to the prototype, the more easily it should be classified as a category member. Moreover, this also applies to nonmembers. That is, the more similar a nonmember is to the prototype the more difficult it will be to exclude it from the category (Medin & Barsalou, 1987).

So far, this review has focused on only one determinant of typicality -- family resemblance. Family resemblance scores were used by Rosch and colleagues as a measure of the average similarity of an instance to other category members. In order to include the notion that people use contrast categories, it was proposed that people rate typicality by considering the similarity of the item to the central tendency of other category members and the
dissimilarity to the central tendency of contrast categories.

However, recent work by Barsalou (1985) examined other determinants of graded structure in category representations: ideals, familiarity of exemplar and frequency of instantiation.

Ideals are attributes that exemplars should have if they are to best serve a goal associated with the category. Barsalou (1985) used the following examples of goal-derived categories in his research: things to take from one's home during a fire, birthday presents, things not to eat on a diet, personality characteristics in people that prevent them from having friends. For each of these categories, there is an ideal value of a particular attribute. For the previous examples, the attributes are: how valuable people think it is, how happy people are to receive it, how many calories it has, and how much people dislike it, respectively. What is interesting about these categories is that the most typical instances do not correspond to the average of the other members. Rather they often fall toward the extremes (e.g. zero calories, the most valuable items, etc.).

However, ideals are not only used with goal-derived categories. It may be that the most typical examples for trait categories are also ideals. For example, we may have
a concept of the perfect (or near perfect) introvert or intellect and use this ideal to make trait judgments. The typical examples of behaviors or persons who exemplify traits like kindness, honesty, intelligence and others tend to be examples that are not the average members but the extreme members in the trait category.

Although the early work by Rosch and colleagues did not find evidence that frequency affected typicality ratings, more recent work has found evidence that familiar exemplars are perceived as more typical than unfamiliar exemplars (Malt and Smith, 1982; Hampton and Gardiner, 1983). Barsalou (1985) distinguishes between familiarity and frequency of instantiation. Although a person can be familiar with an object, the object may not have been instantiated as a member of a specific category. Barsalou (1985) provided the following example. People are probably more familiar with the object chair than with the object log. However, the object log has probably been more frequently instantiated with the category firewood than chair has. Barsalou argues that although both familiarity and frequency of instantiation could be determinants of typicality frequency of instantiation is the more important factor.

Use of Contrast Categories. Rosch and Mervis (1975) proposed that in deciding whether or not an instance was a
member of a concept or not subjects considered the amount of shared features between the test item and the target concept. In addition, the amount of featural overlap between the test item and contrast categories is also considered. Contrast categories were elicited by asking subjects questions like the following: "If something is not a chair, what is it?" In this example, categorization of an object as a chair is more efficient if the test item shares few features with the contrast concepts of sofa, stool, and cushion.

In the present research in experiment three, subjects were given behaviors and asked to make probability judgments about traits or vice versa. The trait that was used in the instructions was either intelligence or kind. The behaviors that were presented varied in intelligence (or kindness) and included behaviors that were extremely stupid (or unkind). In addition to having subjects make probability judgments, we also had subjects provide written explanations for their judgments. This allowed us to examine whether or not subjects made use of the contrast categories (stupid and unkind) when given the stupid and unkind behaviors.

The importance of contrast concepts was incorporated into formal treatments of categorization processes (Rosch, and Mervis, 1975) by proposing the notion of the cue
validity of a feature. The cue validity of a feature F in respect to a target concept X increases with the probability that F occurs with instances of X and decreases with the probability that F occurs in instances of a contrast concept. Therefore, the more probable it is that a feature comes from a contrast concept the less evidence it supplies for the target concept. The notion of cue validities is important because it points to the use of contrast categories in classification tasks.

**Direction of Inference Effects.** Cue validity has been defined as a measure of the diagnosticity of a feature for category membership. If a feature has high cue validity for a category then there is a high probability that an item with that particular feature is an instance of the corresponding category. For example, the feature "has feathers" has high cue validity for the category bird since there is a high probability that an object that has feathers is a bird. In contrast, features that are inferrable from category membership are said to have high category validity. That is, if a feature has high category validity then given that something is an instance of a category then it has a high probability of having the particular feature. For example, the feature "has feathers" also has high category validity since knowing that something is a bird allows us to infer with confidence
that it also has feathers. Although, cue validity has been
explored in the categorization literature there has been
little work examining the differences in the features used
in classification tasks versus features used in inference
tasks.

An important issue is whether or not the inferred
attributes of category members are similar to the
attributes used during initial classification (Lingle,
Altom and Medin, 1984). For natural object categories
Lingle et. al. note that there seems to be a closer
 correspondence between attributes inferred on the basis of
category membership and the attributes used during
classification (although Feldman (1988) disagrees that this
is a social/nonsocial distinction). One might classify an
object as a chair and infer that it is used to sit on or
observe that it is used to sit on and use that fact to
classify it as a chair.

Smith and Medin (1981) actually conceptualize the
inference process as the categorization process run in
reverse. This would be true if categories were
represented by their defining attributes as the classical
view proposes. Yet this doesn't seem appropriate for social
categories and especially not for traits or occupational
roles. For example, if traits are summary representations
of behaviors one might infer that an honest person would
not be likely to cheat on a test. However, knowing that a person did not cheat on a test doesn’t necessarily mean that the person is honest. In terms of occupational roles, Lingle et al. provide the following example. In order to determine if a person is a member of the category “truck driver” we need only check a few defining features such as “employed to drive trucks”. However, if asked to describe a truck driver we may make stereotypical inferences such as “drinks beer”, “listens to country music”, “is tough and rugged”.

The present research examines judgments about inference attributes versus membership attributes for trait categories. In the third experiment subjects are either asked “What is the probability that a kind (or intelligent) person would perform behavior X?” or “What is the probability that the person who performed behavior X is kind (or intelligent)?” Inference attributes are relevant for the first question while membership attributes are relevant for the second.
CHAPTER III
ATTRIBUTIONAL PROCESSES AND TRAIT INFERENCES

Traditional Attribution Approach. Attribution theorists have provided accounts of how people explain their own and other people's behaviors. Following Heider's (1958) lead, traditional theories and research have focused on when people make situational versus dispositional attributions. For example, correspondent inference theory (Jones and Davis, 1965) focused on the correspondence between a specific behavior and a dispositional attribution. If John performs a friendly act, do we infer that John is a friendly person? In making these inferences we examine the situation the action was performed in and the consequences of the action for the person. If the action is expected in the particular situation (e.g., a socially desirable act) or if there are numerous noncommon effects of the action (i.e., a consequence that would occur only if that action were chosen and not others) then we will not infer a disposition. Instead, we are more likely to make a situational attribution. However, if both noncommon effects and the expectedness of the action are low then we
are more likely to infer that the intention was a result of a particular personality disposition (i.e., friendliness).

Building on Heider's distinction between dispositional and situational causes, Kelley (1967) pointed to three general types of explanations that may be used when trying to interpret someone's behavior. The cause of an actor's behavior can be attributed to the actor, to the entity or person with whom the actor is behaving, or to the circumstances or situation in which the behavior occurs. The covariation principle, proposes that we use consensus (i.e. the degree to which others act in a similar manner in the same situation), consistency (i.e., the degree to which the actor behaves in a similar manner across situations) and distinctiveness (i.e., the degree to which the actor acts in a similar manner with other entities in the same situation) information in an effort to try to explain events in a manner similar to the way a scientist would. That is, we examine the evidence and try to figure out what cause varies with the effect.

According to traditional personality theorists and attribution theorists, traits are the cause of specific behaviors. Allport (1966) proposed that traits have the capacity to guide peoples reactions to stimuli. According to traditional attribution theories (Heider, 1958; Jones and Davis, 1965; Kelley, 1967), observers use
trait descriptions because they are believed to be the causes of stability and consistency in behavior patterns. Research has found that people prefer dispositional causes over situational causes (Jones and Nisbett, 1972).

Schematic Model of Attribution. An important paper by Reeder and Brewer (1979) discussed the trait inference process, focusing on alternative schematic structures for the representation of dispositional attributes (see Reeder, 1984 for a more recent discussion). Reeder and Brewer (1979) began by criticizing the traditional approaches of Kelley (1967) and Jones and Davis (1965) for assuming that the same inference processes are used to make attributions about all dispositions such as racial prejudice, intelligence, tennis skill, and honesty.

The attribution process begins when an observer witnesses an actor performing a behavior. The properties of the behavior and the observer's set are used to select an appropriate attribute dimension. Once the appropriate dimension is chosen, Reeder and Brewer (1979) propose that there are two separate processes involved in the attribution process: 1) classifying the observed behavior along the attribute continuum and 2) applying a set of implicational rules that relate the behaviors to dispositions.
Reeder and Brewer (1979) propose two parallel attribute continua, one for dispositions and one for behaviors. Behavior classification involves placing the behavior at some point along a continuum of the attribute being considered. Take for example, the behavior "Drove his car through the car wash and left his car windows open". One possible attribute activated by this behavior might be careless and the behavior would be placed on the "careless" end of the behavioral continuum rather than the "careful" end. Once the behavior is classified, inferences about the actor's level of a disposition are made by considering the probability that alternative levels on the dispositional continuum would give rise to the particular level on the behavioral continuum. Naive conceptions about dispositions includes expectations about the range of behaviors an actor with a particular level of a disposition will perform. For example, people may believe that an extremely careful person would never leave their car windows open when going through a car wash. At this point in the attribution process, observers use assumptions about the relationships between situations and behaviors. People realize that behavior is often constrained by or caused by situational forces.

Reeder and Brewer (1979) argue that different implicational relationships between behaviors and
dispositions exist for different types of dispositions. They use the term schema to refer to "a set of implicational links between dispositional levels and categories of relevant behaviors." (p. 61).

One type of schema proposed is the partially restrictive schema. This type of schema implies that if a person possesses a given level of a disposition, then the likely behaviors are ones from a relatively narrow range on the behavioral continuum. For example, if a person is friendly, then we would expect that person to vary somewhat in terms of the friendliness of their behaviors. However, the variability will be somewhat restricted and we wouldn't expect someone who was extremely friendly to act extremely unfriendly. Similarly, a moderately friendly person would display, for the most part, moderately friendly behaviors. In recent discussions of the schematic assumption model (Reeder, 1984) this assumption is referred to as a central tendency assumption. Knowing that someone is an extrovert we assume that most of their behavior falls near the extroverted end.

A second type of schema is called the hierarchically restrictive schema. The assumptions included are that dispositions falling at the extreme upper end of the continuum are not behaviorally restricted. However, dispositions falling at the lower extreme are restricted to
behaviors at the lower end. Dispositions falling in the middle range are restricted to the range of behaviors falling below that point on the continuum. Reeder and Brewer (1979) point out that this type of schema is most appropriate for unipolar attributes involving skill or ability where the behavioral continuum reflect degree of difficulty of performance. However, it can also be applied to attributes that relate to morality such as honest-dishonest. For these traits, dispositions falling at the lower extreme end are not behaviorally restricted while the dispositions at the upper end are. An honest person is not likely to perform dishonest behaviors. However, even a ruthless thief, may behave honestly under many circumstances.

The third type of schema proposed is the fully restrictive schema. In this case, the specific dispositional location implies performance of a limited range of behaviors that are consistent with the disposition. For example, if a person is compulsively neat, one would expect only neat behaviors. On the other hand, someone labeled sloppy would exhibit only behaviors implying sloppiness. However, not everyone will be given an attribution of neat or sloppy. Some people who display neatness on some occasions and sloppiness on others would not be assumed to possess a dispositional position on the
Reeder and Brewer's (1979) model is important as it points out the use of assumptions about the relationship between dispositions and behaviors. Moreover, they were the first to examine the assumptions about the likelihood that specific levels of a disposition can give rise to specific categories of behaviors. This is different from earlier theories that focused on using the behavior to make inferences about dispositions. In Reeder and Brewer's model, behavior classification on the dispositional continuum is only the first step in making attributions. Also, the impact of positive versus negative behaviors on the attribution process depends on the specific disposition being evaluated.

However, Reeder and Brewer's (1979) model is still a dimensional model as it proposes that people begin the trait inference process by locating a behavior on a psychological continuua. They do not offer an explanation in terms of the cognitive processes involved in this localization. The contribution of their approach is the inclusion of implicational or inferential links between the behavior and trait continuum that are used to locate a person on the trait dimension given different categories of behaviors. Also, important is their proposal that there are different types of implicational links depending on
whether or not the disposition involves an ability or has morality implications.

Skowronski and Carlston (1987; 1989) take a categorical approach to making trait judgments from behaviors. They examined the diagnosticity of behaviors for making judgments about honesty/dishonesty and intelligent/stupid. They found evidence for Reeder and Brewer's proposal that people's implicit assumptions about the relationship between behaviors and traits depends on whether or not the trait has ability or morality implications. Their results suggest that positive acts tended to be more diagnostic than negative acts for the intelligence dimension, whereas negative acts were more diagnostic for the honesty dimension. This suggests that people have assumptions that correspond to a hierarchically restrictive schema for both honesty and intelligence. An intelligent person can perform a wide range of behaviors, including stupid ones, whereas a stupid person is unlikely to perform an extremely intelligent behavior. On the other hand, for honesty, a dishonest person can perform a variety of behaviors, including honest ones, whereas an extremely honest person is unlikely to act in an extremely dishonest manner.

Unlike the Reeder and Brewer (1979) dimensional analysis, Skowronski and Carlston (1987; 1989) propose a categorical model for trait judgments.
Traits As Categories

The Act Frequency Approach. An alternative view of dispositions is the act frequency approach (Buss and Craik, 1983). This view proposes that dispositions summarize observed patterns of behavior over time. Traits are treated as summary categories of observed behaviors. Buss and Craik (1983) extended the earlier work by Rosch and colleagues on categorization of natural objects to trait categories. According to the AFA (Act Frequency Approach) traits are concepts that provide us with a system for categorizing behaviors. Like natural object categories, traits contain instances which are specific behaviors or acts. These acts vary in their centrality or prototypicality to the trait concept. This approach to personality has implications for attribution theory. Specifically, it argues that people look for act trends. Before asserting a disposition, the relative frequency with which an individual displays acts counting as members of that category are assessed. According to this view, traits are not viewed as causes or explanations for behaviors. Rather, they serve as dispositional summaries that can be used to predict future trends in behavior.

This view also has implications for the way trait concepts are represented by the cognitive system.
Research by Buss and Craik (1983;1985) has supported the notion that the internal structure of trait categories is graded where instances vary in their typicality. In their (1981) research, they found substantial between rater reliability in prototypicality ratings for acts for five different trait domains indicating cultural agreement about what behaviors are typical and not so typical examples of a particular trait. Although, this approach has generated approval from personality psychologists (e.g. Pervin, 1985) it is not without critics. Block (1989) argues that the AFA is limited because it does not consider the context of behaviors or the possible different meanings the same behavior could have.

Prototypes in Person Perception. Cantor and Mischel (1977;1979a;1979b) have extended categorization research to how people categorize person types. Their investigation is not limited to trait categories but includes superordinate categories such as extraverted persons, cultured persons, emotionally unstable persons, and persons committed to a belief. Personality prototypes serve as standards against which the perceiver matches and evaluates information about specific individuals. The given prototype contains information about various traits, behaviors and even situations characteristic of the type of person in question. When the similarity between the prototype and
the stimulus person is high, then the target person can be
categorized with more confidence. Moreover, the perceiver
can embellish his or her knowledge by making inferences
based on the classification. Cantor and Mischel (1979a)
manipulated character prototypicality and examined its
effect on free recall and personality impressions. Their
results indicated that recall was greater for the
prototypical characters. Moreover, the written personality
impressions were richer and contained more elaborations for
the prototypical characters. These results support a
categorical model where incoming information is coded,
structured, elaborated, and remembered according to the
typicality or degree of match with preexisting beliefs
about personality types.

Cantor and Mischel (1979b) also examined the structural
properties of person-type categories by developing
taxonomies for person-type categories such as extraverted
person, cultured person, emotionally unstable person, and
person committed to a belief. Three levels for each of
these categories were developed, the superordinate
(e.g. emotionally unstable person), the middle level (e.g.
the criminal madman) and the subordinate (e.g.
the strangler). A card sorting task was used to
assess the consensual agreement for the hierarchical
relations (i.e., the superordinate, middle and subordinate
levels).
Once the hierarchy was established, Cantor and Mischel (1979b) utilized procedures from earlier work on categorization. Following Rosch et. al. (1976a) an attribute listing task was used. Results replicated the earlier work and found that the middle and lower level categories (e.g. criminal madman, strangler) had a larger number of attributes associated with them than the superordinate categories (e.g., emotionally unstable person). The differentiation of categories was investigated by looking at the number of overlap of attributes listed for each category level. Superordinate categories were most well-differentiated (i.e., had the most unique attributes) with differentiation decreasing with lower levels in the hierarchical structure. Interestingly, for each of the category levels trait dispositions were used more often in attribute listings than physical appearance, behaviors or socioeconomic status.

The Use of Contrast Trait Categories. Cantor and Mischel (1979b) also discussed of the use of contrast categories in making judgments about prototypicality. Attributes that are incompatible with the person type under consideration, are considered and negatively weighted in judgments of prototypicality. Cantor and Mischel stressed the importance of addressing "people's tendencies to
perceive themselves and others in terms of psychologically opposing forces, incompatible types, or bipolar dimensions of behavior." (p.33). Each person type includes its own related features but also incompatible behaviors and traits. In making person judgments people consider the degree to which the target matches a particular person type, but also the degree to which the target concept is incompatible with contrast person types.

An interesting difference between contrast categories used for judgments about social categories versus those used for object categories is that the contrast categories for person judgments are polar-opposite categories while the contrast categories for nonsocial objects are closely neighboring categories. For example, for trait categories like intelligence, honesty, kindness the contrast categories are stupid, dishonest, and unkind respectively. However, for object categories like chair, mammal, and bird contrast categories are objects like sofa, amphibian, and fish. Even the instructions given to subjects to elicit contrast categories for object categories asks them to generate the object that is closest to and most similar to the target concept (Rosch & Mervis, 1975).

Categorization in Impression Formation. Brewer (1988) proposed a model of impression formation that includes an initial automatic identification of the person based on a
few characteristics (e.g. sex, age, race). If further processing is necessary the perceiver classifies the stimulus person by comparing its features to the features of "person types". Brewer specifically argues for a categorical approach rather than the traditional dimensional approach to impression formation. Furthermore, she argues that the representation of person types is pictoliteral. Images as representations are assumed to be "more specific, configural and unmediated by verbal description" (p.13) Traits and other conceptual features are assumed to be inferred from the pictoliteral representation when judgments are made rather than represented directly in the mental image.

Although Brewer's focus on person types rather than trait dimensions is compatible with the present view, her focus on pictoliteral representations is viewed as too limiting. Furthermore, Brewer's research focuses on person types such as social roles, occupational categories, and personality types rather than traits. The present research argues that traits like intelligence, kindness, honesty are also person types which are represented categorically rather than dimensionally.

Current Research. Although the present research involves probability judgments about traits, we propose that subjects will use trait categories to give meaning to the
upper and lower endpoints on the probability scale. Therefore, the current research will allow us to examine the graded structure of two trait categories, kindness and intelligence. In the third experiment subjects will be given single behaviors that vary along the trait dimension and asked to make probability judgments. The direction of inference will also be examined. Subjects will either be asked "What is the probability that the person who performed this behavior is intelligent?" or "What is the probability that an intelligent person would perform this behavior?" Response time for judgments will be recorded. Subjects will also provide written explanations for their judgments to determine the psychological processes underlying trait inferences. The explanations that subjects provide for their probability judgments will be coded for the following: use of category labels including traits and probability labels, asserting distance from these categories, the use of contrast trait categories, the use of features versus exemplars, and attribution processes will be addressed.

The data will be used to address the following issues. What points on the probability scale are given conceptual meaning (i.e., can be regarded as categories)? What is the role of the contrast categories in making probability judgments about traits? What is the relative
role of features versus exemplars for this task? Is there evidence that categorizations are explanation-based? Are there differences due to direction of inference?
CHAPTER IV
SUBJECTIVE PROBABILITY IN DECISION MAKING

In applying the information processing approach to bipolar survey responses Ostrom (1987) argued that inferences are categorical rather than dimensional. In terms of probability judgments his analysis suggests that decision makers develop at least three probability categories, "highly probable" (corresponding to a probability value of 1.0) "highly improbable" (corresponding to a probability value of 0) and "uncertain" (corresponding to a probability value of .5) for any domain. Probability inferences are based on finding which of these categories best matches the specific features of the stimulus being evaluated. Therefore, the psychological processes involved in making a judgment will depend on whether or not the stimulus event is a good match to one of the three existing categories. The present research will explore this categorical view of probability judgments. This chapter will focus on research that has examined probability judgments and will include work on decision-making under risk, heuristic models of decision making and a discussion of different types of uncertainty.
Decision Making Research. Early work (pre-1970's) in decision making was dominated by formal models, such as the Bayesian approach, and focused on developing normative models of judgment. These normative models of judgment were used as standards and compared to the judgments of a person. Other formal approaches such as subjective expected utility models are descriptive models and attempt to describe what people actually do during the decision-making process. Although the host of utility models have been successful in predicting decisions, they have been criticized for failing to accurately describe the processes involved in making decisions. Moreover, they are dimensional theories rather than categorical and assume that probability judgments are made on a psychological continuum.

In a recent review of the decision making literature, Abelson and Levi (1985) classify theories of decision making as either structural models or process models. Structural models are interested in explaining what the decision maker ultimately chooses while process models are concerned with how choices are made and the underlying cognitive processes. These early structural models were purely dimensional and were often mathematical models of how people combine information about probabilities and outcomes to reach a decision. However, recent theorizing
about structural models has incorporated process assumptions (Payne, 1980) and even motivational and emotional processes such as regret, (Bell, 1982; 1985, Loomis and Sudgen, 1987) hope and fear (Lopes, 1987) and the influence of affect on risky decisions (Nygren and Isen, 1985). Therefore, there doesn't seem to be as clear a boundary between structural and process models as there once was.

**Models of Decision Making Under Risk.** The models that have incorporated notions about probability are models of risky decisions where the typical tasks faced by subjects are to make decisions between simple gambles with specified probabilities of gains or losses. The simplest theory of decision making is the expected-value principle. This principle states that the value of any gamble is based on the following formula: \( V = p_1(u_1) + p_2(u_2) + \ldots + p_n(u_n) \) where \( n \) is the number of possible monetary outcomes, \( u \) the the gain or loss associated with each outcome, and \( p \) the probability of the particular outcome. For example, if there were 2 chances in 100 of winning $100 and 98 chances out of 100 of winning nothing then the expected value of this gambling option would be $2.

As early as 1738 Bernoulli recognized that the expected value principle failed to predict human behavior. Bernoulli argued that the subjective psychological value of
money did not increase in proportion to its objective value. He then proposed that it is the expected utility and not necessarily the expected value that is important in making decisions about risk. The expected utility principle includes a weighting of the objective value of any outcome (e.g. according to Bernoulli, a logarithmic function).

Subjective Expected Utility. Ramsey (1926) was the first to propose the idea of subjective expected utility. This is a modification of the expected utility principle where the probabilities are subjective rather than objective. This is one of the earliest proposals to argue that people's understanding of probabilities does not always correspond to the objective value. Also, this principle could apply when objective probabilities are not available and people must supply their own estimates. The notion of 'personal probabilities' was considered. This refers to the degree of belief attached to an uncertain outcome (Savage, 1954; DeFinetti, 1937 as cited by Abelson & Levi, 1985; Edwards, 1954; Fisher, 1930).

However, the idea of person probabilities is not as relevant to many of the tasks used in research in this area because subjects are often given objective probabilities. In this case, researchers have proposed that people arrive at personal probabilities by weighting the given objective...

These early utility models formed an important normative basis of how human decision making should occur. The major assumption made is that people should choose options that have the highest expected utility or value. The fact that this assumption does not always hold true is problematic for subjective expected utility theory as a descriptive model. Therefore, several variations and extensions have been suggested which allow for violations of this assumption, and other violations of probability axioms.

Prospect Theory. Kahneman and Tversky (1979) have proposed prospect theory which builds upon subjective expected utility theory. Like subjective expected utility theory, it assumes that the value of any option is calculated as a sum of products over its specified outcomes, each product consisting of a utility $v(x)$ and a weight $b(p)$ attached to the objective probability $p$ of obtaining $x$. Prospect theory builds upon subjective expected utility theory because it includes a set of assumptions about the probability weighting function and the value or utility function.

The Probability Weighting Function. The weighting function reflects how people interpret objective probabilities. Prospect theory makes specific assumptions
about the shape and meaning of this function. The function is assumed to represent not estimates of the probabilities, but rather the weighting of the probabilities in the decision making situation. The function is monotonic with probability, but exhibits curvature at the endpoints. Specifically, small probabilities tend to be overweighthed and large probabilities tend to underweighted.

Abelson and Levi (1985) note that evidence for these weighting biases was available more than thirty years ago (Attneve, 1953; Griffith, 1949) but have only recently been dealt with formally using specific weighting functions. This overweighting of small probabilities can explain the attractiveness of long-shot gambling and the tendency to insure against rare catastrophes. The distinction between weights and probabilities is important because weights do not have to behave like probabilities (i.e., they may not sum to 1).

However, Kahneman and Tversky (1979) do acknowledge that sometimes extremely low probabilities will be discounted and entirely ignored. The weighting function is "not well behaved near the endpoints" of the probability scale because people have a difficult time comprehending and evaluating extreme probabilities. Therefore, it is difficult to predict when small probabilities will be overweighted or ignored or when the difference between high
probability and certainty is either ignored or amplified.

The Subjective Value Function. In prospect theory, each option is evaluated with regard to a neutral reference point, and is interpreted in the value function as either a gain or a loss. The general shape of this value function is concave for gains (indicating that people are generally risk averse in gain situations) and convex for losses (indicating that people are risk seeking in loss situations).

The nonlinearities of the value and probability weighting functions can account for many of the research findings that were challenging to earlier expected utility theories. For example, framing the situation in terms of gains versus losses can affect choices. Consider the following example from Kahneman and Tversky (1982).

There is a disease expected to kill 600 people

Problem 1: Choose between
A. 200 people will be saved
B. 1/3 probability that 600 people will be saved
   2/3 probability that 0 people will be saved

Problem 2: Choose between
A. 400 people will die
B. 1/3 probability that 0 will die
   2/3 probability that 600 will die
Note that the two problems would be considered equivalent according to subjective expected utility theories. However, people’s choices are very different due to framing the problem in terms of gains or losses. For problem 1, when the problem is framed in terms of gains, 72% of subjects are risk averse and choose option A. For problem 2, when the problem is framed in terms of losses, 78% of subjects are risk seeking and choose option B.

Prospect theory also proposes that two stages occur during the choice process: an initial framing phase which includes editing processes and a subsequent evaluation phase. In the editing phase, each prospect is coded as either a gain or a loss in comparison to a neutral reference point (which can be affected by the framing of the initial problem). Other types of simplification that occur during the editing stage are isolating riskless options, disregarding highly risky options, and the rounding of probabilities.

Although prospect theory does have similarities to subjective expected utility models (i.e., both include a utility and probability function), it differs in terms of its proposal of an editing phase where choices are coded in terms of gains and losses. Moreover, prospect theory considers how utilities and probabilities are processed by the cognitive system.
Other models suggest even more complex processes and it has even been proposed that there may be more than one probability function (e.g., Nygren and Isen, 1985). For example, Nygren and Isen (1985) found that subjects made different probability estimates for winning and losing when in a positive affect state. They propose that there may be separate probability functions for gains and losses.

**Venture Theory.** Another theory that is somewhat similar to subjective expected utility and prospect theory is venture theory (Hogarth and Einhorn, 1988; see also Einhorn and Hogarth, 1985). Venture theory is a model of how people make judgments in situations characterized by uncertainty and ambiguity. Most of the models that have been used to explain judgments about risky decisions are concerned with situations where probabilities are provided and assumed to be known with precision. However, in real life situations involving choice, the objective probabilities are not known, nor are all the possible outcomes. The key notion of this theory is that the decision weight applied to an outcome is the result of a process that involves first anchoring on an estimate of probability and then adjusting this by imagining other possible values for the probability. In typical tasks, the anchor could be the objective probability provided by the experimenter. On the other hand in more uncertain
situations, the anchor could be a figure suggested by experience or a best guess. The adjustment is the net effect of a mental simulation process in which the decision maker tries out various weights suggested by different possible scenarios. This model is important in that it addresses how cognitive and motivational factors might affect the decision process by influencing the scenario generation process.

The Heuristic Approach to Probability Judgments. The major finding of research on probability judgments is that people do not follow the principles of probability theory in judging the likelihood of uncertain effects. Tversky and Kahneman (1972; 1973; 1974) proposed that when people were faced with the difficult task of judging probability or frequency they use a number of heuristics to simplify the judgment task. These heuristics are representativeness, availability, anchoring and the simulation heuristic.

Representativeness. In judging the probability that object A belongs to class B, or that A originates from process B, people tend to base their probability judgment on how similar or representative A is of B. For example, if given a personality sketch of a person and asked to judge the person's occupation, people tend to base their judgment on how well the person in the sketch fits their stereotype of that occupation and ignore the base-rate of
the particular occupation. In the present research, subjects will be given behaviors and asked to judge the probability of a trait or vice versa. Both the use of the representativeness heuristic and categorization processes are based on shared features of the two events. Indeed, Sherman and Corty (1984) argue that the representativeness heuristic involves judgments of the similarity between the sample event and some prototype.

**Availability.** The availability heuristic occurs when people make judgments about frequency or probability based on how easily instances or occurrences are brought to mind. One example of the availability heuristic is taken from an experiment by Tversky and Kahneman (1973). Subjects were given lists of men and women, with an equal number of males and females. The relative fame of men and women was varied and the lists consisted of some very famous (Richard Nixon, Elizabeth Taylor) and less famous (William Fulbright, Lana Turner) persons. Subjects were asked to judge whether there were more men or women on the list. The more famous group (i.e., either men or women) was judged to have occurred more frequently, presumably due to the fact that the famous persons were more easily brought to mind.

Related to the availability heuristic is the simulation heuristic. The simulation heuristic refers to the use of the ease with which examples or scenarios can be
constructed (rather than just accessed in memory). In the present research subjects are asked to judge the probability of a behavior, given a trait (or vice versa). The availability and simulation heuristics could be used in the following manner. Subjects may judge the probability of the behavior or trait, on the basis of availability of exemplars of the trait category who they know that have performed the behavior (availability) or they may use the ease of imagining exemplars of the trait category performing the behavior. Moreover, use of the simulation heuristic may lead them to construct scenarios in which an exemplar of the trait category might perform the behavior.

**Verbal/Vague Probabilities.** Psychological views of uncertainty include equating probabilities with "degrees of belief" (de Finetti, 1937; Savage, 1954) or with long-run relative frequencies (Lopes, 1981; Keren & Wegenaar, 1987). Recently, researchers have focused on the vague meaning of verbal probability terms such as doubtful, probable, or likely (Wallsten, Budescu, Rapoport, Zwick and Forsyth, 1986; Wallsten, in press). The fact that people prefer to communicate their uncertainty with verbal terms rather than numerical probability values implies that people's conceptions of uncertainty are not precise, points on a continuum.
Wallsten (in press) points out the importance of understanding how people represent and use vague uncertainties in judgment and decision making. Moreover, he makes the distinction between precision, ambiguity and vagueness. A statement is precise if it can be understood in exactly one way. It is ambiguous if it can be understood in two or more different (but precise) ways. It is vague if it cannot be understood in at least one precise way. The representation of uncertainty can be vague or precise. In the past, both objective and subjective probabilities have been assumed to be represented as precise points on the probability continuum. However, Wallsten (in press) argues that imprecise representations might involve intervals of probability values or linguistic probability concepts such as doubtful, very good chance, etc. Since most decisions in real life are made on the basis of limited information they involve imprecise uncertainty.

Wallsten (in press) approaches the problem of measuring the meaning of vague probability terms by applying methods developed from fuzzy set theory. In fuzzy set theory (Zadeh, 1965) the membership of an element in a set can be any number from 0 to 1. Fuzzy set theory has been used as a means for modeling how people understand and use vague concepts. The use of this approach has enabled
Wallsten and his colleagues to determine over what intervals on the probability continuum certain linguistic values are used. For example, the membership function for the term "toss-up" may include values from probability .4 through probability .6.

Although we share Wallsten's viewpoint that uncertainty is represented conceptually or linguistically rather than numerically, our approaches are markedly different. The aim of Wallsten's research had been to determine the values on the probability continuum that correspond to people's use of verbal phrases to express uncertainty. However, the present research aims to examine the concepts that are used or that develop during the judgment task when subjects are asked to make probability judgments.

**Types of Probability Judgments.** Howell and Burnett (1978) developed a taxonomy for the different tasks and measurement techniques used in studying probabilities. Their view was that given the range of tasks and paradigms used to study psychological processes involving uncertainty, it is doubtful that models of probability judgments proposing a single kind of cognitive process are adequate. Their taxonomy is useful as it delineates different types of uncertain events. The following taxonomy of uncertain events is taken from Howell and
Factors determining the Uncertainty of Events. The frequentistic parameter is relevant for tasks where events occur in a repetitive fashion and permit judgments of likelihood based on relative frequency of occurrence. For example, tasks that involve gambling such as those using coin tosses, dice, or a wheel of fortune are affected by people's knowledge about how likely each outcome is to occur. For each of these tasks, frequency is a relevant way to think about and make judgments about probabilities. That is, people realize that there is a stable generating process for outcomes of a coin toss. Nonfrequentistic events are those that are nonrepetitive and unique. Although people do not have a historical basis for predicting the probability of a nuclear attack upon the U.S. and there is not much chance of future repetition of this event, for many people there is a nonzero probability (this example is taken from Howell and Burnett, 1978).

The knowledge parameter refers to whether or not the generator process is known to subjects. For coin tosses, cards and dice people realize the process that generates events. However, in other types of tasks, such as judging the probability of an occupation, given a personality sketch, the process that relates the outcome to the evidence is more complex.
The use of specific cognitive processes during the judgment task will depend on the specific type of uncertain event and the measurement strategy used. A wide variety of procedures have been used to measure probabilities including: i) direct probability estimation, where subjects report the chances in 100 that a designated event will occur on a given observation, ii) frequency estimation where subjects report how often an event has occurred in the past, iii) confidence or certainty ratings, where subjects indicate the strength of their belief iv) prediction, where subjects make an all-or-none prediction of an outcome and v) choice, where subjects not only predict the outcome but must accept the consequences of that choice (e.g. gains and losses in gambling situations).

In the present research subjects are asked to make probability ratings on a scale from 1 to 9 where 9 is labeled the highest probability and 1 the lowest probability. We do not tell subjects to view probability in any specific way such as relative frequency, confidence, chances, etc. Instead, all subjects are told is that probabilities are values that fall on a continuum from 0 to 1 where 0 is the lowest probability and 1 is the highest probability.

The specific task is to make probability ratings about traits from behaviors or vice versa. Subjects are given
behaviors that vary in the degree to which they exemplify a trait. For example, for the trait intelligence subjects are given the behaviors, "Failed the written drivers license exam four times", "Has trouble using his microwave oven" or "Was valedictorian of his high school class". For each behavior subjects are asked to judge either the probability that the person who performed the behavior is intelligent or the probability that an intelligent person would perform the behavior.

This type of uncertain event would be classified as nonfrequentistic using Howell and Burnett's taxonomy. However, this doesn't mean that people don't use frequency information. For example, subjects may consider the relative frequency of the behavior in intelligent people (and people in general) in making the probability judgment. They may consider the fact that very few people would have trouble using a microwave oven. Moreover, it is a situation where the "generator process" consists of the relationship between traits and behaviors. This is certainly more complex than the stochastic generator process used to estimate the probability of drawing an ace from a deck of cards. Howard and Burnett (1978) argue that in this type of situation, subjects rely on heuristics such as representativeness and availability to make probability judgments.
**Variants of Uncertainty.** Kahneman and Tversky (1983) also discussed the variants of uncertainty by focusing on the phenomenology of uncertainty. The following example taken from their (1983) article is useful in illustrating the conflict between the logical rules of probability and the rules that govern perceptions of probability. Imagine a coin is to be tossed 40 times. What number of "heads" would you expect? Assuming the coin is fair, you would probably estimate that the "20 heads 20 tails" result is more likely than any other. However, you may actually be more surprised by this outcome than a result of "22 heads and 18 tails". What is the "true" subjective probability of the two events? The judgment "20 heads and 20 tails" is derived from knowledge of the rules of chance. However, outcomes such as "22 heads, 18 tails", or "17 heads 23 tails" are more probable when probability is determined by representativeness, since we expect some randomness in tossing. Moreover, the psychological meaning of the possible outcomes may be similar. Outcomes such as 22-18 or 17-23 will be viewed as "approximately even splits" while the 20-20 outcome will be viewed as "an exactly even split."

Kahneman and Tversky (1983) note that people frequently define an event using statements like "X or something like it". The previous example taken from their
paper and their discussion of uncertainty is similar to the concept of hedges in the category literature. Conceptually, people may view the 20-20 outcome as the prototypical outcome and slight variations as being approximations. Also, when people make numerical judgments they may not mean to imply precision in their judgments. Rather, when people make specific numerical probability estimates they may actually be implying a range of values around the exact figure, rather than making a specific precise prediction or judgment. This could be one reason that people seem to prefer verbal statements of uncertainty which convey ranges of probability (Wallsten, in press) than numerical judgments.

Kahneman and Tversky (1983) also discuss the distinction between internal and external attribution of uncertainty. The internal/external distinction refers to whether the uncertainty is attributed to the external world or to our level of knowledge. In research in decision making using games of chance, the uncertainty can be attributed to the external world. However, expressions of lack of knowledge or ignorance such as "I believe that New York is north of Rome, but I am not sure", are examples where uncertainty can be attributed internally to the knowledge of the individual making the statement. Kahneman and Tversky (1983) offer a useful test to assess the
internal/external distinction of uncertainty. Is it appropriate to describe the assessment of uncertainty as "the probability is" (external attribution) or "my probability is" (internal)?

Four prototypical variants of uncertainty were proposed by Kahneman and Tversky (1983) that differ in the type of data that the judge might consider in evaluating probabilities. External uncertainty can be evaluated on the basis of a distributional mode or a singular mode. The distributional mode is used when the relative frequencies of outcomes are known or can be estimated because the problem is an instance of a class of similar cases (e.g. a coin toss or a dice roll). This is similar to Howard and Burnett's frequentistic parameter. The singular mode is used when probabilities are estimated by evaluating the evidence of the particular case. This evaluation process could consist of constructing scenarios and possible events that would produce the outcome. Most of Kahneman and Tversky's research on heuristics has focused on this singular mode and they propose that people prefer this mode where they take "an inside view of the causal system that most immediately produces the outcome, over an outside view which relates the case at hand to a sampling schema" (Kahneman and Tversky, 1983 p.153).
Kahneman and Tversky (1983) also proposed two variants of internal uncertainty: reasoned and introspective. The difference is based on the nature of the evidence that people consider. For reasoned judgments of uncertainty, people sift and weigh the evidence before asserting their judgment. For example, the statement "I think Bill is a fairly honest person, but I just can't be sure" might be based on evaluating the information you have relevant to honesty. For introspective judgments, confidence of a judgment is based on unanalyzed experience in situations where there isn't much evidence available. For example, we may make a guess about the spelling of a word, or the name of a person we recently met at a large party. This is done by assessing the degree to which the word "looks right" or the name sounds familiar.

This analysis of uncertainty is relevant to the present research in a number of ways. First of all, the experimental task is one where uncertainty can be attributed internally or externally. That is, subjects' uncertainties about traits or behaviors can be attributed to causal systems in the real world or to their lack of knowledge. Subjects realize that there is variability in people's behavior, and that even a person who possesses the trait intelligence may not consistently act intelligent. Also, subjects can assess uncertainty in this situation
by using either the singular mode, the distributional mode or a combination. The use of the distributional mode in assessing uncertainties would be evident if subjects reported the use of base rate information making judgments. The use of the singular mode would be evident by reports of possible explanations for the outcome. The content analysis of subjects explanations for their probability judgments for experiment three will enable us to address these questions.

A Categorical View of Probability. The present research proposes that subjects use the categories "highly probable", "highly improbable" and "uncertain" in making probability judgment. Although a number of researchers have argued that probabilities are vague or actually imply a range of values, the present research is a more radical departure from early theories of subjective probability. In its strongest form, we are arguing for an abandonment of the view that probabilities or degrees of belief are represented as points on a continuum. Rather, personal probabilities are represented categorically and consist of features, and causal theories that are relevant for the particular domain. The three experiments presented here will explore the categorical view of probabilities for the domain of trait-behavior inferences.
CHAPTER V
EXPERIMENTS ONE AND TWO

Experiment One

Rationale. The first experiment was designed to test whether subjects find it easier to generate behavioral exemplars at the places along the probability continuum that correspond to the categories "highly probable", "highly improbable" and "uncertain". Again, these three categories will be domain specific. For example, for the trait intelligence, the three categories might be probably intelligent, probably not intelligent (or probably stupid) and uncertain.

This experiment is a conceptual replication of a study reported by Ostrom and Upshaw (1968) in their chapter on psychological perspective and attitude change. A brief summary of their theoretical approach and empirical results will be provided in order to compare their perspective model explanation with the current categorical approach.

Perspective is defined by Ostrom and Upshaw as the range of content alternatives that an individual takes into account when making a rating on a bipolar scale. For example, on an attitude scale, a person's perspective
refers to what that individual considers to be a very positive attitude and a very negative attitude. That is, the endpoints correspond to specific beliefs that a person feels a person with an "anti" or "pro" attitude would hold. In the context of probability judgments about traits, perspective refers to what types of features, or behavioral examples a person considers to typify "highly probable that the person is intelligent" and "highly improbable that the person is intelligent".

Ostrom and Upshaw (1968) proposed that the content that corresponds to the two extremes of a person's perspective provide end anchors for the rating scale. A position along the rating scale was anchored if the individual had prejudged its content. Similarly, a specific cognition is considered to be anchored if its placement on the rating scale has been predetermined. Ostrom and Upshaw's early work is important as it demonstrated that shifts in attitude content, rating or perspective are related to one another in a dynamic manner. Moreover, their discussion about the properties of content anchors and rating scale anchors has a contemporary flavor even though it was written over 20 years ago.

The specific study presented in the Ostrom and Upshaw chapter that is relevant to the present research was designed to test the postulate that psychological anchors
contain prejudged stimuli. They predicted that content examples of a particular point along an attitude scale should come to mind more readily if that point had been previously anchored with content. In a study conducted by Ostrom, subjects were asked to read a list of nine rating labels ranging from "very pro-fraternity" to "very anti-fraternity" and for a second issue "pro-church" to "anti-church". They were then asked to generate a specific belief for each of the nine rating categories. Following this task subjects were asked to rate how easy or difficult it was to generate the statement for each of the 9 categories. The results illustrated that subjects found it easier to generate attitude statements for the end anchors on an attitude scale and for the value that represents the midpoint of the scale than for the other places along the continuum.

In addition, subjects found it easier to generate belief statements for the value that corresponded to their own attitude. That is, subjects with a "pro-church" attitude found it easier to generate "pro-church" belief statements. Ostrom and Upshaw argued that the category that corresponds to a subject's own attitude is also anchored in the sense that there are prejudged beliefs for this point on the attitude rating scale. Moreover, this result indicates that subjects may have used knowledge
about their own experiences and beliefs in generating belief statements.

The psychological perspective approach is conceptually similar to the categorical approach taken in the present research. Ostrom and Upshaw proposed that an important property of end anchors and the middle "neutral" category is that they contain prejudged stimuli. Similarly, the categorical approach could explain results presented by Ostrom and Upshaw (1968) by arguing that these places become reference points on the attitude scale because they enable people to use their categorical knowledge structures about "pro-fraternity" and "anti-fraternity" to generate beliefs.

In the present research, subjects were asked to generate examples of behaviors that fit along the probability continuum. For example, subjects were asked to generate a behavior that an intelligent person would have the probability of 1.0 of performing. The categorical approach argues that people use their knowledge structures about traits to give meaning to the endpoints on the probability scale. The midpoint may also serve as a reference point as it can be interpreted as the boundary between the two endpoint categories. Specifically, this research attempted to extend Ostrom and Upshaw's (1968) findings using a probability scale and we predicted that
subjects would find it easier to generate examples of behaviors for the endpoints, and the middle of the probability scale.

The major prediction is that ease ratings for generating behavioral exemplars for probability levels will parallel the ease ratings for generating belief statements for different locations on the attitude continuum. However, there are a number of alternative predictions. First, pro/con is explicitly bipolar and may readily activate corresponding categorical structures (Judd & Kulik, 1980; Pratkanis, 1989). However, a dimensional approach may be a more appropriate way to give meaning to different locations on a probability scale. The probability scale is different in that it offers no explicit category labels. Moreover, each point along the continuum can be interpreted in terms of frequency, percentages, or proportions. Therefore, the probability scale may be responded to as a continuum with exemplars equally accessible at all points.

Research in the category literature has used the method of exemplar generation to examine categorization processes. Early work in categorization found that typicality ratings were correlated with the probability with which college students listed instances of superordinate categories (Rosch, 1975). Also, Barsalou
(1983) used an exemplar generation task to examine the differences in common categories (e.g. fruit, furniture) and ad hoc categories (e.g. things to sell at a garage sale, things manufactured by humans). Although, Barsalou did not use ease ratings as a dependent variable, he did find that subjects could generate more exemplars for common categories than for ad hoc categories.

This experiment will also examine the effect of direction of inference on ease of generating exemplars. This refers to the earlier discussion of inference attributes versus membership attributes. Literature on categorization has addressed this distinction and it can be easily applied to trait and behavior inferences.

The distinction is made between inference attributes (i.e. once I know someone is intelligent, I can infer other attributes, traits, likely behaviors, etc.) and membership attributes (i.e., the attributes or behaviors used to make the inference about intelligence in the first place). Lingle, Altom and Medin (1984) have argued that these attributes are often not the same, especially for social categories.

In the present experiment all subjects were asked to generate behaviors. However, in one condition they were asked to generate behaviors given that a person has a particular probability of being intelligent (or kind). In
the other case, they were asked to generate a behavior that an intelligent (or kind) person would have a particular probability of doing. So, direction of inference refers to whether or not subjects generated a behavior given a specific probability of a trait, or given a trait and asked to generate a behavior that would have a specific probability of occurring.

Method

Subjects Forty-four undergraduates at The Ohio State University participated as a course requirement in an introductory psychology class.

Procedure. All subjects signed up for an experiment on social judgment and were run individually in small cubicles. Subjects were first given a booklet and asked to generate an example of a behavior that fit at each of 11 probability levels from 0, .1, .2 through 1.0. The between subjects independent variables were trait, direction of inference, and counterbalancing order of the presentation of probability levels. Subjects were randomly assigned to experimental conditions with one subject per cell for a total of 44 subjects. Half of the subjects generated statements for the trait kindness, and half generated behaviors for the trait intelligence. The direction of inference manipulation refers to the specific question subjects were asked. Half of the subjects were asked to
generate a behavior that a kind (or intelligent) person would have the probability of 0.0 (.1,.2,.3...1.0) of performing. The other half were asked to generate a behavior where the probability that the person who performed the behavior was kind (or intelligent) was 0.0 (.1,.2,.3...1.0). Pairwise latin square counterbalancing (Ostrom, Isaac & McCann, 1984) was used in presenting the probability levels. However, since there was an odd number of probability levels (i.e., eleven) twenty-two counterbalancing orders would have been needed to obtain perfect pairwise latin squares. Therefore, only one of the two latin squares was used to conserve subject use. There was one probability level presented on each page.

Subjects were told that they would have 20 minutes to complete the booklet and that they should try not to spend too much time on any one page. They were told that if they got stuck on a page that they could go ahead in the booklet and come back to that page later. On the bottom of each page there was a statement that read "I skipped this page, but will return." Subjects were told to place a check by the statement if they skipped the page and went ahead in the booklet. Initially, we believed that this would serve as an additional dependent variable and that subjects would be more likely to skip the probability levels that they found most difficult. However, since the frequency of
subjects who skipped pages was very low, (less than 9% of all pages were skipped) this data did not turn out to be useful and will not be discussed further.

All subjects finished within 20 minutes. They were then given a second booklet where they were asked to rate how easy or difficult it was for them to generate examples of behaviors for each of the eleven probability levels. Subjects rated on a nine point scale where 1 indicated Very Difficult and 9 indicated Very Easy. The order of the probability levels in the rating task corresponded to the counterbalancing order that subjects received in the generation task. (All stimulus materials used are presented in Appendix A).

Results

Ease Ratings 'A 2 (Trait: Intelligence, Kind) X 2 (Direction of Inference: Trait to Behavior, Behavior to Trait) X 11 (Probability Level: 0, .1, .2 ... 1.0) analysis of variance was conducted with trait and direction of inference as between subjects factors and probability level as a within subjects factor. There were no main effects for either the trait ($F(1,40)=3.51 \ p<.07$) or direction of inference ($F<1.0$) factors. However, there was a main effect for probability level ($F(10,400)=19.99 \ p<.001$). In examining this effect further we found a significant quadratic trend ($F(1,40)=80.45 \ p<.001$). The results
indicated that subjects found it significantly easier to generate behaviors for locations on the endpoints of the probability scale. (See Figure 1).

In order to test whether or not there was an increase in ease at .5, a contrast comparing the average of the ease ratings for .4 and .6 to the ease rating for .5 was conducted. This comparison was not significant ($F(1,40) < 1.00$). Figure 2 displays the ease ratings for each trait. Although, the probability level by trait interaction was not significant ($F(10,400) < 1$), this figure indicates that there was a slight tendency for .5 to be rated as easier for intelligence.

There was also a significant linear trend ($F(1,40) = 9.69 \ p < .01$.) The means indicate that subjects found it easier to generate examples for behaviors for the upper half of the probability scale. This could be due to our instructions which always activated a positive trait (either intelligent or kind) which was used to give meaning to probability 1.0. Subjects had to come up with their own meaning for probability 0.0 (the contrast category). So, the linear trend could be due to the fact that our instructions activated the trait category that was relevant to the upper half of the probability scale, thereby making the generation of category-congruent exemplars easier than incongruent. Moreover, subjects could experience
Figure 1: Experiment 1 - Ease Ratings as a Function of Probability Level
Figure 2: Experiment 1 - Ease Ratings as a Function of Probability and Trait
difficulty with the meaning of probability 0.0. Does this mean "stupid" or just "not extremely intelligent"?

A different explanation for the linear trend in ease ratings is that it is easier to generate examples for positive traits than for negative traits. Further research could manipulate instructions to determine if subjects indeed find the half of the probability scale corresponding to positive traits easier to define or whether they just find it easier to generate behaviors for the half of the probability scale that is given meaning through experimental instructions.

The direction of inference factor did not interact with probability level ($F(10, 400) = 1.35 \ p < .22$). This indicates that the effect of probability level on ease ratings was similar across both direction of inference conditions. (See Appendix B for Anova summary table).

Discussion

The results of experiment one supported our hypothesis that subjects would find it easier to generate examples of behaviors for the endpoints of the probability scale. However, they did not find it easier to generate examples for the midpoint. This study did not replicate the Ostrom and Upshaw (1968) study which did find an increase in ease ratings for the midpoint on the attitude scale. One possible reason for this difference is that subjects did
not have prior experience with the probability scale. It is doubtful that many undergraduate students commonly use probability scales, especially in the context of trait assessment. On the other hand, most undergraduates are familiar with the vocabulary of pro-con attitude scales, and have participated in surveys, public opinion polls, etc.

One possible explanation for the failure to find evidence for a midpoint category is that the midpoint category which corresponds to the probability of .5 posed a problem for our subjects. According to the perspective approach, the meaning for this category depends on how people label the end points. Specifically, people could be using the scale in either a bipolar or unipolar manner. If probability 1.0 is designated as extremely intelligent, probability 0.0 could be labeled "definitely stupid" or "definitely not extremely intelligent." In the case of the stupid label people are using their categorical knowledge structure for stupid to give meaning to probability 0.0. Therefore, the meaning for .5 should correspond to "neither intelligent or stupid" (i.e. irrelevant). However, if probability 0.0 was labeled as "not extremely intelligent" then probability 0.0 could actually mean "average in intelligence." In this case, probability .5 would correspond to behaviors that are in between "average in
intelligence" and "extremely intelligent." These "average in intelligence" behaviors are ones that are probably more difficult to generate than the irrelevant ones.

Our results do support the hypothesis that subjects find it easier to give meaning to the endpoints on the probability scale. Presumably, these are areas along the probability continuum that subjects have or can easily develop categories or concepts for. Experiment two will examine the effect of experience with the probability scale on the ease of generating behavioral examples.

Experiment Two

Rationale. A second experiment was designed to both replicate the first experiment and to test whether experience with the probability scale would increase the ease ratings for the probability value .5. Possibly, the category for .5 is an ad hoc or goal-derived category (Barsalou, 1983; 1985) that develops as subjects gain more experience with the probability scale. Recall, from chapter two that ad hoc categories develop in order to achieve some goal. They are often categories that do not exist and are generated when needed and develop with use. The experience manipulation consisted of having subjects rate 35 behaviors that ranged from extremely unkind (or stupid) to extremely kind (or intelligent). Again, we predicted that subjects
would find it easier to generate behavioral exemplars at the place along the probability continuum that correspond to "highly probable", "highly improbable" and "uncertain".

Method

Subjects Eighty-eight undergraduates at The Ohio State University participated as a part of a course requirement in an introductory psychology class.

Procedure. All subjects signed up for an experiment on social judgment and were run in groups from one to eight. Wooden partitions were placed between subjects so that they could not see each other. The design of this experiment was a 2 (Experience, No Experience) X 2 (Trait: Kindness, Intelligence) X 2 (Direction of inference: Trait to Behavior, Behavior to Trait) X 11 (Probability level) with experience, trait and direction of inference as between subjects factors and probability level as a within subjects factors. Subjects were randomly assigned to experimental conditions with one subject per cell for a total of 88 subjects. As in experiment one, pairwise latin square counterbalancing was used in presenting the probability levels.

Subjects who were assigned to the experience condition first made probability ratings for 35 behaviors. These behaviors were chosen from the Fuhrman, Bodenhausen &
Lichtenstein (1987) list of behaviors. Also, data from four pilot studies where subjects made probability ratings of behaviors was used to select five sets of behaviors. Each set of behaviors contained seven behaviors that fell at seven different locations along the probability scale. See Table 1 and Table 2 for examples of one of the behavior sets for each trait. Thirty-five behaviors were chosen for both intelligence and kindness. Subjects were assigned either to make ratings of intelligence or kindness. Half of the subjects were asked to make inferences about the trait from the behavior. The question read as "What is the probability that the person who performed this behavior is intelligent (kind)?" The other half were asked to rate the probability of the behavior given the trait. The question read as "What is the probability that an intelligent (kind) person would perform this behavior?"

Next, subjects were given a booklet where they were asked to generate an example of a behavior that fit at each of 11 probability levels from 0, .1, .2 through 1.0. Half of the subjects generated statements for the trait kindness, and half generated behaviors for the trait intelligent. The direction of inference manipulation refers to the specific question subjects were asked. Half of the subjects were asked to generate a behavior that a kind (or intelligent) person would have the probability of
Table 1
Example of One Set of Behaviors For Kindness

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attempted to rape a woman walking down a dark street.</td>
<td></td>
</tr>
<tr>
<td>2. Siphoned gas from a car parked on the street.</td>
<td></td>
</tr>
<tr>
<td>3. Filed a complaint against some teenagers for trespassing.</td>
<td></td>
</tr>
<tr>
<td>4. Bought a coffee mug with his initials on it.</td>
<td></td>
</tr>
<tr>
<td>5. Emptied the trash before leaving for class.</td>
<td></td>
</tr>
<tr>
<td>7. Offered to help an elderly neighbor paint his house.</td>
<td></td>
</tr>
</tbody>
</table>

Table 2
Example of One Set of Behaviors For Intelligence

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flushed his house keys down the toilet.</td>
<td></td>
</tr>
<tr>
<td>2. Took the wrong bus on two consecutive days.</td>
<td></td>
</tr>
<tr>
<td>3. Could not figure out how to use an adding machine.</td>
<td></td>
</tr>
<tr>
<td>5. Studied photography in his spare time.</td>
<td></td>
</tr>
<tr>
<td>6. Discovered a cheap way to produce solar energy.</td>
<td></td>
</tr>
<tr>
<td>7. Created a new computer language.</td>
<td></td>
</tr>
</tbody>
</table>
0.0 (1.0, 2.0, 3.0...1.0) of performing. The other half were asked to generate a behavior where the probability that the person who performed the behavior was kind (or intelligent) was 0.0 (.1.0, 2.0, 3.0...1.0). Pairwise latin square counterbalancing was used in presenting the probability levels.

There was one probability level given on each page. Subjects were told that they would have 20 minutes to complete the booklet and not to spend too much time on any one page. They were told that if they got stuck on a page that they could go ahead in the booklet and come back to that page later. On the bottom of each page there was a statement that read "I skipped this page, but will return." Subjects were told to place a check by the statement if they skipped the page and went ahead in the booklet. Again, the frequency of skipping pages was too low for the data to be useful (less than 8% of all pages were skipped). Subjects were told to tell the experimenter when they had finished.

All subjects finished within 20 minutes. They were then given a second booklet where they were asked to rate how easy or difficult it was for them to generate examples of behaviors for each of the eleven probability levels. Subjects rated on a seven point scale where 1 indicated Very Difficult and 7 indicated Very Easy. The order of the
probability levels in the ease rating booklet corresponded to the counterbalancing order that subjects received in the generation task. An additional dependent variable was included in this experiment. Following the ease ratings, subjects were asked to rate how well each of their examples fit each of the 11 probability levels. For each probability level they were asked to rate on a 7 point scale the degree to which their example was 1 "A Very Poor Example" to 7 "A Very Good Example". Subjects were again provided with the 11 probability levels in the same order as the order presented in the exemplar generation task. (See Appendix A for complete set of stimulus materials used).

Results

**Ease Ratings** A 2 (Experience, No Experience) X 2 (Direction of Inference: Trait to Behavior, Behavior to Trait) X 2 (Trait: intelligence, kindness) X 11 (Probability level) analysis of variance was conducted with experience, trait and direction of inference as between subjects factors and probability level as a within subjects factor. There were no main effects for either the experience, trait or direction factors (all F's < 1.00). However, there was a main effect for probability level (F(10,800)=32.27 p < .001). In examining this effect further
we found a significant quadratic trend ($F(1,80) = 139.64$ $p < .001$). The results indicated that subjects found it significantly easier to generate behaviors for locations on the endpoints of the probability scale. (See Figure 3).

There was also a significant probability level by trait interaction ($F(10,800) = 3.06$ $p < .001$). (See Figure 4). In order to test whether or not there was an increase in ease at .5 a contrast comparing the average of the ease ratings for .4 and .6 to the ease rating for .5 was conducted. Overall, this comparison was significant ($F(1,80) = 14.87$ $p < .001$) indicating that subjects found it significantly easier to generate examples for .5 than for adjacent probabilities. However, this contrast did interact with trait ($F(1,80) = 5.77$ $p < .05$). These results illustrate that there was an increase in ease ratings at .5 but primarily for kindness. (See Figure 4).

The experience by probability level interaction was not significant ($F < 1$). However, our predictions were that the experience manipulation would affect the ease ratings for .5 only. In conducting the contrast comparing the ease ratings at .5 to the average ease rating across .4 and .6 the results indicated a nonsignificant contrast by experience interaction ($F(1,80) = 1.80$ $p < .19$). (See Figure 5.)
Figure 3: Experiment 2 - Ease Ratings as a Function of Probability Level
Figure 4: Experiment 2 - Ease Ratings as a Function of Probability and Trait
Figure 5: Experiment 2 - Ease Ratings for Intelligence as a Function of Probability and Experience
However, there was a marginally significant experience by trait by contrast interaction ($F(1,80)=3.61 \ p < .07$). The nature of this interaction was revealed by conducting analyses of the contrast for each trait separately. The overall contrast was not significant for intelligence ($F(1,40)=1.20 \ p < .29$) and did not interact with experience ($F < 1.00$). These results are illustrated in Figure 5. The overall contrast was significant for kindness ($F(1,40)=17.49 \ p < .001$) and interacted with experience ($F(1,40)=4.69 \ p < .05$). This interaction is illustrated in Figure 6. Overall the results indicated that experience led to increased ease ratings for .5 but only for kindness.

Again, as in experiment one there was a significant linear trend ($F(1,40)=9.69 \ p < .01$) in ease ratings due to probability level. The means indicated that subjects found it easier to generate examples for behaviors for the upper half of the probability scale. Again, this could be due to our instructions which always activated a positive trait label which was used to give meaning to probability .5. Subjects had to come up with their own meaning for probability 0.0. So, the linear trend could be due to the fact that our instructions give meaning to the upper half of the probability scale or it may be easier to generate examples for positive traits.
Figure 6: Experiment 2 - Ease Ratings for Kindness as a Function of Probability and Experience
The direction of inference by probability level interaction was not significant ($F < 1.00$). This replicates the results from experiment one and suggests that direction of inference does not affect the relationship between probability level and ease of generating behavioral exemplars.

**Goodness Ratings** A similar analysis was conducted on the goodness ratings. A 2 (Trait: Intelligent, Kindness) X 2 (Direction of Inference: Trait to Behavior, Behavior to Trait) X 2 (Experience: No Experience, Experience) X 11 (Probability Level: 0,.1,.2,.3,...1.0) with probability level as a within subjects factor.

There were no main effects of the trait ($F(1,80)=2.04$ $p < .16$) or direction factors ($F(1,80) < 1.00$). However, there was a significant main effect of experience ($F(1,80)=4.78$ $p < .04$). This main effect is due to higher goodness ratings in the experience condition ($M=4.84$) than in the no experience condition ($M=4.58$) (See Figure 7). A possible explanation for this effect is that subjects in the experience condition have clearer standards for behavior generation. Therefore, they feel that the items they generated were better examples.

There was also a significant probability level main effect ($F(10,800)=20.69$ $p < .0001$) and a trait by probability level interaction ($F(10,800)=2.84$ $p < .01$).
Figure 7: Experiment 2 - Goodness Rating as a Function of Probability Level and Experience
The main effect of probability is displayed in Figure 8 and the nature of the trait by probability interaction is displayed in Figure 9. As you can see, the pattern for kindness does support the notion that subjects can produce better examples of behaviors at three points along the continuum. The pattern of data is similar to the ease rating data for kindness. The intelligence data is somewhat troublesome in that it again does not show an inflection point in the middle of the scale. The goodness ratings start to increase around .4 and keep increasing, flattening out a bit at .5 to .8 and then increase again.

There were a number of significant trends. Again, as with the ease ratings the linear effect was significant \((F(1,80)=27.55 \ p < .0001)\) and in the same direction. Presumably, subjects felt that not only was it easier to generate examples for the upper half of the probability scale but also that their examples were better.

There was also a significant quadratic trend \((F(1,80)=62.67 \ p < .0001)\) indicating that subjects felt that they generated better examples at the endpoints.

The probability level by experience interaction was not significant \((F(10,800)=1.04 \ p < .16)\). Although with experience subjects thought they could generate better examples, it didn't differentially affect probability level .5 as was originally proposed.
Figure 8: Experiment 2 - Goodness Ratings as a Function of Probability Level
Figure 9: Experiment 2 - Goodness Rating as a Function of Probability Level and Trait
A contrast comparing the goodness rating for probability .5 with the average goodness rating for probability .4 and .6 was conducted. The overall contrast was significant (F(1,80)=20.54 p < .001). However, the key test of our predictions about experience, the contrast by experience interaction, was not significant (F < 1.00).

However, there was a significant contrast by trait interaction (F(1,80)=10.61 p < .01). Conducting the contrast separately for each trait yielded a significant contrast for kindness (F(1,40)=25.62 p < .001) but not for intelligence (F(1,40)=1.00 p < .33). Also, experience did not interact with the contrast (F < 1.00 for intelligence, F(1,40)=1.71 p < .20 for kindness).

The effects of direction of inference on goodness ratings paralleled the effects on ease ratings. Again, the probability level by direction of inference interaction was not significant (F(10,800)=1.49 p < .15). Overall, the results suggest that the direction of inference factor does not affect the processes involved in generating exemplars in ways that have implications for ease of generation or goodness of exemplars. (See Appendix B for anova summary tables).
Discussion

The results of experiment two support our hypothesis that subjects find it easier to generate examples of behaviors for the endpoints of the probability scale. Also, the kindness data support the notion that there was a category for probability level .5 and experience made it easier for subjects to form an "uncertainty" category. However, experience did not effect the ease ratings for .5 for intelligence.

As in experiment one, the results do support the hypothesis that subjects find it easier to give meaning to the endpoints on the probability scale. Presumably, these are areas along the probability continuum that subjects can readily develop categories for. This suggests that the categories for the endpoints may differ from the midpoint category in some conceptual way. The category for the midpoint may be a category that is less rich and more difficult to develop. If subjects are using the trait categories kindness and intelligence to define the endpoints then this is understandable. People use these categories frequently and they are associated with a number of related traits and behaviors. On the other hand, the meaning for .5 is one that subjects are not familiar with. They first have to come up with a useful solution or a way to conceptually define .5. Subjects may struggle with this
as they decide whether or not this means average, irrelevant, equal chance of kind/unkind, ambiguous, etc.

The goodness ratings nicely parallel the ease rating data in that the category for .5 appeared for kindness but not for intelligence. Also, the experience manipulation led subjects to perceive that their examples were better overall although it didn't differentially affect goodness ratings across the probability levels. Moreover, the goodness ratings are important in their right. The results found for the ease ratings could be explained by the argument that there are fewer exemplars for locations in the midregion of the probability scale than for the endpoints and midpoint. However, the lower goodness ratings for these areas along the continuum suggest that even though subjects can generate exemplars for these probability values they don't have clear standards to judge the quality of their exemplars. This is true regardless of whether or not subjects have experience in making judgments using the probability scale. On the other hand, for the endpoints, subjects can access categorical structures for the concepts kindness and intelligence and easily generate behaviors that are good fits to these concepts.
Comparison of Experiment One and Two

Examining the results for each experiment separately, we found only mixed evidence regarding our prediction that subjects have a category for probability .5. In order to further examine the .5 category, the contrast comparing the ease rating for .5 with the average ease rating across .4 and .6 was conducted combining the data from both studies and including experiment as a between subjects factor. Overall, the contrast was significant ($F(1,124)=6.30, p<.02$) with higher ease ratings for probability .5 ($M=4.39$) than for the average mean ease rating for probabilities .6 and .4 ($M=3.82$). Overall, there is support that subjects found it easier to generate exemplars for probability .5 than for adjacent probabilities.

Neither experiment found an effect of direction of inference on ease ratings. This suggests that the ease of generating behaviors is not dependent on whether subjects are asked to give membership attributes or inference attributes. However, we don’t know whether the behaviors subjects generated were similar for the two direction of inference conditions. It is possible that subjects used the trait categories and developed similar strategies for dealing with this task. Overall, the data from the first two experiments do not offer any evidence that the direction of inference has an effect on the generation of category exemplars.
Future Research

Future research should examine the effects of different types of experience to determine if it is possible to increase the ease ratings for probability .5. In the present research, the experience manipulation consisted of rating behaviors. Presumably, during the experience manipulation task subjects used their concepts of the traits kindness or intelligence and assessed the degree to which the behavior fit the trait concept. On the other hand, during exemplar generation, subjects are asked to use their concepts of the traits to generate behaviors. A more appropriate experience manipulation would be one that consisted of generating examples of behaviors for the probability levels. In the present research, subjects generated only one behavior for each of the probability levels. A future experiment could have subjects repeatedly generate examples for each of the probability levels. This task could occur until subjects were not able to generate any more. The number of examples for each probability level would be the dependent variable. With this type of task relevant experience subjects may arrive at a solution for generating examples for .5 and once they find a workable solution, they may generate more for .5 than for adjacent probabilities.
Another task that could be used is one described in the Ostrom and Upshaw (1968) chapter. Subjects could be allowed to choose 5 out of 11 probabilities to write behaviors for. If subjects are able to develop categories for these three points more readily than others, then subjects choices should be likely to include 0, .5, and 1.0.
CHAPTER VI
EXPERIMENTS THREE AND FOUR

Rationale. This research proposes that probability inferences are based on categorical knowledge structures representing "highly probable", "highly improbable" and "uncertain". These three generic categories can easily be used for any domain. However, the actual categories will be domain specific. For probability judgments about traits, subjects use the categories of the designated trait (e.g. kind), the contrast trait (mean or unkind) and an irrelevant or uncertain category.

In this experiment subjects were asked to make probability judgments about traits given single behaviors or asked to make probability judgments about single behaviors given a trait. For example, subjects were given the behavior "Was valedictorian of his high school class" and asked to judge the probability that the person who performed the behavior is intelligent or to judge the probability that an intelligent person would perform the behavior. Behaviors were selected based on pretesting so that seven different locations on the judgment continuum were represented. The behaviors used in this experiment were identical to the behaviors used in Experiment two for
the experience manipulation.

When asked to make a probability judgment about traits like intelligence or kindness, subjects must access knowledge structures that correspond to the features of the stimulus behavior being evaluated and compare the features of the stimulus behavior to each of the three probability categories. The categories for probability 0 and probability 1.0 correspond to trait categories with 1.0 consisting of features, exemplars of the designated trait category (intelligence or kindness) and probability 0.0 consisting of features and exemplars of the contrast trait category (stupid or unkind). In addition, we predicted that subjects would develop a way to give meaning to probability .5 by using the concept of irrelevance or uncertainty. So, the extremely kind (or intelligent) behaviors served as prototypical examples of the high probability category, extremely unkind (or stupid) behaviors were prototypical examples of the low probability category, and the behaviors that were irrelevant to kindness (intelligence) were prototypical of probability .5 or the midpoint category.

The major hypothesis was that subjects would make probability judgments faster if the stimulus behavior corresponded closely to one of these three probability (or trait) categories. This research is an extension of
earlier work in categorization on the relationship between response time and typicality (Rosch, 1973; Rips, Shoben & Smith, 1973; Rosch, 1976). For example, subjects can respond with a yes/no decision more quickly to the statement "a robin is a bird" than to the statement "a goose is a bird" since robins are more typical birds than geese are. Similar findings have been found in the social cognition literature for trait relationships (Ebbeson & Allen, 1979) and for ratings of attitude extremity (Judd & Kulik, 1980).

There are also a number of researchers who have examined the relationship between decision time and probability estimates. Early work actually examined the possibility of using decision time as a measure of subjective probability (Cohen, Hansel, & Walker, 1960). Some of this early work suggested that there was an inverted V relationship between probability and decision time with increases in decision time from 0 to .5 and decreases from .5 to 1.0 (Cohen, Hansel & Walker, 1960; Branthwaite, 1974; Diener & Thompson, 1986). However, the inverted V relationship was not always found (Ekehammar & Magnusson, 1973; Diener & Thompson, 1986; Wright & Ayton, 1988) suggesting that task variables affect the relationship.
In a recent study by Wright and Ayton (1988) subjects were presented knowledge based questions such as "Which metal is denser?" and asked to choose the correct answer "iron" or "copper". They were then asked to indicate how sure they were of their answer on a seven-point scale from 50% sure to 100% sure. Response time was measured for both the binary response and the confidence or "probability estimation" judgment. The only clear result was that binary decision time was faster for 100% assessments than other confidence ratings. However, there was a slight tendency for 50% to be faster and the overall quadratic trend test was significant.

Phillips and Wright (1977) proposed a three-stage model of the cognitive processes involved in answering a question in the context of probability responses given to knowledge questions that has implications for response times. The model proposes that there are three possible stages involved. During the first stage the respondent determines if he knows the answer with complete certainty (i.e., a probability of 1.0 or 0). The second stage involves determining whether or not the uncertainty is a "don't know" response (i.e., a .5 probability). The third stage involves determining the degree of uncertainty (i.e., probabilities other than 0, .5, or 1.0). This model
implies that .5 probability responses are quicker than any probability response other than 0 or 1. This prediction is in contradiction to the findings reviewed above which did not find a decrease in response times for .5. However, the predictions of Phillips and Wright's (1977) model are consistent with our categorical interpretation of probability.

In the present research subjects also provided explanations for their probability judgments. The major prediction was that these explanations would provide additional evidence for the hypothesis that subjects use three probability categories in making judgments. These explanations were examined for the use of category labels corresponding to the endpoints and the midpoint. Also, the use of language to assert distance from these categories was examined to address whether or not people use hedges and intensifiers for these types of categories. Other types of statements found in subjects' explanations were features, exemplars, attributions, base rate information, and self references.

Past research in categorization has used the method of asking subjects to explain their categorization. For example, Medin (1989) discussed his ongoing research where subjects are given children's drawings of people and given the type of children who drew the pictures. Subjects were
given one of the following categories: farm children, city children, emotionally disturbed children, mentally healthy children, creative or noncreative children. The task for subjects was to provide a rule that could be used to correctly classify the drawings and new examples that might be presented later. Other examples of categorization research that has used the method of examining subjects explanations for their classifications are experiments by Wattenmaker et. al. (1986) who examined whether or not subjects were using conjunctions of features or disjunctions and the work on how children develop categories (Keil, 1987; Carey, 1986).

However, the present study is unique in that it explicity asks people to explain their numerical probability judgments. The explanations will provide evidence for whether or not subjects are using categorical information, dimensions or both. Although dimensional views of concept representation have offered explanations for the relationship between response time and typicality they make no predictions regarding the types of explanations people offer for their numerical judgments. According to the language of dimensional theories such as N. Anderson's (1974;1981) information integration theory, or Reeder and Brewer's (1979) schematic model, the judgment process involves locating the behavior on the dispositional
continuum. The language of these theories does not allow predictions about variables such as the use of features versus exemplars in explanations for judgments.

The present study also has implications for how people view the relationships between traits and behaviors. The study of trait inferences has a long history in social psychology. Early work in attribution (Kelley, 1967; Jones & Davis, 1965) tended to focus on how people used information to make inferences about traits or other dispositions. However, recent work in attribution and impression formation has examined the relationship between traits and categories of behaviors (Reeder & Brewer, 1985; Reeder, 1985) and has led to research that has examined how people make inferences about the likelihood of behaviors given certain traits (Skowronski & Carlston, 1987; 1989; Reeder, Henderson & Sullivan, 1982).

In the present research the direction of inference (Behavior to Trait Inference, or Trait to Behavior Inference) was manipulated. Subjects were either given a behavior and asked to judge the probability that the person who performed the behavior possessed a certain trait (Behavior to Trait Inference) or they were given the trait and asked to judge the probability that someone who possessed that trait would perform a particular behavior (Trait to Behavior Inference).
No specific predictions regarding the effects of direction of inference on response time were made since neither categorization nor attribution models have addressed the differences in processing due to direction of inference and most categorical models assume that there is no effect. Moreover, there is some evidence that suggests that people tend to shift all too easily from one direction to the other. For example, Eddy (1982) reported that clinicians tend to make errors and misinterpret probability information. If provided with the information that given that a person has breast cancer there is a 79% chance of getting a positive mammogram result, physicians also estimate that given a positive mammogram there is a 79% chance of cancer. Zuckerman, Eghrari & Lambrecht (1988) point out that these shifts are consistent with the assumption of bidirectionality in models of cognition (e.g. J.R. Anderson, 1982; 1983). A similar assumption is made by Smith (1984) in his application of Anderson's model to social inferences where he proposes that predicting A from B will follow the same rules as predicting B from A.

However, the categorical and dimensional views do make different predictions regarding the effects of direction of inference on actual judgments subjects make. If subjects are using a pure categorical approach to probability, they could simply make prototypicality judgments (i.e., how
typical is the behavior as an exemplar of the trait category) in both direction of inference conditions. This categorical approach would predict bidirectionality in inferences and no differences in judgments due to direction of inference. However, if subjects use frequency or base-rate information, which is a dimensional conception of probability, then there should be a direction of inference effect on probability judgments with the Trait to Behavior Inference condition providing lower probability judgments than the Behavior to Trait Inference Condition. This is due to lower base rates for behaviors given traits than for traits given behaviors.

Method

Subjects. Eighty undergraduates participated as part of a course requirement in introductory psychology at Ohio State University.

Materials. Behaviors were chosen from the Fuhrman, Bodenhausen and Lichtenstein (1987) list of behaviors. Thirty-five behaviors were chosen for both kindness and intelligence. Five sets of seven behaviors were chosen so that the seven behaviors represented seven different locations along the probability continuum. Data from four pilot tests were used in choosing statements and behaviors were chosen so that adjacent behaviors along the continuum were at nearly equal intervals across the trait continuum.
Also, behaviors were chosen so that the average number of words for each behavior location (1-7) were nearly equal to control for the confound of reading time. (See Appendix C for a complete list of behaviors used).

**Experimental Design.** The between subjects factors were trait order, direction of inference, and explanation. All subjects made judgments about both intelligence and kindness. The trait order factor refers to which trait the subject received first. Half of the subjects made ratings for intelligence first and half received kindness first. The direction of inference factor refers to the specific question subjects were asked. Subjects in the Behavior to Trait Inference condition received the question "What is the probability that the person who performed this behavior is intelligent (or kind)?" and the subjects in the Trait to Behavior Inference condition received the question "What is the probability that an intelligent (or kind) person would perform this behavior?" The explanation condition refers to when subjects were asked to provide written explanations for their judgments. Half of the subjects provided explanations after the first set of seven behaviors they received for each trait. Each set of seven behaviors will be referred to as a trial, so this was the first trial. The other half provided explanations after the last set of seven behaviors they received (i.e., the fifth trial). Five
pairwise latin square counterbalancing orders were used (Ostrom, McCann & Isaacs, 1984) to present the five sets of behaviors. The seven behaviors within each set were presented randomly with a different random order for each subject.

There were 40 between subject conditions with the following factors: 2 (trait order: kind first, intelligent first) X 2 (direction of inference: trait to behavior, behavior to trait) X 2 (explanation: first trial, fifth trial). There were also five counterbalancing orders for the 5 behavior sets. Two subjects were randomly assigned to each of the 40 conditions for a total of 80 subjects. The within subjects factors were behavior location with 7 values, trial with 5 values (i.e., the five behavior sets) and trait set (first trait, second trait). The trial effect allowed us to examine the effect of practice on categorization processes. The dependent variables were response time, judgments and subjects' explanations for their judgments.

Procedure. Subjects signed up for an experiment on social judgment and were run individually in cubicles using IBM personal computers. Initial instructions were provided by the experimenter with the rest of the instructions given on the computer screen. The following introductory instructions appeared on the screen and were read aloud by
the experimenter: "This is an experiment about social judgments. Specifically, we are interested in how people make judgments about traits like honesty, intelligence, and kindness. During this experiment you will read examples of behaviors on the computer screen. In the first part of this experiment you will be asked to judge the probability that an INTELLIGENT (KIND) person would perform the behavior (or subjects were asked to judge the probability that the person who performed the behavior is INTELLIGENT (KIND)). As you know probability values range on a continuum from 0 to 1.0. However, in this study you will be making probability judgments on a scale from 1 to 9. For each behavior, a probability scale like the one below will appear on the computer screen. You will make your probability judgment by pressing one of the keys marked 1 through 9 where 9 means HIGHEST PROBABILITY and 1 means LOWEST PROBABILITY.

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The majority of your responses will be made by pressing numbers on the computer keyboard. The computer will keep track of the probability judgments that you make and the amount of time it takes for you to make your judgment.
Please try to answer as ACCURATELY AND AS QUICKLY AS POSSIBLE. ACCURACY AND SPEED ARE EQUALLY IMPORTANT. The FIRST FOUR BEHAVIORS ARE PRACTICE BEHAVIORS which will help you get used to using the probability scale. You will be making judgments about HONESTY for these first four practice behaviors. Then you will be making judgments about the trait intelligence (kindness).

The experimenter also told subjects that the computer would instruct them when it was time to answer the questions in the booklets. Two booklets were placed on the table next to subjects. Subjects were told to carefully follow the instructions provided on the computer screen and not to write in the booklets until instructed to do so. They were then reminded to answer as quickly and as accurately as possible. Subjects responded to 70 behaviors in all, 35 for intelligence and 35 for kindness. In order to make direction of inference salient, the probability question along with the scale appeared on the screen along with each behavior. For each trait, subjects responded to five sets of seven items and each set of 7 spanned the trait dimension.

Subjects were asked to provide written explanations for one set of seven behaviors for each trait. Therefore, each subject generated 14 explanations. Half of the subjects provided explanations for their judgments after
the first trial and half provided explanations after the last (fifth) trial. Explanations were provided after all seven judgments in that trial were completed. Subjects were given the behavior, the probability scale, the probability question and the judgment they gave for that behavior and were presented with the following instructions: "Now I would like you to describe the thoughts that guided your judgment about the behavior that is on the screen. Please write down all the information that you considered providing as much detail as possible. What was it that led you to make the probability rating that you did?"

After subjects finished judging the 70 behaviors and providing explanations, they were debriefed and thanked for their participation.

Results

Judgments. The mean probability judgment for each behavior was computed. This was done separately for each direction of inference condition since direction of inference could have influenced behavior location. Although, the behaviors were chosen from normative data, there were a number of reversals in behavior location. That is, the behavior originally chosen to be second lowest may have actually been rated third lowest. Moreover, the reversals were slightly different in the two direction of
inference conditions. Before the response time data was analyzed it was important that the behaviors be reordered based on the mean probability judgments given in this experiment. Therefore, the behaviors were reordered separately for each direction of inference condition so that behavior location 1 always corresponded to the behavior in that particular behavior set that received the lowest probability judgment, location 2 corresponded to the next lowest etc. There were a total of 8 reversals in the Behavior to Trait Inference condition and 8 reversals in the Trait to Behavior Inference condition. All behaviors and the mean probability judgment for each direction of inference condition are presented in Appendix D.

It was important to ensure that the relative location of behaviors remained the same across all experimental conditions. In order to assess the effect of our experimental conditions on probability judgments a 2 (Direction of Inference: Trait to Behavior Inference, Behavior to Trait Inference) X 2 (Explanation: First Trial, Fifth Trial) X 2 (Trait order: Kind first, Intelligent first) X 2 (Trait Set: First trait, Second Trait) X 5 (Trial: 1-5) X 7 (Behavior Location: 1-7) analysis of variance was conducted. Direction of inference, explanation, and trait order were between subjects factors and trait set, trial and behavior location
were within subjects factors. In this analysis the trait effect will come out as the trait order by trait set interaction. To avoid confusion effects containing this interaction will be referred to as the trait main effect.

There was an overall effect of behavior location \( (F(6,432)=1064.08 \ p < .000001) \). This effect is presented in Figure 10. Trend analyses indicated a significant linear trend \( (F(1,72)=2226.14 \ p < .0001) \).

There was a significant main effect of direction of inference on probability judgments \( (F(1,72)=11.94 \ p < .001) \). The mean probability judgment for the Behavior to Trait Inference condition was 5.23 and the mean for the Trait to Behavior Inference condition was 4.93. This finding is relevant to the distinction between categorical versus dimensional conceptions of probability. If subjects are simply accessing trait categories and making prototypicality judgments, this process should be the same for both direction of inference conditions. However, if subjects are using frequency or base-rates in making judgments (i.e., a dimensional conception of probability) this can account for the fact that the Trait to Behavior Inference condition has lower probability judgments than the Behavior to Trait Inference condition since the base rate of particular behaviors given certain traits is probably fairly low.
Figure 10: Judgment as a Function of Behavior Location
In addition, there was a significant behavior location by direction of inference interaction ($F(6,432)=11.23$ $p < .0001$) which is displayed in Figure 11. There was a slight difference in judgments for the two direction of inference conditions especially for the behaviors on the lower end of the continuum. Trend analyses indicated that the linear component of the behavior location effect significantly interacted with direction of inference ($F(1,72)=7.31$ $p < .01$). This interaction is also relevant to the distinction between dimensional and categorical approaches to probability. Figure 11 suggests that the probability judgments for trait to behavior judgments are lower than those for behavior to trait judgments but primarily for behaviors on the lower half of the scale. This suggests that subjects may be using the fact that the base rates for the negative behaviors (unkind or stupid) are low overall and are especially low given that the person possesses the positive trait (kindness or intelligence). However, the judgments on the upper half of the scale indicate little difference in probability judgments due to direction of inference.

There was also a trait by behavior location interaction ($F(6,432)=32.99$ $p < .0001$) which is displayed in Figure 12. Trend analyses indicated that the linear component of the behavior location effect significantly
"Figure 11: Judgment as a Function of Behavior Location and Direction of Inference"
Figure 12: Judgment as a Function of Behavior Location and Trait
interacted with the trait effect ($F(1,72) = 48.32, p < .001$). Figure 12 indicates that the judgments for kindness spanned a broader range on the probability scale than the intelligent judgments. This was due to the fact that the judgments for behaviors at location 1 and 2 were judged lower than the corresponding behaviors for intelligence. Again, both traits display the upward trend in probability judgments. There were a number of other significant effects on judgment. However, they won't be discussed further here. The complete anova summary table for judgments along with figures for the significant effects are presented in Appendix D. Overall, these results indicated that the behaviors maintained their location relative to the other behaviors used across experimental conditions.

Response Time. The overall mean response time in the original data set was 4.59 seconds. The following procedure was used to remove outliers from the analysis. First, a cutoff of three standard deviations above the mean was established. This original cutoff was 12.63 seconds. One subject was replaced with a new subject because more than 15% of his response times exceeded the cutoff. After this subject was replaced, a new cutoff of 13.03 was established using the same method. This average of 13.03 is higher than the original average of 12.63 because the
new subject had higher response times overall. In the final sample, no subject had more than 15% of their response times greater than this new cutoff. All response times exceeding this cutoff were replaced with the mean response time for that particular location, trial, direction of inference, trait order and explanation condition. Less than 2% of response times were replaced using this method.

Analysis Strategy. In order to test the major hypothesis that subjects use three categories when making probability judgments a subset of the complete data set was analyzed. The response time data for the first trait that subjects received was examined as it provided the best test of how subjects initially gave meaning to the probability scale and how this changed over trials when the judgment was about the same trait. In addition, only subjects who gave explanations on the last trial were included. This was done because pilot tests indicated that response times increased as a result of giving explanations on the first trial. Therefore, the data from the first trait for subjects who did not give explanations until after the fifth trial provided us with the cleanest data to examine the overall hypothesis regarding the use of three probability categories. The discussion of this subset of the data will focus on the major theoretical hypotheses.
Following this discussion, the complete data analysis will be discussed to examine the effects of the other experimental conditions.

A number of planned orthogonal contrasts were performed to pinpoint specific effects of theoretical interest. These contrasts were performed on the subset data and the full data set. The first contrast compared the average of the response time for the endpoints, and the midpoint to the average response time for the other locations. This was done to test the primary hypothesis that subjects were using three categories. The primary hypothesis was that the average response time for the endpoints and midpoint would be faster than for the other locations.

A second contrast compared the average response time for the endpoints to the response time for the midpoint. This contrast was used to test the hypothesis that the categories for the endpoints were relatively stronger categories than the midpoint category. If subjects used trait categories to give meaning to high probability and low probability then these categories should be better developed, and have more features, exemplars, and personal experiences associated with them than the midpoint category. On the other hand, the midpoint category may be of the ad hoc type and take time to develop. We predicted
that the average response time for the endpoints would be faster than the average response time for the midpoint.

The third contrast compared the response time for the behaviors corresponding to the designated trait (i.e., intelligence or kindness) to the behaviors corresponding to the contrast trait (i.e., stupid or unkind). This comparison was useful as it allowed us to test the strength of the contrast category relative to the designated category when making probability inferences. Since our instructions activated the trait that corresponds to high probability, the behaviors corresponding to this designated trait may have been responded to more quickly.

**Subset Analysis.** A 2 (Trait: Intelligence, Kindness) X 2 (Direction of Inference: Behavior to Trait Inference, Trait to Behavior Inference) X 5 (Trials) X 7 (behavior location) analysis of variance was conducted with trait and direction of inference as between subjects variables and trial and location as within subject variables. The major test of the hypothesis involves the overall effect of behavior location on response time. This main effect of location was significant ($F(6,216) = 16.40 \ p < .0001$). (See Figure 13). This figure indicates that subjects were much faster in responding to behaviors corresponding to high probability and low probability than for the other locations. There was also a significant trial by location
Response Time as a Function of Behavior Location For Subset Analysis
interaction \( (F(24,864)=1.84 \ p < .01) \) which is illustrated in Figure 14. The means reported are based on running averages computed by getting the mean for each location value across trials 1 and 2, 2 and 3, etc. This figure indicates that response time for the midpoint of the scale decreases over trials. This suggests that, over trials, subjects developed a category for the midpoint of the scale.

In addition, there was an overall significant trial effect \( (F(4,144)=35.98 \ p < .0001) \) with a decrease in response time over the five trials with response times of 5.16, 4.35, 4.00, 3.83, and 3.55 respectively.

There was also a significant location by trait interaction \( (F(6,216)=2.90 \ p < .01) \) and a significant location by trait by direction of inference interaction \( (F(6,216)=3.41 \ p < .01) \). These latter effects will be examined further in the complete data set. In order to satisfy the interested reader, the complete analysis of variance summary tables and the figures for the additional significant effects involving location are presented in Appendix D.

**Planned Contrasts.** A contrast comparing the average response time for the endpoints and the midpoint to the average response time for the other locations was used to directly test the hypothesis that subjects were using
Figure 14: Response Time as a Function of Behavior Location and Trial For Subset Analysis
categories that corresponded to these locations. This contrast was significant ($F(1,36)=26.70$ $p < .0001$) and did not interact with trial ($F(4,144) < 1.00$) or the other variables. The means indicated that the average response time for the endpoints and the midpoint ($M=3.95$) was faster than for the other locations ($M=4.38$).

A contrast comparing the average of the endpoints to the midpoint was conducted to test the hypothesis that the endpoints were relatively stronger categories than the midpoint. The overall contrast was significant ($F(1,36)=41.18$ $p < .0001$) with the response time for the endpoints faster ($M=3.62$) than for the midpoint ($M=4.49$). Moreover, this contrast interacted with trial ($F(4,144)=7.46$ $p < .0001$). As indicated in Figure 14, the difference between the endpoints and the midpoint decreases over trials as subjects develop a strategy for giving meaning to the midpoint category.

A final contrast compared the response time of the endpoint corresponding to the designated trait (or high probability) to the endpoint corresponding to the contrast trait (or low probability). The overall contrast was not significant ($F(1,36)=1.15$ $p < .29$). However, this contrast significantly interacted with trait ($F(1,36)=5.50$ $p < .05$) and with the trait by direction of inference interaction ($F(1,36)=18.58$ $p < .0001$). This trait by contrast
Figure 15: Response Time as a Function of Behavior Location, and Trait For Behavior Inference Task, Subset Analysis
Figure 16: Response Time as a Function of Behavior Location, and Trait For Trait Inference, Subset Analysis
interaction for the Trait to Behavior Inference condition is displayed in Figure 15 and for the Behavior to Trait Inference condition in Figure 16. Examining the contrast separately for each condition indicated that there was only a significant contrast between the two endpoints for the Behavior to Trait Inference condition for intelligence.

This is an intriguing interaction but one that is difficult to explain theoretically. Neither Reeder and Brewer’s (1979) model nor models of categorization provide ready explanations for direction of inference effects on response time. However, the schematic assumptions provided by Reeder and Brewer’s analysis do provide some insight.

The highest response time occurs in the intelligence data for trait inferences given stupid behaviors. This increase in response time could be explained by the assumptions of the hierarchically restrictive schema. Recall, that according to Reeder and Brewer (1979), for the location on the trait continuum corresponding to intelligence there are a greater range of behaviors that can occur than for other locations on the trait continuum. This range of possible behaviors decreases as you move lower on the trait continuum. That is, a moderately intelligent person would perform a more narrow range of behaviors than an extremely intelligent person since the moderately intelligent person wouldn’t be likely to perform
the extremely intelligent behaviors. When asked to judge the probability that the person who performed a stupid behavior is intelligent subjects may take longer because they realize that stupid behaviors can be performed by a person at any level on the trait continuum and that even an extremely intelligent person can act stupid on occasion. Therefore, it takes them longer to judge the probability of the trait intelligence when given stupid behaviors than when given intelligent behaviors.

But why doesn't this pattern occur for the trait to behavior condition? One possibility is that subjects realize that it is difficult to predict a specific behavior from knowledge of a general trait. For example, knowing that a person is intelligent isn't that helpful in predicting whether or not that person would "develop a new computer language". Other types of information like base rate information, specific abilities, effort attributions, become relevant. On the other hand, the trait inference from the behavior "developed a new computer language" is easier to make.

On the other hand, the fact that the contrast between the endpoints is not significant for kindness judgments suggests that the schematic implications between behaviors and traits may be similar for the two endpoints. This pattern was even more pronounced in the full data set which
will be examined shortly.

**Full Analysis.** In order to further examine the hypotheses across both trait sets and the effects of the other experimental factors a $2 \times 2 \times 2 \times 2 \times 5 \times 7$ analysis of variance was conducted with direction of inference, explanation, trial, and item location as within subjects factors. In this analysis the trait main effect will come out as a trait order by trait set interaction. Again, to avoid confusion, effects containing this interaction will be referred to as trait main effects.

**Location Effects.** There was a significant main effect of location ($F(6, 432) = 45.91, p < .0001$). Figure 17 displays the overall location effect. These data clearly support the major prediction and indicate that subjects were fastest for the endpoints and the midpoint on the scale.

The trial by location interaction was also significant ($F(24, 1728) = 2.54, p < .0001$). This is presented in Figure 18 which displays the running averages across trials for each location value. The pattern of this interaction is
Figure 17: Response Time as a Function of Behavior Location
Figure 18: Response Time as a Function of Behavior Location Across Trials
slightly different from the trial by location data for the subset analysis (first trait, explanation last conditions only). Recall that on the early trials there wasn't evidence of a category for the midpoint. Rather, the midpoint category developed around the third trial. When you collapse across both sets of traits as displayed in Figure 18 the response time for the midpoint location is lower than adjacent locations. It appears that the effort of forming an ad hoc category for the first trait facilitated the development of such a category for the following, but semantically independent, second trait.

In addition, the trait set (first trait, second trait) by location interaction was significant ($F(6, 432)=6.60 \ p < .0001$) suggesting that the overall location effect was different in the second trait. This interaction is displayed in Figure 19 and clearly displays that the use of the midpoint category was stronger for the second trait set.

The location by direction of inference interaction was also significant ($F(6, 432)=9.91 \ p < .002$) and is displayed in Figure 20. This figure suggests that the category corresponding to the midpoint was stronger when subjects were making inferences about traits from behaviors than vice versa. There was also a location by trait interaction ($F(6, 432)=11.66 \ p < .0001$) which is illustrated in Figure
Figure 19: Response Time as a Function of Behavior Location and Trait Set
Figure 20: Response Time as a Function of Behavior Location and Direction of Inference
Figure 21: Response Time as a Function of Behavior Location and Trait
21. The data suggest that the category for the midpoint was stronger for kindness than for intelligence. This is consistent with the results of Experiment 2 (See Figure 4).

However, there was also a trait by location by direction of inference interaction ($F(6, 432)=3.58 p < .002$). The trait by location interaction for the behavior to trait inference task is illustrated in Figure 22 and for the trait to behavior inference task in Figure 23. The weakened midpoint category for the trait to behavior inference task was due primarily to the intelligence data. In all other conditions there was a decrease in response time for the midpoint.

There was also an overall location by trait order by direction of inference by explanation condition interaction ($F(6, 432)=2.20 p < .05$) and a significant trial by location by trait order interaction ($F(6, 432)=1.56 p < .05$). (See Appendix D).

Endpoints/Midpoint Versus Other Locations. The overall contrast comparing the average of the endpoints and the midpoint to the average of the other four locations was significant ($F(1, 72)=140.71 p < .0001$) with the average response time for the endpoints and the midpoint ($M=3.92$) being faster than the average of the other locations ($M=4.52$). This result supports our primary hypothesis that subjects were using categories corresponding to the endpoints and the midpoint.
Figure 22: Response Time as a Function of Behavior Location and Trait For Behavior to Trait Inferences
Figure 23: Response Time as a Function of Behavior Location and Trait For Trait to Behavior Inferences
However, this contrast interacted with trait 
\( F(1,72)=9.05 \ p < .004 \). For kindness the average response 
time for the endpoints and midpoint was 4.02 compared with 
4.75 for the average of the other locations. For 
intelligence, the average for the endpoints and the 
midpoint was 4.13 and the average for the other locations 
was 4.58. As can be seen in Figure 21, there was a bigger 
difference for kindness. But as was noted previously, the 
decrease in response time for the midpoint was much weaker 
for the intelligence judgments for the trait to behavior 
inferences which contributes to this effect.

Endpoints versus Midpoint. The contrast comparing the 
average of the two endpoints to the midpoint was 
significant \( F(1,72)=21.98 \ p < .0001 \) with the average for 
the endpoints \( (M=3.85) \) significantly lower than for the 
midpoint \( (M=4.35) \). Since the endpoint categories 
corresponded to trait categories these categories may be 
better developed and contain more features, and exemplars 
than the midpoint category. Therefore, we predicted that 
response times for behaviors that matched these categories 
would be faster than the response time for behaviors that 
corresponded to the midpoint.

There was also a contrast by trial interaction 
\( F(4,144)=7.46 \ p < .0001 \) which is displayed in Figure 24. 
This figure also indicates that the midpoint category 
developed over trials.
Figure 24: Contrast Comparing Average of Endpoints to the Midpoint Across Trials Using Running Averages.
Lower Endpoint Versus Upper Endpoint. A final contrast compared the response times of the two endpoints. The behaviors for location seven were prototypical of the designated trait that appeared in the instructions (intelligence or kindness). Location one behaviors were prototypical behaviors of the contrast traits unkindness or stupidity. The overall contrast comparing the two endpoints was significant ($F(1,72)=7.62$ $p < .01$) with the mean response time for the behaviors corresponding to the contrast trait ($M=4.04$) significantly greater than for the behaviors corresponding to the designated trait ($M=3.84$). However, there was also a contrast by direction of inference interaction ($F(1,72)=6.79$ $p < .02$), a contrast by trait interaction ($F(1,72)=20.59$ $p < .0001$) and a contrast by trait by direction of inference interaction ($F(1,72)=14.84$ $p < .001$).

The contrast by trait interaction for the trait to behavior inference condition is displayed in Figure 25 and for the behavior to trait inference condition in Figure 26. Analyzing the data separately for each trait indicated that the contrast by direction of inference interaction was significant for intelligence ($F(1,76)=25.28$ $p < .0001$) but not for kindness ($F < 1.00$). Examining the contrast separately for each direction of inference condition for the intelligence data indicated that there was no contrast
Figure 25: Contrast Comparing Response Times for Designated and Contrast Trait Behaviors For Behavior Inference Task
Figure 26: Contrast Comparing Response Times for Designated and Contrast Trait Behaviors For Trait Inference Task
effect in the Trait to Behavior Inference condition (F < 1.00) but a significant effect for the Behavior to Trait Inference condition (F(1,38)=54.98 p < .0001). These results are similar to the results found in the subanalysis but suggest more clearly that the unique condition is the behavior to trait condition for intelligence. In all other conditions there is no evidence of a contrast effect between behaviors corresponding to the contrast trait and behaviors corresponding to the designated trait. Again, this can be explained by the assumptions of the hierarchically restrictive schema. For intelligence, people realize that even intelligent people perform stupid behaviors on occasion. Therefore, it is more difficult to make trait inferences from the stupid behaviors. However, it is unlikely that a stupid person could perform an extremely intelligent behavior. Therefore, subjects can more readily make probability inferences from the intelligent behaviors.

It is possible to argue for a similar asymmetry for kindness. People may believe unkind people are more likely to do kind things than vice versa. While there was some suggestion of this in the subanalysis (p < .07), (See Figures 15 and 16), the full analysis does not support an asymmetry for kindness. Since intelligence is an ability whereas kindness is a moral disposition, this difference of
ability needed to perform the behavior versus motivation to perform the behavior may be crucial to obtaining the asymmetry effect.

The contrast comparing the response times for the two endpoints also interacted with the trial factor \((F(4,288)=3.01 p < .03)\). This interaction is displayed in Figure 27 using running averages. The results indicate that the difference in response time to behaviors corresponding to the contrast and trait categories decreased across trial. By trials 4 and 5, the response times were nearly identical, suggesting that the contrast trait is conceptually as strong as the designated trait by the fourth and fifth trial.

**Direction of Inference effects.** There were a number of significant interactions involving the direction of inference effect. The trait by direction of inference interaction was significant \((F(1,72)=5.87 p < .02)\) and is displayed in Figure 28. The simple main effect of direction of inference was not significant for either kindness \((F < 1.00)\) or intelligence \((F(1,72)=1.31 p < .26)\). However, the trait main effect is significant for behavior to trait inferences with response times for kindness \((M=4.49)\) greater than response times for intelligence \((M=4.25)\) \((F(1,36)=5.80 p < .03)\) but not significant for trait to behavior inferences \((F(1,36)=1.40 p < .25)\).
Figure 27: Contrast Comparing Response Times For Endpoints Across Trials
Figure 28: Response Time as a Function of Trait and Direction of Inference
There was also an explanation condition by trait by direction of inference interaction. Figure 29 shows the trait by direction of inference condition for subjects who gave explanations for their probability judgments after the first trial. This data is similar to the overall trait by direction of inference interaction. Figure 30 shows the trait by direction of inference effect for the explanation last trial condition subjects. Analyses on the explanation last trial data indicated that there were no significant trait (F(1,36)=1.75 p < .20) or direction main effects (F < 1.00) or a significant trait by direction of inference interaction (F < 1.00).

Contrasts of response time means for the explanation first trial data indicated that the main effect for direction of inference was not significant for either kindness (F < 1.00) or for intelligence (F(1,36)=1.92 p < .18). However, for the behavior to trait inference condition there was a significant trait effect with greater response times for kindness than intelligence (F(1,18)=6.40) p < .03). Moreover, there was a marginally significant trait effect for the trait to behavior condition with greater response times for intelligence than kindness (F(1,18)=4.19 p < .06). This is difficult to interpret since it could be due to specific behaviors used in this experiment. However, the interaction with
Figure 29: Response Time as a Function of Trait and Direction of Inference For Explanation First Trial Condition
Figure 30: Response Time as a Function of Trait and Direction of Inference For Explanation Fifth Trial Condition
explanation is interesting. Obviously, providing explanations for the first trial affects judgmental strategies, possibly by making schematic assumptions more accessible. However, there isn't a clear theoretical interpretation that would explain why behavior to trait inferences should be faster for intelligence than kindness but trait to behavior inferences faster for kindness than intelligence.

**Practice Effects.** There were a number of significant effects that indicate that subjects became quicker in making inferences across the experimental session. First, the overall trial main effect was significant ($F(4,288)=60.05 \ p < .0001$) with the response time decreasing over trials. The means across the five trials were 5.02, 4.74, 4.35, 4.08, 3.86, respectively. There was also a significant trait set effect ($F(1,72)=55.96 \ p < .0001$) with the response time for the first trait ($M=4.71$) greater than for the second trait ($M=4.11$). In addition there was a trial by trait set interaction which indicates that the trial main effect was different for the first trait and the second trait ($F(4,288)=4.32 \ p < .01$). This interaction is graphed in Figure 31. The slope of the two trial effects appears similar except that response time leveled off by the fifth trial for the second trait set.
Figure 31: Response Time Across Trials For Each Trait Set
Explanation Effects. Providing explanations after the first trial also affected response time. Results indicated that there was a main effect for explanation condition $(F(1,72)=6.68 \ p < .05)$ with greater response time for the explanation first trial subjects $(M=4.71)$ than for explanation last trial subjects $(M=4.11)$. Presumably, providing explanations led subjects to elaborate more during the judgment process. This effect was qualified by the trial by explanation interaction $(F(4,288)=6.52 \ p < .0001)$ which is displayed in figure 32. Beginning with the second trial the response times were greater for explanation first subjects. This makes sense since subjects who gave explanations on the first trial did not give their explanations until after all first trial judgments were made.

There was also an explanation by trait set interaction $(F(1,72)=32.28 \ p < .0001)$ which is illustrated in Figure 33. Although there was a large effect of explanation on response time for the first trait, this effect was not evident during the second trait set. This was qualified by a trial by explanation by trait set interaction $(F(4,288)=3.03 \ p < .02)$. The trial by explanation interaction for the first trait is displayed in Figure 34. Again, there was a big increase in response time in the explanation first trial condition for trial 2. Figure 35 displays this interaction for the second trait set. Here,
Figure 32: Response Time Across Trials By Explanation Condition
Figure 33: Response Time For Each Trait Set By Explanation Condition
Figure 34: Response Time Across Trials By Explanation Conditions For the First Trait
Figure 35: Response Time Across Trials By Explanation Conditions For the Second Trait
response times were nearly identical for the first trial and there was a smaller effect of explanation condition across trials. This pattern makes sense since after the first trait all subjects have given explanations. Even the subjects in the explanation fifth condition gave explanations on the fifth trial for the first trait.

Discussion of Response Time Results

There was strong support that subjects were using categories that corresponded to the endpoints and the midpoint of the probability scale as response times were lower for behaviors that corresponded to these three locations. Moreover, the response time for the midpoint category developed across the first five trials and there was clear evidence that once subjects developed the concept for the midpoint they could easily apply it even when the trait changed.

These results suggest that the midpoint category may be an ad hoc category that develops with use of judgments in the middle of the scale. The fact that response times for the midpoint category start out fairly high (i.e., they were the highest response time for trial 1 for the first trait set) and decrease across trials suggests that subjects are acquiring a concept for the midpoint.
However, an alternative explanation is that the judgments for the irrelevant behaviors are more difficult. After making a number of these judgments subjects become unwilling to work on the irrelevant items. Therefore, the decrease in response times could be accounted for by this selective fatigue effect for midpoint items. Although this is a reasonable argument, it is problematic. First of all, the explanation data (to be discussed shortly) provide strong support for the existence of a midpoint category. In subjects' explanations they provide labels for this category (e.g., uncertainty, irrelevance, etc.). However, subjects do not express the fact that these items are more difficult in their explanations. A second problem with this selective fatigue hypothesis is that in order to decide not to work on an item (because it is difficult) subjects must first categorize it as a midpoint (or as a difficult) item. And in order to make this type of categorization they must use the features of irrelevance, uncertainty, which serves as a category label for the midpoint category. However, the ultimate result may be that subjects actually do work less on these midpoint items.

These results extend the work on categorization and the relationship between typicality and response time. These data support the proposal that traits are
categories of behaviors and the representation possesses a graded structure with some behaviors more typical examples than others.

Moreover, this research examined the cognitive processes involved in providing meaning to numerical response scales. These results suggest that when people are asked to make probability judgments they use the three categories "highly probable", "highly improbable" and "uncertain". This is in contrast to the notion that people access a psychological continuum representing the values from 0 through 1.0.

The direction of inference effect indicated that subjects took longer to make inferences when given stupid behaviors and asked to judge the probability that the person was intelligent than when they were given intelligent behaviors. This is consistent with the notion that people employ the assumptions of a hierarchically restrictive schema for making intelligence judgments. These assumptions include the belief that an intelligent person performs a wider range of behaviors (including stupid ones) than a stupid person. Therefore, when given a stupid behavior subjects take longer to make their judgment. On the other hand, the failure to find a difference between judgments for kind and unkind behaviors is consistent with the notion that kindness is partially
restrictive. In this case, subjects are less likely (or equally likely) to consider the fact that a kind person could act in an extremely unkind way, or that an unkind person could act in an extremely kind manner.

The direction of inference effect only occurred when subjects provided explanations on the first trial. This indicates that generating explanations for judgments led to different strategies and possibly activated these schematic assumptions.

Over trials subjects became increasingly faster in making probability judgments. This is consistent with research that proposes that peoples' production rules for making inferences become more efficient with practice (Smith, Branscombe, and Bormann, 1988).

Content Analysis of Explanations

The coding of subjects' explanations for their numerical judgments was done to examine whether or not subjects were using categories that referred to the endpoints and the midpoint on the probability scale and, if they were, to determine how subjects gave meaning to those categories. That is, do they use trait categories, probability ranges, features, exemplars? Also, we assessed the extent to which subjects used hedges (e.g., sort of, somewhat) and intensifiers (e.g., very, extremely) which would indicate that these categories had a graded
structure. The other types of statements that we found were attributions, base rates, self-references and assumptions based on the specific behavior.

**Coding of Explanations.** The rules for coding explanations were both theory and data driven. Explanations given by subjects in pilot experiments were used to develop coding classifications. One coder was used for the final coding of all explanations. Reliability of coding was assessed by having a second person code 20 percent of the explanations. The second coder coded explanations for 2 subjects from each of the 8 major conditions for a total of 224 explanations. Protocols were coded in a random order within each trait and direction of inference condition.

The major coding classifications are displayed in Table 3. Within each coding classification, there were a number of possible specific statements that were used. For example, to assert the upper endpoint category, subjects could assert that the person was intelligent, that the behavior was intelligent, that an intelligent person would be likely to perform the behavior, etc. Explanations were coded for as many as these specific categories that were evident in the explanation.

Reliability was assessed by using the following formula: $2(\text{number of agreements between coders})/(\text{number of agreements} + \text{number of disagreements})$. 


codings by coder 1 + number of codings by coder 2). This indicates the proportion of times the two coders agreed on their classification. This formula was applied to the overall 14 categories. (See Table 3). An agreement occurred if both coders had both found at least one statement within the overall category. The reliability across the 14 major classifications was 81%. This formula was also applied to the 60 specific statements where an agreement occurred only if both coders found the same specific statement. The reliability across the 60 specific statements dropped to 70%. There were a total of 5 uncodable explanations, 4 for kindness, and 1 for intelligence.

**Justification of Coding Categories.** Table 4 provides a list of the specific statements that were used as possible labels for the category corresponding to the upper endpoint and the distribution of each of these statements across judgments. Subjects gave meaning to this category either by using the designated trait category (i.e, kindness or intelligence) or by asserting high probability. The use of intensifiers like "very", "extremely", "definitely" were also included in this coding category. Before the use of these particular statements as indicators of the overall classification could be justified, it was important to provide evidence that the statements were used in a similar
Table 3: Major Coding Classifications Used to Code Explanations

I. Categorical Constructs

A. Use of Category Labels

1. Label for Upper Endpoint Category: Asserting Designated Trait or High Probability

2. Label for Lower Endpoint Category: Asserting Contrast Trait or Low Probability

3. Label for Midpoint Category: Asserting Uncertainty, Irrelevance, Neutral or Average

B. Graded Structure

4. Distance from Upper Endpoint Category

5. Distance from Lower Endpoint Category

6. Distance from Midpoint Category

C. Features and Exemplars

7. Features (Traits, Inferred Behaviors) of Designated Trait

8. Features (Traits, Inferred Behaviors) of Contrast Trait

9. Exemplars of Designated Trait (including self as exemplar)

10. Exemplars of Contrast Trait (including self as exemplar)

II. Attributional Information

11. Possible Causes of Behavior (internal and external)

12. Base Rate of Behavior

III. Other

13. Assumptions Based on or Features of Behavior

14. Self References
Table 4: The Proportion of Subjects Using Statements To Assert the Upper Endpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 sum</td>
</tr>
<tr>
<td>1. Person is DT</td>
<td>.00 .00 .00 .01 .00 .04 .06 .13 .15 .39</td>
</tr>
<tr>
<td>2. Behavior is DT</td>
<td>.00 .01 .00 .00 .00 .03 .04 .07 .07 .22</td>
</tr>
<tr>
<td>3. High probability is DT</td>
<td>.00 .00 .00 .00 .00 .01 .03 .03 .07</td>
</tr>
<tr>
<td>4. Low probability is CT</td>
<td>.00 .00 .00 .00 .00 .00 .00 .00 .00 .00</td>
</tr>
<tr>
<td>5. DT person would</td>
<td>.00 .00 .00 .00 .00 .02 .04 .05 .07 .18</td>
</tr>
<tr>
<td>6. High probability DT would</td>
<td>.00 .00 .00 .00 .00 .01 .04 .05 .05 .15</td>
</tr>
<tr>
<td>7. Low probability CT would</td>
<td>.00 .00 .00 .00 .00 .00 .00 .00 .00 .00</td>
</tr>
<tr>
<td>8. Intensifiers</td>
<td>.00 .00 .00 .00 .00 .00 .03 .10 .13 .26</td>
</tr>
<tr>
<td>9. Negate CT person</td>
<td>.00 .00 .01 .00 .00 .01 .00 .00 .00 .02</td>
</tr>
<tr>
<td>10. Negate CT behavior</td>
<td>.00 .00 .00 .00 .00 .01 .00 .00 .00 .01</td>
</tr>
<tr>
<td>11. CT person wouldn’t</td>
<td>.00 .00 .00 .00 .00 .00 .00 .00 .01 .01</td>
</tr>
<tr>
<td>12. CT person would do other</td>
<td>.00 .00 .00 .00 .00 .00 .00 .00 .00 .00</td>
</tr>
<tr>
<td>Sum</td>
<td>.00 .01 .01 .01 .00 .12 .22 .43 .51</td>
</tr>
</tbody>
</table>

Note: DT stands for designated trait (i.e. kindness or intelligence), CT stands for contrast trait (i.e. unkindness or stupid). Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
manner. If the frequency distributions across judgments were similar across the statements within the overall classification then we can be fairly confident that subjects were using the statements in a similar manner in their explanations.

Table 4 supports the use of these statements as indicators of the use of a label corresponding to the upper endpoint category. Across items, the use of these statements increased with judgment value with the exception of judgment 5. This is not surprising since for judgments at the midpoint subjects were probably more likely to refer to the category for the midpoint.

Table 5 reports the probability distributions across judgments for the specific statements that were used as possible labels for the lower endpoint category. These statements included assertions of the contrast trait, assertions of low probability of the designated trait, etc. Again, the proportions support our use of these statements as indicators of the use of labels for the lower endpoint as the proportions are highest for lower judgment values.

Table 6 presents the proportion of subjects who used the statements that provided possible labels for the midpoint category. Again, the data clearly show that subjects use these statements for judgments at the midpoint of the scale. The largest proportion (i.e., .26) occurs for
Table 5: The Proportion of Subjects Using Statements To Assert the Lower Endpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1. Person is CT</td>
<td>.06</td>
</tr>
<tr>
<td>2. Behavior is CT</td>
<td>.07</td>
</tr>
<tr>
<td>3. High probability is CT</td>
<td>.01</td>
</tr>
<tr>
<td>4. Low probability DT</td>
<td>.00</td>
</tr>
<tr>
<td>5. CT person would</td>
<td>.01</td>
</tr>
<tr>
<td>6. High probability CT would</td>
<td>.00</td>
</tr>
<tr>
<td>7. Low probability DT would</td>
<td>.05</td>
</tr>
<tr>
<td>8. Intensifiers</td>
<td>.08</td>
</tr>
<tr>
<td>9. Negate DT person</td>
<td>.06</td>
</tr>
<tr>
<td>10. Negate DT behavior</td>
<td>.03</td>
</tr>
<tr>
<td>11. DT person wouldn't</td>
<td>.15</td>
</tr>
<tr>
<td>12. DT person would do other</td>
<td>.07</td>
</tr>
<tr>
<td>Sum</td>
<td>.59</td>
</tr>
</tbody>
</table>

Note: DT stands for designated trait (i.e. kindness or intelligence), CT stands for contrast trait (i.e. unkindness or stupid). Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
Table 6: The Proportion of Subjects Using Statements To Assert the Midpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----</td>
</tr>
<tr>
<td>1. Uncertain</td>
<td>.00</td>
</tr>
<tr>
<td>2. Irrelevant</td>
<td>.01</td>
</tr>
<tr>
<td>3. Ambivalence</td>
<td>.00</td>
</tr>
<tr>
<td>4. Missing Information</td>
<td>.00</td>
</tr>
<tr>
<td>5. 50/50 chance</td>
<td>.00</td>
</tr>
<tr>
<td>6. Neutral</td>
<td>.00</td>
</tr>
<tr>
<td>7. Average</td>
<td>.00</td>
</tr>
<tr>
<td>8. Middle</td>
<td>.00</td>
</tr>
<tr>
<td>9. Anybody could</td>
<td>.00</td>
</tr>
<tr>
<td>Sum</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note: Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
irrelevance indicating that this was the most prevalent label given to the midpoint category. These data are relevant to whether or not subjects are using a bipolar or a unipolar scale. A unipolar scale where probability 1.0 is conceptualized as intelligent and 0.0 as not intelligent, would imply that the midpoint would correspond to average in intelligence. However, if subjects were using a bipolar interpretation then probability 0.0 would be labeled stupid and the midpoint would be the boundary between the two categories intelligent and stupid. The fact that the majority of our subjects conceptualized the midpoint as irrelevant suggests that they were using a bipolar interpretation of the probability scale.

Table 7 reports the probability distributions across judgments for the statements that were used as indications of asserting distance from the upper endpoint category. These statements appear to be used either to assert that the behavior is toward the positive end (e.g., probability statements, hedges) or to assert that the behavior is somewhere in the middle (e.g., could be intelligent, intelligent person could). Although we originally thought that these statements would be used for judgments on the upper half of the scale, some of them are used throughout the midrange values. However, it isn't difficult to understand the use of these statements for judgments in the
Table 7: The Proportion of Subjects Using Statements To Assert Distance From the Upper Endpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1. Probability Language</td>
<td>.00</td>
</tr>
<tr>
<td>2. Could Be DT</td>
<td>.00</td>
</tr>
<tr>
<td>3. Doesn't Mean DT</td>
<td>.00</td>
</tr>
<tr>
<td>4. Hedges DT (person)</td>
<td>.00</td>
</tr>
<tr>
<td>5. Hedges DT (behavior)</td>
<td>.00</td>
</tr>
<tr>
<td>6. DT person could</td>
<td>.00</td>
</tr>
<tr>
<td>7. DT doesn't mean behavior</td>
<td>.00</td>
</tr>
<tr>
<td>Sum</td>
<td>.00</td>
</tr>
</tbody>
</table>

Note: DT stands for designated trait (i.e. kindness or intelligence). Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
lower range on the probability scale. Even though subjects gave a low judgment they realized that there was a chance that the person "could be intelligent". Yet across all specific statements with the exception of "could be intelligent (or kind)" and "intelligent person could", there was greater use for judgments on the upper half of the scale. Moreover, the proportions drop to 0 for judgments of 9 and 1. None of these statements occurred when subjects were making judgments of "highest probability" or "lowest probability".

Table 8 reports the probability distributions across judgments for the statements that were used as indicators of asserting distance from the lower endpoint category. The results are similar to distance from upper endpoint category. Again, there was greater use of these statements for judgments on the lower half of the scale with the exception of "could be stupid (unkind)".

Only one statement type was used for asserting distance from the midpoint category. It is important to note that coders applied a broad sense of the term hedges. Therefore, any statements that referred to the midpoint and asserted distance from it were coded in this category. For example, statements such as, "This behavior is slightly below the midpoint" were coded as distance from the midpoint. The proportion of times subjects used statements asserting distance from the midpoint is presented in Table 9.
Table 8: The Proportion of Subjects Using Statements To Assert Distance From the Lower Endpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>Sum</th>
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<tbody>
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<td>.01</td>
<td>.02</td>
<td>.00</td>
<td>.01</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
<td>.06</td>
</tr>
<tr>
<td>Could Be CT</td>
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<td>.00</td>
<td>.01</td>
<td>.01</td>
<td>.02</td>
<td>.01</td>
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<td>.00</td>
<td>.06</td>
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<tr>
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<td>.02</td>
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<td>.00</td>
<td>.00</td>
<td>.15</td>
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<tr>
<td>Hedges CT (person)</td>
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<td>.01</td>
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<td>.00</td>
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<td>.00</td>
<td>.03</td>
</tr>
<tr>
<td>Hedges CT (behavior)</td>
<td></td>
<td>.00</td>
<td>.01</td>
<td>.01</td>
<td>.00</td>
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<td>CT person could</td>
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<td>.00</td>
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<td>.00</td>
<td>.00</td>
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</tr>
<tr>
<td>CT doesn’t mean behavior</td>
<td></td>
<td>.00</td>
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</tr>
<tr>
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<td>.00</td>
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<td>.07</td>
<td>.09</td>
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<td>.05</td>
<td>.03</td>
<td>.00</td>
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<td>.00</td>
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</tbody>
</table>

Note: CT stands for contrast trait (i.e. unkindness or stupidity). Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.

Table 9: The Proportion of Subjects Using Statements To Assert Distance From the Midpoint Category Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hedges Midpoint</td>
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<td>.05</td>
<td>.00</td>
<td>.06</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
<td>.14</td>
</tr>
</tbody>
</table>

200
The other classifications have only one statement as an indicator or the statements within the classification can be justified on theoretical grounds. For example, it was theoretically meaningful to combine internal and external attributions into an overall attribution classification. Exemplars used included self as exemplar and other exemplars. The self reference statements included any type of statement that referred to the self, including self as exemplar. Features of the trait category or contrast category included both behavioral inferences, and trait inferences. Tables 10, 11, 12, and 13 display the proportions of times each specific category was used for each of the major coding classifications. (See Appendix C for complete coding rules and examples).

Results

Analysis Strategy. Since the coding of explanations resulted in a binary code for each possible statement (e.g., subjects either used a label for the midpoint in their explanations or did not) the following strategy was used so that analysis of variance could be used to analyze the data. Instead of having each subject as the unit of analysis, the unit of analysis consisted of a group of five subjects collapsing across the behavior set counterbalancing factor, and maintaining the trait order, explanation condition and direction of inference factors.
Table 10: The Proportion of Subjects Using Features and Exemplars Across Judgment Values

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
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<td>1 2 3 4 5 6 7 8 9 Sum</td>
</tr>
<tr>
<td>1. Features of DT</td>
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</tr>
<tr>
<td>2. Features of CT</td>
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</tr>
<tr>
<td>3. Other Exemplars DT</td>
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</tr>
<tr>
<td>4. Self Exemplar DT</td>
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<tr>
<td>5. Other Exemplars CT</td>
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<tr>
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<td>.11 .10 .10 .07 .03 .09 .15 .06 .19</td>
</tr>
</tbody>
</table>

Note: DT stands for designated trait, CT stands for contrast trait (i.e. unkindness or stupidity). Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
Table 11: The Proportion of Subjects Using Attributional Information Across Judgment Values

<table>
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</tr>
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<td>3. Base Rate Information</td>
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</tbody>
</table>

Note: Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
Table 12: The Proportion of Subjects Using Self-References Across Judgment Values

<table>
<thead>
<tr>
<th>Statement</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 Sum</td>
</tr>
<tr>
<td>1. Self Exemplar DT</td>
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</tr>
<tr>
<td>2. Self Exemplar CT</td>
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</tr>
<tr>
<td>3. Other Self-references</td>
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</tr>
<tr>
<td>Sum</td>
<td>.02 .01 .04 .00 .01 .02 .05 .02 .02</td>
</tr>
</tbody>
</table>

**Note:** Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.

Table 13: The Proportion of Subjects Using Assumptions About Behaviors Across Judgment Values

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 Sum</td>
</tr>
<tr>
<td>1. Assumptions</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Proportions based on 359, 218, 198, 229, 467, 195, 297, 324, and 316 for judgments 1 through 9 respectively.
The unit of analysis, a group of five subjects, will be referred to as a megasubject. This strategy resulted in 16 megasubjects, 2 for each of the 8 experimental conditions (Direction of inference, explanation condition and trait order).

The following strategy was used. For each megasubject, for each judgment value 1 through 9, the proportion of times each coding category was used was computed. For example, proportions were computed for the label for the midpoint category (i.e., Category A3, Table 3). A proportion was computed for each of the 16 megasubjects across the 9 judgment values. This was done for each trait. For each megasubject, there were 35 explanations for each trait (i.e., 5 subjects each providing 7 explanations). If within a megasubject, there were 6 occurrences of the particular judgment value and for 3 of these judgments, the explanation included a statement using a label for the midpoint category, then the proportion for that judgment value would be 3/6 or .5. This was done for each megasubject, for each judgment value 1 through 9.

This analysis could only be used if within each megasubject there was at least one judgment of each value 1 through 9. There were only 5 missing data points using this strategy, 1 for intelligence and 4 for kindness.
These were replaced with the average proportion for the corresponding trait and judgment value. All proportions were transformed using an arcsin transformation (Winer, 1971).

This megasubject strategy was also used to examine the tendency to use specific statements more than others within a major coding category, regardless of judgment value. In comparing Table 4 and Table 5, it appeared that subjects were more likely to refer to the designated trait in their explanations than to the contrast trait. This occurred even when subjects were asserting the lower endpoint category. That is, subjects were more likely to negate the designated trait when making low judgments than they were to assert the contrast trait. The results from a contrast comparing designated trait versus contrast trait was significant \( (F(1,8)=860.87 \quad p < .0001) \) with more use of the designated trait \( (M=.25) \) than the contrast trait \( (M=.04) \). There was also an endpoint (upper, lower) by trait (designated, contrast) interaction \( (F(1,8)=85.90 \quad p < .0001) \). Figure 36 displays this interaction. For both the upper endpoint category and the lower endpoint category the designated trait was referred to more often. However, the use of the contrast trait did increase in use for asserting the lower endpoint category.
Figure 36: Use of Designated Trait and Contrast Trait in Explanations For Upper and Lower Endpoint Assertions
A similar contrast compared the use of distance statements across the lower endpoint, and upper endpoint categories. (Compare proportions in Tables 7 and 8). There was a significant effect of category with more distance statements from the designated trait \( (M=.17) \) than for the contrast trait \( (M=.07) \) \( (F(1,8)=82.52 \ p < .0001) \). However, this was qualified by a category by direction of inference interaction \( (F(1,8)=18.03 \ p < .003) \) which is displayed in Figure 37. The means indicate that there was a greater difference between use of distance statements from the contrast and designated trait for the trait to behavior condition than for the behavior to trait condition. This isn’t surprising since subjects in this condition are asked to judge the probability of a behavior given a specific trait. Subjects begin by assuming that the actor possesses the given trait. Therefore, they were more likely to couch their explanations in terms of distance from this given trait than from the contrast trait.

An additional contrast compared the use of distance from the midpoint category with the use of distance from the contrast category. The use of distance of the midpoint category \( (M=.03) \) was significantly less than the use of distance from the contrast category \( (M=.07) \) \( (F(1,8)=14.75 \ p < .005) \). This is consistent with the response time results.
Figure 37: Use of Distance Statements From Upper and Lower Endpoint Categories as a Function of Direction of Inference
which indicated that the midpoint category is relatively weaker than the two endpoint categories.

A separate analysis of variance was conducted for each of the 14 classifications listed in Table 3. For each classification a 2 (Direction of Inference: Trait to Behavior, Behavior to Trait) × 2 (Trait order: Intelligence First, Kindness First) × 2 (Explanation: First trial, Fifth trial) × 2 (Trait Set: First Trait, Second Trait) × 9 (Probability Judgment: 1 through 9) analysis of variance was conducted with direction of inference, trait order, and explanation as between subjects factors and trait set and probability judgment as within subjects factors. Again, the trait main effect came out as the trait set by trait order interaction. To minimize confusion this interaction will be referred to as the trait main effect.

Use of Category Label for Upper Endpoint Category: Asserting Designated Trait or High Probability. There was a significant effect of judgment ($F(8,64)=142.59$, $p < .0001$). This effect is illustrated in Figure 38. The data indicated that relatively few subjects referred to this category when making judgments one through five. However, for judgments of six and above, the proportion of subjects who used a label for the endpoint category increased dramatically and was almost 90% for judgments of
Figure 38: Use of Label for Upper Endpoint Category as a Function of Judgment
9. This is consistent with our categorical predictions. Behaviors judged as 9 should fit well to subjects existing categorical structures for the designated trait or high probability concepts.

There was a significant main effect for trait \( (F(1,8)=6.00 \ p < .05) \) with greater use of an upper endpoint category label for kindness \( (M=.29) \) than for intelligence \( (M=.25) \). There was also a significant main effect of trait order \( (F(1,8)=8.01 \ p < .03) \), with greater use in the intelligence first condition \( (M=.30) \) than in the kindness first condition \( (M=.24) \). There was also a direction of inference by explanation interaction \( (F(1,8)=6.38 \ p < .04) \) and a judgment by explanation interaction \( (F(8,64)=2.48 \ p < .03) \). Anova summary table and means for these effects are presented in Appendix D.

**Use of Category Label for Lower Endpoint: Asserting Contrast Trait or Low Probability.** There was a significant effect of judgment \( (F(8,64)=88.14 \ p < .0001) \) (See Figure 39) and a significant trait by judgment interaction \( (F(8,64)=3.84 \ p < .03) \). This interaction is displayed in Figure 40. Overall, the results indicated that subjects were more likely to refer to the category for the lower endpoint for judgments on the lower half of the scale. Additionally, the results indicated that for judgments of one through three subjects were more likely to
Figure 39: Use of Label For the Lower Endpoint Category as a Function of Judgment
Average proportion across megasubjects

Judgment

Figure 40: Use of Label for the Lower Endpoint Category as a Function of Judgment and Trait
refer to the lower endpoint category when making kindness judgments than when making intelligence judgments. (See Figure 40). Even though they did make low probability judgments about intelligence their explanations were less likely to assert the lower endpoint category when making judgments about intelligence. This could be due to the different nature of the traits. Intelligence is viewed as a more stable permanent attribute than kindness. Subjects were less likely to say that someone was stupid (or not intelligent) than they were to say that someone was unkind. There was also a significant trait order by explanation interaction ($F(1,8)=8.35 \ p < .03$) and a trait order by explanation by judgment interaction ($F(8,64)=2.83 \ p < .01$). (See Appendix D for anova summary table and means for these additional effects.)

**Use of Category Label for Midpoint.** The only significant effect was the judgment main effect ($F(8,64)=33.86 \ p < .0001$). Figure 41 displays this effect and clearly shows the increase of category label as judgments approach 5 from both directions. (See Appendix D for anova summary table).

**Asserting Distance from Upper Endpoint Category.** The main effect for judgment was significant ($F(8,64)=11.32 \ p < .0001$). This is presented in Figure 42. Notice that there is a bimodal distribution with modes at judgment 4
Figure 41: Use of Labels for the Midpoint Category as a Function of Judgment
Figure 42: Asserting Distance From the Upper Endpoint Category as a Function of Judgment
and 6. This is due to the fact that there were a few statements within this coding category that were used to explain judgments on the lower half of the scale. Recall that the statements "could be intelligent (kind)" and "intelligent (kind) person could" were distributed across all midrange judgments. They differed from the other statements in the classification in that they were used more often on the lower half of the scale. These statements explain the bimodal distribution.

Overall, our hypothesis was supported. As predicted, the use of distance statements increased from the lower judgment values, peaked at judgment six and then decreased through judgment 9. Distance statements decreased at the upper endpoint as the behaviors become better fits to the category for the upper endpoint. Also, there was a decrease at judgments of 5. For these behaviors, subjects were more likely to use the category for the midpoint than the category for either endpoints.

There was also a trait set (First trait, Second trait) main effect with greater use of distance statements from the upper endpoint in explanations provided for the first trait (M=.21) than for the second trait (M=.15). Moreover, there was a trait set by judgment interaction (F(8,64)=2.27 p < .04) which is illustrated in Figure 43. Note that the bimodal distribution disappears in the second trait set.
Figure 43: Asserting Distance From the Upper Endpoint Category as a Function of Judgment and Trait Set
This indicates that subjects were less likely to use statements to assert distance from the upper endpoint category when making judgments on the lower half of the scale for the second trait set. (See Appendix D for anova summary table).

Distance From Lower Endpoint. The judgment main effect was significant \( F(8,64) = 8.01, p < .0001 \) and is displayed in Figure 44. Overall, the pattern of the data was the reverse of the data for distance from upper endpoint, except that the proportions are lower overall (Compare Figures 42 and 44). The distribution is also bimodal with modes at 4 and 6. Again, this can be accounted for by the distributions for the statement "could be stupid (unkind)". There were a number of other interactions with the judgment effect. The judgment by explanation interaction was significant and is shown in Figure 45 \( F(8,64) = 2.54, p < .02 \). Note that the distribution for subjects who gave explanations on the fifth trial is not bimodal. Again, experience with the judgment task leads people to be more likely to assert distance from the category corresponding to their judgment. There was also a main effect for direction of inference \( F(1,8) = 13.37, p < .01 \) with more use in the behavior to trait condition \( (M = .10) \) than the trait to behavior condition \( (M = .03) \). There was also a judgment by explanation
Figure 44: Asserting Distance From the Lower Endpoint Category as a Function of Judgment
Average proportion across megasubjects

Figure 45: Asserting Distance From the Lower Endpoint Category as a Function of Judgment and Explanation Condition
by direction of inference interaction ($F(8,64)=3.40$ $p < .01$), and a trait set by direction of inference by judgment interaction ($F(8,64)=2.19$ $p < .04$). (See Appendix D for anova summary table and means for these additional interactions).

**Distance From Midpoint.** The main effect for judgment was significant ($F(8,64)=8.25$ $p < .0001$) and is displayed in Figure 46. The results indicated that subjects used distance from midpoint statements for the judgments 3, 4 and 6, 7. This is consistent with the predictions and provide support for the proposal that subjects use a category that corresponds to the midpoint. However, there were a number of higher order interactions. The judgment by direction by explanation interaction ($F(8,64)=2.12$ $p < .05$), the set by judgment interaction ($F(8,64)=2.36$ $p < .03$), the trait by direction of inference by judgment interaction ($F(8,64)=2.28$ $p < .04$), the trait set by judgment by explanation interaction ($F(8,64)=3.18$ $p < .01$), and the trait by direction of inference by explanation by judgment interaction ($F(8,64)=2.19$ $p < .04$) were all significant. (See Appendix D for anova summary table and means for these additional significant effects.)

**Features Versus Exemplars.** In order to examine the relative use of features versus exemplars in subjects' explanations, for each megasubject the mean proportion across
Figure 46: Asserting Distance from the Midpoint Category as a Function of Judgment
all 9 judgments was used as the dependent variable. The contrast comparing the use of features versus exemplars was significant ($F(1,8)=148.93 \, p < .0001$). This contrast also interacted with trait (See Figure 47). For both intelligence and kindness there were more features used in explanations than exemplars. However, the difference was greater for kindness than for intelligence.

Features of Upper Endpoint Category. The extent to which subjects generated behavioral inferences or traits as features of the upper endpoint category was examined. The average use of features of the designated trait category was .19 across the 16 megasubjects. There was a significant effect of judgment ($F(8,64)=15.60 \, p < .0001$) and a direction of inference by judgment interaction ($F(8,64)=2.65 \, p < .02$) which is displayed in Figure 48. The major difference between the two direction of inference conditions is for the lower judgment values. Here subjects provided more features for trait to behavior inferences than for behavior to trait inferences. This effect will be examined and explained in detail shortly. There were a number of other significant main effects and higher order interactions. (See Appendix D).

Features of Lower Endpoint Category. These were statements that included traits or behavioral inferences related to the contrast trait category. Overall, the use
Figure 47: The Use of Features and Exemplars in Explanations for Kindness and Intelligence
Figure 48: Use of Features of the Upper Endpoint Category as a Function of Judgment and Direction of Inference
of features for this category was lower than the features for the designated trait category (.03 versus .19) ($F(1,8)=22.30 \ p < .002$). There was a main effect of judgment ($F(8,64)=11.30 \ p < .0001$) and a significant judgment by direction of inference interaction ($F(8,64)=5.90 \ p < .0001$) which is displayed in Figure 49. Results indicated that for lower judgments subjects provided more features corresponding to the contrast traits unkind or stupid when they were making behavior to trait inferences than trait to behavior inferences. Again, this effect will be examined shortly. There was also a main effect of direction of inference with more use of features of the contrast trait category when making behavior to trait judgments ($M=.06$) than for trait to behavior judgments ($M=.01$).

**Direction of Inference Effects on Use of Features of Designated and Contrast Traits.** Since the direction of inference effects appeared to occur only for lower judgments for feature use of both contrast and designated trait categories, an analysis focusing on these effects was conducted. A contrast comparing the use of features in explanations for judgments below the midpoint was compared with the use of features in explanations given for judgments above the midpoint. This was done for both features of the contrast trait and features of the
Figure 49: Use of Features of the Lower Endpoint Category as a Function of Judgment and Direction of Inference
designated trait. For each megasubject, the average proportion of feature use was computed across judgments 1 through 4 to get the proportion for the lower judgments, and the average proportion across judgments 6 through 9 was used for the proportion for the upper judgments.

The category (designated, contrast) by direction of inference (trait to behavior, behavior to trait) by scale half (upper half, lower half) was significant (F(1,8)=32.60, p < .0005). The direction of inference by category interaction for trait to behavior judgments is presented in Figure 50 and for behavior to trait judgments in Figure 51. These results are important as they indicate that the direction of inference effects only occurred for lower judgments. Moreover, for negative judgments the effect of direction of inference was different for contrast trait features than for designated trait features.

For the positive judgments (upper half of scale), subjects were more likely to use features of the designated trait than features of the contrast trait regardless of direction of inference condition. This isn’t surprising since for both direction of inference questions, subjects are matching their inferences (which are positive features) with the designated trait (which is also positive).

However, for negative judgments, the direction of inference affects whether or not the given information
Figure 50: Use of Features of Designated and Contrast Traits for Trait to Behavior Inferences
Figure 51: Use of Features of Designated and Contrast Traits for Behavior to Trait Inferences
about a person is negative (i.e., the behavior) or positive (i.e., the designated trait). For the trait to behavior condition, subjects assume the person possesses the given trait which is always positive. Recall that the question subjects respond to is "What is the probability that an intelligent (kind) person would perform this behavior?" This leads them to generate features of the designated trait category in order to figure out what the person would be like. They then match these positive inferences with the behavior to determine whether or not the person would perform the behavior. However, in the behavior to trait condition, subjects assume that the person performed a behavior and are asked to judge the probability of the designated trait. The subject tries to determine what the person is like by making inferences from the given behavior. Thus, if the behavior is a negative one these inferences are more likely to be features of the contrast trait category than features of the designated trait category.

Exemplars of Upper Endpoint Category. This category included references to specific persons who possessed the designated trait (e.g. Einstein was intelligent, my mother is kind) and also references to the self as an exemplar (e.g. I consider myself an intelligent person). The average proportion across the 16 megasubjects was .02.
Although, an analysis of variance was conducted examining the relationship between judgment and the use of exemplars, the results were not theoretically interpretable. The overall judgment effect was not significant ($F(8,64)=1.50$ $p < .18$). There was a trait by direction of inference by judgment interaction ($F(8,64)=2.47$ $p < .03$). The trait by judgment interaction for behavior to trait inferences is displayed in Figure 52 and for trait to behavior inferences in Figure 53.

The most notable finding is the infrequent use of exemplars overall. For this task, subjects were more likely to refer to features of the designated trait than they were to use exemplars. There were a number of other significant effects. (See Appendix D for complete anova summary table and means for these additional effects on exemplar use).

**Use of Exemplars for Contrast Category.** The analysis of variance results indicated no significant effects on the use of exemplars of contrast trait categories. The overall judgment effect was not significant ($F < 1.00$). The average proportion across the 16 megasubjects was low ($M=.01$). This was significantly lower than the use of exemplars for the designated trait category ($M=.03$) ($F(1,8)=12.89$ $p < .01$).
Figure 52: Use of Exemplars of DT as a Function of Judgment and Trait for Behavior to Trait Inferences
Average proportion across megasubjects

DT stands for Designated Trait

Figure 53: Use of Exemplars of DT as a Function of Judgment and Trait For Trait to Behavior Inferences
Use of Attributions. There was a significant main effect of judgment \( (F(8,64)=4.77 \ p < .0001) \) which is displayed in Figure 54. The results indicate that there were more attributions provided for judgments in the intermediate ranges than for the endpoints and a greater proportion given for judgments in the lower range (i.e., judgments 3 and 4).

There was also a significant trait order by direction of inference by explanation by judgment interaction \( (F(8,64)=2.37 \ p < .03) \) (See Appendix D).

In order to test whether or not subjects provided more attributions when making negative judgments than positive judgments, a contrast was conducted comparing the average proportions across judgments 1 through 4 to the average proportions across judgments 6 through 9. This contrast was significant \( (F(1,8)=8.68 \ p < .02) \) with more attributions for negative judgments \( (M=.34) \) than for positive judgments \( (M=.24) \). This suggests that even though subjects were willing to give lower judgments, they also indicated that there were other possible explanations for the behavior in addition to the negative trait disposition. This is consistent with the literature that has found that unexpected behaviors tend to elicit attributions (Hastie, 1984).
Figure 54: Use of Attributions as a Function of Judgment
Use of Base Rate of Behavior. There is a growing literature that has examined the use of base rates in making judgments. Early work focused on people's insensitivity to base rates (Kahneman and Tversky, 1973). This was followed by research that focused on the conditions that lead people to use base rates (Manis, Dovalina, Avis and Cardoze, 1980). The typical paradigm used in this research has been to provide subjects with base rate information along with other types of information (e.g. individuating, or vivid information) to determine whether or not the other information would be weighted more heavily in the final judgment.

The present research differs from past research in that subjects were not provided with base rate information. Instead, subjects made judgments based on single behaviors and responded to open ended questions. Results indicated that there was a main effect of trait ($F(1,8)=8.15 \ p < .03$) with greater use of base rate information for intelligence ($M=.13$) than for kindness ($M=.08$).

Although, the overall effect of judgment was not significant ($F(8,64)=1.69 \ p < .12$), there was a trait by judgment interaction ($F(8,64)=2.34 \ p < .03$) which is displayed in Figure 55. Since we didn't have apriori predictions regarding the use of base rates, the analyses are exploratory and the discussion speculative. The
Average proportion across megasubjects

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</tbody>
</table>

Judgment

- intelligence
- kindness

Figure 55: Use of Base Rates as a Function of Judgment and Trait
greatest reference to base rate information for intelligence is for the stupid behaviors. For these behaviors, subjects provided statements such as "everyone can spell their name" or "most people pass the written drivers licence exam on the first or second time." The greatest reference to base rate information for kindness is for judgment 6. These are behaviors that are judged just over the midpoint. It could be that these are behaviors that were viewed as being somewhat helpful or kind to others but were also viewed as behaviors that most people would perform since they don’t take alot of time, energy, money, etc. (e.g., Went to the grocery store with his kids, Took a friend out for a beer to celebrate a promotion.)

There was also a main effect for direction with greater use of base rate information for trait to behavior inferences (M=.13) than for behavior to trait inferences (M=.09). This is a reasonable effect. When subjects are asked to judge that probability that a behavior would occur the base rate of that behavior is more relevant than when asked to judge the probability of the trait given that the behavior occurred. There were a number of other significant effects involving the trait order factor and a few significant higher order interactions. (See Appendix D).
Assumptions about the Behavior. Examples of statements coded as assumptions were statements like "This is an extremely difficult task", "Takes analytical, logical ability", "painting a house is difficult work and takes a long time", or "an elderly person would have a tough time doing it for themselves". The analysis of variance indicated that there was a significant effect of judgment (F(8,64) p < .002). This effect is displayed in Figure 56. The results indicate that subjects were more likely to generate inferences when their judgments were more extreme. There were relatively few assumptions generated for judgments of 5. There was also a direction of inference effect (F(1,8)=43.72 p < .0003) an explanation condition effect (F(1,8) = 18.20 p < .003) and a direction of inference by explanation interaction (F(1,8)=6.88 p < .04).

For subjects who gave explanations on the first trial, there were more assumptions generated for behavior to trait inferences (M=.33) than for trait to behavior inferences (M=.24). For subjects who gave explanations after the fifth trial, the effect of direction of inference was much greater with a mean of .48 for behavior to trait inferences, and .27 for trait to behavior inferences. For the behavior to trait inference condition, the experience of providing judgments across the first four trials leads subjects to be more likely to consider assumptions derived
Figure 56: Use of Assumptions Based on the Behavior as a Function of Judgment
from aspects of the specific behavior. There was also a main effect for trait with more assumptions for intelligence judgments ($M=.38$) than for kindness ($M=.28$).

**Self-References.** These statements included any statement that referred to the self. Typical statements referred to instances when the subject performed the same behavior or knew someone who had performed the behavior. Also, the use of self as an exemplar was included in this classification. It has been suggested that the "self" is a relatively stable and habitually used reference point for interpreting and responding to social information (Rogers, 1981; Srull and Gaelick, 1983). Yet in the present study, the use of the self was relatively low, with an average proportion of .04 across the 16 megasubjects. The analysis of variance indicated that there was a significant judgment effect ($F(8,64)=5.71 \ p < .0001$), a significant judgment by direction interaction ($F(8,64)=3.05 \ p < .001$), and a significant judgment by explanation interaction ($F(8,64)=3.94 \ p < .001$). The judgment by direction of inference interaction is displayed in Figure 57. The greatest use of self-references is for judgments of seven, indicating that subjects are more likely to refer to themselves when making higher, and in this study, more positive, probability judgments.
Figure 57: Use of Self-References as a Function of Judgment and Direction of Inference
Effects of Explanation on Use of Midpoint Category.

The response time results indicated that subjects developed a concept for the midpoint category across trials. If this was the case then subjects should use more labels for the midpoint category and be more likely to assert distance from this category if their explanations were written after the first trial than if they were written after the fifth trial. However, the greater use of the midpoint category in explanations may only occur for the first trait set since the response time results indicated that once subjects acquired the midpoint concept that could easily apply it to a new trait domain.

Yet, the results of the content analyses do not support this. Results from the analysis of variance on use of the midpoint category indicated that the main effect of explanation condition was not significant ($F(1,8)=2.81 p < .14$) and did not interact with trait set (first trait, second trait) ($F(1,8)=1.03 p < .34$). This suggests that the semantic labeling of the midpoint category is not affected by explanations.

The results from the analysis of variance on use of statements asserting distance from the midpoint also indicated that there was no main effect of explanation condition ($F(1,8)=1.08 p < .33$). However, there was a significant trait set by explanation condition interaction.
(F(1,8)=17.70 p < .003). But the results are not what we would have predicted. For the first trait, subjects actually provided more statements asserting distance from the midpoint, when they provided explanations after the first trial (M=.09) then when they provided explanations after the fifth trial (M=.02). For the second trait, the mean for the explanation first trial was .02 and for the fifth trial .04.

How can we make sense out of these findings? One possible reason for the results is that the coding for hedges from the midpoint was done loosely so that any reference to "somewhere around the middle", "slightly above the middle" was coded as a hedge. However, these statements do not imply that subjects have a clear concept for the midpoint. In fact, they may actually indicate subjects' lack of clear definition for the midpoint.

Use of judgments of 5. Another way to examine how subjects use the midpoint category is to analyze the number of times subjects actually gave a response of 5. If subjects are acquiring a concept for the midpoint the judgments of 5 should increase across trials. The data were analyzed by computing the number of midpoint judgments that occurred for each trial. The results indicated a significant set main effect (F(1,72)=6.26 p < .02) with more judgments of five in the second trait set (M=1.51).
than in the first trait set (M=1.29).

There was also a trait set by explanation condition interaction (F(1,72)=10.14 p < .01) which is displayed in Figure 58. The means indicate that there is an effect of explanation condition but only for the first trait set. In the first trait set, subjects who provided explanations after the first trial provide more judgments of five than subjects who provided explanations after the fifth trial. However, this effect does not occur in the second trait set. One explanation for this is that providing explanations leads subjects to develop the concept for the midpoint category more quickly thus leading to more use of it. However, an equally plausible explanation is that subjects who provide explanations after the first trial realize that it is difficult to explain their numerical responses thus leading to greater use of the "uncertainty" category. However, after the fifth trial on the first trait set, all subjects have provided explanations for their judgments. There was also a main effect for direction of inference (F(1,72)=7.64 p < .01) with more judgment of 5 for behavior to trait judgments (M=1.59) than for trait to behavior judgments (M=1.21). (See Appendix D for complete anova summary table).
Figure 58: Judgments of Five Across Trait Sets for Each Explanation Condition
Discussion

The analyses of the explanations do provide support for the categorical approach to probability judgments. Specifically, subjects explained their probability judgments by referring to category labels for the endpoints and the midpoint. These labels were either probability labels, trait labels, or for the midpoint, a specific characteristic of behaviors placed in the category (e.g. irrelevant, neutral).

Moreover, there was strong evidence to suggest that these categories possessed a graded structure as the category labels were more likely to be used as behaviors approached the specific categories. Subjects also used hedges to assert distance from these three categories in their explanations when the behaviors were not good fits to the three probability categories. However, they were less likely to assert distance from the lower endpoint category than the upper endpoint category and even less likely to assert distance from the midpoint category. This indicates that subjects were using the designated trait category (i.e., the one provided in the instructions to give meaning to the probability scale).

This preference for the designated trait category was also evident in subjects' use of features. Features of the designated trait category were used more often than
features of the contrast category. However, this did not occur for explanations for negative judgments for the behavior to trait condition. This result is important as it suggests that direction of inference does make a difference in terms of category activation, and that predicting A from B is not the same as predicting B from A, especially when the features of A and B do not overlap.

Experiment Four

Rationale. An alternative explanation for the response time results found in experiment three is that subjects can respond more quickly when they are pressing the keys 1, 5 and 9 on the keyboard. This is a reasonable argument. Since the keyboard was covered except for the keys 1 through 9 these endpoints on the keyboard may be easier to find. Also, subjects may have developed the strategy of holding their finger above the number 5 key to try to be as fast as possible. In this experiment subjects were asked to press the number on the keyboard corresponding to the number that appeared on the computer screen. This experiment examined the effects of number key location (the top row of numbers 1 through 9 on an IBM PC keyboard) on the amount of time it takes for subjects to press the key that corresponds to that particular number.
Method

Subjects. Forty-six undergraduate subjects participated as part of a course requirement.

Procedure. All the instructions were presented on the computer screen. Subjects were told the following: In this experiment we are interested in determining how much difficulty people have responding to numbers that appear on the computer screen. Your task is to press the number on the keyboard that corresponds to the number that appears on the computer screen. The computer will keep track of the number that you press and the amount of time it takes for you to press the key. Please try to respond as ACCURATELY AND AS QUICKLY AS POSSIBLE. ACCURACY AND SPEED ARE EQUALLY IMPORTANT."

There were ten trials. In each trial the numbers 1 through 9 were presented in a random order. A different random order was used for each subject and for each trial. The design was a 9 (number location) X 10 (trial) completely within subject design.

Results and Discussion

A 10 (Trial) X 9 (Number Key) analysis of variance was conducted on response times with trial and number key as within subjects variables. There were significant main effects of both trial ($F(9, 405) = 14.34, p < .0001$) and number key ($F(8, 360) = 26.19, p < .0001$) and a significant trial by
number key interaction \((F(72,3240)=5.63\ p<.0001)\). The number key effect is of primary importance and is presented in Figure 59. Although there was a tendency for response times to decrease for lower numbers, the overall pattern does not mirror the response times for probability judgments. Especially prominent was the increase for the number key 6. Figure 60 displays the number key effect separately for the first five trials and the last five trials and indicates that the overall pattern was the same for both trial sets.

Figures for the number key effect for each trial are displayed in Appendix E. Overall, across trials there was no drop in response time for number key 9. However, trials 8 through 10 do show a hint of decrease in response time for number keys 1 and 5. Presumably, subjects developed the strategy of either holding their finger over the 1 key or the 5 key. However, this does not pose a problem for our interpretation of experiment three results since the decrease in response time to the number key 5 doesn't occur until the eighth trial or after at least 63 responses (7 trials X 9 numbers). Yet, in experiment three subjects made a total of 74 (including 4 practice behaviors) judgments and the decrease in response time for the endpoints was apparent in the first trial and the midpoint category was evident by trial 3 or after 18 behaviors. Therefore, we
Figure 59: Response Time as a Function of Number Key
Figure 60: Response Time as a Function of Number Key For the First and Last 5 Trials
can be fairly confident that the response time data for experiment three was due to cognitive processing differences and not due to the effect of the location of the specific key that subjects were pressing.
Support for the Categorical View. Taken together, the four experiments presented provide strong support for the categorical view of probability judgments. Results of experiments one and two indicated that subjects found it much easier to generate examples of behaviors that corresponded to the endpoints on the probability scale than for the intermediate values. And when the data was combined across the two experiments, there was support for the prediction that the midpoint category was easier than adjacent probability values.

Experiment two also included ratings of the goodness of exemplars and examined the effects of experience with the probability scale on ease ratings and goodness of exemplar ratings. The goodness ratings paralleled the ease ratings and indicated that even though subjects could generate behaviors for the values across the probability scale they felt that their generated behaviors for intermediate values didn’t fit as well as their behaviors for the endpoints. Although the experience manipulation did not lead to the development of the midpoint category, it did lead to higher ratings of the goodness of exemplars.
In hindsight, since the specific experience manipulation consisted of rating behaviors on a probability scale, it is not surprising that it did not lead to increased ease of generating exemplars.

The response time results for experiment three indicated that subjects could respond more quickly to items that were a good match to one of the three probability categories. This replicates past research that has found that more typical items are categorized more quickly (Rosch et. al., 1975).

The Midpoint as an Ad Hoc Category. The first three experiments all point to the midpoint category as a special case. In experiments one and two, subjects found it more difficult to generate behaviors that corresponded to the midpoint than to the endpoints. In experiment three, the response time for the midpoint decreased across trials. During the first trial there was no evidence for the midpoint category. However, once subjects developed a midpoint category, they could easily apply this category, even when the judgment domain changed. The results of experiment three point to the role of experience in developing the midpoint category. Experiment three enabled us to examine the decrease in response time for the midpoint category over trials, where subjects were making probability judgments about behaviors.
The data presented suggest that the midpoint category is similar to the ad hoc categories used in Barsalou’s (1983; 1985) research. These categories are goal derived and develop out of use. The specific exemplars within these categories often do not appear to share similar features. For example, the categories, used in Barsalou’s research include "things to take from your house if it is on fire", "things to buy someone for their birthday", "foods to eat on a diet", etc. These categories are unique in that the items within the category are more variable than traditional categories used in categorization research (e.g. fruit, animals, furniture). Moreover, these types of categories develop when the need arises. Most people probably have not thought about what items they would take from their house if it were on fire. However, when the situation arises, people can readily create ad hoc categories. In the present research, the data suggest that across trials subjects developed an ad hoc category for the midpoint. The behaviors that belong to this category were also variable (e.g. Bought a coffee cup with his initials on it., Attended aerobic exercise classes for only a week.) The only feature that they shared was that they were all irrelevant to the trait category. This feature became apparent across trials and subjects used the feature irrelevance to give meaning to the midpoint.
The role of the midpoint on the probability scale in this paradigm may differ from the .50 probability used in typical tasks used in decision making research. Would we expect similar results in other domains? In the present research most subjects label the midpoint category "irrelevance to the given trait". In typical decision making research where probability is conceptualized in terms of frequency of occurrence, the meaning for the midpoint could be immediately clear (e.g., the probability of tails in a coin toss). Under these circumstances, subjects are aware that the probability of heads as a result of a coin toss is a typical example of an event that has a .5 probability.

Content Analyses Summary. The content analyses indicated that subjects did refer to the three categories when explaining their numerical judgments. Although there were a number of specific statements that subjects used to refer to the three categories, subjects were using the endpoints, and the midpoints as reference points and these categories were referred to in their explanations. Moreover, these categories were used even when subjects judgments' did not specifically match the given category. In these cases, subjects provided statements to assert distance from these categories in their explanations. That is, subjects used hedges in their explanations to indicate
that the behavior approached but did not fit exactly their prototype for the trait category.

In addition to the use of category labels and hedges, the explanations enabled us to examine the inference process used by subjects to classify behaviors on the probability scale. One important finding is the prevalence of attributions and additional assumptions in subjects' explanations. In many cases, subjects actually gave a fairly detailed explanation for the event, by generating a possible context or scenario that may have led an intelligent person to perform a stupid behavior. The use of scenario generation in probability estimation supports the proposal that the categorization process is more than just feature matching. Rather, it is an inference process by which the observer actually generates possible features, and explanations for the features inherent in a given event.

The present research also allowed us to examine the use of contrast categories in judgment. In all three experiments subjects were only given the positive trait categories (kindness and intelligence). The explanations in experiment three indicated that although subjects did use the contrast traits stupid and unkind, they were more likely to negate or hedge the given trait than they were to assert the contrast traits. This suggests that many
subjects may have been using a single category, (i.e., the given trait) rather than comparing the behavior to both trait categories.

In the explanations provided subjects were much more likely to generate features than exemplars. However, the relatively infrequent use of exemplars does not pose a serious threat to exemplar based category models. In the present research subjects are asked to explain their numerical judgments. The fact that subjects primarily list features of the designated trait category may be because these are what subjects feel are most relevant in explaining their judgments. This does not tell us what the representation consists of.

Categorical Models. There are a number of cognitive models that could be used to explain the results. Categorical models have traditionally focused on the use of prototypes, features, and exemplars. Recently, researchers have begun to stress the importance of causal relationships among features, and the role of the inference process in categorization of objects or events.

Judd and Kulik (1980) proposed that attitudes were represented as bipolar schema that consisted of very agreeable and very disagreeable points of view. The representation they imply is one where there are two collections of beliefs on the two opposing poles (i.e.,
agreeable and disagreeable) that are connected in memory. Although, this is a reasonable proposal, and their research is noteworthy in its use of cognitive methodology, the notion of a bipolar schema is still reminiscent of the continuum approach. Rather than proposing two categories of beliefs, the notion of a bipolar schema is proposed.

It seems logical to predict that trait categories might be represented in a similar bipolar manner. Indeed, our response time results are consistent with Judd and Kulik’s (1980) results (although they did not examine response time for midpoint items). However, our explanation data suggest that subjects do not readily use the contrast trait category. Our results suggest that subjects were more likely to refer to the designated trait category than to the contrast category. This indicates that the representation that subjects accessed was the designated trait category rather than a bipolar schema.

The present research also addressed the direction of inference effects in categorization. There were a number of effects of this factor indicating the importance of further research. Recent cognitive and social cognition theories (Anderson, 1983; Smith, 1984) have both proposed a bidirectionality in cognition. However, the present research indicates that predicting A from B is not the same as predicting B from A. In the present research the types
of inferences subjects provided in their explanations were influenced by direction of inference. In experiment three, subjects who were given negative behaviors and asked to judge the probability of a positive trait were more likely to generate features (i.e., behaviors and traits) of the negative trait. However, when subjects were given the positive trait and asked to judge the probability of the negative behavior they were more likely to provide features of the positive trait in their explanations.

**Views of Uncertainty.** Researchers who have studied how people deal with uncertainty have found that people's judgments do not always follow the rules of probability (Kahneman & Tversky, 1983). For example, the $p(A) + p(\text{not } A)$ should equal 1.0. In the present context this rule of complementarity implies that the $p(\text{kind}) + p(\text{unkind})$ should equal 1.0. The fact that uncertainty does not follow these rules has implications for cognitive models. Specifically, dimensional approaches including a bipolar model would imply that complementarity should hold true. However, a categorical approach has no problem with this violation. Specifically, the instructions would activate a category (i.e., either kind or unkind). The activation of the specific category affects what features, exemplars, and inferences are used in making the probability judgment.
Although, the categorical view has received strong support in the present research, the results should not be used to imply that probability is used categorically in all situations. In situations where the frequentistic view of probability is relevant (e.g. external uncertainty where events are generated through a sampling process) people may rely on dimensional representations of probability. However, when probability refers to internal uncertainty, the categorical representation may be the dominant one.
LIST OF REFERENCES


APPENDIX A

STIMULUS MATERIALS - EXPERIMENTS ONE AND TWO
Instructions for Experiments 1 and 2

(The paragraph in parentheses was used for the trait to behavior condition instead of the paragraph directly above it which was used in the behavior to trait condition.)

In our research we are examining how people make probability judgments about traits like intelligence, kindness and honesty from behavioral information.

During this experiment we would like you to generate examples of behaviors that fit at different levels on the probability scale. As you know, probabilities range on a continuum from 0 to 1.0 where 0 is the lowest probability and 1.0 is the highest probability. During this study we would like you to generate an example of a behavior that you see as fitting each of the eleven probability levels on the scale given below.

<table>
<thead>
<tr>
<th>0</th>
<th>.1</th>
<th>.2</th>
<th>.3</th>
<th>.4</th>
<th>.5</th>
<th>.6</th>
<th>.7</th>
<th>.8</th>
<th>.9</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWEST</td>
<td>PROBABILITY</td>
<td>HIGHEST</td>
<td>PROBABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For example, if you were generating behaviors for the trait honesty, you might write "Hit a parked car and left a note to the owner" as a behavior that fits at the probability level of .8. This means that a person who would do this behavior has a probability of .8 of being honest. On the other hand, you might write "Cheated on a take-home exam from the University." as a behavior that fits the probability level of .2.

(For example, if you were generating behaviors for the trait honesty, you might write "Hit a parked car and left a note to the owner." as a behavior that fits at the probability level of .8. This means that an honest person who would have a probability of .8 of doing this behavior. On the other hand, you might write "Cheated on a take-home exam from the University." as a behavior that fits the probability level of .2.)

We would like you to generate behaviors for the trait INTELLIGENCE (KINDNESS). At the top of each page in this booklet is the probability scale. There will also be one of the probability levels written beneath the scale. On each page write one behavior that fits the given probability level. You will have about 25 minutes to complete this part of the experiment. Therefore, don’t spend too much time on any one page. If you get stuck on a page and can’t think of a behavior, you can go on in the booklet and come back to that page later. If you do go ahead, please check the statement at the bottom of the page indicating that you skipped that page but will return.
Generation Task Instructions

(Trait to Behavior Condition)

What is an example of a behavior that an intelligent (kind) person would have a probability of 0.0 of doing?

Probability level 0.0

Please check below if you go ahead in this booklet without generating a behavior.

(Behavior to Trait Condition)

If there is a probability of 0.1 that a person is intelligent (kind) what is a behavior this person would exhibit?

Probability level 0.1

Please check below if you go ahead in this booklet without generating a behavior.
Ease Rating Instructions
(Experiment 1 used a 9 point scale)

Now we would like you to rate how easy or difficult it was for you to come up with examples of behaviors for each of the probability levels. Feel free to go back to the first booklet if it will help you make your ratings. For each of the probability levels circle the number that corresponds to how easy or difficult it was for you to generate a behavior.

Probability of 0.0

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tr>
<td>Very Easy</td>
<td>Difficult</td>
<td>Very Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Goodness of Exemplar Rating Instructions
(Used in Experiment 2 Only)

Now we would like you to rate how well your example fits each of the probability levels. That is, for some of the probability levels you may feel that your examples are "good" examples and fit the probability level very well. For other probability levels, you may feel that your example doesn't fit the probability level very well. Please rate the degree to which you feel your example is a good example of a behavior for each of the probability levels. Again, feel free to go back to the first booklet to help you make your ratings. Please circle the number that corresponds to how well your behavior fits each of the probability levels.

How good of an example is your behavior for probability of 0.0?

1  2  3  4  5  6  7
Very Poor Example
Very Good Example
Experience Manipulation Used in Experiment 2

(The experience manipulation consisted of rating the following behaviors on the probability scale. Subjects were given either the trait to behavior inference question or the behavior to trait inference question.)

(Trait to Behavior Inference)

What is the probability that a KIND (INTELLIGENT) person would perform this behavior?

0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
LOWEST HIGHEST
PROBABILITY PROBABILITY

(Behavior to Trait Inference)

What is the probability that a person who performed this behavior is KIND (INTELLIGENT)?

0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
LOWEST HIGHEST
PROBABILITY PROBABILITY
BEHAVIORS USED FOR KINDNESS

Attempted to rape a woman walking down a dark street.
Siphoned gas from a car parked on the street.
Filed a complaint against some teenagers for trespassing.
Bought a coffee mug with his initials on it.
Emptied the trash before leaving for class.
Left town on short notice because of his father's sudden death.
Offered to help an elderly neighbor paint his house.

Ridiculed a handicapped child by making fun of him.
Shoved a man who was handing out leaflets.
Demanded a refund at a restaurant for slow service.
Attended aerobic exercise classes only for a few weeks.
Gave a beggar a five dollar bill at Christmas time.
Worked all summer to give his parents a trip to Hawaii.
Stayed up late helping his child with homework.

Stole money and jewelry from the relatives he was living with.
Refused to take phone messages for a roommate.
Considered himself to be an authority on all subjects.
Watched an old western on the late show.
Circulated a petition in support of civil rights.
Volunteered his time as a big brother to a fatherless child.
Visited a sick friend in the hospital.

Criticized an old woman for being too slow.
Put a roach down another person's shirt.
Could not remember the birthdays of his family members.
Played a video game on his lunch break.
Went to the grocery store with his kids.
Gave out toys to the Children's Hospital at Christmas.
Comforted a man whose wife had recently died.

Refused to hold the door open for a man in a wheelchair.
Broke a friend's album and neither apologized or replaced it.
Went out of his way to tell strangers about his accomplishments.
Caught three trout on a weekend fishing trip.
Worked on a campaign to release prisoners of war.
Took a friend out for a beer to celebrate his promotion.
Helped an elderly woman put in storm windows.
BEHAVIORS USED FOR INTELLIGENCE

Failed the written driver's license exam four times.
Could not do fifth grade homework problems.
Has difficulty using his microwave oven.
Found a dollar bill outside his office door.
Drove for hours to hear a lecture on the aerospace program.
Won a science fiction writing award.
Was valedictorian of his graduating class.

Could not spell his name correctly.
Could not add numbers without his calculator.
Often uses incorrect grammar.
Called a TV station for weather information.
Sailed his boat across Lake Michigan.
Was in the school's honor society.
Ranked number 1 in his medical school class.

Asked the same question in class three times.
Does not know the multiplication tables.
Has difficulty understanding Time magazine.
Took his clothes to a nearby laundromat.
Usually watches the educational television station.
Converts measurements in his head.
Was accepted into Harvard's Law school.

Flushed his house keys down the toilet.
Took the wrong bus on two consecutive days.
Could not figure out how to use an adding machine.
Bought a new album on Monday.
Studied photography in his spare time.
Discovered a cheap way of producing solar energy.
Created a new computer language.

Left his windows open while washing his car.
Failed to follow the regular maintenance schedule for his car.
Has difficulty using the card catalogue in the library.
Bought a remote control for his television set.
Attends many drama performances.
Sets the curve on the history exam.
Scored in the 99th percentile on the SAT exam.
APPENDIX B

RESULTS OF EXPERIMENT ONE AND EXPERIMENT TWO
Table 14

Experiment I: Anova Summary Table For Ease Ratings

<table>
<thead>
<tr>
<th>Source</th>
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<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
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<tbody>
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<td>Trait</td>
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<td>29.91</td>
<td>29.91</td>
<td>3.51</td>
<td>.07</td>
</tr>
<tr>
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<td>1</td>
<td>.16</td>
<td>.16</td>
<td>.02</td>
<td>.89</td>
</tr>
<tr>
<td>TD</td>
<td>1</td>
<td>.29</td>
<td>.29</td>
<td>.03</td>
<td>.86</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>340.45</td>
<td>8.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob.</td>
<td>10</td>
<td>758.01</td>
<td>75.80</td>
<td>19.99</td>
<td>.0001</td>
</tr>
<tr>
<td>PT</td>
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<td>29.06</td>
<td>2.91</td>
<td>.77</td>
<td>.66</td>
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<td>5.11</td>
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<td>3.79</td>
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</table>
Table 15

Experiment 1: Anova Summary Table
Contrast comparing .5 with the average of .4 and .6
For Base Ratings

<table>
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<td>.34</td>
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<td>.74</td>
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<tr>
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<td>.34</td>
<td>.34</td>
<td>.11</td>
<td>.74</td>
</tr>
<tr>
<td>Error</td>
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<tr>
<td>Prob.</td>
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<td>.34</td>
<td>.17</td>
<td>.69</td>
</tr>
<tr>
<td>PT</td>
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<td>2.07</td>
<td>2.07</td>
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<td>.32</td>
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<tr>
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<td>.03</td>
<td>.03</td>
<td>.01</td>
<td>.91</td>
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<td>.03</td>
<td>.03</td>
<td>.01</td>
<td>.91</td>
</tr>
<tr>
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<td>82.16</td>
<td>2.05</td>
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</table>
Table 16

Experiment 2: ANOVA Summary Table for Ease Ratings

<table>
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<td>Direction</td>
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Table 17

Experiment 2: Anova Summary Table For Goodness Ratings

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| Probability| 10  | 432.50| 43.25| 20.69| .0001 |
| PT         | 10  | 59.28 | 5.93 | 2.84 | .002  |
| PD         | 10  | 31.07 | 3.11 | 1.49 | .14   |
| PTD        | 10  | 30.39 | 3.04 | 1.45 | .15   |
| PE         | 10  | 21.83 | 2.18 | 1.04 | .40   |
| PTE        | 10  | 15.75 | 1.57 | .75  | .67   |
| PDE        | 10  | 14.71 | 1.47 | .70  | .72   |
| PTDE       | 10  | 12.89 | 1.29 | .62  | .80   |
| Error      | 800 | 1672.66| 2.09 |      |       |
Table 18

Experiment 2: Anova Summary Table
Contrast Comparing .5 with the average of .4 and .6 For Ease Ratings

<table>
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Table 19

Experiment 2: Anova Summary Table
Contrast Comparing .5 with the average of .4 and .6 For Goodness Ratings
Table 20

Experiments 1 and 2: Anova Summary Table for Combined Data
Contrast Comparing .5 with the average of .4 and .6 For
Ease Ratings

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APPENDIX C

STIMULUS MATERIALS AND CODING INSTRUCTIONS FOR EXPERIMENT 3
Experiment 3: Mean Probability Ratings for the Behaviors For Each Direction of Inference Condition

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<th>Behavior to Trait</th>
<th>Trait to Behavior</th>
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</thead>
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<td>Attempted to rape a woman walking down a dark street.</td>
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<td>1.18</td>
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<tr>
<td>Siphoned gas from a car parked on the street.</td>
<td>2.23</td>
<td>1.58</td>
</tr>
<tr>
<td>Filed a complaint against some teenagers for trespassing.</td>
<td>4.65</td>
<td>4.30</td>
</tr>
<tr>
<td>Bought a coffee mug with his initials on it.</td>
<td>5.05</td>
<td>5.13</td>
</tr>
<tr>
<td>Emptied the trash before leaving for class.</td>
<td>6.45</td>
<td>6.48</td>
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<tr>
<td>Left town on short notice because of his father’s sudden death.</td>
<td>6.15</td>
<td>6.55</td>
</tr>
<tr>
<td>Offered to help an elderly neighbor paint his house.</td>
<td>8.08</td>
<td>7.78</td>
</tr>
<tr>
<td>Ridiculed a handicapped child by making fun of him.</td>
<td>1.43</td>
<td>1.33</td>
</tr>
<tr>
<td>Shoved a man who was handing out leaflets.</td>
<td>2.20</td>
<td>1.78</td>
</tr>
<tr>
<td>Demanded a refund at a restaurant for slow service.</td>
<td>4.05</td>
<td>3.25</td>
</tr>
<tr>
<td>Attended aerobics exercise classes only for a few weeks.</td>
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<td>5.13</td>
</tr>
<tr>
<td>Gave a beggar a five dollar bill at Christmas time.</td>
<td>7.38</td>
<td>7.60</td>
</tr>
<tr>
<td>Worked all summer to give his parents a trip to Hawaii.</td>
<td>8.25</td>
<td>7.55</td>
</tr>
<tr>
<td>Stayed up late helping his child with homework.</td>
<td>7.27</td>
<td>7.75</td>
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<tr>
<td>Stole money and jewelry from the relatives he was living with.</td>
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<td>1.43</td>
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<tr>
<td>Refused to take phone messages for a roommate.</td>
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<tr>
<td>Considered himself to be an authority on all subjects.</td>
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<td>3.35</td>
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<tr>
<td>Watched an old western on the late show.</td>
<td>4.75</td>
<td>5.40</td>
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<tr>
<td>Circulated a petition in support of civil rights.</td>
<td>6.93</td>
<td>6.68</td>
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<tr>
<td>Volunteered his time as a big brother to a fatherless child.</td>
<td>8.18</td>
<td>7.70</td>
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<tr>
<td>Visited a sick friend in the hospital.</td>
<td>7.40</td>
<td>8.23</td>
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<tr>
<td>Criticized an old woman for being too slow.</td>
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<td>1.95</td>
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<tr>
<td>Put a roach down another person’s shirt.</td>
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<td>2.18</td>
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<tr>
<td>Could not remember the birthdays of his family members.</td>
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<td>3.88</td>
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<tr>
<td>Played a video game on his lunch break.</td>
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<td>Went to the grocery store with his kids.</td>
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<tr>
<td>Gave out toys to the Children’s Hospital at Christmas.</td>
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<td>7.90</td>
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<tr>
<td>Comforted a man whose wife had recently died.</td>
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<td>8.23</td>
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<tr>
<td>Refused to hold the door open for a man in a wheelchair.</td>
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<td>1.99</td>
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<tr>
<td>Broke a friend’s album and neither apologized or replaced it.</td>
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<tr>
<td>Went out of his way to tell strangers about his accomplishments.</td>
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<td>3.23</td>
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<tr>
<td>Caught three trout on a weekend fishing trip.</td>
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<tr>
<td>Worked on a campaign to release prisoners of war.</td>
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<td>7.33</td>
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<td>Took a friend out for a beer to celebrate his promotion.</td>
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<td>7.40</td>
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<tr>
<td>Helped an elderly woman put in storm windows.</td>
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<td>8.88</td>
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Table 21 (continued)

<table>
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<tr>
<td>Could not do fifth grade homework problems.</td>
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</tr>
<tr>
<td>Has difficulty using his microwave oven.</td>
<td>3.95</td>
</tr>
<tr>
<td>Found a dollar bill outside his office door.</td>
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<tr>
<td>Drove for hours to hear a lecture on the aerospace program.</td>
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<tr>
<td>Won a science fiction writing award.</td>
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<tr>
<td>Was valedictorian of his graduating class.</td>
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<tr>
<td>Could not spell his name correctly.</td>
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<tr>
<td>Could not add numbers without his calculator.</td>
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<tr>
<td>Often uses incorrect grammar.</td>
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<tr>
<td>Called a TV station for weather information.</td>
<td>5.35</td>
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<tr>
<td>Sailed his boat across Lake Michigan.</td>
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<tr>
<td>Was in the school's honor society.</td>
<td>7.63</td>
</tr>
<tr>
<td>Ranked number 1 in his medical school class.</td>
<td>8.75</td>
</tr>
<tr>
<td>Asked the same question in class three times.</td>
<td>3.78</td>
</tr>
<tr>
<td>Does not know the multiplication tables.</td>
<td>3.30</td>
</tr>
<tr>
<td>Has difficulty understanding Time magazine.</td>
<td>4.10</td>
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<tr>
<td>Took his clothes to a nearby laundromat.</td>
<td>5.28</td>
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<tr>
<td>Usually watches the educational television station.</td>
<td>6.43</td>
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<tr>
<td>Converts measurements in his head.</td>
<td>7.33</td>
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<tr>
<td>Was accepted into Harvard's Law school.</td>
<td>8.33</td>
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<td>Flushed his house keys down the toilet.</td>
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<td>Took the wrong bus on two consecutive days.</td>
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<td>Could not figure out how to use an adding machine.</td>
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<td>Bought a new album on Monday.</td>
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<td>Studied photography in his spare time.</td>
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<td>Discovered a cheap way of producing solar energy.</td>
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<td>Created a new computer language.</td>
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<td>Left his windows open while washing his car.</td>
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<td>Failed to follow the regular maintenance schedule for his car.</td>
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<td>Has difficulty using the card catalogue in the library.</td>
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<td>Bought a remote control for his television set.</td>
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<td>Attends many drama performances.</td>
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<tr>
<td>Sets the curve-on the history exam.</td>
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<tr>
<td>Scored in the 99th percentile on the SAT exam.</td>
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Protocol Coding Categories and Examples

1. Label for the Upper Endpoint Category

PERSON IS DT Using the given behavior to infer that the person possesses the designated trait.
"This person is intelligent."

BEHAVIOR IS DT Asserting that the behavior is intelligent or kind.
"This is an intelligent thing to do"

HIGH PROB THAT PERSON IS DT Same as PERSON IS DT with probability language
"This person is certainly intelligent"

LOW PROB THAT PERSON IS CT
"It is unlikely that this person is stupid."

DT PERSON WOULD Stating that an intelligent/kind person would perform the behavior.
"A kind person would help their neighbor."

HIGH PROBABILITY DT WOULD Same as DT PERSON WOULD with probability language
"An intelligent person would definitely be able to do this".

LOW PROBABILITY CT WOULD
"It is unlikely that a stupid person would make it into Harvard law school."

INTENSIFIERS OF DT Assert prototypicality
"very intelligent" "extremely"

NEGATE CT PERSON Negate that the person possesses the contrast trait
"This person is not stupid"

NEGATE CT BEHAVIOR Negate that the behavior is contrast trait
"This is not a dumb thing to do."

CT PERSON WOULDN'T Stating that a person possessing the contrast trait wouldn't perform the behavior
"A stupid person could never create a new computer language."
Protocol Coding Categories (continued)

CT PERSON WOULD DO OTHER  Similar to CT PERSON WOULDN'T except stating what an unkind or unintelligent person would do.
"An unkind person wouldn’t offer to help their neighbor."

2. Label for Lower Endpoint Category

PERSON IS CT  Using the given behavior to infer that the person possesses the contrast trait.
"This person is unkind."

BEHAVIOR IS CT  Asserting that the behavior is unkind or unintelligent
"This is an unkind thing to do"

HIGH PROB THAT PERSON IS CT  Same as PERSON IS CT with probability language
"This person is certainly stupid"

LOW PROB THAT PERSON IS DT
"It is unlikely that this person is intelligent."

CT PERSON WOULD  Stating that a stupid/unkind person would perform the behavior.
"An unintelligent person would ask the same question in class three times."

HIGH PROBABILITY CT WOULD  Same as CT PERSON WOULD with probability language
"A stupid person would definitely do this"

LOW PROBABILITY DT WOULD
"It is improbable that an intelligent person would have trouble with their multiplication tables."

INTENSIFIERS CT  Assert prototypicality of contrast trait
"very stupid" "extremely"

NEGATE DT PERSON  Negate that the person possesses the designated trait "This person is not kind"

NEGATE DT BEHAVIOR  Negate that the behavior is an instance of the designated trait
"This is not an intelligent action."
Protocol Coding Categories (continued)

DT PERSON WOULDN'T Stating that a person possessing the designated trait wouldn't perform the behavior "A kind person would not steal from their relatives."

DT PERSON WOULD DO OTHER Similar to DT PERSON WOULDN'T except stating what a kind or intelligent person would do. (Usually instead of the given behavior.) "A kind person would not criticize the old woman but would help her."

3. Label for Midpoint Category

UNCERTAIN "unsure"

IRRELEVANT "What does this have to do with kindness?"

AMBIVALENCE BOTH TRAITS POSSIBLE "I thought that the person could be either kind or unkind."

MISSING INFORMATION "I need to know more than this single behavior."

50/50 CHANCE

NEUTRAL "non-committal", "neutral"

AVERAGE

MIDDLE "in the middle" "mid-level amount"

ANYBODY COULD "any type of person could do this"

4. Distance from the Upper Endpoint Category

PROBABILITY LANGUAGE ASSERTING DISTANCE DT "doubtful that the person is intelligent" "improbable"

COULD BE DT Stating that the person could possess the designated trait "This person could be kind"
Protocol Coding Categories (continued)

BEHAVIOR DOESN'T MEAN DT Stating that just because a person performed the behavior doesn't necessarily mean they possess the designated trait
"Just because a person went to Harvard doesn't mean he was smart - maybe his parents were rich."

HEDGES DT PERSON "This person is somewhat kind."

HEDGES DT BEHAVIOR "This behavior is slightly intelligent."

DT PERSON COULD "A kind person could do this."

DT DOESN'T MEAN BEHAVIOR "Just because a person is intelligent doesn't mean they would be interested in solar energy."

5. Distance from Lower Endpoint Category

PROBABILITY LANGUAGE ASSERTING DISTANCE CT "doubtful that the person is unkind"
"improbable"

COULD BE CT Stating that the person could possess the contrast trait
"This person could be stupid"

BEHAVIOR DOESN'T MEAN CT Stating that just because a person performed the behavior doesn't necessarily mean they possess the contrast trait
"Just because a person doesn't know how to spell their name doesn't mean they are from a different country and never had the opportunity to go to school."

HEDGES CT PERSON "This person is somewhat stupid."

HEDGES CT BEHAVIOR "This behavior is slightly unkind."

CT PERSON COULD "An unkind person could do this."

CT DOESN'T MEAN BEHAVIOR "Just because a person is unkind doesn't mean they would be rude to others."
Protocol Coding Categories (continued)

6. Distance from the Midpoint Category

HEDGES FROM MIDPOINT "somewhat uncertain" "slightly above the midpoint"

7. Features and Exemplars

FEATURES OF DT "A kind person is unselfish, caring and honest." "An intelligent person is one who does well in school, and enjoys learning."

FEATURES OF CT "An unkind person often hurts others for no reason, and doesn't consider other people's feelings before he acts."

EXEMPLARS DT "I thought of my father who is very smart and the fact that sometimes misspells words."

EXEMPLARS CT "Unkind people, like Hitler, are cruel to handicapped people."

8. Attributional Information

SITUATIONAL ATTRIBUTION "Maybe the person didn't have time to take messages for their roommate because they were studying for a big exam."

INTERNAL ATTRIBUTION "Maybe this person is kind but was in a bad mood that day."

BASE RATE OF BEHAVIOR "Everyone knows how to spell their name." "Very few people are accepted to Harvard Law School."

ASSUMPTIONS GENERATED BY THE SPECIFIC BEHAVIOR "Using a microwave is very easy. The instructions are usually on the appliance." "Painting a house takes alot of time and is very hard work."
Protocol Coding Categories (continued)

9. SELF-REFERENCES

SELF-REFERENCES
"I am not a very good speller."
"I had a friend who ruined my favorite record album."

SELF AS EXEMPLAR
"I consider myself to be an intelligent person."
APPENDIX D

RESULTS OF EXPERIMENT THREE
Table 22

Experiment 3: Anova Summary Table For Judgments

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Table 22 (continued)

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Table 23

Experiment Three: Means For Significant Effects on Judgments

1. Trait order X Direction of Inference Interaction

Intelligence First

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Kindness First

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2. Set X Trait order Interaction (Trait Main effect)

Intelligence 5.21
Kindness 4.96

3. Set X Trait order X Direction of Inference Interaction (Trait X Direction)

Intelligence

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Kindness

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4. Set X Trait order X Explanation (Trait X Explanation)

Intelligence

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Kindness

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For the following interactions see Figures 61-69

5. Location X Trait order
6. Location X Trait order X Explanation
7. Location X Direction X Set
8. Trial X Location X Set
9. Trait X Location X Direction
Figure 61: Judgment as a Function of Behavior Location and Trait Order
Behavior Location

Figure 62: Judgment as a Function of Behavior Location, Trait Order For Explanation First Trial Condition
Figure 63: Judgment as a Function of Behavior Location, Trait Order For Explanation Last Trial Condition
Figure 64: Judgment as a Function of Behavior Location, and Direction of Inference For the First Trait Set
Figure 65: Judgment as a Function of Behavior Location, and Direction of Inference for the Second Trait Set
Figure 66: Judgment as a Function of Behavior Location and Trial for the First Trait
Figure 67: Judgment as a Function of Behavior Location and Trial for the Second Trait
Figure 68: Judgment as a Function of Behavior Location, Direction of Inference for Kindness
Figure 69: Judgment as a Function of Behavior Location, Direction of Inference for Intelligence
### Table 24

**Experiment 3: Anova Summary Table**  
First Trait, Explanation Fifth Trial Only For Response Time

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Location X Trait Interaction  See Figure 70  
Location X Trait X Direction Interaction  See Figures 71 and 72
Figure 70: Response Time as a Function of Behavior Location and Trait for Subanalysis
Figure 71: Response Time as a Function of Behavior Location, and Direction of Inference for Kindness, for Subanalysis
Figure 72: Response Time as a Function of Behavior Location, and Direction of Inference for Intelligence, for Subanalysis
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Table 26

Experiment 3: Means For Significant Effects on Response Time for Full Analysis

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   (Trait X Direction X Explanation)

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2. Trial X Location X Trait Order Interaction

See Figures 73 and 74
Figure 73: Response Time as a Function of Behavior Location, and Trial For Intelligence First Trait Condition
Figure 74: Response Time as a Function of Behavior Location and Trial for Kindness First Trait Condition
Table 27

Experiment 3: Anova Summary Table for Use of a Label for the Upper Endpoint Category

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Table 28

Experiment 3: Means for Significant Effects on Use of a Label for the Upper Endpoint Category

Direction of Inference X Explanation Interaction

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<td>Trait to Behavior</td>
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Judgment X Explanation Interaction See Figure 75
Figure 75: Use of a Label for the Upper Endpoint Category as a Function of Judgment and Explanation Condition
### Table 29

Experiment 3: Anova Summary Table for Use of a Label for the Lower Endpoint Category

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### Table 30

**Experiment 3: Means for Significant Effects on Use of a Label for the Lower Endpoint Category**

Trait order x explanation condition interaction  
\( n = 4 \)

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### Table 31

**Experiment 3: Anova Summary Table for Use of a Label for the Midpoint Category**

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Table 32

Experiment 3: Anova Summary Table for Asserting Distance From the Upper Endpoint Category

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Table 33

Experiment 3: Anova Summary Table for Asserting Distance From the Lower Endpoint Category

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### Table 34

#### Experiment 3: Anova Summary Table for Asserting Distance From the Midpoint Category

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Table 35
Experiment 3: Means for Significant Effects for Distance From the Midpoint Category

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<tr>
<td></td>
<td>.02</td>
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<td>.04</td>
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2. Trait X Explanation Interaction

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3. Judgment X Direction of Inference X Explanation Interaction
   See Figures 76 and 77

4. Judgment X Trait Set Interaction
   See Figure 78

5. Judgment X Trait X Direction of Inference Interaction
   See Figures 79 and 80
Figure 76: Use of Distance From Midpoint Category as a Function of Judgment and Explanation Condition For Trait to Behavior Inferences
Figure 77: Use of Distance From Midpoint Category as a Function of Judgment and Explanation Condition For Behavior to Trait Inferences
Figure 78: Use of Distance From Midpoint Category as a Function of Judgment and Trait Set
Average proportion across megasubjects

Figure 79: Use of Distance From Midpoint Category as a Function of Judgment and Direction of Inference For Kindness
Figure 80: Use of Distance From Midpoint Category as a Function of Judgment and Direction of Inference For Intelligence
### Table 36

**Experiment 3: Anova Summary Table For Use of Features of the Designated Trait**

<table>
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<tr>
<th>Source</th>
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<th>F Value</th>
<th>P &gt; F</th>
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<tr>
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Table 37

Experiment 3: Means For Significant Effects on Use of Features For the Designated Trait

1. Direction of Inference Main Effect

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<th>Kindness First</th>
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3. Direction of Inference X Explanation Interaction

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4. Trait Set Main Effect

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5. Trait Main Effect

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6. Trait Set X Direction of Inference Interaction

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<tr>
<td></td>
<td>Trait to Behavior</td>
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</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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Table 37 (continued)

7. Trait Set X Direction of Inference X Explanation

Explanation first Trial

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Explanation fifth Trial

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<td>.19</td>
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<tr>
<td>Trait to Behavior</td>
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<td>.15</td>
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8. Trait X Judgment Interaction  See Figure 81
Figure 8: Use of Features of the Designated Trait as a Function of Judgment and Trait
### Table 38

**Experiment 3: Anova Summary Table For Use of Features of the Contrast Trait**

<table>
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<tr>
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<table>
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Table 39

Experiment 3: Anova Summary Table For Use of Exemplars of the Designated Trait

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<td>0.15538260</td>
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<td>0.3553</td>
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<td>0.31566525</td>
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<td>0.2664</td>
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<table>
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<td>0.3043</td>
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</tbody>
</table>
Table 40

Experiment 3: Means for Significant Effects on Use of Exemplars of Designated Trait

1. Set Main Effect

First Trait Set .03
Second Trait Set .01

2. Trait X Direction of Inference Interaction

<table>
<thead>
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<th>Intelligence</th>
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<tbody>
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<tr>
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3. Set X Direction of Inference X Explanation Condition

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<th>Second Trait</th>
</tr>
</thead>
<tbody>
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<td>.01</td>
</tr>
<tr>
<td>Trait to Behavior</td>
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<th>Second Trait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior to Trait</td>
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<td>.03</td>
</tr>
<tr>
<td>Trait to Behavior</td>
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<td>.00</td>
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4. Trait X Explanation X Direction of Inference Interaction

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<tbody>
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<td>Behavior to Trait</td>
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</tr>
<tr>
<td>Trait to Behavior</td>
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<table>
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<th>Kindness</th>
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</thead>
<tbody>
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<td>.01</td>
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<tr>
<td>Trait to Behavior</td>
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</table>

1. Set X Judgment X Direction Interaction See Figure 82 and Figure 83

2. Set X Judgment X Explanation Interaction See Figures 84 and 85
Figure 82: Use of Exemplars of Designated Trait as a Function of Judgment, Trait Set For Trait to Behavior Inferences
Figure 83: Use of Exemplars of Designated Trait as a Function of Judgment, Trait Set For Behavior to Trait Inferences
Figure 84: Use of Exemplars of Designated Trait as a Function of Judgment, Trait Set For Explanation First Trial Condition
Average proportion across megasubjects

Figure 85: Use of Exemplars of Designated Trait as a Function of Judgment, Trait Set For Explanation Fifth Trial Condition
Table 41

Experiment 3: Anova Summary Table For Use of Exemplars of The Contrast Trait Category

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Experiment 3: Anova Summary Table For Use of Attributions

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Experiment 3: Anova Summary Table For Use of Base Rate Information

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Experiment 3: Means for Significant Effects on Use of Base Rate Information

1. Trait order Main effect

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2. Trait order X direction of inference interaction

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3. Trait order X Direction of Inference X Explanation Interaction

Explanation First Trial

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Explanation Fifth Trial

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4. Judgment X Trait order X Direction of Inference Interaction See Figures 86 and 87
5. Judgment X Trait Set X Direction of Inference Interaction See Figures 88 and 89
Figure 86: Use of Base Rate Information as a Function of Judgment, Direction of Inference For Intelligence First Condition
Figure 87: Use of Base Rate Information as a Function of Judgment, Direction of Inference For Kindness First Condition
Figure 88: Use of Base Rate Information as a Function of Judgment, Direction of Inference For the First Trait Set
Figure 89: Use of Base Rate Information as a Function of Judgment, Direction of Inference For the Second Trait Set
Table 45

Experiment 3: Anova Summary Table For Use of Assumptions

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Table 46

Experiment 3: Means for Significant Effects on the Use of Assumptions

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Experiment 3: Anova Summary Table For Use of Self-References

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Table 48

Experiment 3: Means For Significant Effects on Use of Self-References

1. Direction of Inference Main Effect

Behavior to Trait       .06
Trait to Behavior       .02

2. Trait order X Direction of Inference X Explanation Interaction

Explanation first Trial

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</table>

Explanation Fifth Trial

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3. Judgment X Explanation Interaction  See Figure 90

4. Judgment X trait order X explanation Interaction  See Figures 91 and 92
Figure 90: Use of Self-References as a Function of Judgment and Explanation Condition
Figure 91: Use of Self-References as a Function of Judgment and Explanation Condition For Intelligence First Condition
Average Proportion Across Megasubjects

Judgment

- Explanation First  - Explanation Fifth

Figure 92: Use of Self-References as a Function of Judgment and Explanation Condition For Kindness First Condition
Table 49

Experiment 3: Anova Summary Table For Use of Judgments of 5

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Set X Trial Interaction See Figure 93
Set X Trial X Explanation See Figures 94 and 95
Figure 93: Use of Judgments of 5 Across Trials For Each Trait Set
Figure 94: Use of Judgments of 5 Across Trials For Each Explanation Condition For the First Trait.
Figure 95: Use of Judgments of 5 Across Trials For Each Explanation Condition For the Second Trait
Table 50

Experiment 3: Anova Summary Table, The Effects of High Versus Low Judgments on Use of Features of Contrast and Designated Traits

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APPENDIX E

RESULTS OF EXPERIMENT FOUR
Table 51

Experiment 4: Anova Summary Table on Response Time

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2. Trial X Number Key Effect

See Figures 96-105
Figure 96: Response Time as a Function of Number Key for Trial 1
Figure 97: Response Time as a Function of Number Key for Trial 2
Figure 98: Response Time as a Function of Number Key for Trial 3
Figure 99: Response Time as a Function of Number Key for Trial 4
Figure 100: Response Time as a Function of Number Key for Trial 5
Figure 101: Response Time as a Function of Number Key for Trial 6
Figure 102: Response Time as a Function of Number Key for Trial 7
Figure 103: Response Time as a Function of Number Key for Trial 8
Figure 104: Response Time as a Function of Number Key for Trial 9
Figure 105: Response Time as a Function of Number Key for Trial 10