

**LAY PERSONALITY KNOWLEDGE AND CONFIDENCE IN SOCIAL
INFERENCES: INDIVIDUAL DIFFERENCES, TEMPORAL CHANGE, AND
MOMENTARY ACTIVATION**

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Psychology

Waterloo, Ontario, Canada, 2001

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Lay Personality Knowledge and Confidence in Social Inferences: Individual Differences, Temporal Change, and Momentary Activation

Abstract

This thesis investigated the relationship between people's lay conceptions about the malleability of personality and their social inferences. In Part I, a series of studies was conducted to examine how people who subscribe to the belief that personality is fixed (entity theorists) differ from people who subscribe to the belief that personality is malleable (incremental theorists) in their confidence in inferring an individual's standing on a certain trait based on knowledge about the individual's standing on another trait construct (i.e., inter-construct inferences). Based on a program of research by Dweck, Chiu and Hong (1995), we hypothesized that entity theorists would make more confident or extreme inferences than would incremental theorists. This hypothesis was clearly borne out only under limited conditions. Participants' theories were related to the extremity of their inferences involving only conceptually related, and not unrelated, construct pairs. Moreover, participants' theories exhibited temporal instability, and the extremity of their inferences was strongly related to their theories only as measured at the time of inference. A strict individual-differences approach cannot explain or predict such intra-individual variability.

In Part II, a knowledge-activation perspective was used to illuminate the social-cognitive processes underlying intra-individual variations in states of knowledge and confidence in social inferences. Assuming that most people possess some knowledge consistent with the notion that personality is fixed (entity knowledge) and with the notion

that personality is malleable (incremental knowledge), it was hypothesized that social inferences would be made with greater confidence when entity knowledge is more accessible than when incremental knowledge is more accessible. Participants' pre-existing entity or incremental knowledge was made temporarily more accessible (or primed) in two studies. In one study, participants were exposed to a biography of a fictitious character whose personality remained stable (entity-prime condition) or changed a lot (incremental-prime condition) over the course of his lifetime. In another study, participants evaluated the meaning of proverbs consistent with the notion that personality is fixed (entity-prime condition) or with the notion that personality is malleable (incremental-prime condition). As predicted, across both studies, participants in the entity-prime condition made more extreme or confident inferences than did participants in the incremental-prime condition. Expressed beliefs about the malleability of personality elicited following the priming manipulations also differed across the two conditions in the direction consistent with the primed knowledge. Overall, Part II illustrates the value of using a knowledge-activation framework to understand how people's lay personality knowledge influences their social inferences.

Acknowledgements

I would like to express my very special gratitude and respect for Derek Koehler for agreeing to supervise this project. This thesis has benefited from his sage advice and support throughout the past four years. I consider working on this thesis as the most worthwhile learning experience in graduate school, and I thank Derek for being a great teacher and role model in this process.

Much appreciation is extended to members of the dissertation committee, Michael Ross and Jonathan Oakman, for helpful suggestions. I also thank Jodi Cryderman, Emily Marks, Natasha Chlebowski, Anya Rameshwar and Jaymis Goertz for their assistance in data collection and coding. Financial support from a SSHRC Doctoral Fellowship is gratefully acknowledged.

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PART I

WHEN DO IMPLICIT THEORIES PREDICT EXTREMITY OF SOCIAL INFERENCES?

Do friendly people tend to be honest? Do artists tend to be eccentric? How likely is a timid person to act assertively? In the course of our daily lives, we sometimes make inter-construct inferences, inferring an individual's standing on a certain trait or personal attribute based on knowledge about his or her standing on another trait construct. Some evidence suggests that while people in general are fairly accurate in predicting the direction of empirical association between trait constructs, they tend to overestimate the strength of such associations (Koehler, Brenner, Liberman & Tversky, 1996; see also Schneider, 1973). In the present research, we are interested in whether some people are more likely than are others to perceive trait co-variations. We set out to examine whether and under what conditions individual differences in beliefs about the malleability of personality are related to the extremity of inter-construct inferences. Before describing the present studies that address this issue, we briefly review a program of research by Dweck and colleagues and explain how their work suggests that individual differences in beliefs about the malleability of personality may be linked to inter-individual variations in these kind of inferences.

Background: Implicit Theories and Trait-focused Social Perception

Dweck and colleagues (Dweck & Leggett, 1988; Dweck, Chiu & Hong, 1995a; Dweck, Hong & Chiu, 1993; Levy & Dweck, 1998; Levy, Plaks & Dweck, 1999) have

identified two implicit theories of personality^{1,2,3}: (1) entity theory, the belief that personality is fixed, and (2) incremental theory, the belief that personality is malleable. Individuals who hold an entity theory are referred to as entity theorists, whereas those who hold an incremental theory are referred to as incremental theorists. These researchers proposed that an individual's implicit theory about the fixedness versus malleability of personality may establish an interpretative framework for understanding the social world and rendering social judgments.

According to Dweck and colleagues, entity theorists, in viewing personality as a set of fixed traits, may see the task of person perception as being to judge or diagnose underlying traits. This view of personality may imply an expectation of high consistency in trait-related behavior across situations, and engender a perception of close correspondence between traits and their behavioral manifestations. Such perceived regularity permits diagnosis of a person's underlying traits even with a small sample of behavior. Also, with the view of traits as fixed, diagnosis made at one point in time is

¹ The focus of this part of the thesis is on people's beliefs about the malleability of personality. It should be noted that, according to Dweck and colleagues, individuals need not possess one sweeping belief that cuts across all domains; they may hold different lay beliefs regarding such domains as intelligence and morality. For instance, some people may believe that personality is malleable but intelligence is fixed, and vice versa (Dweck et al., 1995a).

² In this thesis, the term implicit theory refers specifically to people's beliefs about the malleability of personality, as defined by Dweck and colleagues (Dweck et al., 1995a). It is worth noting that this term has been used by other researchers to refer to other lay conceptions about personality. For example, the term has been used to refer to people's beliefs about the stability of personal attributes over time (M. Ross, 1989), and to people's conceptions of relations among personality traits (Schneider, 1973).

³ The implicit theorist depicted by Dweck and colleagues (Dweck et al., 1995a) bears some similarity with that described by M. Ross (1989), given that there is a certain degree of conceptual overlap in the idea of "fixedness versus malleability" central to the former and the idea of "stability versus change" fundamental to the latter. Yet, there are differences between the two theoretical formulations. First, while an attribute that changes over time is "malleable", an attribute that is stable over time is not necessarily "fixed". Ross' implicit theorist possesses an understanding of conditions that facilitate change, even for attributes deemed to be rather stable. Secondly, whereas Dweck and colleagues focus on individual differences in implicit theories, Ross emphasizes the shared aspects of theories. In Dweck and colleagues' perspective, Person A may believe that a given attribute is fixed and Person B may believe that it is malleable. In Ross' perspective, people in general may believe that Attribute X is more stable than Attribute Y (M. Ross, 1989).

deemed to hold at a later time. Hence, from the standpoint of an entity theorist, trait constructs are useful and reliable bases for organizing, understanding, and making predictions about the social world (Dweck et al., 1995a; see also Chiu, Hong & Dweck, 1997; Levy, Stroessner & Dweck, 1998).

By contrast, incremental theorists, in viewing traits as malleable qualities and personality as dynamic, may see the task of person perception as being to understand the psychological processes (e.g., goals, emotional states) that mediate behaviors at different times and in different contexts. With this view of personality, behaviors are not seen as unambiguous manifestations of underlying traits. Consequently, trait constructs are not accorded with much value in social understanding and predictions (Dweck et al., 1995a; see also Chiu et al., 1997; Levy et al., 1998). In short, Dweck and colleagues proposed that entity and incremental theorists differ in their relative emphasis on trait constructs versus dynamic psychological processes in their social perception.

Dweck and colleagues have presented an extensive body of evidence consistent with this proposal (for reviews, see Dweck, 1996; Dweck et al., 1993; Dweck et al., 1995a; Levy & Dweck, 1998; Levy et al., 1999). For example, entity theorists have been shown to assign a more important role to traits in explaining social events, relative to incremental theorists. In a study by Levy and Dweck (1999), when asked to explain others' behaviors (e.g., "one kid would not loan his extra pencil to a classmate who needed one", "one kid borrowed one of his classmate's favorite CDs and never returned it"), entity theorists emphasized traits (e.g., "they are mean", "they are dishonest") more than did incremental theorists. In contrast, relative to entity theorists, incremental theorists focused more on dynamic psychological processes, including goals and

emotional states (e.g., “to get attention”, “they don’t feel like being nice”), as well as situational forces (e.g., “their friends taught them how to be bad”, “their parents don’t teach them right”) in their attributions of social behavior (e.g., Levy & Dweck, 1999).

Relative to incremental theorists, entity theorists were also found to render more extreme inferences or predictions based on information pertaining to trait constructs.⁴ More specifically, on the basis of traits, entity theorists make corresponding behavioral predictions with greater confidence. In a study by Chiu et al. (1997), when told that Henry is “more aggressive” than Edward on average, entity theorists more readily predicted that Henry would “act more aggressively” than Edward in a particular situation, compared to incremental theorists. At the same time, entity theorists also make more extreme correspondent trait inferences based on concrete behaviors. Chiu et al. found that entity theorists perceived a variety of positive and negative behaviors (e.g., “risking one’s life for another”, “stealing a car”) as more indicative of the “goodness” and “badness” of the actors than did incremental theorists (see also Erdley & Dweck, 1993). Furthermore, entity theorists are more confident that trait-correspondent behavior will be consistent across different situations. Given the information that Jack was “more friendly” than Joe in a particular situation, Chiu et al. found that entity theorists predicted with greater confidence that Jack would also be “more friendly” than Joe in a different situation, compared to incremental theorists (see also Erdley & Dweck, 1993).

⁴ For most trait constructs, there is likely to be a direct correspondence between the underlying trait (or disposition) and the kind of behaviors that one might expect from it (e.g., the disposition friendly would predict friendly behavior). Thus, information pertaining to trait constructs may include not only the underlying trait (or disposition) typically described in the form of trait adjectives (e.g., “friendly”, “polite”), but also trait-relevant behaviors.

Taken together, Dweck and colleagues' work suggests that individual differences in beliefs about the malleability of personality are linked to inter-individual variations in the tendency to use trait constructs to understand and make inferences about the social world. Relative to incremental theorists, entity theorists, in viewing personality as consisting of fixed traits, appear to regard information about trait constructs as more useful and reliable, and thereby having greater predictive value.

Current research: Implicit Theories and Inter-construct Inferences

To date, in studying the link between people's implicit theories and their social inferences, Dweck and colleagues have focused on inferences that lie primarily within the boundary of a single trait construct. We call such inferences intra-construct inferences. Intra-construct inferences include, for example, predicting the likelihood of aggressive behavior from a person known to be (i.e., characterized by the trait) aggressive, predicting the likelihood of friendly behavior in a particular situation on the basis of friendly behavior in another situation, and inferring "goodness" or "badness" from the observation of positive and negative behaviors.

The present research sought to extend Dweck and colleagues' work by examining the role of implicit theories in how people make inferences about an individual's standing on one trait construct, based on knowledge about the individual's standing on another trait construct (inter-construct inferences). We hypothesized that the extremity of people's inter-construct inferences would vary as a function of two factors. The first factor is the strength of conceptual or semantic relatedness (i.e., similarity versus oppositeness) between the trait construct on which the prediction is based (predictor construct) and the trait construct about which the prediction is to be made (predicted

construct). Based on previous findings by Koehler et al. (1996), we expected that perceived empirical association would be more extreme if the conceptual relatedness between the the predictor and predicted constructs is high. No evidence in the literature we are aware of suggests that entity and incremental theorists would differ in their evaluation of conceptual relatedness between trait constructs. A second, plausible factor is the perceived reliability or credence of trait constructs as information upon which to base inferences (cf. Griffin & Tversky, 1992). Assuming that, all else being equal, more reliable information would be accorded greater weight in inferences, more extreme inferences between the predictor and predicted constructs would be expected if the reliability of information pertaining to trait constructs is deemed to be high rather than low. As explicated in the previous section, Dweck and colleagues' work suggests that entity theorists regard trait constructs as more reliable bases on which to understand and make predictions about the social world than do incremental theorists. Thus, one might expect that, relative to incremental theorists, entity theorists would make more extreme inter-construct inferences.

In the present investigation, we began with an exploratory study in which we first assessed participants' implicit theories. Then, six to ten weeks later, we gauged their inter-construct inferences using trait pairs with different levels of conceptual relatedness (Study 1). The progression of our studies was in part results-driven; in light of findings from each study, in subsequent studies we systematically varied certain aspects of the our research design with the goal of pinpointing conditions that moderate the strength of the hypothesized relation between people's implicit theories and the extremity of their inter-construct inferences. We regard this condition-seeking approach as potentially valuable

in that it can increase the precision of our conclusions, and motivate refinement of the current theoretical formulation (cf. Greenwald, Pratkanis, Leippe & Baumgardner, 1986).

In the course of the present research, we investigated two major boundary conditions on the relationship between implicit theories and inter-construct inferences. One such condition pertains to the degree of conceptual relatedness between the predictor and predicted constructs. We sought to determine whether people's implicit theories play a role in their inferences only when the predictor and predicted constructs are conceptually related (Studies 1, 2 & 3). Another boundary condition concerns the temporal stability of people's implicit theories. We assessed the temporal stability of implicit theories (Studies 3 & 4) and pursued the issue of whether people's inferences are strongly related only to their current implicit theories (Studies 1, 2 & 3). Finally, a study was conducted to verify our assumption that people's judgments about the conceptual relatedness of trait constructs do not vary as a function of their implicit theories (Study 5).

Study 1

Method

Overview

We collected data from three separate groups of participants. Participants in the Inventory Group completed a personality inventory in which they rated themselves on 30 personality trait constructs. Their ratings would provide baseline information regarding the actual empirical associations of trait constructs against which the accuracy of trait inferences could be assessed. Participants in the Similarity Judgment Group rated the semantic similarity of various pairs of trait terms used in the personality inventory. The

semantic similarity ratings elicited from this group would serve to index the conceptual relatedness of all possible pairs of trait constructs used in the present research.

Participants in the Inference Group first completed the 3-item Person Theory Measure designed to assess their implicit theories. Six to 10 weeks later, they completed a social inference questionnaire in which they estimated the empirical associations among 60 pairs of trait constructs, drawn randomly from all possible pairs of trait constructs used in the personality inventory.

Inventory Group

Participants. Students of both genders at the University of Waterloo were approached by an experimenter in a student lounge and invited to participate in a short study for a payment of two dollars. One hundred and ninety-four students agreed to participate.

Personality inventory. Participants completed a personality inventory individually. In the inventory, they were asked to rate themselves in terms of 30 specific, commonly-used personality trait constructs (e.g., organized, polite, secretive, shy). These trait constructs were drawn randomly from a list of 50 trait constructs used in a study by Koehler et al. (1996). For each of the 30 constructs, participants were asked to rate how well the trait construct described themselves, relative to other students at the University of Waterloo, using a percentile score on an 11-point scale running from 0 to 100 in intervals of 10. The meaning of a percentile score was clearly explained in the instructions.

Similarity Judgment Group

Participants. Students of both genders at the University of Waterloo were approached by an experimenter in a student lounge and invited to take part in a short study for a payment of two dollars. One hundred and twenty students agreed to participate. Another 71 students enrolled in Introductory Psychology participated in exchange for either partial course credit or payment if they had already earned the maximum number of credits through participation in research.

Linguistic similarity judgments. The Similarity Judgment Group, as a whole, rated the linguistic (or semantic) similarity of all 630 possible pairs that could be formed among 36 trait terms, which included the 30 specific trait terms appearing in the personality inventory and six additional global trait terms (i.e., extrovert, introvert, analytical, intuitive, decisive, and adaptive) ⁵. These 630 pairs of trait terms were randomly allocated across 6 questionnaire forms for participants recruited from Introductory Psychology. Each of these forms consisted of 105 pairs, and required about 20 minutes to complete. The 630 pairs of trait terms were randomly allocated across 10 questionnaire forms for participants recruited from the student lounge. Each of these shorter forms comprised 63 pairs, and required about 10 minutes to complete. All questionnaire forms were entitled “Linguistic Similarity Judgments”. Each participant was instructed rate the similarity in meanings of pairs of trait terms appearing in his or her questionnaire:

Imagine that as part of the preparation of a thesaurus of personality trait

⁵ The six global traits were irrelevant for the present study. They were, however, included in the linguistic similarity questionnaires because they were used in a study not included in this thesis.

terms, you are asked to make some judgments regarding the meaning of different trait terms. Some personality trait terms are quite similar in meaning (e.g., cheerful and friendly), whereas others are quite opposite in meaning (e.g., friendly and hostile). Moreover, some trait terms are essentially unrelated in meaning (e.g., creative and cheerful).

Below you will find pairs of personality trait terms. For each pair, please rate how similar they are in terms of their meaning.

Participants indicate their similarity ratings on a 7-point scale, ranging from -3 (opposite meaning) through 0 (unrelated meaning) to 3 (similar meaning).

The mean similarity rating for each of the 630 pairs of trait terms was then computed. In computing the mean similarity ratings, data from four participants recruited at the student lounge were discarded because their responses on many of the items were more than three standard deviations away from the means of the respective items.

Inference Group

Participants. Eighty-one students of both genders enrolled in Introductory Psychology at the University of Waterloo participated in exchange for partial course credit. These participants were recruited on the basis of their scores on the 3-item Person Theory Measure (Dweck et al., 1995a). This measure was one of many other unrelated measures included in a prescreening questionnaire booklet distributed to all students enrolled in Introductory Psychology at the beginning of the academic term. The Person Theory Measure consists of the following items: (1) “The kind of person someone is is something very basic about them and it can’t be changed very much”; (2) “People can do things differently, but the important parts of who they are can’t really be changed”; and

(3) “Everyone is a certain kind of person and there is not much that can be done to really change that” (Dweck et al., 1995a, p. 269). For each item, respondents were asked to indicate the extent of their agreement on a scale running from 1 to 6 (1 = strongly agree, 2 = agree, 3 = slightly agree, 4 = slightly disagree, 5 = disagree, 6 = strongly disagree). For each respondent, a person theory score was computed by averaging his or her agreement with each item. A lower person theory score reflects a stronger expressed belief in an entity theory. Dweck and colleagues classify respondents with a person theory score of 3.0 or below as entity theorists, and those with a score of 4.0 or higher as incremental theorists. Using these cutoff scores, Dweck and colleagues have typically found that about 85% of respondents tend to be evenly distributed between the two theorist groups, and the remaining 15% or so are unclassified (Chiu et al., 1997; Dweck et al., 1995a; Levy et al., 1998). Following the criteria used by these researchers, only respondents with a person theory score of 3.0 or below (entity theorists) and those with a score of 4.0 or above (incremental theorists) were recruited for the inference group of the present study.

In validation studies conducted by Dweck and colleagues, the Person Theory Measure showed high internal consistency, with Cronbach’s alphas ranging from .90 to .96 (Cronbach’s alpha was .86 in the present study). The test-retest reliability of the measure was reported to be .82 over a 2-week interval. In terms of the discriminant validity of the measure, these researchers reported that scores on the Person Theory Measure are independent of respondents’ age and sex. Person theory scores also do not correlate with standard measures of self-presentational concerns, cognitive abilities, self-esteem, optimism about human nature, ideological rigidity or political stance (see Chiu et

al., 1997; Dweck et al., 1995a; Levy et al., 1998 for further details about the psychometric properties of the Person Theory Measure).

Social inference questionnaire. Any time from 6 to 10 weeks after students enrolled in Introductory Psychology completed the Person Theory Measure, participants were recruited to take part in an experimental session in which they completed a social inference questionnaire. Each experimental session included between one and 10 participants. In the social inference questionnaire, participants were asked to judge the empirical association of 60 pairs of trait constructs. These construct pairs were randomly selected from all 435 possible pairs that could be formed among the 30 specific trait constructs appearing in the personality inventory. For each construct pair, participants were presented with the information that, based on self-ratings, one character (Person A) is higher than another person (Person B) in terms of their relative standing on a designated trait construct. With such information, participants were asked to estimate the probability that the same relative standing holds for another trait construct. Here is a sample question:

Person A is more SYMPATHETIC than Person B.

What is the probability that Person A is also more GENTLE than Person B?

Participants were asked to indicate their judgment on a 21-point probability scale running from 0% to 100% in intervals of 5% for each item. They were provided with detailed instructions of how to use the scale, as follows:

If you think the information that Person A is higher than Person B on the first trait (e.g., SYMPATHETIC) does not provide any useful information regarding their relative standing on the second trait (e.g., GENTLE), you

would circle 50%. By giving a judgment of 50%, you are saying that Person A and Person B have an equal chance of being higher on the second trait even though Person A is higher on the first trait.

If you think that Person A will also be higher than Person B on the second trait, circle a value above 50%. In the extreme case where you are completely certain that Person A is higher than Person B on the second trait, circle 100%.

In contrast, if you think that Person A will be lower than Person B on the second trait, circle a value below 50%. In the extreme case where you are completely certain that Person A is lower than Person B on the second trait, circle 0%.

This question format followed that used by Kunda and Nisbett (1986), where participants were asked to estimate the probability that two pairs of observations would have the same rank ordering. An advantage of this question format is that participants' percentage estimates can be mathematically converted into correlation coefficients. For example, an estimate of 50% can be converted to a correlation coefficient of 0, an estimate of 100% can be converted to a correlation coefficient of 1, and an estimate of 0% can be converted into a correlation coefficient of -1. Using this question format, people have been shown to be capable of providing probability estimates that yielded accurate estimates of actual correlations (Kunda & Nisbett, 1986). In the present study, such conversion would permit comparisons between participants' percentage estimates and the actual correlations of trait constructs, as obtained using the self-ratings from the Inventory Group.

Results

Probability Judgments in the Social Inference Questionnaire

To examine how the Inference Group participants' probability judgments in the social inference questionnaire varied as a function of their implicit theories and the semantic similarity of the construct pairs, their probability judgments were subjected to a criterion-scaled, hierarchical regression analysis^{6,7} with variables listed in Table 1.1 as predictors.^{8,9} Data from two participants from the Inference Group were discarded because they failed to complete a fairly large number of items. Also discarded were data from one participant whose responses on many inference items were more than three standard deviations from the means of the respective items, leaving a total of 78 Inference Group participants in the analysis. As noted earlier, the semantic similarity of the construct pairs was indexed by the mean similarity ratings from Similarity Judgment Group. Results are presented in Table 1.1.

-----Insert Table 1.1 about here-----

⁶ Throughout the current investigation, we chose to treat "implicit theory" as a continuous variable to fully capture the magnitude of participants' implicit beliefs in our main statistical analyses. Treating "implicit theory" as a two-level categorical variable, as Dweck and colleagues have done in their research, generally yielded similar results. With "implicit theory" as a continuous variable, a regression approach was used. As similarity was a within-subject variable in the present design, criterion-scaling was required to represent subject-related variables. An introduction to criterion-scaled regressions can be found in Pedhazur (1982, chap. 14).

⁷ This analysis involved a series of regressions whereby each predictor variable in Table 1 was cumulatively entered in the order listed. In the first regression, the first predictor variable was entered. In the second regression, both the first and the second predictor variables were entered. In the third regression, the first, second and third predictors were entered, and so on.

⁸ All subject-related variables were criterion-scaled variables serving as error terms.

⁹ The sum of squares associated with each predictor variable was obtained by subtracting the regression sum of squares at the step where it was entered by the regression sum of squares obtained at the preceding step. Using a similar logic, the degrees of freedom associated with each predictor variable was obtained. As usual, the mean squares of the predictor variables were computed by dividing the relevant sum of squares by their associated degrees of freedom, and the F ratios by dividing the relevant mean squares by their associated mean square errors.

Figure 1.1 helps to clarify the pattern of results. In this figure, the horizontal axis represents the mean similarity ratings of constructs pairs obtained from the Similarity Judgment Group; the vertical axis represents the mean probability judgments for the construct pairs obtained from the Inventory Group. The means of entity and incremental theorists' probability judgments for construct pairs of different levels of similarity are displayed in this figure. Also displayed are the simple regression lines predicting the mean probability judgments from the mean similarity ratings of the construct pairs, with separate lines for entity and incremental theorists.

-----Insert Figure 1.1 about here-----

As indicated in Table 1.1, the criterion-scaled regression yielded a significant main effect of similarity. Inspection of Figure 1.1 shows that, regardless of implicit theory, the more similar (i.e., positively semantically related) the construct pair, the higher was the judged probability that the relative standing of Person A and Person B on one member of the construct pair would also hold for the other member of the pair. The more opposite (i.e., negatively semantically related) the construct pair, the lower was the judged probability that Person A and Person B's relative standing on one member of the construct pair will hold for the other member.

The main effect of similarity was qualified by a significant Theory X Similarity interaction. As illustrated in Figure 1.1, the two theorist groups differed in their judgments of empirical association of construct pairs as the pairs became increasingly similar, or increasingly opposite, but not when they were unrelated.¹⁰ Relative to

¹⁰ Due to the complicated nature of the present study, results are described here in terms of entity versus incremental theorist distinction to simplify presentation, even though "implicit theory" was treated as a continuous variable in the criterion-scaled regression.

incremental theorists, entity theorists perceived that it was slightly more probable that a person having a relatively high standing on a trait construct would also have a relatively high standing on another trait construct if the two constructs had reasonably similar meanings. At the same time, compared to incremental theorists, entity theorists perceived that it was slightly less probable that a person who had a relatively high standing on a trait construct would also have a relatively high standing on another trait construct if the two constructs had reasonably opposite meanings. It should be noted that this Theory X Similarity interaction was a very weak one. As clearly shown by a comparison of the slopes of the regression lines for the two groups of theorists in Figure 1.1, implicit theories appeared to exert only a very modest influence on the relationship between construct similarity and extremity of trait inferences.

Comparing Estimated and Actual Correlations among Trait Constructs

Recall that participants in the Inventory Group provided self-ratings on each of the specific trait constructs used in the social inference questionnaire. Actual correlations for all the construct pairs used in the social inference questionnaire could be computed using these self-ratings. To compare Inference Group participants' estimates of the empirical associations among the construct pairs with the actual correlations from the Inventory Group, their probability judgments were mathematically converted into correlation coefficients (cf. Kunda & Nisbett, 1986). For each construct pair, we computed the mean of these coefficients for both entity and incremental theorists. In Figure 1.2, the mean of entity and incremental theorists' estimates for each construct pair, expressed in terms of mean correlation coefficients, were plotted along with the actual correlations for each construct pairs against the mean similarity ratings provided by the

Similarity Judgment Group. Note that the vertical axis now represents correlation coefficients.

-----Insert Figure 1.2 about here-----

Inspection of Figure 1.2 shows that both entity and incremental theorists were generally accurate in predicting the direction of empirical associations for the construct pairs. That is, for the most part, participants predicted positive empirical associations for construct pairs that were in fact positively correlated, and predicted negative empirical associations for construct pairs that were in fact negatively correlated. Note, however, that the predictions from the Inference Group tended to be far too extreme. On average, the predictions vastly overestimated the extent to which actual correlations among construct pairs increased with positive semantic relatedness (i.e., similarity) and decreased with negative semantic relatedness (i.e., dissimilarity). Compared to the sizeable deviations of both entity and incremental theorists' perceived associations from the actual associations, the theory effect we found for conceptually related pairs appears particularly small.

Discussion

Consistent with the findings by Koehler et al. (1996), Inference Group participants' estimates of empirical association between trait constructs were based, to a large extent, on the conceptual relatedness of the constructs. The more similar or the more opposite in meaning the construct pairs, the stronger was the perceived empirical association. In their heavy reliance on conceptual relatedness as a basis for judgment, participants tended to predict a degree of empirical association between trait constructs far greater than the actual correlations.

Participants' implicit theories, as measured any time from 6 to 10 weeks prior to their inferences, were related to the extremity of their inter-construct inferences only when the constructs involved were conceptually related. For similar or opposite construct pairs, entity theorists rendered more extreme inferences than did incremental theorists; for unrelated construct pairs, entity and incremental theorists' inferences generally did not differ. Although the observed relationship between participants' implicit theories and the extremity of their inferences was in the direction we expected for the conceptually related construct pairs, the magnitude of this relationship was very weak in Study 1. In the next two studies, we attempted to identify the conditions under which a stronger relationship might be observed between people's implicit theories and their inter-construct inferences.

Study 2

In Study 1, the 60 construct pairs used in the social inference questionnaire were randomly selected from all 435 possible pairs among 30 specific constructs appearing in the personality inventory. A natural consequence of this random selection method was that the majority of the construct pairs were essentially unrelated in meaning. Only a few pairs were moderately related, and even fewer were strongly related, as rated by the Similarity Judgment Group. With so few strongly related constructs, the social inference questionnaire in Study 1 may not have offered an ideal test of conditions under which an implicit theory effect might emerge, as it was only under conditions of high conceptual relatedness that we found some hint of such an effect. In Study 2, we attempted to more clearly demonstrate the role of implicit theories in people's inter-construct inferences by

including more construct pairs with a high degree of conceptual relatedness in the social inference task.

A secondary purpose of Study 2 was to explore how people's inter-construct inferences might be affected by how the trait constructs were depicted. Trait constructs can be referred to simply by trait adjectives (which we often simply call "traits"), such as "friendly" and "aggressive", which are typically interpreted as reflecting dispositions or some underlying qualities. Alternatively, trait constructs could also be depicted in terms of their correspondent behaviors, such as "friendly behavior" and "aggressive acts". In Study 2, we made a fine distinction between underlying traits and trait-relevant behavior (cf. Chiu et al., 1997). With this distinction, we incorporate several possible variants into the inter-construct inference task: (a) using information about a certain kind of behavior to predict a trait (i.e., behavior-to-trait inference), (b) using information about a trait to predict a certain behavior (i.e., trait-to-behavior inference), (c) using information about a certain behavior to predict another kind of behavior (i.e., behavior-to-behavior inference), and (d) using information about a trait to predict another trait (i.e., trait-to-trait inference). Participants in Study 1 essentially made only trait-to-trait inferences. In the present study, participants were asked to make all four types of inferences.

Method

Overview

Participants' implicit theories were first assessed using the 3-item Person Theory Measure. Two to 10 weeks later, they completed a social inference questionnaire in which they made behavior-to-trait, trait-to-behavior, behavior-to-behavior, and trait-to-trait inferences involving similar, unrelated and opposite pairs of trait constructs.

Participants

Two hundred and eight students of both genders enrolled in Introductory Psychology at the University of Waterloo participated in exchange for partial course credit. Participants were recruited on the basis of their responses on the 3-item Person Theory Measure. This measure was one of many other unrelated measures included in a prescreening booklet distributed to all students enrolled in Introductory Psychology at the beginning of a term. Only respondents with a person theory score of 3.0 or below (entity theorists) and those with a score of 4.0 or above (incremental theorists) were recruited for the present study. The Cronbach's alpha for the Person Theory Measure was .94 in the present study.

Social Inference Questionnaire

Any time from 2 to 10 weeks after students enrolled in Introductory Psychology completed the Person Theory Measure, participants were recruited to take part in an experimental session in which they completed a social inference questionnaire. Each experimental session included between one and 10 participants. In the social inference questionnaire, participants were presented with the information that one character (Person A) is higher than another (Person B) with regard to their standing on a designated trait construct. Based on this information, participants were asked to estimate the probability that the same relative standing holds for another trait construct. The predictor and predicted constructs were further specified as either underlying traits or as trait-relevant behavior (see Table 1.2).

-----Insert Table 1.2 about here-----

The questionnaire was divided into four major sections. Each section dealt with one of the following types of inference: (a) behavior-to-trait inference, in which participants made predictions about a certain trait, based on information about a certain class of behavior; (b) trait-to-behavior inference, in which they made predictions about a certain class of behavior, based on information about a certain trait; (c) behavior-to-behavior inference, in which they made predictions about a certain kind of behavior, based on information about another kind of behavior; and (d) trait-to-trait inference, in which they made predictions about a certain trait, based on information about another trait. The order in which the sections including these four inference types appeared in the questionnaire was counterbalanced in a Latin square design. Thus, there were four versions of the questionnaire, each with a different order of inference types.

In each section of the questionnaire, there were 60 inference items, with an equal number (20) involving similar, unrelated and opposite construct pairs (see Table 1.2). The same 60 construct pairs were used in each of the four inference types, yielding 240 items in each version of the social inference questionnaire. The 60 construct pairs were drawn from the list of all possible pairs (i.e., 435 pairs) among the 30 specific constructs used in the personality inventory in Study 1. Recall that mean similarity ratings for each possible construct pair were obtained in Study 1, where the Similarity Group participants rated the similarity of construct pairs on a 7-point scale, ranging from -3 (opposite meaning) through 0 (unrelated meaning) to 3 (similar meaning). To maximize the differences in the mean similarity ratings among the similar, unrelated, and opposite construct pairs in the present study, one might simply use the 20 pairs with the most positive similarity ratings, the 20 pairs with similarity ratings closest to 0, and the 20

pairs with the most negative similarity ratings. However, we found that this approach of maximizing similarity difference would result in a high level of redundancy in the selected constructs (i.e., the tendency for some constructs to show up in many more pairs than others). In general, there was a tradeoff between the goals of maximizing similarity differences and minimizing construct redundancy. In selecting the similar, unrelated and opposite sets of construct pairs, we identified a combination of construct pairs that maintained a fairly large similarity difference between sets while preventing the redundancy from becoming too extreme. For the set of construct pairs thus selected, the mean similarity ratings for the similar, unrelated and opposite sets were 2.03, 0, and -1.18 respectively. Within each selected construct pair, one member was randomly assigned as the predictor construct, and the other member as the predicted construct. The same 60 pairs of constructs were used for all four inference types, and appeared in the same random order within each of the four sections of the questionnaire.

Table 1.2 shows the exact wordings of several example items for each inference type. As in Study 1, participants were asked to indicate their predictions on a 21-point probability scale, running from 0% to 100% in intervals of 5%. They were given detailed instructions on how to use the probability scale comparable to those provided in Study 1. The social inference questionnaire took about an hour to complete.

Results

To examine how the probability judgments varied as a function of implicit theory, construct similarity, and inference type, we averaged each participants' judgments within the 20 similar, 20 unrelated, and 20 opposite items for each inference section. With three similarity levels and four inference types, there were 12 such composite judgment scores

for each participant. These judgment scores served as the dependent variable in a criterion-scaled hierarchical regression analysis, with variables listed in Table 1.3 as predictors.¹¹

-----Insert Table 1.3 about here-----

As shown in Table 1.3, the analysis yielded significant main effects of inference type and similarity, which were qualified by two statistically reliable two-way interactions. Of foremost relevance to this study was the significant Similarity X Theory interaction. To clarify the nature of this interaction, we performed three simple regressions, one for each similarity level. In each of these simple regressions, participants' average composite judgment scores over the four inference type conditions were regressed on their implicit theory scores.

Figure 1.3 displays graphically the slopes of these simple regressions. In general, participants' theory scores did not co-vary with the extremity of their probability judgments for unrelated constructs. For related constructs, however, there was a trend such that lower theory scores, reflecting stronger expressed belief in an entity theory, were associated with slightly more extreme inter-construct inferences. Specifically, the more strongly participants believed in an entity theory, the more probable they thought that a person having a relatively high standing on a specific construct would also have a higher standing on another specific construct if the two constructs were similar in meaning. At the same time, a stronger endorsement of an entity theory was also

¹¹ In this analysis, "similarity" was treated as a categorical variable with three levels (similar, unrelated and opposite) instead of as a continuous variable, as in Study 1. The reason was that, in the present study, the way we selected construct pairs for the similar, unrelated and opposite conditions ensured that there would be little variance in similarity ratings within each of the three similarity conditions. Treating "similarity" as a continuous variable would not increase the precision of the analysis to any discernable extent, but would increase the complexity of the analysis considerably.

associated with lower perceived likelihood that an individual with a relatively high standing on a specific construct would also have a higher standing on another construct when the two constructs were opposite in meaning. In short, consistent with Study 1, the Similarity X Theory interaction effect indicated that people's implicit theories appeared to play a role in their predictions regarding empirical association between semantically related constructs, but not unrelated ones. As can be seen in Figure 1.3, this interaction effect was quite modest in magnitude.

-----Insert Figure 1.3 about here-----

In addition to the Similarity X Theory interaction effect, the analysis also revealed a significant Inference X Similarity interaction. Generally, regardless of participants' theory scores, inference type affected their judgments for similar construct pairs but did not have a clear effect for unrelated and opposite pairs¹². For similar pairs, participants exhibited greater confidence when basing their inferences on trait information ($M = 76.71$ for trait-to-behavior inferences; $M = 77.02$ for trait-to-trait inferences) than when basing their predictions upon behavioral information ($M = 74.36$ for behavior-to-trait inferences; $M = 73.16$ for behavior-to-behavior inferences).

Discussion

The findings of the present study were highly similar to those obtained in Study 1. Participants' implicit theories, as assessed any time from 2 to 10 weeks prior to their inferences, were predictive of their inter-construct inferences only when the constructs involved were conceptually related. While a strong expressed belief in an entity theory

¹² This statement was made through inspection of means, and was not made on the basis of more fine-grained statistical analyses. Given that the sample size of the present study was very large ($n = 208$) and that both "inference type" and "similarity" were within-subject factors, follow-up tests to the Inference X Similarity interaction were highly sensitive; almost any such test yielded statistically significant results.

was associated with more extreme inferences involving similar or opposite pairs, such belief did not bear any relationship with inferences involving unrelated pairs. Even though the direction of relation between participants' implicit theories and the extremity of their inter-construct inferences was consistent with our expectation, it was a very weak relationship, despite our effort to more clearly demonstrate an effect of implicit theory by using more strongly related construct pairs in the present study. The small effect of implicit theory across the first two studies perplexed us, given that Dweck and colleagues' work strongly suggests that trait constructs are regarded by entity theorists, relative to incremental theorists, as more reliable bases for social understanding and predictions. In the next study, we continued with our attempt to identify critical procedural variations that would strengthen the relationship between people's implicit theories and inter-construct inferences.

Results of the present study showed that the extremity of people's inter-construct inferences can be affected by whether the trait constructs involved are described solely in terms of trait adjectives (trait information), or depicted through trait-relevant behavior (behavioral information). Participants were found to make more extreme inferences involving similar constructs when such inferences were based on trait information than when they were based on behavioral information. To the extent that people are dispositionists who regard traits as underlying causes and behaviors as consequences (cf. L. Ross & Nisbett, 1991), the present finding meshes well with Tversky and Kahneman's (1982) view that inferences from causes to consequences would be made with a greater degree of certainty than inferences in the reverse direction. The observation that trait-to-behavior inferences involving similar constructs were made with greater confidence than

were behavior-to-trait inferences involving the same constructs is particularly consistent with their view.

Study 3

Only a very weak theory effect was observed for participants' inferences involving related constructs in Studies 1 and 2. We suspected that one possible explanation for the weak theory effect concerns the timing of the assessment of implicit theories. Recall that participants in these two studies completed the 3-item Person Theory Measure several weeks prior to the inter-construct inference task (6 to 10 weeks in Study 1, 2 to 10 weeks in Study 2). Such an assessment was conducted on the assumption that implicit theories as measured by the Person Theory Measure are temporally stable. Careful examination of the available data pertaining to the stability of the Person Theory Measure, however, suggests that this assumption may not be entirely justified. In validation studies conducted by Dweck and colleagues, the test-retest reliability of the 3-item Person Theory Measure was reported to be .82 over a two-week interval; the corresponding figure for the 8-item Person Theory Measure (to be described in greater detail in Study 4) was reported to be .82 over a one-week interval and .71 over a four-week interval (Dweck et al., 1995a; Levy et al., 1998). Data on longer-term stability of the Person Theory Measure are lacking. In fact, some researchers (e.g., Schunk, 1995; Sorrentino, 1995) have questioned but not tested whether people's implicit theories remain stable over a relatively long period of time.

The predictive utility of people's implicit theories depends upon the temporal stability of such theories. If an individual's implicit theory changes over time, then his or her theory at one point in time might not be very indicative of his or her social inferences

at another point in time. Dweck and colleagues typically obtained both measures of implicit person theories and related inferences within a single experimental session (e.g., Chiu et al., 1997; Erdley & Dweck, 1993; Gervey, Chiu, Hong & Dweck, 1999; Heyman & Dweck, 1998; Levy & Dweck, 1999; Levy et al., 1998), with some exceptions involving a one- or two-week gap between the measurement of implicit theories and related inferences (e.g., Hong, Chiu, Dweck & Sacks, 1997). From these studies alone, the relatively long-term predictive utility of implicit theories cannot be ascertained.

In Study 3, to address the possibility of temporal fluctuations in people's implicit theories, we assessed participants' theories on two occasions. First, their theories were assessed any time from 2 to 10 weeks before they made inter-construct inferences (Time-1), using the 3-item Person Theory Measure, as in the previous studies. On the day they made inferences (Time-2), their theories were re-assessed using the 3-item Person Theory Measure.

Another possible explanation for the weak effect of theory in Studies 1 and 2 was that the 3-item Person Theory Measure used in these studies may have been far too general. It might not adequately capture participants' beliefs about the malleability of the specific constructs appearing in the inter-construct inference task. To ensure that beliefs regarding all specific constructs involved in the inference task were fully covered in our theory assessment, we developed an additional, 30-item theory measure that specifically assessed people's beliefs about each of the constructs appearing in the inference task. In Study 3, this 30-item measure was included as part of the Time-2 assessment of participants' implicit theories, along with the 3-item Person Theory Measure.

Yet another possible account for the weak effect of theory in the first two studies pertained to the fact that each participant was exposed to inference items involving similar, unrelated and opposite construct pairs. Since semantic similarity of construct pairs has a very strong effect on people's inter-construct inferences (Koehler et al., 1996), participants' attention might be drawn so heavily to this influential variable that other potential considerations, such as the malleability of trait constructs, are overlooked. We conjectured that if each participant was to make inter-construct inferences involving only one of the three similarity categories (similar, unrelated or opposite), the relative salience of similarity in inter-construct inferences would be reduced, thus allowing for leeway for implicit theories to play a larger role in the inferences. Consequently, in our attempt to create favorable conditions for the emergence of a larger theory effect, participants in Study 3 were presented with inference items involving either only semantically similar or only unrelated pairs. To simplify the design, opposite pairs were omitted in the present study.

Method

Overview

Participants' implicit theories were initially assessed by the 3-item Person Theory Measure. Two to 10 weeks later, they made behavior-to-trait, trait-to-behavior, behavior-to-behavior, and trait-to-trait inferences involving either similar or unrelated pairs of constructs. Their implicit theories were also re-assessed by the 3-item Person Theory Measure, as well as by a 30-item measure that addressed their beliefs about the specific constructs involved in the inter-construct inference task.

Participants

Two hundred and four students of both genders enrolled in Introductory Psychology at the University of Waterloo participated for partial course credit. As in Studies 1 and 2, participants were recruited on the basis of their responses on the 3-item Person Theory Measure. This measure was one of many other unrelated measures included in a prescreening booklet distributed to all students enrolled in Introductory Psychology at the beginning of the term. Only respondents with a person theory score of 3.0 or below (entity theorists) and those with a score of 4.0 or above (incremental theorists) would be recruited to participate in the present study.

Procedure and Measures

Social inference questionnaire. Any time from 2 to 10 weeks after students enrolled in Introductory Psychology had completed the Person Theory Measure, participants were recruited to take part in an experimental session on social judgments. Each experimental session included between one and 10 participants. To start with, each participant was asked to complete a social inference questionnaire. The questionnaire was identical to that used in Study 2, with the exception that, on each version of the questionnaire, the inference items involved either only similar construct pairs (similar condition) or only unrelated construct pairs (unrelated condition). For both similar and unrelated conditions, the same 20 construct pairs were for each of the four types of inference (behavior-to-trait, trait-to-behavior, behavior-to-behavior, and trait-to-trait inferences), yielding 80 items in each version of the social inference questionnaire. This questionnaire took about 30 minutes to complete.

Measures of implicit theories. Participants were then asked to complete two measures of implicit theories. The first was the 3-item Person Theory Measure, which

was exactly the same measure that they had completed two to 10 weeks earlier. The second was a 30-item measure that specifically assessed participants' implicit theories regarding each of the 30 constructs appearing in the social inference questionnaire. The wording of the items in this measure followed one of the items in the Person Theory Measure (i.e., "The kind of person someone is, is something basic about them, and it can't be changed very much"). Each item specifically addressed their beliefs regarding the malleability of one trait construct. For example, the item for the construct organized was "How organized a person is, is something fixed, and cannot changed very much". As in the Person Theory Measure, participants were asked to indicate the extent to which they agreed with each of the 30 items on a 6-point scale (1 = strongly agree, 2 = agree, 3 = slightly agree, 4 = slightly disagree, 5 = disagree, 6 = strongly disagree). Lower values on this scale reflect a stronger expressed belief that a certain trait construct is fixed rather than malleable.

For the ease of presentation, we will call the 3-item Person Theory Measure administered at the beginning of the term the time-1 general theory measure. As for the scales administered during the experimental session, we will call the 3-item Person Theory Measure the time-2 general theory measure, and the 30-item measure the time-2 omnibus theory measure.

Results

Responses to Measures of Implicit Theories

Participants' responses to all three measures of implicit theories showed high internal consistency (Cronbach's $\alpha = .94$ for time-1 general theory measure, .91 for time-2 general theory measure, .94 for time-2 omnibus theory measure). Each participant's

responses to all items within each measure were averaged to give a theory score. Hence, there were three theory scores for each participant, namely, a time-1 general theory score, a time-2 general theory score, and a time-2 omnibus theory score, with lower scores indicating stronger expressed belief in an entity theory.

The two- to 10-week test-retest reliability of the general theory measure, as indexed by the Pearson product-moment correlation between time-1 and time-2 general theory score, was .46. This figure suggests that although people scoring higher on the measure at time 1 also tended to score higher at time 2, there is a considerable degree of instability in people's theories over a two- to 10-week interval.

There was a reasonably strong relationship between scores on the general and omnibus theory measures, with a Pearson correlation coefficient of .57 between the general and omnibus scores obtained at time-2.

Probability Judgments in the Social Inference Questionnaire

For both similar and unrelated conditions, we averaged each participant's probability judgments over all 20 items within each of the four types of inferences, yielding 4 composite judgment scores for each participant. These composite judgment scores were submitted to criterion-scaled, hierarchical regression analyses, with variables listed in Table 1.4 as predictors¹³. We used the time-1 general theory scores, the time-2 general theory scores and the time-2 omnibus theory scores in turn to index implicit theories in the analyses. Results are summarized in Table 1.4.

-----Insert Table 1.4 about here-----

¹³ Following Study 3, "similarity" was treated as a categorical variable in the analyses.

In general, participants' implicit theories were reliably related to their composite judgment scores only when measurement of their theories was obtained in the same session in which they made social inferences. As shown in Table 1.4, neither the main effect of theory nor the Theory X Similarity interaction was statistically significant when the time-1 measure was taken as an index of implicit theories. By contrast, when either of the time-2 theory measures was used as an index of implicit theories, there was a significant main effect of theory, qualified by a significant Theory X Similarity interaction.

To elucidate the nature of a Theory X Similarity interaction, one can perform a simple regression at each level of similarity. In these simple regressions, participants' average composite judgment scores over the four inference conditions were regressed on theory scores. We performed such analyses using each of the three measurements of implicit theories in turn. The slopes of these simple regressions are graphically depicted in Figure 1.4. Generally, the time-1 general theory scores did not co-vary with participants' judgments to any meaningful degree in either the similar or the unrelated condition. In contrast, the time-2 general theory scores were used, lower theory scores were clearly associated with higher or more extreme probability judgments in the similar condition, but no such association was observed in the unrelated condition. Note that both time-1 and time-2 general theory scores were obtained from the same 3-item Person Theory Measure. When the time-2 omnibus theory scores were used to index participants' implicit theories, the pattern of association between theory scores and probability judgments was similar to that when the time-2 general theory scores were used. In short, the significant Theory X Similarity interactions obtained using the time-2

general and omnibus measures indicated that the more strongly participants endorsed an entity theory at a particular moment, the more probable they thought that one's relative standing on a certain construct is predictive of one's relative standing on other semantically similar, but not unrelated, constructs at that moment.

-----Insert Figure 1.4 about here-----

Theory-related effects aside, as in Study 2, we found main effects of similarity and inference type. These two main effects were qualified by a significant Inference X Similarity interaction (see Table 1.4). To clarify the nature of the interaction, we conducted a separate one-way analysis for each similarity condition. For the similar condition, a significant effect of inference type emerged, $F(3, 294) = 17.70, p < .001, MSE = 24.71$. Participants exhibited greater confidence when basing their inferences involving similar constructs on trait information ($M = 69.23$ for trait-to-behavior inferences; $M = 68.29$ for trait-to-trait inferences) than when basing such inferences on behavioral information ($M = 65.41$ for behavior-to-trait inferences; $M = 64.95$ for behavior-to-behavior inferences). By contrast, for the unrelated condition, the effect of inference type was not significant, $F(3, 312) = .79, MSE = 20.08$. Participants' judgments across the four inference types in the unrelated condition were virtually identical. The pattern of this Inference X Similarity interaction was similar to that found in Study 2.

Finally, a significant Inference X Theory X Similarity effect emerged when time-1 general theory measure was used as an index for implicit theories (see Table 1.4). Considering that we did not expect such an effect on theoretical grounds and that the corresponding three-way interaction was not statistically significant in other two

regression models involving time-2 theory measures in the present study, nor in the regression analysis in Study 2, this apparently incidental result will not be considered further.

Discussion

Results of the present study pinpoint a critical procedural factor necessary for the emergence of a clear theory effect in people's inter-construct inferences. Participants' implicit theories exhibited a certain degree of temporal instability across the two- to 10-week interval between the two assessments of their theories. Accordingly, in the present study, a systematic relationship between implicit theories and social inferences was found only when the implicit theory measure and the social inferences were obtained within the same experimental session, and not when they were obtained weeks apart. This observation is consonant with the findings in Studies 1 and 2 that participants' theories as measured weeks prior to their inferences tended to bear only a weak relationship with the extremity of their inferences. Taken together, results across Studies 1, 2 and 3 reveal a major boundary condition on the relation between people's implicit theories and the extremity of their social inferences: implicit theories fluctuate across time, and the extremity of social inferences is related strongly only to current theories.

Participants' current (or time-2) theories were clearly related to their inferences involving similar, but not unrelated, constructs. For similar constructs, current belief in an entity theory was associated with more extreme or confident inter-construct inferences. Recall that a theory effect comparable in direction though much smaller in magnitude was observed for related, but not unrelated, constructs in Studies 1 and 2, where participants' theories were measured weeks prior to the inference task. Based on

Dweck and colleagues' work, we have suggested in the Introduction that people holding an entity theory could be expected to make more extreme inter-construct inferences because an entity theory engenders the perception that trait constructs are reliable bases for social understanding and prediction. In light of the findings from the first three studies, a qualification of our suggestion is in order. It appears that the perceived reliability of trait constructs, as determined at least in part by people's beliefs about the malleability of personality, is considered relevant or applicable in inter-construct inferences only when the constructs involved are conceptually related. This observation rules out the possibility that subscribing to an entity theory is associated with generally greater confidence or generally more extreme judgments (e.g., a greater tendency to use response scale endpoints). Holding an entity theory is associated with more extreme inferences only when beliefs regarding the malleability of personality are deemed to be relevant or applicable to the inference task at hand.

To summarize, findings thus far suggest that a clear association between endorsement of an entity theory and relatively more extreme inter-construct inferences can be expected only under certain conditions: People's implicit theories will predict their inter-construct inferences well only when their theories are measured at the time the inferences are made and only so long as such inferences involve conceptually related constructs.

Study 4

In Study 3, participants' implicit theories were assessed on two occasions, with an intervening period of any time between two to 10 weeks. Such repeated assessments permit us to estimate the temporal stability of their theories over a two- to 10-week

interval.¹⁴ In Study 4, we sought to increase the precision of the test-retest reliability estimate by focusing on the stability of people's theories over an eight-week interval and using a larger sample of participants. In the present study, participants' implicit theories were assessed by the recently developed 8-item Person Theory Measure (Levy et al., 1998), instead of the original 3-item measure, allowing us to evaluate the possibility that the 8-item measure would exhibit greater temporal stability. Given that the 3-item measure is a proper subset of the 8-item measure (see Method section), test-retest reliability estimates of both measures can be obtained simultaneously from repeated administration of the 8-item measure.

Method

Participants

The sample consisted of 269 students enrolled in Introductory Psychology at the University of Waterloo. At the beginning of the term (time-1), most students enrolled in the course completed a lengthy prescreening booklet in which the 8-item Person Theory Measure was included along with many other unrelated measures. About eight weeks after students returned the questionnaire booklets (time-2), a second questionnaire booklet was distributed. In this second booklet, the 8-item Person Theory Measure was again included along with other unrelated measures. Students received partial course credit for completing these booklets. The sample of the present study is composed of students who completed the 8-item Person Theory Measure in both booklets and allowed their responses in the second booklet be linked to those in the first booklet.

¹⁴ One might in fact examine the test-retest reliability of the measure on a week-by-week basis within the two- to 10-week interval. A major concern of using this approach in Study 3 was that the sample sizes for some of the weeks would be too small to yield reliable estimates of temporal stability.

Person Theory Measure

Whereas the original 3-item Person Theory Measure only comprises items endorsing an entity theory, the 8-item Person Theory Measure consists of an equal number of items endorsing each theory. The 8-item measure includes the three entity items from the original measure, one new entity item, and four new incremental items. The new entity item is: “As much as I hate to admit it, you can’t teach an old dog new tricks. People can’t really change their deepest attributes”. The incremental items are as follows: “Everyone, no matter who they are, can significantly change their basic characteristics”; “People can substantially change the kind of person they are”; “No matter what kind of a person someone is, they can always change very much”; “People can change even their most basic qualities” (Levy et al., 1998, p. 1431).

As in the original 3-item measure, for each item in the 8-item Person Theory Measure, participants were asked to indicate the extent of their agreement on a scale running from 1 to 6 (1= strongly agree, 2 = agree, 3 = slightly agree, 4 = slightly disagree, 5 = disagree, 6 = strongly disagree). For each respondent, an 8-item person theory score was computed by averaging his or her responses to the entire scale, with the incremental-items reverse scored. A 3-item person theory score was also computed by averaging his or her responses to the subset of entity items comprising the original 3-item measure. A lower 8-item or 3-item person theory score reflects a stronger expressed belief in an entity theory.

Results

The 8-item Person Theory Measure showed high internal consistency (Cronbach’s $\alpha = .91$ at time-1, $.93$ at time-2), as did the 3-item subset which comprises the original 3-

item Person Theory Measure (Cronbach's $\alpha = .86$ at time-1, $.88$ at time-2)¹⁵. The test-retest reliability of the 8-item measure, as indexed by the Pearson product-moment correlation between time-1 and time-2 8-item person theory scores, was $.57$ over the eight-week interval. For the 3-item subset, the eight-week test-retest reliability was $.43$. Table 1.5 illustrates the extent of changes in participants' status as entity or incremental theorists over the eight-week interval. In general, regardless of whether the entire 8-item measure or just the 3-item subset was used as a basis of classification, about 60% participants classified as either entity or incremental theorists at time-1 received the same classification at time-2, while the remaining 40% received a different classification.

-----Insert Table 1.5 about here-----

Discussion

The present study yielded new data regarding the temporal stability of people's implicit theories as measured by the Person Theory Measure. While Dweck and colleagues reported that the test-retest reliability of the Person Theory Measure is fairly high over a relatively short interval ($.82$ over a two week interval for the 3-item measure, $.82$ over a one-week interval and $.71$ over a four-week interval for the 8-item measure), findings of the present study suggest that its test-retest reliability drops considerably over a longer time span ($.43$ and $.57$ over an eight-week interval for the 3-item and 8-item measure respectively). This level of temporal stability is arguably lower than what one would expect for a stable personality disposition. An analysis of temporal stability of eight frequently used self-report personality inventories (Schuerger, Zarrella & Hotz,

¹⁵ The average inter-item correlation for the 8-item Person Theory Measure was $.57$ at time-1 and $.62$ at time-2. The corresponding figure for the 3-item subset was $.67$ at time-1 and $.71$ at time-2.

1989), including the Myers-Briggs Type Indicator, the California Psychological Inventory (CPI), the Minnesota Multiphasic Personality Inventory (MMPI), the Sixteen Personality Factor Questionnaire (16 PF), indicated that the average test-retest reliability for all the scales tapping personality traits was about .73 over a two-month period. The test-retest reliability was .80 for extraversion scales alone and .70 for anxiety scales alone. By comparison, then, people's implicit theories appear less stable than many other individual differences variables measured by self-report.

Study 5

In Study 3, we found that endorsement of an entity theory at the time of inferences was associated with more confident or extreme inter-construct inferences for conceptually related constructs. To account for this finding, we have argued that the perceived stability or malleability of trait constructs is a relevant consideration in inferences involving semantically related personality constructs. As Dweck and colleagues' work indicates that an entity theory fosters the view of trait constructs as more reliable bases for social perception than does an incremental theory, more confident inferences could be expected from people holding an entity theory at the time of judgment. In our view, the relatively more extreme inferences rendered by participants holding an entity theory at the time of judgment was not due to the fact that they perceived stronger semantic associations between traits than those holding an incremental theory, but rather that they made more extreme judgments given a particular level of semantic association between the constructs in question. Study 5 was designed to rule out the possibility that entity and incremental theorists differ in their perceptions of semantic association.

Method

Overview

Participants rated the semantic relatedness of either the 20 pairs of similar or unrelated traits that were used in Study 3. Afterwards, participants also completed the 8-item Person Theory Measure.

Participants

Participants were 103 students of both genders enrolled in Introductory Psychology at the University of Waterloo. A booklet that consisted of a number of short questionnaires from different researchers, including two questionnaires for the present study, were distributed to students enrolled in the course. Students were given partial course credit for returning the questionnaire booklet.

Procedures and Measures

Linguistic Similarity Judgments. Participants completed a questionnaire entitled “Linguistic Similarity Judgments”. They were instructed to imagine that as part of the preparation of a thesaurus of personality trait terms, they were asked to rate the similarity of meaning of 20 pairs of trait terms. In the similar condition, participants were presented with 20 pairs of similar traits used in Study 3. In the unrelated condition, they were presented with 20 pairs of unrelated traits used in Study 3. In both conditions, they were asked to indicate their similarity ratings on a 7-point scale, ranging from –3 (opposite meaning) through 0 (unrelated meaning) to 3 (similar meaning).

Person Theory Measure. The “Linguistic Similarity Judgments” Questionnaire was followed by the 8-item Person Theory Measure, content and scoring of which was identical to that described in Study 4.

Results and Discussion

Data from one participant whose responses on many the similarity judgment items were more than three standard deviations from the corresponding means were discarded, leaving a total of 102 participants. For both similar and unrelated conditions, we averaged each participant's linguistic similarity judgments for all 20 items, thus yielding a composite similarity judgment score for each participant. Participants' composite similarity judgment scores were submitted to hierarchical regression analyses, with variables listed in Table 1.6 as predictors.¹⁶ Their 8-item person theory scores and 3-item person theory scores (computed from the subset of items constituting the original 3-item measure) were used in turn to index their implicit theories. Results of the analyses are presented in Table 1.6.

-----Insert Table 1.6 about here-----

Only a significant main effect of similarity was found. This effect indicated that participants generally rated the trait pairs in the similar condition as more similar than those pairs in the unrelated condition (see Figure 1.5). This observation is not surprising, given that the assignment of trait pairs in the similar and unrelated conditions in both the present study and Study 3 was based on the linguistic similarity judgments obtained from the Similarity Judgment Group in Study 1. Regardless of whether the 8-item person theory score or the 3-item person theory score was used to index participants' implicit theories, neither the theory main effect nor the Theory X Similarity reached statistical significance, indicating that participants' current implicit theories were not related to their linguistic similarity judgments. Based on these results, one can conclude that more

¹⁶ Following Studies 2 and 3, the predictor "similarity" was treated as a categorical variable in the analyses.

extreme inferences involving related constructs observed from participants endorsing an entity theory rather than an incremental theory at the time of inference in Study 3 was not due to the possibility that these participants perceived closer semantic associations among trait constructs.

-----Insert Figure 1.5 about here-----

General Discussion

The current research examined how individual differences in beliefs regarding the malleability of personality are linked to inter-individual variations in the extremity of inter-construct inferences. Based on previous research by Dweck and colleagues, which suggested that entity theorists more strongly regard trait constructs as reliable bases for social predictions than do incremental theorists, we hypothesized that entity theorists would make more extreme inter-construct inferences than would incremental theorists. In a series of studies, this hypothesis was clearly borne out only under circumscribed conditions. The goal of the current investigation became one of identifying conditions that affect the strength of the hypothesized relation between implicit theories and inter-construct inferences.

One boundary condition concerns the conceptual or semantic relatedness between the predictor and predicted constructs. Participants' implicit theories were related, to various degrees, to their inter-construct inferences as hypothesized only when the predictor and predicted constructs were conceptually related (Studies 1, 2 & 3). This observation suggests that the issue of fixedness versus malleability of personality is considered relevant and hence applied only in inferences involving conceptually related, and not unrelated, constructs. Among other things, this result indicates that it is indeed

the implicit personality theory held by entity or incremental theorists, rather than some other individual difference variable distinguishing the two groups (e.g., general sense of confidence, or tendency to use response scale endpoints), that contributes to observed differences in their social inferences.

Another boundary condition stems from the temporal instability of people's implicit theories (Studies 3 & 4). A systematic relationship between implicit theories and social inferences was clearly observed only when participants' implicit theories were measured at the time the inferences were made (Study 3). The extremity of participants' inferences was only weakly related to their implicit theories as measured weeks before the inference task (Study 1, 2 & 3). In short, the extremity of people's inter-construct inferences appears to be related strongly only to their current theories.

Identification of these boundary conditions in the current investigation is important in two ways. First, demonstrating that people's social inferences are strongly related to their implicit theories only as measured at the time of inference, and only where such theories are perceived to be relevant, provides a more fine-grained understanding of the relationship between individual differences in implicit theories and inter-individual variations in social inferences. Second, a deeper contribution is that the present results motivate refinements to the current theoretical perspective. Our initial research used Dweck and colleagues' individual-differences perspective to investigate the link between implicit theories and social inferences. From this perspective, in which individuals are classified as entity or incremental theorists, how the entity and incremental theorists differ in their social inferences is the question of interest (Dweck et al., 1995a). The observation that people's implicit theories exhibit temporal instability and that people's

inferences are related strongly only to their current theories highlights the limitations of the individual-differences perspective. A strict individual-differences approach cannot explain and predict variations in the states of knowledge and confidence in inferences for a given individual. To accommodate such intra-individual variability, a broader theoretical formulation is required. We reasoned that a knowledge-activation framework (Higgins, 1996) has the potential to capture intra-individual variations in knowledge states. In Part II, how this alternative framework can be used to understand the link between people's knowledge regarding the malleability of personality and their social inferences was delineated and empirically evaluated.

PART II

LAY PERSONALITY KNOWLEDGE AND CONFIDENCE IN SOCIAL INFERENCES: A KNOWLEDGE-ACTIVATION PERSPECTIVE

When trying to understand or make predictions about themselves or others, people may draw upon their lay personality knowledge. Broadly defined, lay personality knowledge refers to a set of commonsense assumptions about the nature of the self and other people. The idea that such knowledge plays a role in people's social understanding is not new (e.g., Kelly, 1955), and has recently gained increasing recognition among social-cognitive psychologists (Wegener & Petty, 1998). Many kinds of lay knowledge have been found to have implications for social thinking; for example, knowledge about the nature of personal attributes (e.g., Dweck et al., 1995a; M. Ross, 1989), causes of behavior (e.g., Trope & Gaunt, 2000; Ybarra & Stephan, 1999), relations among personality traits (e.g., Anderson, 1995a; Schneider, 1973), stereotypes (e.g., Devine, 1989; Kunda & Sinclair, 1999), attachment styles (e.g., Baldwin, Keelan, Fehr, Enns & Koh-Rageragoo, 1996), as well as culturally conferred conceptions of persons (e.g., Menon, Morris, Chiu & Hong, 1999). In our research program, we focus on how people's lay conceptions about the malleability of personality relate to the confidence with which they make inferences based on person information (see also Part I, this thesis).

Individual-differences Perspective

The present research is largely built upon Dweck and colleagues' seminal contributions. They proposed an individual-differences model to conceptualize the

relationship between people's lay beliefs about the malleability of personality and their associated patterns of social judgments and reactions (Dweck & Leggett, 1988; Dweck et al., 1995a; Dweck et al., 1993). Dweck and her colleagues have identified two lay beliefs (or implicit theories) that people may hold about personality: (1) entity theory, the belief that personality is fixed, and (2) incremental theory, the belief that personality is malleable. People who subscribe to an entity theory are referred to as entity theorists, whereas those who subscribe to an incremental theory are referred to as incremental theorists.

Assessment of Implicit Theories

Dweck and colleagues developed a Person Theory Measure to assess people's implicit theories of personality.^{1,2,3} The original measure comprises three items: (1) "The kind of person someone is, is something basic about them, and it can't be changed very

¹ The focus of our research program has been on people's lay knowledge about the malleability of personality. It is worth noting that, according to Dweck and colleagues, individuals need not possess one sweeping belief that cuts across all domains. Individuals may hold different lay beliefs in such domains as intelligence and morality (Dweck et al., 1995a). For example, some individuals may believe that personality is malleable but intelligence is fixed, and vice versa. Indeed, these researchers have developed domain-specific measures that assess people's beliefs about the malleability of intelligence and moral character.

² In this thesis, the term implicit theory refers specifically to people's beliefs about the malleability of personality, as defined by Dweck and colleagues (Dweck et al., 1995a), although this term has also been used by other researchers to refer to other commonsense notions about personal attributes. For instance, this term has been used to refer to people's conceptions of relations among personality traits (e.g., Anderson, 1995a; Schneider, 1973), and to people's beliefs about the stability of personal attributes over time (M. Ross, 1989).

³ The implicit theorist depicted by Dweck and colleagues (Dweck & Leggett, 1988; Dweck et al., 1995a) bears some resemblance with that described by M. Ross (1989), given the similarity of the idea of "fixedness versus malleability" of personal attributes central to the former and the idea of "stability versus change" fundamental to the latter. There are, however, some conceptual differences between the two theoretical formulations. First, whereas a personal attribute that changes over time is essentially "malleable", an attribute that is stable over time is not necessarily "fixed". M. Ross' implicit theorist possesses an understanding of conditions that facilitate change, even in attributes deemed to be rather stable. Second, while Dweck and colleagues emphasize individual differences in implicit theories (see further discussion in text), M. Ross concentrates on the shared aspects of theories. In Dweck and colleagues' analysis, Person A may believe that a given attribute is fixed and Person B may believe that it is malleable. In contrast, in M. Ross' formulation, people in general may believe that Attribute X is more stable than Attribute Y (M. Ross, 1989).

much”; (2) “People can do things differently, but the important parts of who they are can’t really be changed very much”; (3) “Everyone is a certain kind of person and there is not much that can be done to really change that” (Dweck, et al., 1995a, p. 269).

Respondents are asked to indicate their extent of agreement with each item on a scale running from 1 to 6 (1 = strongly agree, 2 = agree, 3 = slightly agree, 4 = slightly disagree, 5 = disagree, 6 = strongly disagree). An individual’s agreement with each item is averaged to compute a person theory score. A lower theory score reflects a stronger expressed belief in an entity theory. Respondents with a score of 3.0 or below are classified as entity theorists and those with a score of 4.0 or above as incremental theorists. More recently, Dweck and colleagues also developed an eight-item Person Theory Measure. Whereas the original measure only includes items endorsing an entity theory, this new measure includes an equal number of items endorsing each theory (the three entity items from the original measure, one new entity item, and four new incremental items). The new entity item is: “As much as I hate to admit it, you can’t teach an old dog new tricks. People can’t really change their deepest attributes”. The incremental items are as follows: “Everyone, no matter who they are, can significantly change their basic characteristics”; “People can substantially change the kind of person they are”; “No matter what kind of a person someone is, they can always change very much”; “People can change even their most basic qualities” (Levy et al., 1998, p. 1431).

Dweck and colleagues reported that scores on the Person Theory Measure are independent of respondents’ age and sex. Scores on the Person Theory Measure also do not correlate with standard measures of self-presentation concerns, cognitive abilities, self-esteem, optimism about human nature, ideological rigidity or political stance (see

Chiu et al., 1997; Dweck et al., 1995a; Levy et al., 1998 for detailed discussion of the psychometric properties of the Person Theory Measure).

Implicit Theories and Social Inferences

Dweck and colleagues proposed that people's implicit theories have wide-ranging consequences for how they understand and react to person information (for reviews, see Dweck, 1996; Dweck et al., 1995a; Dweck et al., 1993; Levy & Dweck, 1998; Levy et al., 1999). Indeed, these researchers presented an extensive body of evidence that, when faced with incoming person information, entity and incremental theorists differ how they attend to, encode, and organize such information in memory (e.g., Hong et al., 1997). Furthermore, entity and incremental theorists also differ in their social inferences about individuals (e.g., Chiu et al., 1997) and groups (Levy & Dweck, 1999; Levy et al., 1998), as well as in their social decision-making (Gervy et al., 1999).

In the realm of social inferences, more specifically, Dweck and colleagues showed that entity theorists make more confident inferences about themselves and others based on incoming person information than do incremental theorists. Relative to incremental theorists, entity theorists more strongly believe in a close correspondence between traits and behaviors. Entity theorists more readily infer traits on the basis of one's behavior in a particular situation (Chiu et al., 1997; Heyman & Dweck, 1998), and predict with greater certainty one's behavior in a particular situation based on one's traits (Chiu et al., 1997). Furthermore, entity theorists more strongly believe that one's behaviors exhibit cross-situational consistency (Chiu et al., 1997) and temporal stability (Erdley & Dweck, 1993) than do incremental theorists.

Evaluating the Individual-differences Perspective

The emphasis of Dweck and colleagues' work has been on individual differences in implicit theories. One person may subscribe to an entity theory and another an incremental theory. How the entity and incremental theorists differ in their judgments and reactions has been the main focus of investigations.

The predictive utility of an individual-differences perspective depends on the temporal stability of people's implicit theories. To the extent that their theories are stable, tremendous parsimony is offered by the possibility that diverse patterns of social inferences and reactions, as demonstrated by Dweck and colleagues, can be traced to the entity versus incremental theorist distinction. The usefulness of this individual-differences approach, however, will be undermined if people's theories are temporally or situationally unstable. In that case, an individual's status as an entity or incremental theorist at a certain point of time might not be very indicative of his or her patterns of judgments and reactions at another point in time.

Recent studies in our laboratory, together with validation studies conducted by Dweck and colleagues, have yielded some data pertaining to the temporal stability of implicit theories. Dweck and colleagues (Dweck et al., 1995a; Levy et al., 1998) reported that the test-retest reliability of the Person Theory Measure is fairly high over a relatively short interval (.82 over a two-week interval for the three-item measure, .82 over a one-week interval and .71 over a four-week interval for the eight-item measure). Several studies in our laboratory, however, indicate that its stability drops over a longer time span (see Part I, this thesis). For example, in a large-scale validation study, we

found that the eight-week test-retest reliability of the Person Theory Measure was .43 for the three-item measure and .57 for the eight-item measure.

The temporal stability of people's implicit theories is arguably lower than what one would expect for a stable personality attribute. An analysis of test-retest reliabilities of eight frequently used self-report personality inventories (Schuerger, Zarrella, & Hotz, 1989), including the Myers-Briggs Type Indicator, the California Psychological Inventory (CPI), the Minnesota Multiphasic Personality Inventory (MMPI), the Sixteen Personality Factor Questionnaire (16 PF) revealed that the average stability for all the scales tapping personality traits was about .73 over a two-month period. The corresponding figure was .80 for extraversion scales alone, and .70 for anxiety scales alone. By comparison, then, people's implicit theories appear to be less stable than many other individual difference variables measured by self-report, even though available reliability data also indicate a certain degree of stability in such theories.

As noted, the temporal instability of people's implicit theories might weaken its predictive utility. In studies conducted by Dweck and colleagues, both measures of implicit theories and related inferences were typically obtained within the same experimental session (e.g., Chiu et al., 1997; Erdley & Dweck, 1993; Gervy et al., 1999; Heyman & Dweck, 1998; Levy & Dweck, 1999; Levy et al., 1998), with some exceptions involving a one- or two-week gap between the measurement of implicit theories and related inferences (e.g., Hong et al., 1997). The predictive utility of implicit theories over a longer time frame cannot be ascertained from these studies alone. A series of studies we conducted, however, revealed that temporal fluctuations in people's implicit theories constitute a major boundary condition on the relation between their theories and

confidence in social inferences. Specifically, we found that the confidence of participants' personality inferences was clearly related to their theories as measured at the time of judgment, but not much so to their theories as measured a month or two before they made the inferences (see Part I, this thesis).

Taken together, there is evidence that people's implicit theories exhibit some temporal instability, and that people's confidence in their social inferences is related to their current theories. Such intra-individual variability limits the usefulness of an individual-differences approach in adequately describing the relation between people's lay personality knowledge and their social inferences.

Knowledge-activation Perspective

Given the apparent limitations of the individual-differences perspective, in this part of our research program, we use a knowledge-activation perspective to elucidate the link between people's lay personality knowledge and their social inferences. This knowledge-activation perspective incorporates insights from social cognition theorists regarding the activation of knowledge structures (e.g., Higgins, 1996; Kruglanski, 1990). As will be clear in the following analysis, a distinctive virtue of this perspective is that it has the capacity to capture variations in the state of knowledge within an individual, which are not amendable to an explanation from a strict individual-differences standpoint.

Entity Knowledge and Incremental Knowledge

We proceed from the assumption that most people possess some knowledge consistent with the notion that personality is fixed, and also possess some knowledge consistent with the notion that personality is malleable, even though they may only

explicitly endorse one of the two contradictory notions (or neither) at a particular moment. Such knowledge may include general abstractions about the determinants of personality and memories of specific people or instances accumulated through personal experience, everyday social encounters, or from the media. We refer to the packet of knowledge consistent with the notion that personality is fixed as entity knowledge, and the packet consistent with the notion that personality is malleable as incremental knowledge. These packets of lay personality knowledge can be viewed as knowledge structures.

At this point, it might be useful to clarify a subtle distinction between lay personality beliefs and lay personality knowledge in our conceptualization. Lay personality beliefs are viewed as general notions about personality that are endorsed or accepted as true. The existence (or availability) of both entity and incremental knowledge in one's memory does not necessarily entail endorsement of the general notion that personality is fixed, or the notion that personality is malleable. In this sense, lay personality beliefs are only a subset of lay personality knowledge. In fact, a similar distinction between belief and knowledge has been made by some stereotype researchers (e.g., Devine, 1989), who argue that knowledge of a stereotype does not necessarily imply endorsement of the stereotype. Indeed, under certain conditions, it has been found that knowledge of a stereotype has an impact on social perception even for people who do not endorse the stereotype (see, e.g., Devine, 1989). From our perspective, Dweck and colleagues' model pertains to lay personality beliefs about the malleability of personality, in that individuals are classified as entity or incremental theorists based on whether they endorse the general notion that personality is fixed or the notion that

personality is malleable. People's lay personality knowledge about the malleability of personality is more inclusive, as it encompasses not only their general beliefs, but also any other pieces of knowledge associated with the notions of fixedness and malleability of personality.

It should be noted that Dweck and colleagues, along with a few other researchers (e.g., Anderson, 1995b; Kruglanski, 1995), have similarly suggested that people may hold both entity and incremental theories, and that these theories can be viewed as knowledge constructs (Dweck, Chiu & Hong, 1995b; Levy et al., 1999). However, as mentioned earlier, Dweck and colleagues have chosen to focus primarily on the implications of individual differences in implicit theories in their research, and have not pursued the issue of how implicit theories might vary within an individual using a knowledge-activation framework. The value of using a knowledge-activation framework to understand how people's lay knowledge about the malleability of personality influences their social thinking remains to be empirically evaluated, and is the main focus of this thesis.

Accessibility of lay personality knowledge and social inferences

Insights about the activation of knowledge structures amassed in social cognition research can be applied to address how people's entity and incremental knowledge might become operative in particular social inference tasks. A key premise of such research is that possessing a certain knowledge structure does not entail continuously relying on it in one's judgments and behaviors. Attempts have been made to identify factors affecting the activation of knowledge structures (see, e.g., Higgins, 1989; Higgins, 1996; Higgins & Brendl, 1995; Kruglanski, 1990). The concept of accessibility has received the most

attention. Generally, accessibility refers to the readiness with pieces of knowledge come to the fore of the individual's mind. Different lines of research investigating the role of lay knowledge in social-information processing have converged to the general conclusion that the more accessible an existing knowledge structure is, the more likely it is to guide social interpretation. For example, Baldwin et al. (1996) showed that most people possess knowledge about different attachment styles; how they evaluate information about personal relationships at a particular moment is influenced by the relational pattern most accessible at the time. In a similar vein, Hong, Morris, Chiu and Benet-Martinez (2000) reported evidence that, for people who have internalized two cultures, their interpretations of social behavior are affected by the set of culturally-conferred social knowledge that is accessible at the time of judgment.

People's lay knowledge about the malleability of personality may guide their social inferences in an analogous manner. The relative accessibility of entity versus incremental knowledge is likely to be an important determinant as to which set of knowledge is used at a particular moment. Where applicable, the relatively more accessible set of lay knowledge would be expected to have a greater impact on the individual's social inferences than the less accessible set. All else being equal, individuals might differ in the relative readiness with which their entity or incremental knowledge comes to mind (i.e., chronic accessibility). Situational or contextual factors, however, are likely to operate in addition to any influence of chronic accessibility and momentarily affect the relative ease and speed with which the two sets of knowledge come to the fore of an individual's mind (i.e., temporary accessibility) (cf. Levy et al., 1999). In essence, the present conceptualization has the capacity to accommodate inter-

individual differences in the relative accessibility of entity versus incremental knowledge, as well as intra-individual variations of such accessibility found over time and across situations.

Current Research

In the current research, we used a knowledge-activation framework to investigate the relation between people's lay conceptions about the malleability of personality and their confidence in social inferences. We sought to evaluate the causal influence of participants' lay knowledge on their social inferences by experimentally manipulating the relative accessibility of pre-existing entity versus incremental knowledge through situational cues (i.e., temporary accessibility) before asking them for their inferences. We expected that, where applicable, the same general principle—that greater confidence in social inferences is associated with the view of personality as fixed than with the view of personality as malleable—would apply regardless of whether such views are made temporarily accessible through situational cues (or primed), or naturally endorsed by different individuals. In other words, we hypothesized that participants would exhibit greater confidence in their social inferences when their entity knowledge is primed than when their incremental knowledge is primed.

Evaluation of this hypothesis requires social inference tasks where people's knowledge about the malleability of personality is applicable. To this end, the present research focused on the kinds of social inferences that bear well-understood links with people's current implicit theories: (1) inferring personality traits from relevant behaviors, (2) predicting behaviors from relevant personality traits, (3) predicting the cross-situational consistency of behaviors, and (4) predicting the temporal stability of

personality traits (Chiu et al., 1997; Erdley & Dweck, 1993; see also Part I, this thesis). Before testing our hypothesis, Study 1 was conducted to ascertain that the confidence with which people make these inferences—in the form to be presented to participants in subsequent priming studies (Studies 2 & 3)—is associated with their current implicit theories. Findings of Study 1 will also allow us to assess whether our priming manipulations in Studies 2 and 3 can exert effects on social inferences comparable to those exerted by naturally-occurring variance in implicit theories.

Study 1

Method

Participants

Ninety-seven undergraduates of both genders enrolled in Introductory Psychology at the University of Waterloo participated in exchange for course credit. Each experimental session included between one and 10 participants.

Procedures and Measures

Social inference questionnaire. Participants first completed a four-part social inference questionnaire. In each part, they made one of the following types of inferences: (1) inferring traits on the basis of relevant behaviors (i.e., behavior-to-trait inferences), (2) predicting behavior from relevant traits (i.e., trait-to-behavior inferences), (3) predicting the consistency of behaviors across situations (i.e., behavior-to-behavior inferences), and (4) predicting the stability of traits over time (i.e., trait-to-trait inferences). The order in which these four types of inferences appeared in the questionnaire was counterbalanced in a Latin square design. Hence, there were four versions of the questionnaire, each with a different sequence of inference types.

We employed a questionnaire format used by Kunda and Nisbett (1986) involving judgments of the probability that Person A's standing on a designated personality attribute exceeds that of Person B given their relative standing on some other attribute. Table 2.1 shows the exact wordings of an example item for each inference type. In each item, participants were asked to make social inference regarding a single personality attribute. For example, they were asked to predict "friendly behavior" on the basis of the trait "friendly" in a trait-to-behavior inference item. They were asked to indicate their judgment on a 21-point probability scale running from 0% to 100% in intervals of 5% for each item.

-----Insert Table 2.1 about here-----

Participants were instructed in detail how to use the probability scale. The instruction for the part on trait-to-behavior inference, for example, read as follows:

If you think that the relative standing of Person A and Person B on a certain trait (e.g., the trait friendly) does not provide any useful information about their relative standing on a certain kind of behavior (e.g., behaved in a **friendly** way) in a particular situation, you would circle 50%. By giving a judgment of 50%, you are saying that Person A and Person B have an equal chance of exhibiting a certain kind of behavior even though Person A is higher on the trait.

If you think that Person A will exhibit more of the kind of behavior than Person B, circle a value above 50%. In the extreme case where you are completely certain that Person A will exhibit more of the kind of behavior than Person B, circle 100%.

In contrast, if you think Person A will exhibit less of the kind of behavior than

Person B, circle a value below 50%. In the extreme case where you are completely certain that Person A will exhibit less of the kind of behavior, circle 0%.

For each inference type, participants were asked to make inferences regarding 30 commonly-used personality attributes, such as warm, polite, optimistic, and assertive. The same 30 attributes were used for all four inference types, yielding 120 inference items in each version of social inference questionnaire. The questionnaire took about 30 to 40 minutes to complete.

Measures of implicit theories. Upon completion of the social inference questionnaire, participants' implicit theories were assessed. They were asked to complete the 3-item Person Theory Measure developed by Dweck and colleagues. Moreover, they also completed a 30-item theory measure that we developed. This 30-item measure was designed to assess participants' implicit beliefs about each of the personality attributes used in the social inference task. In this measure, the wording of the items generally followed one of the items in the Person Theory Measure (i.e., "The kind of person someone is, is something basic about them, and it can't be changed very much"). Each item specifically addressed their beliefs regarding the malleability of one personality attribute. As an example, the item for the attribute assertive was "How assertive a person is, is something fixed and cannot be changed very much". Similar to Dweck and colleagues' measure, participants were asked to indicate the extent to which they agreed with each of the 30 items on a 6-point scale (1 = strongly agree; 2 = agree; 3 = slightly agree; 4 = slightly disagree; 5 = disagree; 6 = strongly disagree). Lower values on this scale reflect a stronger expressed belief that a certain personality attribute is fixed.

For the ease of presentation, we will call the 3-item Person Theory Measure developed by Dweck and colleagues the general theory measure, as it is a domain-general measure regarding personality as a whole. We will call the 30-item measure we devised the omnibus theory measure, as it covers a broad range of individual personality attributes.

To some extent, the present study is a replication of Dweck and colleagues' work (Chiu et al., 1997; Studies 1 & 2). Within the same experimental session, they assessed participants' implicit theories using the general theory measure and their confidence in making either trait-to-behavior or behavior-to-behavior inferences using the Kunda and Nisbett (1986) questionnaire format. They found that entity theorists were more confident than were incremental theorists when making both types of inferences. This finding, however, was based on a relatively small number of personal attributes (10 in the behavior-to-trait inference task and 4 in the behavior-to-behavior inference task). The present study thus supplements their work with a much broader selection of personality attributes. Furthermore, as the present study used the same 30 personality attributes for four types of social inferences, it allows us to directly compare participants' confidence in these four types of inferences and to determine whether or not the role of implicit theories differs across different inference types.

Results

Responses to Measures of Implicit Theories

Both measures of implicit theories demonstrated high internal consistency (Cronbach's $\alpha = .87$ for the general theory measure and .93 for omnibus theory

measure).⁴ For each participant, we computed a general theory score and an omnibus theory score by averaging his or her responses to all items on each scale. Participants' general theory scores and the omnibus theory scores were moderately related ($r = .45, p < .01$).

Probability Judgments in the Social Inference Questionnaire

For each participant, we computed four composite judgment scores by averaging his or her probability judgments of all 30 items within each of the four inference types in the social inference questionnaire. These composite judgment scores served as the dependent variable in criterion-scaled, hierarchical regression analyses^{5, 6}, with variables listed in Table 2.2 as predictors.^{7, 8} We used participants' general theory scores and omnibus theory scores in turn to index their implicit theories in these analyses, the results of which are presented in Table 2.2.

-----Insert Table 2.2 about here-----

⁴ The mean inter-item correlation for the general theory measure (.69) was higher than the corresponding figure for the omnibus theory measure (.31). However, since the omnibus theory consists of a larger number of items than the general theory measures, the internal reliabilities of the two measures are comparable.

⁵ We chose to treat "implicit theory" as a continuous variable instead of as a categorical variable so that the magnitude of participants' implicit beliefs could be fully captured in our statistical analyses. With "implicit theory" as a continuous variable, a regression approach was used in lieu of a typical mixed ANOVA. As inference type was a within-subject variable in the present design, criterion-scaling was required to represent subject-related variables. An introduction to criterion-scaled regressions can be found in Pedhazur (1982, chap. 14). Treating "implicit theory" as a two-level categorical variable, as Dweck and colleagues have done in their research, and using a mixed ANOVA as an analytical technique yielded results similar to those obtained by our regression analyses.

⁶ This technique involved a series of regressions whereby each predictor variable in Table 2 was cumulatively entered in the order listed. In the first regression in the series, the first predictor variable was entered. In the second regression, both the first and the second predictor variables were entered. In the third regression, the first, second and third predictors were entered, and so on.

⁷ All subject-related variables were criterion-scaled variables serving as error terms.

⁸ The sum of squares associated with each predictor variable was obtained by subtracting the regression sum of squares at the step where it was entered by the regression sum of squares obtained at the preceding step. Using a similar logic, the degree of freedom associated with each predictor variable was obtained. As usual, the mean squares of the predictor variables were then computed by dividing the relevant sum of squares by their associated degrees of freedom, and the F ratios by dividing the relevant mean squares by their associated mean square errors.

The analyses yielded a significant main effect of theory only when the omnibus theory scores were used to index participants' implicit theories. When the general theory scores were used, the theory main effect was not significant (see Table 2.2). Using each of the two measurements of implicit theories in turn, we performed simple regressions to clarify the nature of the relationship between participants' implicit theories and their probability judgments. In these simple regressions, participants' average composite judgment scores over the four types of inferences were regressed on their theory scores. Figure 2.1 depicts the slopes of these simple regressions. When the general theory scores were used, lower theory scores appeared to be very weakly associated with more confident judgments. When the omnibus theory scores were used, the association between the theory scores and probability judgments became more apparent. Lower omnibus theory scores, reflecting a stronger belief in the fixedness of the personality attributes, were clearly associated with more confident judgments. In short, the confidence with which participants made social inferences was specifically related to their beliefs about the malleability of the personality attributes used in the social inference questionnaire, and much less so to their beliefs regarding the malleability of personality in general.

-----Insert Figure 2.1 about here-----

We also found a significant main effect of inference type (see Table 2.2). In general, participants were more confident when basing their predictions on trait information ($M = 74.34$ for trait-to-behavior inferences; $M = 68.94$ for trait-to-trait inferences) than when basing their predictions on behavioral information ($M = 66.04$ for

behavior-to-trait inferences; $M = 63.73$ for behavior-to-behavior inferences). This inference type effect did not interact reliably with any theory effects.

Discussion

In the present study, the direction of relationship between participants' current implicit theories and their confidence in social inferences is largely consonant with Dweck and colleagues' general observation that expressed belief in an entity theory is associated with more confident social inferences. Results indicated that the more strongly participants believed the attributes used in the social inference questionnaire are fixed, the more confidence they exhibited in their social inferences. A much weaker trend in the same direction was also found between people's confidence and their theories regarding the malleability of personality in general.

Note that studies by Dweck and colleagues using a similar questionnaire format (Chiu et al., 1997; Studies 1 & 2) revealed a much stronger association between people's general person theory and confidence than that obtained in the present study. As mentioned earlier, the present study used many more personality attributes than was used by Dweck and colleagues. Conceivably, when faced with numerous inference items, each concerning a single attribute, our participants might have focused on distinguishing one attribute from another. Consequently, they might have been more inclined to draw upon their current beliefs about specific attributes rather than more general beliefs about people. This possibility might account for the present finding that the omnibus theory scores predicted participants' social inferences much better than did the general theory scores.

As in our previous research (see Part I, this thesis), participants in the present study were more confident when basing their inferences on trait information than when basing their inferences on behavioral information, regardless of their implicit beliefs. To the extent that people are dispositionists who regard traits as causes and behaviors as consequences (cf. L. Ross & Nisbett, 1991), this finding maps nicely onto Tversky and Kahneman's (1982) view that inferences from causes to consequences would be made with greater confidence than inferences in the reverse direction. The observation that trait-to-behavior inferences were made with greater confidence than were the behavior-to-trait inferences, in particular, is consistent with their treatment.

Taken together, using a broad range of personality attributes and a measure that assessed people's specific beliefs about these particular attributes, the present study replicated the basic finding regarding the relationship between current implicit theories held by different individuals and their confidence in social inferences as reported previously by Dweck and colleagues. In the next two studies, we used the same social inference questionnaire to examine how the relative accessibility of entity and incremental knowledge, which presumably co-exist within the minds of individuals, influence their inferences.

Study 2

In a number of studies, Dweck and colleagues successfully manipulated people's implicit theories by presenting them with a fabricated "scientific" article that included persuasive arguments and cited evidence supporting either an entity or incremental theory (e.g., Chiu et al., 1997; Levy et al., 1998). Although this manipulation served well for these researchers' stated purpose of demonstrating a causal relationship between implicit

beliefs and related inferences, it is not suitable for our present purpose. While the effect of this manipulation could be attributed to changes in the relative accessibility of participants' pre-existing entity versus incremental knowledge, a highly plausible alternative interpretation cannot be ruled out. Conceivably, this persuasive manipulation could provide participants with a great deal of new knowledge and could compel them to endorse either the notion that personality is fixed or the contradictory notion that personality is malleable. In the present research, we sought to temporarily activate (or prime) participants' pre-existing entity or incremental knowledge without, if possible, persuading them to accept a designated conclusion on the issue of whether people's personality is fixed or malleable.

In the present study, we primed participants' entity or incremental knowledge by exposing them to a biography of a fictitious character named "Max Hermann." In the entity-prime condition, Hermann's personality was prototypical of the notion that personality is fixed; his personality remained unchanged throughout his life (see Appendix A). In the incremental-prime condition, Hermann's personality was prototypical of the notion that personality is malleable; his personality changed throughout his life (see Appendix B). Assuming that activation will spread from one piece of knowledge to other closely associated pieces (cf. Higgins, 1989), exposing participants to the entity biography was expected to increase the accessibility of their entity knowledge, whereas exposing them to the incremental biography would increase the accessibility of their incremental knowledge. To reinforce the manipulation, we also asked participants to explain why Hermann's personality remained unchanged (entity-prime condition), or why his personality changed (incremental-prime condition) over the

course of his life. When trying to explain a certain event or a hypothesis, people tend to draw upon their existing repertoire of knowledge and select pieces of knowledge that fit well with the event or hypothesis to be explained (cf. Koehler, 1991). Hence, we reasoned that the explanation task would further increase the accessibility of the targeted set of knowledge in each priming condition. After this priming task, participants proceeded to a second, ostensibly unrelated study, in which they made social inferences. It was hypothesized that participants in the entity-prime condition would make social inferences with greater confidence than would those in the incremental-prime condition.

Method

Participants

One hundred and four students of both genders from the University of Waterloo participated for partial credit in their Introductory Psychology class. Each experimental session included between one and 10 participants.

Procedure

Priming manipulation. Participants were told that they would be completing two unrelated questionnaire studies during the same experimental session. Each questionnaire was given a separate study name and a separate consent form. The first questionnaire, which was used to produce the priming manipulation, was called a study of reading comprehension and explanation. Participants were instructed to read and answer questions about three passages. The first passage was on gardening, and the second one on cooking. These two passages were created to reinforce our cover story and conceal our intention of using the third passage, a two-page biography, as a prime. The biography described the life of a fictitious Nobel Prize winner named “Max

Hermann”. It detailed Max Hermann’s achievements, the major milestones in his life (e.g., born in Germany, attended university in Germany, and later settled in the U.S.), as well as descriptions of his personality at various stages of his life. Participants were randomly assigned to one of the two priming conditions. In the entity-prime condition, Hermann was portrayed as unchanging throughout his life. He was generally described as introverted and analytical from childhood through adulthood to old age. In the incremental-prime condition, temporal changes in Hermann’s personality were emphasized. He was first described as an uncouth youth, then as a single-minded, introverted scientist during adulthood, and finally as an outgoing, generous old man concerned with spiritual issues. In both conditions, participants were asked to summarize and then to answer a question about the biography. In the entity-prime condition, participants were asked, “It has been noted that Hermann’s personality has remained unchanged throughout his life. Explain why”. In the incremental-prime condition, participants were asked, “It has been noted that Hermann’s personality has changed a lot throughout his life. Explain why”. The biographies did not directly explain why Hermann remained unchanged or why he changed a lot, and participants were explicitly instructed to use their own knowledge or common sense in providing explanations. We did, however, allow participants to make use of any materials contained in the biographies. This part of the experimental session took about 30 minutes to complete.

Social inferences and belief ratings. After completing the study on reading comprehension and explanation, participants proceeded to a social judgment study. Participants were asked to complete the social inference questionnaire used in Study 1. To assess the impact of the priming manipulation on their beliefs about the malleability

of personality, we then administered a brief questionnaire entitled “What have you found to be true of people in general?” In this questionnaire, participants were asked to rate people in general along a number of dimensions, such as happy—unhappy, untrustworthy—trustworthy, and rational—irrational. We embedded the crucial question, “Do you think people’s personality traits can or cannot change?” in the middle of the questionnaire.⁹ Participants were asked to circle a number representing their view on a 9-point scale (1 = can always change, 9 = cannot change).

Towards the end of the experimental session, participants were asked to write down any ideas they had about the purpose of the experimental session. None of them reported any suspicion that the biography was relevant to the questionnaires administered following the explanation task. Participants were fully debriefed.

Results

Probability Judgments in the Social Inference Questionnaire

As in Study 1, for each participant, we computed four composite judgment scores by averaging his or her probability judgments for all 30 items within each of the four types of inferences in the social inference questionnaire. Participants’ composite judgment scores were then submitted to a 2 (priming: entity vs. incremental) X 4 (inference type: behavior-to-trait, trait-to-behavior, behavior-to-behavior, and trait-to-trait) mixed ANOVA with the second factor varied within participants. Table 2.3 displays the means for this analysis as a function of the two factors. This analysis revealed a significant main effect of priming, $F(1, 102) = 7.35$, $MSE = 212.47$, $p < .01$,

⁹ The wording of this particular item closely follows that of the implicit theory manipulation check used by Levy et al. (1998).

indicating that participants who received the entity prime generally made more confident inferences than did those who received the incremental prime ($M_s = 71.44$ vs. 67.56). The main effect of inference type was also statistically reliable, $F(3, 306) = 39.82$, $MSE = 63.89$, $p < .001$. Consistent with Study 1, participants were generally more confident when basing their inferences on trait information ($M = 76.29$ for trait-to-behavior inferences; $M = 69.76$ for trait-to-trait inferences) than when basing their inferences on behavioral information ($M = 67.08$ for behavior-to-trait inferences; $M = 64.87$ for behavior-to-behavior inferences). The Priming X Inference Type interaction did not reach significance, $F(3, 306) = .35$, $MSE = 63.89$, indicating that the effect of priming was similar across inference types.

-----Insert Table 2.3 about here-----

Belief Ratings

We examined the effect of priming on participants' responses to the item, "Do you think that people's personality traits can or cannot change?" (1 = can always change, 9 = cannot change), using a one-way ANOVA. This analysis showed that the priming manipulation had a significant effect on people's belief ratings, $F(1, 102) = 7.83$, $MSE = 2.71$, $p < .01$. Participants who received the incremental prime more strongly endorsed the notion that people's personality traits can change ($M = 3.33$) than did participants who received the entity prime ($M = 4.23$).

Within each priming condition, participants' belief ratings did not reliably correlate with their overall probability judgments ($r = -.07$ in the entity-prime condition; $r = .18$ in the incremental-prime condition). At the same time, the aforementioned main effect of priming on probability judgments remained significant when the belief ratings

were included as a covariate. Thus, the effect of the priming manipulation on participants' judgments did not appear to be mediated by their post-priming beliefs regarding the malleability of personality attributes, at least to the extent that such beliefs could be properly assessed by this one-item belief measure.

Content of Open-ended Explanations

The priming manipulation was intended to activate knowledge regarding either the stability or the malleability of personality attributes. Having established the priming manipulation's effect on subsequent social inferences, the content of the explanations generated in response to the two priming conditions was analyzed to confirm that the manipulation did in fact produce explanations that focused differentially on either stable personality differences or on the malleability of personality across time and situations. In short, this analysis tests whether the priming manipulation indeed influenced the extent to which participants used or made reference to knowledge relevant to an incremental versus an entity theory of personality.

Coding scheme. Dweck and colleagues have distinguished three categories of social information that people may use in explaining social behavior or outcomes. They are: (1) trait-focused information, which includes personality traits and such context-free dispositions as intelligence and morality; (2) process-focused information, which Dweck and colleagues define as specific psychological mechanisms that mediate behavior or outcomes, such as context-sensitive goals, construals and mood states; and (3) situational factors that affect a person's behavior. Dweck and colleagues found that, relative to incremental theorists, entity theorists tend to focus more on traits, and less on

psychological processes and situational forces, when trying to explain social behavior (Levy & Dweck, 1999; see also Levy & Dweck, 1998; Levy et al., 1999).

Accordingly, we analyzed the content of our participants' explanations in terms of the relative weights they accorded to trait-focused information, process-focused information, and situational factors. For coding purposes, all responses were segmented into units corresponding to each clause.¹⁰ Irrelevant units were then identified. Reiterations of the explanation question, personal reactions to the passage which were clearly unrelated to the explanation question, as well as units that did not fit into any of the three social information categories were classified as irrelevant. The remaining units were regarded as relevant. Following this extraction process, two raters were given transcriptions of participants' entire responses with units demarcated and numbered, in addition to coding sheets with corresponding numbers (cf. Morris & Peng, 1994). Relevant units were indicated on the coding sheets. The two raters independently coded each relevant unit as falling into one of the three social information categories. Across the two priming conditions, there were 439 relevant units. Both raters were blind to the experimental conditions associated with responses.¹¹ Examples of each category of social information appear in Table 2.4. The inter-rater reliability of the coding, as

¹⁰ We chose to break down each of our participant's response into smaller units for coding purposes because in many cases, while part of a response would clearly fit into one category, another part might well be coded into another category. Thus, this coding method is slightly different from that used by Levy and Dweck (1999), who coded each participant's entire open-ended explanation into a given category. Note that in their study, participants were children, whose responses are likely to be less complex, relative to our undergraduate sample.

¹¹ While the raters were not shown the experimental conditions associated with the explanations, participants' responses in the two conditions differed so markedly that the raters might well distinguish two major classes of responses, one class explaining why Hermann remained unchanged and another explaining the changes in his personality.

calculated by Cohen's kappa, was acceptable (.70). The proportion of inter-rater agreement, before Cohen's correction for chance, was .80.

-----Insert Table 2.4 about here-----

Differences in social information focus across priming conditions. For each participant, the number of units coded into each of the three social information categories was tallied from each rater's coding. To give each rater's coding equal weight, for each participant, we simply averaged the frequency counts of each category of social information from the two raters. We submitted the averaged frequencies to a 2 (priming: entity vs. incremental) X 3 (information category: trait-focused, process-focused and situational) mixed ANOVA, with the second factor varied within participants. Table 2.5 displays the relevant mean frequencies as a function of the two factors. This analysis yielded a significant main effect of information category, $F(2, 204) = 4.05$, $MSE = 2.30$, $p < .05$. Collapsed across priming conditions, participants focused more on traits ($M = 1.75$) than on psychological processes ($M = 1.27$) or situations ($M = 1.20$) in their explanations. The main effect of priming condition was marginally significant, $F(1, 102) = 2.99$, $MSE = 1.98$, $p < .1$. Overall, participants' explanations in the incremental-prime condition ($M = 4.63$) comprised slightly more relevant units than did those in the entity-prime condition ($M = 3.81$). More importantly, these two main effects were qualified by a significant Priming X Information Category interaction, $F(2, 204) = 49.92$, $MSE = 2.30$, $p < .001$.¹² This interaction effect indicates that relative to the participants in the entity-prime condition, those in the incremental-prime condition focused less on traits [t

¹² This effect remained significant even when participants' belief ratings was used as a co-variate.

(102) = -7.38, $p < .001$] but more on psychological processes [$t(102) = 6.43, p < .001$] and situational factors [$t(102) = 3.70, p < .001$] (see Table 2.5).

-----Insert Table 2.5 about here-----

Discussion

As predicted, we found that participants exhibited greater confidence in their social inferences when their entity knowledge was primed than when their incremental knowledge was primed. This finding is consistent with the idea that people possess both knowledge consistent with an entity theory and knowledge consistent with an incremental theory, and that the relative accessibility of these two sets of pre-existing knowledge is a key factor moderating the influence of such knowledge on social inferences.

Another noteworthy finding is that our priming manipulation had a reliable effect on participants' belief regarding the malleability of personality traits. After receiving an incremental prime, participants expressed a stronger belief that personality traits can change than after receiving an entity prime. This finding suggests that the temporal instability of people's implicit beliefs could be produced by changes in the relative accessibility of entity versus incremental knowledge over time.

Participants' post-priming belief ratings did not correlate with their confidence in inferences within each priming condition, even though our priming manipulation had an effect on both social inferences and belief ratings. The distinction we made between people's knowledge and beliefs about the malleability of personality might help explicate this pattern of results. Both social inferences and belief ratings could be considered as social judgments that were subject to direct influence by relevant pieces of accessible knowledge. When making inferences, our participants might rely on whatever entity and

incremental knowledge happens to be accessible, without considering or relying on the extent to which they believed in the general notion that personality is fixed or the notion that personality is malleable. Such a tendency to rely on readily accessible knowledge might be driven in part by a high need for closure situationally induced by the pressure to complete several questionnaires within a reasonable time frame in group settings (cf. Kruglanski, 1990; see also Chiu, Morris, Hong & Menon, 2000).

A caveat of the foregoing interpretation is in order. It is possible that the correlation between belief ratings and probability judgments was non-significant within priming conditions simply because the one-item belief measure did not adequately capture participants' beliefs about the malleability of the specific personality attributes evaluated in the social inference questionnaire. This account would be analogous to our earlier suggestion that the general theory measure fared less well as a predictor of people's confidence than the omnibus theory measure because the general measure did not adequately cover the specific personality attributes used in the social inference task.

An analysis of the content of participants' open-ended explanations in response to the priming task suggests that the manipulation had the intended effect of drawing attention to either entity or incremental knowledge. Although such responses might not fully represent all pieces of knowledge activated by our priming procedure, our content analysis did serve to reveal the kinds of social-personality knowledge that they spontaneously used when trying to make sense of the biographical sketch of Max Hermann. When explaining why Hermann remained unchanged, an outcome prototypical of the notion that personality is fixed, participants appeared to think like trait theorists (e.g., Costa & McCrae, 1994), focusing on traits rather than on psychological

processes and situational forces. When explaining why Hermann's personality changed, an outcome prototypical of the notion that personality is malleable, participants seemed to think like social-cognitive theorists (e.g., Cervone, Shadel & Jencius, 2001; Mischel, 1999; Shoda, 1999), focusing more on psychological processes and situational factors than personality traits or other dispositions. As noted earlier, Dweck and colleagues found that relative to incremental theorists, entity theorists tend to focus more on traits and less on psychological processes and situational information when making attributions for social behaviors or outcomes (Levy & Dweck, 1999). The present study extended their finding by showing that the relative weights that people accord to traits, psychological processes and situation factors in interpreting social outcomes may also vary as a function of changes in knowledge accessibility within an individual. The same priming manipulation that produced apparent differences in the relative accessibility of knowledge about traits, psychological processes and situational forces also influenced the confidence with which participants made social inferences. This result is consistent with suggestions of previous researchers (e.g., Trope & Gaunt, 2000) that activation of knowledge about situational forces can attenuate people's tendency to infer dispositions from behavior.

Study 3

As described above, our goal in the present research was to prime participants' pre-existing entity and incremental knowledge without persuading them to accept a designated conclusion regarding whether people's personality is fixed or malleable. To this end, in Study 2, we exposed participants to a biography of a fictitious character named "Max Hermann", whose personality was either prototypical of the notion that

personality is fixed or of the notion that personality is malleable. This manipulation was non-persuasive; in no way were participants compelled to generalize from this single case to people in general on the issue of whether personality can change. However, in documenting Hermann's personality, the biographies did present our participants with new data regarding the nature of human attributes. The present study was designed to complement Study 2 by using a priming procedure that minimized the amount of information to be presented participants and more fully capitalized on their pre-existing knowledge.

In the present study, we chose to use a task in which participants described the meaning of various proverbs as the basis for our priming manipulation. Proverbs have been used by other researchers to prime people's existing knowledge (e.g., Trope & Gaunt, 2000). Proverbs can serve as primes because interpretations of these short, pithy sayings often appeal to the pieces of folkloristic or experiential knowledge that they embody. As a priming task, participants in the present study were asked to evaluate the meaning of proverbs consistent with the notion that personality is fixed (entity-prime condition) or with the notion that personality is malleable (incremental-prime condition). On the assumption that activation will spread over pieces of knowledge that are closely associated (cf. Higgins, 1996), participants' entity knowledge should be more accessible in the entity-prime condition, whereas their incremental knowledge should be more accessible in the incremental-prime condition. After the priming task, participants proceeded to a second, allegedly unrelated study, in which they made social inferences. As in Study 2, we hypothesized that participants in the entity-prime condition would

exhibit greater confidence in their social inferences than would those in the incremental-prime condition.

Method

Participants

One hundred and eleven undergraduates of both genders from the University of Waterloo participated in exchange for partial credit in their Introductory Psychology class. Each experimental session included between one and 10 participants.

Procedure

Priming manipulation. Participants were told that they would be participating in two unrelated questionnaire studies during the same experiment session. Each questionnaire was given a separate study name and a separate consent form. First, they participated in a study of proverbs in everyday life. In this part, their task was to answer questions about three proverbs. Participants were randomly assigned to one of the two priming conditions. In the entity-prime condition, the proverbs pertained to the notion that personality is fixed (i.e., “You cannot teach an old dog new tricks”; “Old habits die hard”; “A leopard cannot change its spots”). In the incremental-prime condition, the proverbs pertained to the notion that personality is malleable (i.e., “It is never too late to learn”; “Experience is the best teacher”; “When in Rome, do as the Romans do”). For each proverb, participants were first asked to rate their familiarity with its meaning on a 6-point scale (1 = not at all familiar; 6 = very familiar). Then, in an open-ended format, they were asked to explain its common meaning and describe three situations to which the proverb could be applied. Next, they were asked to indicate the initials of the first person who comes to mind when thinking about the proverb, and to describe how that

person exemplifies the meaning of the proverb. This part of the experimental session lasted about 30 minutes.

Social inferences and belief ratings. After finishing the study on proverbs, participants proceeded to a social judgment study, in which they completed the social inference questionnaire used in Studies 1 and 2. To determine whether they interpreted the probability rating scale as instructed, we also included two forced-choice questions at the end of the questionnaire in the present study. Recall that participants were asked to judge the probability that Person A would exhibit more of a certain trait or behavior than would Person B. The first question was, “In making your judgments, how did you interpret the 0% and 100% endpoints of the scale?” Participants were asked to circle one of the following: “(a) 100% meant that Person A would certainly exhibit more of the trait or behavior than Person B; 0% meant that Person B would certainly exhibit more of the trait or behavior than Person A”, or “(b) 100% meant that Person A was definitely more likely than Person B to exhibit the trait or behavior; 0% meant that Person A was no more or less likely than Person B to exhibit the trait or behavior”. A choice of (a) would indicate correct (i.e., consistent with our intended meaning) interpretations of the two endpoints of the rating scale. A choice of (b) would indicate correct interpretation of the 100% rating but misinterpretation of the 0% rating. The second question was, “In making your judgments, how did you interpret a rating of 50%?” Participants were asked to choose one of the following: “(a) Person A and Person B had an about equal chance of being the person exhibiting more of the trait or behavior”, or “(b) Person A was somewhat more likely than Person B of being the person exhibiting more of the trait or

behavior". A choice of (a) would indicate correct interpretation of the 50% rating, where as a choice of (b) would indicate misinterpretation of the 50% rating.

As in Study 2, we administered a brief questionnaire entitled "What have you found to be true of people in general?" following the inference task. Embedded in this questionnaire was the crucial question, "Do you think people's personality traits can or cannot change?" (1 = can always change, 9 = cannot change). Finally, participants were asked to write down any ideas they had about the purpose of the experimental session.

Two participants who were suspicious of the link between different parts of the experimental session were excluded from data analyses. Also excluded were one participant who reported having heard about the present study, and another one who reported feeling very annoyed about the experimental session. Four additional participants were excluded because they misinterpreted a rating of 50% (i.e., failed the second question about the rating scale), leaving a total of 103 participants in the following data analyses.¹³

Results

¹³ We did not exclude 24 participants who only misinterpreted the 0% rating (i.e., the group who only failed the first question about the rating scale). This group of participants did not deviate from the group who passed both questions about the rating scale in terms of the range of values they used in the probability scale; for both groups, their probability judgements typically fell between 50% and 100%. It appeared that, in the present research, as long as participants could identify 50% as the point which indicates they could not make inferences with any confidence given the information provided, how they interpreted the 0% rating did not have a big impact on the way they responded to the inference items. In fact, similar results were obtained whether or not the 24 participants were included in the analyses. We did, however, exclude four participants who misinterpreted the 50% rating (i.e., failed the second question about the rating scale), as misinterpretation of this point seemed to be associated with a markedly different pattern of responding. Most notably, compared to the group of 24 participants who only misinterpreted the 0% rating and the remaining participants who passed both questions about the rating scale, these four participants used ratings below 50% fairly frequently. These four participants might in fact have treated 0% instead of 50% as the point indicating that they could not make an inference with any confidence. As we did not ask participants how they interpreted the 50% rating in Studies 1 and 2, we could only assume that, as in the present study, misinterpretation of the 50% rating occurred infrequently, and presumably about equally often across experimental conditions.

Familiarity with Proverbs

For each participant, the familiarity ratings for the three proverbs in his or her priming condition were averaged to give an overall familiarity score. Participants in the entity- and incremental-prime conditions did not differ on their overall familiarity scores, $t(101) = .18$, *ns*. In general, the meaning of the proverbs in both priming conditions were familiar to participants ($M = 4.51$ for the entity-prime condition; $M = 4.47$ for the incremental-prime condition; 1 = not at all familiar, 6 = very familiar).

Probability Judgments in the Social Inference Questionnaire

As was done in the previous studies, four composite judgment scores were computed for each participant by averaging his or her probability judgments for all 30 items within each of the four inference types in the social inference questionnaire. Participants' composite judgment scores were subjected to a 2 (priming: entity vs. incremental) X 4 (inference type: behavior-to-trait, trait-to-behavior, behavior-to-behavior, and trait-to-trait) mixed ANOVA with repeated measures on the latter factor. Table 2.6 presents the means of this analysis as a function of the two factors. There was a significant main effect of the priming manipulation, $F(1, 101) = 6.24$, $MSE = 254.39$, $p < .05$. Similar to Study 2, participants in the entity-prime condition generally exhibited greater confidence in their social inferences than did those in the incremental prime condition ($M_s = 70.02$ vs. 66.10). The mixed ANOVA also revealed a significant main effect of inference type, $F(3, 303) = 44.49$, $MSE = 40.41$, $p < .001$. As in the previous studies, participants were generally more confident when basing their inferences on trait information ($M = 73.80$ for trait-to-behavior inferences; $M = 68.45$ for trait-to-trait inferences) than when basing their inferences on behavioral information ($M = 64.46$ for

behavior-to-trait inferences; $M = 65.53$ for behavior-to-behavior inferences). The Priming X Inference Type interaction was not statistically reliable, $F(3, 303) = .01$, $MSE = 40.41$, indicating that the effect of priming did not differ across inference types.

-----Insert Table 2.6 about here-----

Belief ratings

To examine the effect of priming on participants' responses to the belief-rating item, "Do you think that people's personality traits can or cannot change?" (1 = can always change, 9 = cannot change), we conducted a one-way ANOVA. This analysis revealed that priming had a significant effect on belief ratings, $F(1, 101) = 7.85$, $MSE = 3.34$, $p < .01$. Participants who received the incremental prime ($M = 3.48$) expressed a stronger belief that people's personality traits can change than did those who received the entity prime ($M = 4.49$).

Within each priming condition, as in the previous experiment, participants' belief ratings did not significantly correlate with their overall probability judgments ($r = .06$ in the entity-prime condition; $r = .20$ in the incremental-prime condition). Also, the effect of priming on the probability judgments remained significant when participants' belief ratings were used as a covariate. Hence, the effect of priming on participants' judgments did not seem to be mediated by their post-priming expressed beliefs about the malleability of personality attributes, at least to the extent that such beliefs are adequately assessed in this one-item belief measure.

Discussion

The use of proverbs as primes in this study minimized the amount of information presented to participants, and at the same time required participants to draw heavily upon

their own knowledge in answering the questions about the proverbs. Their familiarity ratings indicated that they were familiar with the meaning of proverbs in both priming conditions. Not surprisingly, we found that most participants were able to explain the meaning of proverbs, give examples of the situations to which the proverbs can be applied, and provide illustrations using their experiences from people they know. These observations validate our assumption that most people possess knowledge consistent with the notion that personality is fixed and also consistent with the contradictory notion that personality is malleable.

Despite the difference in the priming manipulation, the major findings in Study 2 were replicated in the present study. Participants who received an entity prime made social inferences with greater confidence than did those who received an incremental prime. In addition, participants in the entity-prime condition endorsed the notion that personality can change to a lesser extent than did those in the incremental-prime condition. Taken together, the results from Studies 2 and 3 are compatible with our proposal that the relative accessibility of entity versus incremental knowledge is a crucial determinant as to which set of knowledge is likely to guide social inferences at a particular moment. Moreover, the results also suggest that changes in knowledge accessibility can have an impact on people's expressed beliefs about the malleability of personality.

General Discussion

We began by noting that temporal instability in people's implicit theories about the malleability of personality limits the usefulness of an individual-differences approach in studying the link between implicit theories and social inferences. We reasoned that a

knowledge-activation perspective holds some promise in illuminating the social-cognitive processes underlying intra-individual variations in knowledge accessibility. The current work set out to use a knowledge-activation perspective to understand how people's knowledge about the malleability of personality influences their social inferences.

Study 1 showed that people's current implicit beliefs are related to how they make several kinds of social inferences. Generally consistent with previous research (Chiu et al., 1997), participants who believed more strongly in the fixedness of the specific personality attributes involved in our social inference questionnaire (entity theorists) exhibited greater confidence in their inferences than those who believed in the malleability of these attributes (incremental theorists). A similar, yet much weaker trend was also observed between people's beliefs about the malleability of personality in general and their confidence in making social inferences (Study 1).

In Studies 2 and 3, we evaluated implications derived from a knowledge-activation framework. Assuming that most people possess some knowledge consistent with the notion that personality is fixed (entity knowledge) and with the contradictory notion that personality is malleable (incremental knowledge), we tested the hypothesis that people's social inferences are guided by the currently more accessible set of knowledge. Across the two studies, we experimentally manipulated the relative accessibility of participants' pre-existing entity versus incremental knowledge. Parallel to previous studies (including Study 1) demonstrating greater confidence in entity than incremental theorists' inferences, we found that participants whose entity knowledge was primed subsequently made inferences with greater confidence than did participants whose incremental knowledge was primed. While this finding is not amendable to an

explanation from an individual-differences standpoint, it is readily interpretable within a knowledge-activation perspective. This finding is compatible with the idea that most people possess entity and incremental knowledge, and that temporary accessibility is a factor moderating the relative influence of the two sets of knowledge on social inferences made by a given individual at a particular time.

The finding that the two different priming manipulations (Studies 2 and 3) yielded similar results also serves to shed light on how knowledge about the malleability of personality is organized. These manipulations involved different priming stimuli (biographies in Study 2, proverbs in Study 3), and could be seen as leading participants to use slightly different aspects of their entity or incremental knowledge. Specifically, in Study 2, when trying to explain why the personality of a fictitious character remained unchanged or changed throughout his life, participants might be prone to use their causal schemas. In Study 3, when explaining the meaning of proverbs, they might use their semantic memory; when illustrating the meaning of proverbs using their everyday experience, they might draw upon their episodic memory. Despite these potentially important differences, the effectiveness of both manipulations required that activation spread over closely associated pieces of knowledge; that is, the entity prime is assumed to activate the packet of entity knowledge and the incremental prime the packet of incremental knowledge. The finding that the two studies yielded similar results is consistent with the view that pieces of knowledge about the malleability of personality form two distinct knowledge structures, one surrounding the notion of fixedness and another the notion of malleability (cf. Levy et al., 1999).

Results from the current investigation also permit us to speculate on the mechanisms underlying the instability in an individual's implicit beliefs across time, as documented in our previous studies (see Part I, this thesis). Based on the finding that changes in the relative accessibility of entity and incremental knowledge affected participants' beliefs about the malleability of personality (Studies 2 and 3), we posit that changes in knowledge accessibility may contribute to temporal instability in an individual's implicit beliefs. Changes in the relative accessibility of entity and incremental knowledge could be brought about by changes in the relative frequency with which the two sets of knowledge are activated over an extended period of time or by recent activation of one set of knowledge over another (cf. Higgins, 1996).

Together, the current work illustrates the value of using a knowledge-activation perspective to understand how people's lay knowledge regarding the malleability of personality influences their social inferences. In particular, this work shows how pieces of pre-existing entity and incremental knowledge can shift in their relative accessibility in the mind of an individual and become operative in guiding the individual's inferences. While the present knowledge-activation framework has the capacity of capturing intra-individual variations in knowledge accessibility left unexplained by an individual-differences approach, individual differences in knowledge states can be accommodated within a knowledge-activation framework. As noted in the Introduction, even though people's implicit theories exhibit temporal instability, there is also a certain degree of stability. Such stability in implicit beliefs might be viewed as reflecting, at least in part, chronic (or baseline) individual differences in the accessibility of entity versus incremental knowledge (cf. Levy et al., 1999).

Research on the link between people's lay knowledge about the malleability of personality and social inferences can continue to benefit by importing insights accumulated in the social cognition literature. The emphasis of the current work was on temporary accessibility of people's entity and incremental knowledge. More precise understanding of how such knowledge impacts social inferences can be reached by exploring other factors known to govern the activation and use of pre-existing knowledge structures including cultural knowledge, trait constructs, and stereotypes (see, e.g., Chiu et al., 2000; Higgins, 1996; Kunda & Sinclair, 1999).

The current investigation is somewhat narrow in scope in that it focused exclusively on people's knowledge about personality and their social inferences. By comparison, Dweck and colleagues' work on implicit theories about the malleability of human attributes is much broader in scope. Their work spans the domains of personality, intelligence and morality. A wide array of cognitive, emotional, motivational, and behavioral correlates have been found in each of these domains (Dweck et al., 1995a). It would be interesting to examine in future research whether a knowledge-activation framework can be fruitfully applied to different domains and be used to understand a wider variety of psychological phenomena.

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Table 1.1

Results of Criterion-scaled Hierarchical Regression Analyses of Probability Judgments

(Part I, Study 1)

Source	df	F
Between subjects		
Theory	1	0.04
<u>S</u>	76	(1657.13)
Within subjects		
Similarity	1	2166.57***
Similarity X Theory	1	15.97***
Similarity X <u>S</u>	4600	(254.96)

Note. Variables were cumulatively entered in the order listed. All subject-related variables were criterion-scaled variables serving as error terms. Values enclosed in parentheses represent mean square errors. S = subjects within groups.

*** $p < .001$

Table 1.2

Example Items for Each Level of Similarity by Inference Types (Part I, Study 2)

Inference type and similarity	Example
Behavior-to-trait	
Similar	<p>Person A <u>behaved</u> in a more likable way than Person B in a particular situation.</p> <p>What is the probability that Person A is more strongly characterized by the <u>trait warm</u> than Person B?</p>
Unrelated	<p>Person A <u>behaved</u> in a more secretive way than Person B in a particular situation.</p> <p>What is the probability that Person A is more strongly characterized by the <u>trait sympathetic</u> than Person B?</p>
Opposite	<p>Person A behaved in a <u>more active</u> way than Person B in a particular situation.</p> <p>What is the probability that Person A is more strongly characterized by the <u>trait shy</u> than Person B?</p>
Trait-to-behavior	
Similar	<p>Person A is more strongly characterized by the <u>trait likable</u> than Person B.</p> <p>What is the probability that you would find Person A to <u>behave</u> in a more warm way than Person B in a particular situation?</p>

Unrelated Person A is more strongly characterized by the trait
secretive than Person B.

What is the probability that you would find Person A to
behave in a more **sympathetic** way than Person B in a
particular situation?

Opposite Person A is more strongly characterized by the trait
active than Person B.

What is the probability that you would find Person A to
behave in a more **shy** way than Person B in a particular
situation?

Behavior-to-Behavior

Similar Person A behaved in a more **likable** way than Person B
in a particular situation.

What is the probability that in a completely different
situation, you would find Person A to behave in a more
warm way than Person B?

Unrelated Person A behaved in a more **secretive** way than Person B
in a particular situation.

What is the probability that in a completely different
situation, you would find Person A to behave in a more
sympathetic way than Person B?

Opposite Person A behaved in a more **active** way than Person B in
a particular situation.

What is the probability that in a completely different situation, you would find Person A to behave in a more **shy** way than Person B?

Trait-to-trait

Similar

Person A is more strongly characterized by the trait **likable** than Person B.

What is the probability that Person A is more strongly characterized by the trait **warm** than Person B?

Unrelated

Person A is more strongly characterized by the trait **secretive** than Person B.

What is the probability that Person A is more strongly characterized by the trait **sympathetic** than Person B?

Opposite

Person A is more strongly characterized by the trait **active** than Person B.

What is the probability that Person A is more strongly characterized by the trait **shy** than Person B?

Table 1.3

Results of a Criterion-scaled Hierarchical Regression Analysis of Composite Probability

Judgment Scores (Part I, Study 2)

Source	df	F
Between subjects		
Theory	1	0.13
<u>S</u>	206	(244.69)
Within subjects		
Inference	3	21.78***
Inference X Theory	3	0.38
Inference X <u>S</u>	618	(26.01)
Similarity	2	1438.03***
Similarity X Theory	2	4.48*
Similarity X <u>S</u>	412	(217.26)
Inference X Similarity	6	15.82***
Inference X Similarity X Theory	6	1.09
Inference X Similarity X <u>S</u>	1236	(15.31)

Note. Variables were cumulatively entered in the order listed. All subject-related variables were criterion-scaled variables serving as error terms. Values enclosed in parentheses represent mean square errors. S = subjects within groups.

* $p < .05$. *** $p < .001$.

Table 1.4

Results of Criterion-scaled Hierarchical Regression Analyses of Composite Judgment Scores Using Different Measures of Implicit Theories (Part I, Study 3)

Source	df	F		
		Time-1 general Theory	Time-2 general theory	Time-2 omnibus theory
Between subjects				
Theory	1	0.94	6.93**	29.40***
Similarity	1	252.62***	270.11***	282.66***
Theory X Similarity	1	0.66	7.24**	6.32**
<u>S</u>	199	(255.61)	(211.58)	(197.53)
Within subjects				
Inference	3	13.68***	13.43***	13.37***
Inference X Theory	3	1.30	1.77	1.45
Inference X Similarity	3	6.55***	6.77***	6.85***
Inference X Theory X Similarity	3	5.67***	1.05	0.33
Inference X <u>S</u>	597	(21.93)	(22.35)	(22.45)

Note. Variables were cumulatively entered in the order listed. All subject-related variables were criterion-scaled variables serving as error terms. Values enclosed in parentheses represent mean square errors. S = subjects within groups.

** $p < .01$. *** $p < .001$.

Table 1.5

Percentages of Each Time-1 Theorist Category Falling into Various Theorist Categories at Time-2 (Part I. Study 4)

Time-1	Time-2		
	Entity	Unclassified	Incremental
Entity			
8-item	58.5 (62)	31.1 (33)	10.4 (11)
3-item subset	63.2 (91)	14.6 (21)	22.2 (32)
Unclassified			
8-item	27.8 (25)	38.9 (35)	33.3 (30)
3-item subset	41.7 (20)	22.9 (11)	35.4 (17)
Incremental			
8-item	13.7 (10)	24.7 (18)	61.6 (45)
3-item subset	27.3 (21)	18.2 (14)	54.5 (42)

Note: Values in parenthesis represent frequency counts. Following Dweck et al. (1995), for both the 8-item Theory Measure and its 3-item subset, participants with a theory score

of 3.0 or below were classified as entity theorists, and those with a theory score of 4.0 or above as incremental theorists.

Table 1.6

Results of Hierarchical Regression Analyses of Composite Similarity Judgment Scores using Different Measures of Implicit Theories (Part I, Study 5)

Source	df	F	
		8-item general theory	3-item general theory
Theory	1	.27	.20
Similarity	1	175.40***	175.68***
Theory X Similarity	1	.63	.73
Error	98	(.19)	(.19)

Note. Variables were cumulatively entered in the order listed. Values enclosed in parentheses represent mean square errors.

*** $p < .001$

Table 2.1

An example item for each type of inference (Part II, Study 1)

Inference Type	Example
Behavior-to-trait	<p>Person A <u>behaved</u> in a more friendly way than Person B in a particular situation.</p> <p>What is the probability that Person A is more strongly characterized by the <u>trait friendly</u> than Person B?</p>
Trait-to-behavior	<p>Person A is more strongly characterized by the <u>trait friendly</u> than Person B.</p> <p>What is the probability that you would find Person A to <u>behave</u> in a more friendly way than Person B in a particular situation?</p>
Behavior-to-behavior	<p>Person A <u>behaved</u> in a more friendly way than Person B in a particular situation.</p> <p>What is the probability that in a completely different situation, you would find Person A to <u>behave</u> in a more friendly way than Person B?</p>
Trait-to-trait	<p>Presently, Person A is more strongly characterized by the <u>trait friendly</u> than Person B.</p> <p>What is the probability that Person A will be more strongly characterized by the <u>trait friendly</u> than Person B five years from now?</p>

Table 2.2

Results of Criterion-scaled Hierarchical Regression Analyses of Composite Judgment Scores Using Different Measures of Implicit Theories (Part II, Study 1)

Source	df	F	
		General theory	Omnibus theory
Between subjects			
Theory	1	0.93	11.19**
<u>S</u>	95	(369.11)	(333.47)
Within subjects			
Inference	3	36.82***	37.23***
Inference X Theory	3	0.77	1.85
Inference X <u>S</u>	285	(53.89)	(53.27)

Note. Variables were cumulatively entered in the order listed. Values enclosed in parentheses represent mean square errors. S = subjects within groups.

** < p < .01. ***p < .001.

Table 2.3

Probability Judgments as a Function of Priming and Inference Type (Part II, Study 2)

Priming	Inference Type			
	Behavior-to-trait	Trait-to-behavior	Behavior-to-behavior	Trait-to-trait
Entity	69.58	77.16	67.55	71.46
Incremental	64.58	75.41	62.20	68.06

Table 2.4

Examples of Trait-focused, Process-focused, and Situational Information Used in Participants' Explanations in Each Priming Condition (Part II, Study 2)

Social information category and priming condition	Example
Trait-focused	
Entity-prime	“... because he was shy”
Incremental-prime	“Hermann changed from being an introvert to an extrovert.”
Process-focused	
Entity-prime	“Completing his research and finding the truth obviously made Hermann happy”
Incremental-prime	“... because his goals changed”
Situational	
Entity-prime	“His parents never really socialized him as a child.”
Incremental-prime	“The environment around him changed from time to time.”

Table 2.5

Frequency of Use of Each Social Information Category in Open-ended Explanations for Each Priming Condition (Part II, Study 2)

Priming	Social Information Category		
	Trait-focused	Process-focused	Situational
Entity	2.81	.36	.64
Incremental	.69	2.19	1.75

Note: Numbers in table represent mean number of units coded into each information category per participant.

Table 2.6

Probability Judgments as a Function of Priming and Inference Type (Part II, Study 3)

Priming	Inference Type			
	Behavior-to-trait	Trait-to-behavior	Behavior-to-behavior	Trait-to-trait
Entity	66.34	75.82	67.52	70.41
Incremental	62.58	71.77	63.54	66.48

Figure 1.1. Probability judgments as a function of implicit theories and similarity of construct pairs (Part I, Study 1).

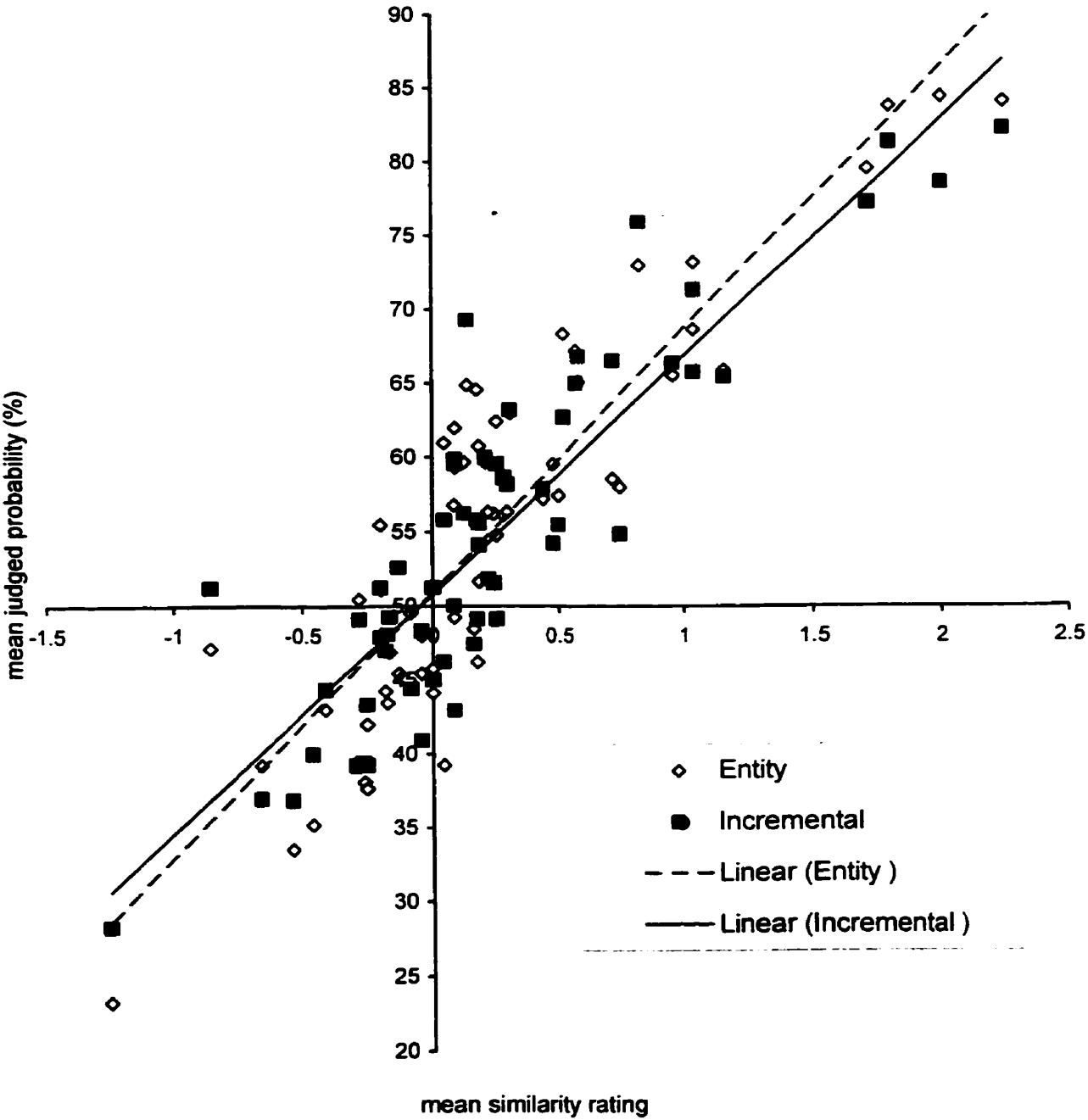


Figure 1.2. Estimates of empirical associations plotted against actual correlations of trait constructs (Part I, Study 1).

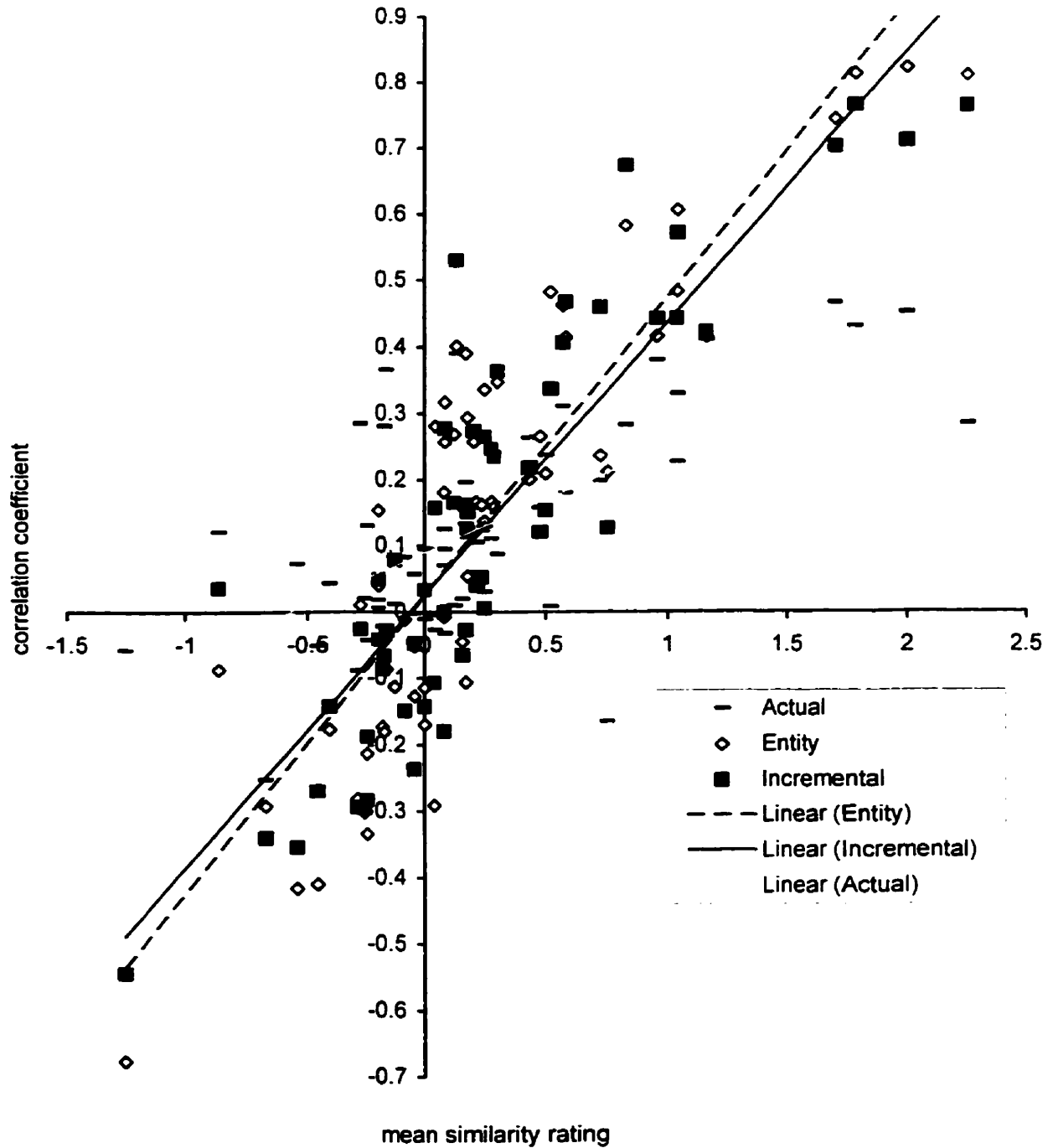


Figure 1.3. Probability judgments as a function of similarity between constructs and implicit theories (Part I, Study 2). A lower person theory score reflects a stronger expressed belief in an entity theory.

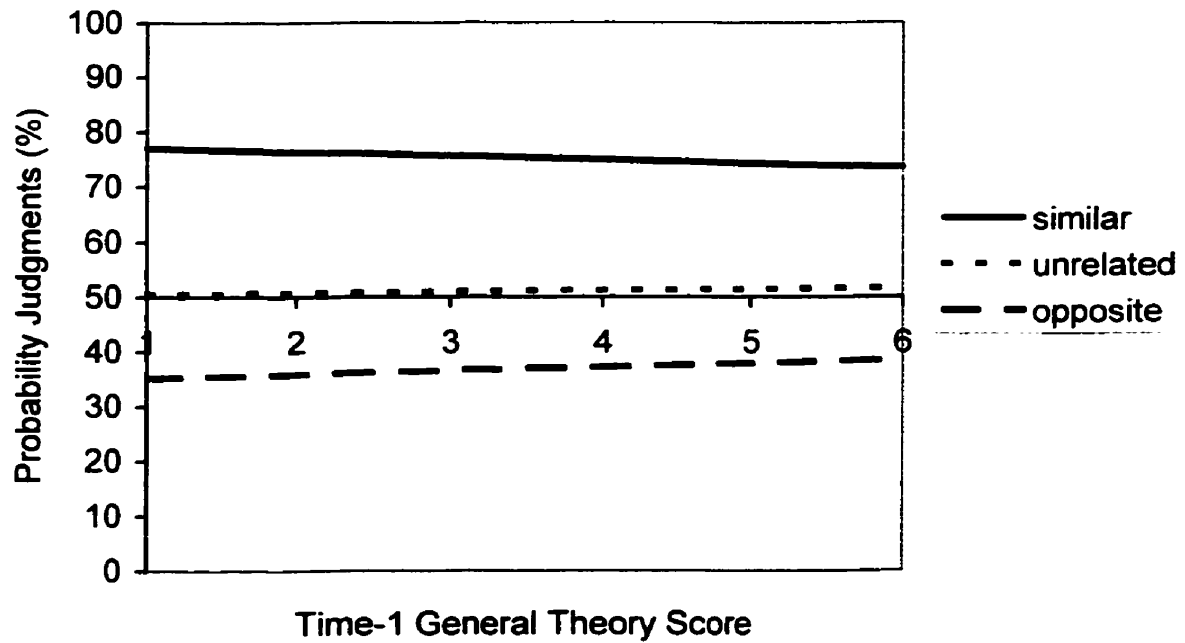


Figure 1.4. Probability judgments as a function of implicit theories assessed by three different measures (Part I, Study 3). A lower person theory score reflects a stronger expressed belief in an entity theory.

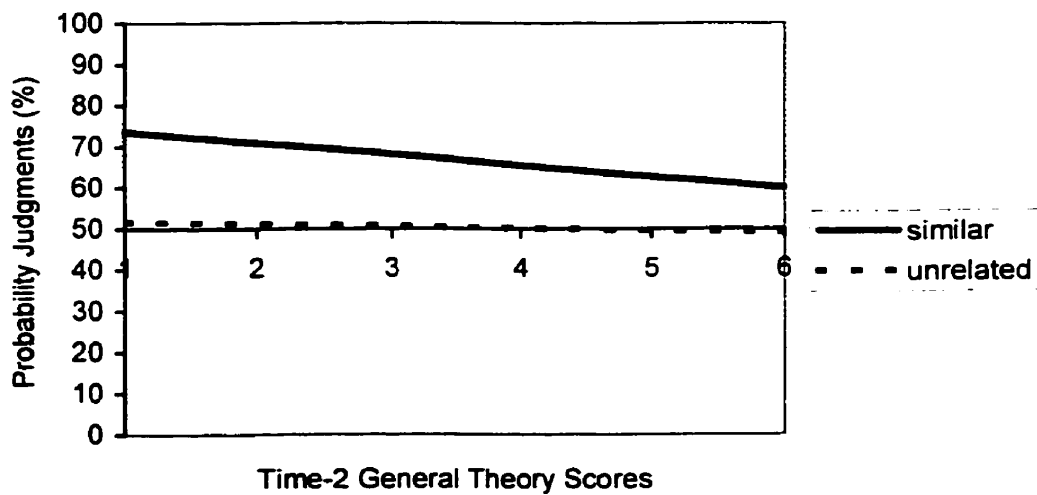
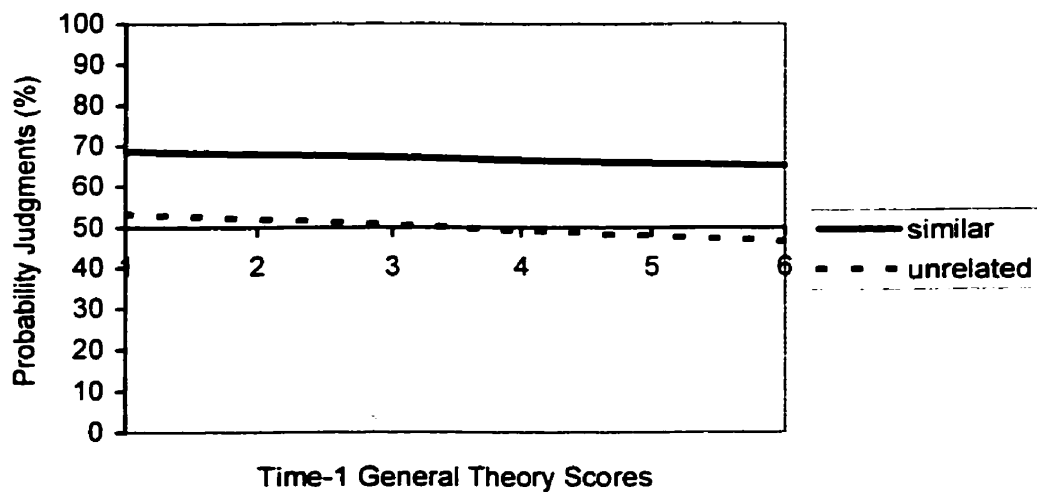


Figure 1.4 (continued). Probability judgments as a function of implicit theories assessed by three different measures (Part I, Study 3). A lower person theory score reflects a stronger expressed belief in an entity theory.

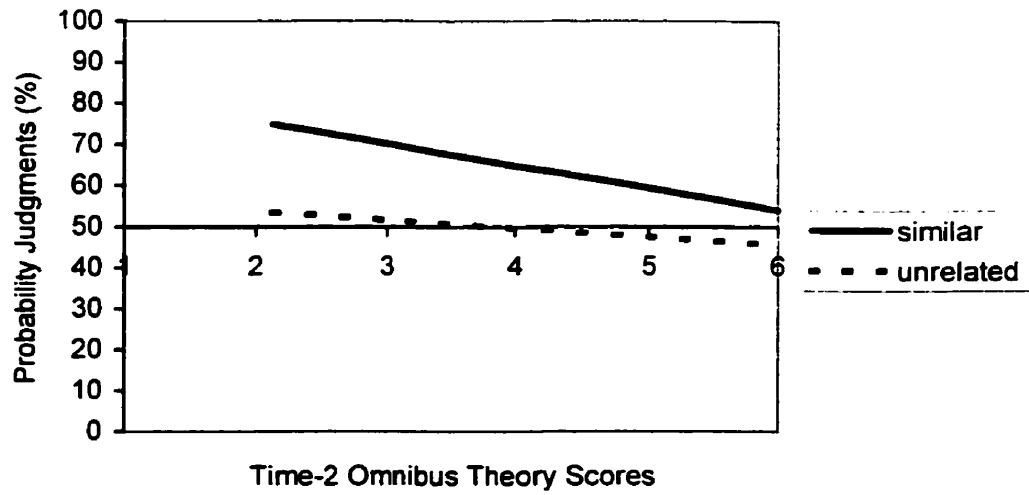


Figure 1.5. Semantic similarity judgments as a function of similarity conditions and implicit theories (Part I, Study 5)

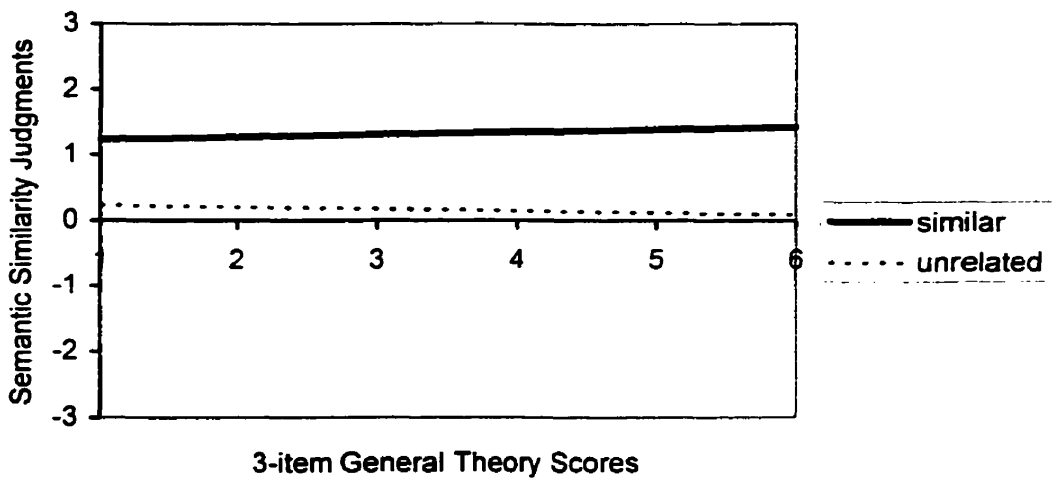
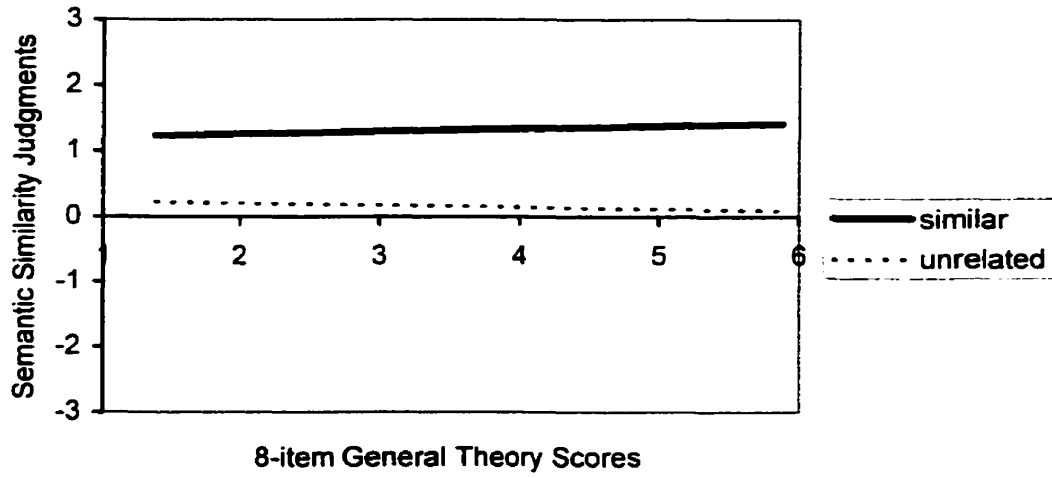
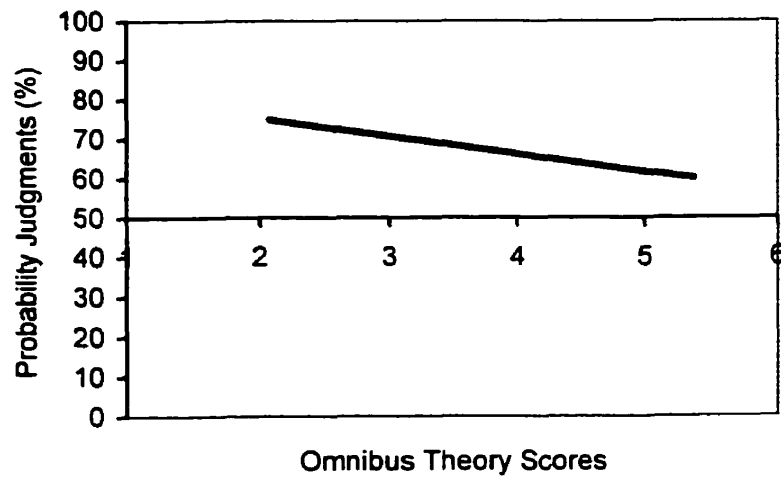
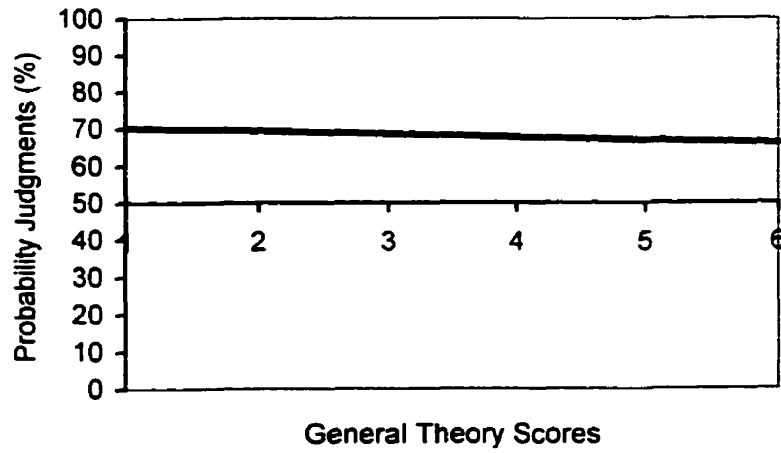


Figure 2.1 Probability judgments as a function of implicit theories assessed by the two different measures (Part II, Study 1). A lower theory score reflects a stronger belief in an entity theory.



Biography Used in the Entity-prime Condition (Part II, Study 2)

The Life of Max Hermann

BY PHILIP GIGERENZER

The 20th century has been described as an amazing century of science. By some estimates, about 80% of all the scientific discoveries ever made in human history occurred in the last 100 years. As we embark on the new century, BIOGRAPHY WEEKLY will profile the lives of some of the most outstanding scientists in the past century. We begin with Max Hermann and will follow from time to time with profiles of other prominent scientists.

ACHIEVEMENTS: Max Hermann's greatest achievements lie in the fields of physics and astronomy. He made fundamental contributions to the development of wave mechanics, for which he eventually received the Nobel Prize in Physics. He also invented an optical system that revolutionized astronomy by significantly widening the field of vision of the largest telescopes that were used in his time.

Max Hermann was born in Germany on September 12, 1891. He grew up in an intellectual family. Max's great-grandfather was Karl Hermann, a famous biologist; his grandfather, Richard Hermann, was a professor of mathematics; and his father, Walter Hermann, had a doctorate in physics. Since his very early years, Max Hermann had been an introvert; he liked to spend time alone rather than with others. He showed great interest in music as a young child and, long before he could speak, enjoyed sitting quietly as he listened to

simple songs. His parents described him as an even-tempered child who never made a fuss. He was generally regarded as a reserved, thoughtful, and precocious child. Young Hermann lived a relatively confined existence, watching the world outside from the windows and courtyard of his protected home. He had very few friends.

At school, Hermann achieved very high grades. As one could expect, subjects like mathematics and physics were the strongest areas of this to-be-Nobel-Prize-winner in physics. In this teacher's view, Hermann was a hardworking student with exceptionally strong scholastic aptitude. He was also very well-behaved. In class, he listened to his teachers with deep absorption and he never argued with them, even though he sometimes secretly harbored the thought that his teachers could be wrong. Hermann had such a strong passion for science that he turned his home into a laboratory. He read voraciously and patiently conducted series of experiments at home. Indeed, he spent most of the meager allowance his father gave him on equipment and supplies for his experiments. By the age of 16, Hermann had designed and built windmills, pumps, and a unique device for measuring distances.

In 1910, Hermann graduated at the top of his high school class. He won a scholarship to pursue his studies at the University of Berlin, where he studied physics. As an adult, he had much greater freedom. Yet he chose to continue to

lead a quiet life. He remained an introvert; keeping to himself as much as possible, and spending most of his time on laboratory experiments. He continued to be fervently interested in his academic pursuits, studying with seriousness and deep conviction. In short, Hermann was a well-behaved, model university student. His academic brilliance was fully recognized, and by 1916 he had received his doctorate from the University of Berlin.

Upon receiving his doctorate degree, Hermann applied for and won a faculty position at the University of Munich. There, he began a quarter of a century of experimentation and inventions. Despite his accomplishments, Hermann's lifestyle did not change. As in his childhood and adolescence, he was totally devoted to his work. The thoughtful child grew up to be a thoughtful scientist. Hermann constantly questioned, revised and upgraded his ideas, which he recorded in a little notebook that he always carried with him. As always, he worked patiently and determinedly to reach his research goals through cumulative small steps.

Hermann's career reached its heights when he made several fundamental contributions to the development of wave mechanics, for which he later received a Nobel Prize. In addition, he also invented an optical system that significantly widened the field of vision of the largest telescopes in use at the time. Although Hermann was held in very high esteem in the scientific community, he had his critics. Hermann never argued with his teachers when he was a student; and he often did not respond to criticisms from others when he was a prominent scientist. Indeed, a number of his colleagues at the University of Munich described him as a very reserved man with a high level of emotional restraint. A man of few words,

he continued with his work in solitude, letting the work speak for him.

Throughout his career at Munich, he lived a very simple life: he ate simply, dressed simply, and lived in a very humble house. He remained unmarried, and had very few friends. He never drank.

In 1938, as Adolf Hitler gained increasing power in Germany, Hermann migrated to the U.S., where he accepted a position at New York University. Shortly after he had settled in New York, Hermann's health began to decline. His hair grew thin and his eyes obscured behind thick glasses. New York was a strange place to Hermann, but Hermann never changed. He conducted his life the same way as he did in Germany. He single-mindedly continued his quest for the "scientific truth" in America. By 1942, he had established a physics library and a laboratory at New York University, where he sustained a productive research career. He lived frugally. He did not have any personal interest beyond this research, except perhaps listening to music in the privacy of his modest apartment. According to some biographers, at New York University, a young and beautiful professor named Caroline Pozzulo deeply admired his exceptional talents, and made several attempts to initiate a romantic relationship. Hermann, however, was not interested. Hermann remained unchanged—quiet, detached, reserved, hardworking and brilliant—until his death in 1971, at the age of 80.

Philip Gigerenzer (1949 -) is a biographer and Professor of German History at Columbia University, New York. This article is taken from his book, "Great lives of the 20th century".

Biography Used in the Incremental-prime Condition (Part II, Study 2)

The Life of Max Hermann

BY PHILIP GIGERENZER

The 20th century has been described as an amazing century of science. By some estimates, about 80% of all the scientific discoveries ever made in human history occurred in the last 100 years. As we embark on the new century, BIOGRAPHY WEEKLY will profile the lives of some of the most outstanding scientists in the past century. We begin with Max Hermann and will follow from time to time with profiles of other prominent scientists.

ACHIEVEMENTS: Max

Hermann's greatest achievements lie in the fields of physics and astronomy. He made fundamental contributions to the development of wave mechanics, for which he eventually received the Nobel Prize in Physics. He also invented an optical system that revolutionized astronomy by significantly widening the field of vision of the largest telescopes that were used in his time.

Max Hermann was born in Rottluff, a rural village in Germany on September 12, 1891. He grew up as the only child in his family. His father worked in a small shoe shop, and his mother was a daughter of a farmer. During his very early years, he was an extrovert; he enjoyed spending time with a gang of boys in his neighborhood rather than by himself alone. The gang often behaved wildly, doing things together like piling a family's porch furniture on the roof of the house just for fun. Hermann and his gang frequently involved in fights

with boys from other parts of their village, often in dispute over a territory that they considered "theirs."

At school, Hermann's grades were low, and ironically, subjects like mathematics and physics were among the weakest areas of this to-be-Nobel-Prize-winner in physics. Teachers chastised him for his laziness, and they thought that young Hermann did not have the intellectual capacity to succeed in school, even if he tried hard. In his teachers' view, he was not only a mediocre student, but also a rebellious troublemaker. In elementary school, he once set a snake loose in the classroom. Later on, in high school, he and his gang often skipped classes. Hermann was very outspoken. He debated with his teachers about such matters as what to wear to school, and whether or not students were permitted to eat during class. On a number of occasions, headmasters were called on to settle these controversies.

In 1910, Hermann entered the University of Berlin, where he studied physics. He did not actually attain high enough grades in high school to gain admission to this university. He was only admitted accidentally due to a clerical error. Upon entry to the University, Hermann changed dramatically. He became an introvert. Instead of enjoying himself with others, Hermann kept to himself as much as possible. He cut off all contact with his old gang. He became fervently interested in his academic pursuits, studying with seriousness and deep conviction. No longer was he a

troublemaker. Hermann's academic brilliance was fully recognized, and by 1916 he had received a doctorate from the University of Berlin.

Upon receiving his doctorate degree, Hermann applied and won a faculty position at the University of Munich. There, he began a quarter of a century of experimentation and inventions at the University of Munich. The impulsiveness evident in his childhood and adolescence were totally gone. He worked patiently, and determinedly to reach his research goals through cumulative small steps. He was an extremely reflective scientist; he constantly questioned, revised and upgraded his ideas, which he recorded in a little notebook that he always carried with him.

Hermann's career reached its heights when he made several fundamental contributions to the development of wave mechanics, for which he later received a Nobel Prize. In addition, he also invented an optical system that significantly widened the field of vision of the largest telescopes in use at the time. Although Hermann was held in very high esteem in the scientific community, he had his critics. Unlike the young Hermann who had a passion for debate, the adult Hermann did not respond to criticisms. Indeed, a number of his colleagues at the University of Munich described him as a very reserved man with a high level of emotional restraint. A man of a few words, he continued with his work in solitude, letting the work speak for him. Throughout his career at Munich, he lived a very simple life: he ate simply, dressed simply, and lived in a very humble house. He remained unmarried, and had very few friends. He never drank.

In 1938, as Adolf Hitler gained increasing power in Germany, Hermann migrated to the U.S., where he accepted a position at New York University. Shortly

after he had settled in New York, Hermann's health began to decline. He began to re-evaluate how he should conduct the rest of his life in America. Hermann became less concerned with "scientific truth", and more concerned with "spiritual truth". Hermann ceased to confine himself to his home and laboratory. Instead of investing in scientific research and inventions, Hermann directed his energy and time to religion and other endeavors that he thought would enrich his life. He attended church regularly and he traveled across the continent to talk about the connection between science and spirituality. He donated generously to charity and he did a great deal of volunteer work for the elderly. Through all this work, he came into contact with people of very different backgrounds, and his social circle expanded significantly. In 1946, at the age of 55, he married Caroline Pozzulo, a young and beautiful woman he met through his church. The couple eventually had two children. Hermann was a loving husband and father in his close-knit family. Hermann passed away in his home in New York in 1971, at the age of 80, with his wife and children beside him.

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