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Yuk-Yue TONG
Singapore Management University, jennifertong@smu.edu.sg

Chi-Yue CHIU
University of Hong Kong

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Yuk-yue Tong
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People may believe that personal attributes are fixed entities that cannot be changed (hold an entity theory). Alternatively, they may believe that qualities of a person are malleable (hold an incremental theory). In the present research, the authors used Sternberg's (1966) memory search task to examine entity and incremental theorists' cognitive strategies in memory search. It was hypothesized that entity theorists, who have a greater tendency to make spontaneous evaluation of people, would organize impressions in short-term memory according to whether the stimulus persons are positively or negatively evaluated. Next, they might compare the probe only to the stimulus persons with matched valence or discard the ones that did not match the probe in valence. By comparison, incremental theorists, who tend not to make immediate evaluative trait judgments, should be less likely to use these evaluation-based strategies. These hypotheses were confirmed in two memory search experiments, in which the names of positive or negative persons were used as stimuli.

There is considerable evidence that lay theories about human attributes structure the way people understand and react to human actions and outcomes (see Dweck, Chiu, & Hong, 1995). Some people may believe that an individual's personal attributes are fixed, unchangeable entities, that is, they subscribe to an entity theory of personal attributes. Others may conceive of personal characteristics as malleable qualities that can be developed, that is, they hold an incremental theory of personal attributes. These beliefs may function as background assumptions and set up an interpretive framework that gives meaning to incoming information (Dweck et al., 1995; Jones & Thibaut, 1958; Wegner & Vallacher, 1977). Consistent with this idea, research has shown that lay theories could influence interpersonal perception (Chiu, Hong, & Dweck, 1997), social decision making (Gervey, Chiu, Hong, & Dweck, 1999), intergroup perception (Hong, Chiu, Yeung, & Tong, 1999; Hong, Levy, & Chiu, 2001; Levy, Stroessner, & Dweck, 1998), moral reasoning (Chiu, Dweck, Tong, & Fu, 1997), and reactions to academic failures and social rejections (e.g., Hong, Chiu, Dweck, Lin, & Wan, 1999).

In the domain of person cognition, past research has shown that entity theorists, who believe in fixed personal traits, tend to diagnose traits from behavioral information (Dweck et al., 1995). Because evaluation is an integral part of trait diagnosis (see Tesser & Martin, 1996, for review), compared to incremental theorists, entity theorists may process person information in a more evaluative manner. Consistent with this idea, a series of studies by Hong, Chiu, Dweck, and Sacks (1997) found that compared to incremental theorists, entity theorists are more likely to attach evaluative meaning to information about a person and form a global evaluative impression of the person. In the present research, we sought to extend this work by examining how evaluation affects entity and incremental theorists' processing strategies in memory search. If entity theorists are more likely than incremental theorists to represent impressions of others in terms of global, evaluative traits (Chiu, Hong, & Dweck, 1997; Dweck, Hong, & Chiu, 1993), do they also have a greater tendency than incremental theorists to

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use evaluation to organize impressions of multiple individuals in memory search?

In one study, Chiu (1994) provided participants with explicit trait and goal information about nine target persons and had the participants rate the similarity and dissimilarity of various target persons. The results showed that entity theorists used evaluative traits (intelligence and morality) as the primary basis for judging similarity and thus as the basis for organizing their impressions of the target persons. In contrast, incremental theorists used goals as the major basis for judging people as similar. These findings provided evidence for the idea that entity theorists rely more heavily on evaluative information than do incremental theorists in organizing impressions of people. Thus, it seems possible that entity and incremental theorists may differ in how they perform cognitive operations on impressions of others.

THE MEMORY SEARCH TASK

We proposed that compared to incremental theorists, entity theorists are more ready to use evaluative information to perform cognitive operations on impressions. In the present research, we adopted the memory search task developed by Sternberg (1966) to test this idea. In a memory search task, the participant memorizes a list of stimuli (memory set) and judges whether a target presented at the end (probe) is a member of the memory set. According to Sternberg's (1969) multistage model of information processing, when the stimuli enter short-term memory, participants will prepare the information for memory search by encoding the information into a certain representational format. Researchers can create a linear reaction time function by regressing search time on set size. When this is done, the zero intercept in the reaction time function would reflect the constant amount of time needed for stimulus encoding. Next, to complete the memory search, the participants would engage in serial comparison. At this stage, search time should increase linearly with set size, and the slope of the reaction time function should reflect the speed of serial comparison (Sternberg, 1966).

In Experiment 1, names of people in each participant's social circle were collected and used in the memory search task as stimuli. On each trial, a memory set of two to six names was presented. Half of the stimulus persons were positively evaluated and half negatively evaluated by the participant. The participant's task was to judge whether the target name (the probe) presented at the end of each trial was in the memory set.

In the information encoding stage, participants could encode the stimuli persons in terms of their valence. We believe that evaluative encoding of the stimulus persons could result in clustering of stimulus persons by valence. Participants in this experiment could then use at least two evaluation-based strategies to complete the memory search: (a) segregation and selective search and (b) elimination of stimulus persons with mismatched valence. Note that the stimulus persons were either positively or negatively evaluated acquaintances of the participants. Participants who used the segregation and selective search strategy would first separate the positive stimulus persons from the negative ones. When they needed to determine whether a particular target was in the memory set, they could selectively access either the positive cluster or the negative cluster (but not both) depending on the valence of the target. For example, when they needed to determine whether a positively evaluated target was in the memory set, they would scan the stimulus persons in the positive cluster only. Because half of the stimulus persons were in the positive cluster and half were in the negative cluster, the number of stimulus persons they needed to search before making the judgment would be half of the set size. With fewer items to search, the amount of time they needed to complete the search should be smaller.

Participants who used the elimination of stimulus persons with mismatched valence strategy also could sort the stimulus persons in the memory set by their valence and then use the valence of the probe to reduce the size of the memory set. For example, when the probe was a negatively evaluated person, they would discard the positively evaluated persons in the memory set and reduce the size of memory set. This strategy also would reduce the amount of time required to complete the memory search.

We predicted that although evaluation-based strategies are available to both entity and incremental theorists in memory search, entity theorists are more likely than incremental theorists to employ these strategies. On one hand, compared to incremental theorists, entity theorists rely more heavily on evaluation to categorize people (Chiu, 1994). On the other hand, incremental theorists are more likely than entity theorists to consider other dimensions when they categorize individuals. For example, in the Chiu (1994) study, incremental theorists tended to categorize people on the basis of more specific mediating factors such as the actor's goals or motivation. Because organization of impressions by evaluation is a precondition for using the two evaluation-based search strategies, we predicted that entity theorists would be more prepared than incremental theorists to use these strategies and hence be more able to save time in memory search.

In Experiment 1, the stimulus persons were real acquaintances from the participants' social circles. Using stimulus persons that the participants had known for a while helps to protect the external validity of the study. However, this procedure also leaves open a few

alternative explanations of the findings. For example, the stimulus persons generated by entity and incremental theorists might differ in evaluative extremity. In addition, the stimulus persons generated by the two groups also might differ in the amount of familiarity with the participants. To address this problem, we had taken caution to minimize the threats of these confounds to the experiment's internal validity. We also attempted to replicate the findings of Experiment 1 in another study that used fictitious names as stimulus persons. Specifically, in Experiment 2, participants were first trained to attach evaluative meaning to 32 fictitious names, which were later used in a memory search task. In both Experiments 1 and 2, we predicted that compared to incremental theorists, entity theorists, who are likely to use evaluation-based strategies, would need shorter time to complete the memory search.

EXPERIMENT 1

Method

OVERVIEW

The stimuli in the memory search task were names of eight positively and eight negatively evaluated persons. On each trial, the participant listened to a sequence of two to six names, saw a visual probe (target name) on the screen, and indicated whether the target name was in the memory set. We hypothesized that relative to incremental theorists, entity theorists would show a smaller increase in response time as the size of the memory set increased.

PARTICIPANTS

The participants were 41 (10 men, 31 women; average age = 20.8) undergraduates from a local university in Hong Kong. They participated to receive course requirement credits.

LAY THEORIES MEASURE

The lay theories of the participants were measured using a questionnaire developed by Dweck and her colleagues (Dweck et al., 1995).

Lay theories are domain-specific beliefs (Dweck et al., 1995). Individuals who hold an entity theory of intelligence may hold an incremental theory of moral character. Moreover, it is the lay theory in a particular domain that affects judgments and reactions in that domain. Although we did not collect information on how the participants formed evaluative judgments of the target persons, past research has shown that intelligence and moral character are the two dominant dimensions that perceivers use to form impressions of others (Wegner & Vallacher, 1977). Chiu (1994) also found intelligence and morality to be the two major trait dimensions entity theorists use to categorize impressions of others. Thus, in the present experiment, we assessed the participants' lay theories of intelligence and moral character.

The items in the lay theory of intelligence measure are as follows: "You have a certain amount of intelligence and you really can't do much to change it," "Your intelligence is something about you that you can't change very much," and "You can learn new things but you can't really change your basic intelligence." The items in the lay theory of moral character measure are as follows: "A person's moral character is something very basic about them and it can't be changed much," "Whether a person is responsible and sincere or not is deeply ingrained in their personality. It cannot be changed very much," and "There is not much that can be done to change a person's moral traits (e.g., conscientiousness, uprightness, and honesty)" (Dweck et al., 1995). Respondents indicated their agreement with each of the items on a 6-point scale that ranged from 1 (*very strongly agree*) to 6 (*very strongly disagree*). Their responses to the three items were averaged to form a measure of lay theory for each domain, with a higher score on the measure indicating a stronger belief in an incremental theory.

In past research (Chiu, Hong, & Dweck, 1997; Hong, Chiu, Dweck, et al., 1999; Levy et al., 1998), participants who agreed with an entity theory and those who disagreed with it (or those who agreed with an incremental theory) often displayed distinct patterns of social inferences and reactions. In addition, when participants were experimentally led to believe in an entity or incremental theory, their responses looked very much the same as those who agreed or disagreed with the entity theory items. These findings have led some researchers to believe that entity and incremental theorists are two distinct worldviews (as opposed to two ends of a belief continuum) (Dweck et al., 1995). Therefore, we classified participants who scored below 3.5 (the theoretical midpoint of the scale) on the lay theory measures as entity theorists and those who scored above 3.5 as incremental theorists. Using this criterion, 14 and 27 participants were classified as entity and incremental theorists of intelligence, respectively. In the domain of moral character, 18 were classified as entity theorists and 23 as incremental theorists. The correlation between the two lay theory measures was significant ($r = .46$, $p < .05$). Nine and 18 participants were entity and incremental theorists in both domains, respectively.[1]

Dweck et al. (1995) have reported extensive information attesting to the reliability and validity of the measures. Very briefly, test-retest reliability for a 2-week interval is .80 for both the intelligence theory measure and the moral character theory measure. The internal reliability of the intelligence theory measure ranged from .94 to .98, and that of the moral character theory mea-

TABLE 1: Means and Standard Deviations (in parentheses) of the Evaluative Ratings of the Positive and Negative Stimulus Persons

	Intelligence Theory			*Moral Character Theory*		
	Entity	*Incremental*	t *Ratio*	*Entity*	*Incremental*	t *Ratio*
Mean valence rating of the eight positive stimulus persons	4.48 (.35)	4.42 (.46)	–.63	4.48 (.44)	4.41 (.38)	–.52
Mean valence rating of the eight negative stimulus persons	3.83 (.85)	3.56 (.73)	–1.04	3.85 (.83)	3.51 (.71)	–1.42

sure ranged from .85 to .94 (Dweck et al., 1995). Concerning the validity of the measure, past research has found the moral character measure to be predictive of the respondents' moral and justice beliefs (Chiu, Dweck, et al., 1997) and the tendency to make moral trait inferences from behavior in a theoretically meaningful manner (see Dweck et al., 1993). The intelligence theory measure also has been found to be predictive of theoretically relevant judgments and reactions in the achievement domain (Hong, Chiu, Dweck, et al., 1999). With respect to discriminant validity, the lay theory measures do not correlate with standard measures of self-presentation concerns (see Snyder's [1974] Self-Monitoring Scale), socially desirable responding (see Paulhus's [1984] Social Desirability Scale), intellectual abilities (Scholastic Aptitude Test scores), self-esteem (Coopersmith, 1967), and political attitudes (Kerlinger, 1984; see also Dweck et al., 1995; Levy et al., 1998).

GENERATION OF NAMES OF STIMULUS PERSONS FOR THE MEMORY SEARCH TASK

Participants attended the first session of the experiment in small groups. They first filled out the lay theories measures. Next, they wrote down the names of 30 real acquaintances from their social circles. They were asked to name 15 people they liked and 15 people they disliked. Participants in some groups named the 15 disliked persons first and the remaining participants named the 15 liked persons first. Next, the participants rated how good or bad was their impression of the people they had named on a 5-point scale, from 1 (*slightly positive/negative*) to 5 (*very positive/negative*).

For each participant, we selected eight persons who received the most positive evaluations and eight who received the most negative evaluations as the stimulus persons in the memory search task. The names of the selected stimulus persons were recorded in a female voice and digitized for computerized auditory presentation. Table 1 shows that in both domains (intelligence and morality) and for both positive and negative stimulus persons, the stimulus persons generated by entity and incremental theorists did not differ in evaluative extremity (*t*s ranged from –1.42 to –.52). At the end of the memory search task, we asked the participants to report their relationship with the 16 stimulus persons. Two independent coders who were blind to the participants' lay theories coded the reported relationships into 17 relationship categories: immediate family member, relatives, grade school classmates, high school classmates, university classmates, coworker in the same university student society, ex-coworker in the same university student society, member of the same voluntary group, resident in the same student dormitory, teacher, student, colleague or ex-colleague, spouse, friend, neighbor, ex-boyfriend or ex-girlfriend, and indirect relationship. Intercoder agreement was 99.7%, and disagreements were resolved through group discussion.

For each domain (intelligence and morality), we compared entity and incremental theorists' likelihood of having a stimulus person in each of the 17 relationship categories. Of the 34 comparisons summarized in Table 2, only 3 reached the .05 level of significance. Independent of the participants' lay theories, grade school classmates, university classmates, residents in their own student dormitory, and friends were most likely to be selected as the stimulus persons.

THE MEMORY SEARCH TASK

Two weeks after the first session, the participant took part in the memory search task. We used a Macintosh computer and the software Power Laboratory to control the presentation of the stimuli and to record the participant's responses.

In the memory search task, there were 80 trials, which were randomly distributed into four blocks of 20 trials each. Each block consisted of four trials of each set size (2, 3, 4, 5, or 6). The order of presentation of the four blocks was counterbalanced using a Latin Square design.

On each trial, we presented the names of two to six stimulus persons, half of which were positive stimulus persons. The remaining ones were negative stimulus persons. When set size equaled three, one positive and two negative stimulus persons were presented in half of the trials and two positive and one negative stimulus persons were presented in the remaining trials. Similarly, when set size equaled five, two positive and three negative stimulus persons were presented in half of the trials and three positive and two negative stimulus persons were presented in the remaining trials. The presentation order of the stimulus persons within each trial was randomized.

TABLE 2: Distribution of the Selected Stimulus Persons in the 17 Relationship Categories

	Intelligence Theory			*Morality Theory*		
Relationship Category	*Entity*	*Incremental*	t *Ratio*	*Entity*	*Incremental*	t *Ratio*
Immediate family member	0.64	0.93	.84	0.44	1.13	2.24*
Relative	1.00	0.93	–.15	1.11	0.83	–.59
Grade school classmate	4.07	5.41	1.33	4.72	5.13	.42
High school classmate	0.29	0.81	1.14	0.78	0.52	–.57
University classmate	2.93	1.37	–2.44*	2.00	1.83	–.27
Coworker in the same university student society	0.71	1.07	.64	0.89	1.00	.21
Ex-coworker in the same student society	0.00	0.37	2.44*	0.22	0.26	.25
Member of the same voluntary group	0.00	0.15	1.52	0.17	0.04	–1.32
Resident in the same student dormitory	2.57	1.44	–1.08	2.50	1.30	–1.21
Teacher	0.07	0.07	.03	0.00	0.13	1.21
Student	0.57	0.44	–.47	0.67	0.35	–1.26
Colleague/ex-colleague	0.14	0.04	–.93	0.11	0.04	–.62
Spouse	0.21	0.37	.83	0.22	0.39	.95
Friend	1.50	1.41	–.15	1.17	1.65	.82
Neighbor	0.43	0.70	.55	0.44	0.74	.62
Ex-boyfriend/ex-girlfriend	0.00	0.11	.72	0.00	0.13	.88
Indirect relationship (e.g., sister's boyfriend, roommate's teacher)	0.43	0.26	–.50	0.28	0.35	.22

*$p < .05$.

As in Sternberg (1966), we presented each name in the memory set for 2 sec. One second after the presentation of all the names in the memory set, the word *end* appeared for 1 sec. Next, the participant saw the probe and judged whether it was on the memory list. The probes were positively evaluated targets in half of the trials and negatively evaluated targets in the remaining trials. The participant responded by pressing the appropriate key on the keyboard as accurately and quickly as possible. In half of the trials (the "yes" trials), the probe was in the memory set. In the remaining trials (the "no" trials), the probe was not in the set. The participant's responses ("yes" or "no") and reaction times were recorded.

The participants first completed several practice trials before they proceeded to the task. Feedback on the correctness of the responses was given during the practice trials. On the experimental trials, the participants did not receive any feedback.

It was important that the participants attended to the full name of the stimulus persons so that the evaluative association of the names could be activated. If the names were presented visually on the screen, participants could attend to the family name or the last name only. Thus, we presented the names of the stimulus persons auditorily.

In the first two blocks of trials, the answer key for "yes" and "no" was "c" and "m," respectively. The answer keys were reversed after the participants had finished the first two blocks of trials. The participants went through another series of practice trials before they proceeded to the last two blocks of trials.

We conducted a postexperiment interview with the participants. None of the participants reported any knowledge of the research hypotheses.

Results

We eliminated reaction time outliners (6.7% of all responses) by excluding reaction times that were 3 standard deviations above the mean reaction time. Before the outliners were eliminated, mean reaction time = 1224.61 msec, *Mdn* = 1081 msec, *SD*= 652.65 msec, and skewness = 5.87. After the outliners were eliminated, mean reaction time = 1169.27 msec, *Mdn* = 1074 msec, *SD* = 454.36 msec, and skewness was reduced to 1.48. Reaction times for incorrect responses (1.7%) were excluded from further analysis.

According to Sternberg (1969), in a short-term memory search task, participants would engage in an exhaustive serial search, that is, they would compare the probe to all the memorized items. Thus, for both "yes" and "no" trials, search time should be proportional to the set size. When search time is regressed on set size, the intercept reflects the constant amount of time needed for stimulus encoding, whereas the slope reflects the additional amount of time needed for serial comparison with a unit increase in the size of the memory set. To assess whether participants performed an exhaustive serial search in our memory search task, for each participant, we computed the average reaction time of correct responses for each of the five set sizes. Then, for each set size, we collapsed the reaction times across participants to yield the average reaction time for each set size. The resulting five

reaction times were regressed on set size. The slope of the regression line (76.6 msec) was significant, $F(1, 3) = 132.4$, $p < .05$, indicating that average search time increased with set size. The same analysis performed on the "yes" trials and the "no" trials yielded the same result: The slope of the regression line was 85.9 msec for the "yes" trials, $F(1, 3) = 179.30$, $p < .05$, and 68.0 msec for the "no" trials, $F(1, 3) = 88.50$, $p < .05$. In short, the data provided clear evidence that participants had used an exhaustive serial search strategy.

If participants adopted one or both evaluation-based strategies in memory search, they should be able to complete the memory search more quickly. Specifically, they needed to scan through one item only when set size equaled two, two items only when set size equaled four, and three items only when set size equaled six. Thus, if we regressed the average reaction time for each set size on set size, the slopes of the regression lines should be flatter among those who used the evaluation-based strategies than among those who scanned all the stimulus persons in the memory set. According to this line of reasoning, a critical test of our hypotheses was whether entity theorists had flatter regression slopes than did incremental theorists. Thus, for each participant, we regressed their memory search time on set size and obtained the intercept and slope of the regression line. Although this analytic strategy may seem novel in social cognition research, it has been widely used in memory search experiments. As Sternberg (1969) put it,

> An effect of stimulus degradation on the *stimulus-encoding stage,* which generates the stimulus representation, would increase the zero-intercept of the RT-function. An effect on the *serial-comparison stage* would increase the slope, since a time increment would be added for each item compared. (p. 433)

Entity theorists and incremental theorists did not differ in the intercept, $F(1, 39) = 2.64$ for lay theory of intelligence, and $F(1, 39) = 1.30$ for lay theory of moral character. A similar result was found for the "yes" trials, $F(1, 39) = 1.96$ for lay theory of intelligence, $F(1, 39) = 0.01$ for lay theory of moral character, and for the "no" trials, $F(1, 39) = 2.04$ for lay theory of intelligence, $F(1, 39) = 3.98$ for lay theory of moral character. Thus, entity and incremental theorists did not differ in the amount of time they needed to complete the stimulus encoding stage.[2]

Table 3 shows the mean of the slopes of the regression lines as a function of (a) entity versus incremental theory of intelligence and (b) entity versus incremental theory of moral character. The slope was significantly steeper for incremental than for entity theorists of intelligence, $F(1, 39) = 8.96$, $p < .05$. In other words, compared to incremental theorists, entity theorists needed less time to complete the memory search when set size increased. A similar trend was found for lay theory of moral character, although the difference was not significant, $F(1, 39) = 3.15$, $p = .08$.

TABLE 3: Mean Slope of the Regression Line as a Function of Lay Theories

	Lay Theory of Intelligence		
Lay Theory of Moral Character	*Entity Theorists*	*Incremental Theorists*	*Marginal Mean*
Entity theorists	56.21	75.76	66.0
Incremental theorists	55.65	92.96	84.9
Marginal mean	56.0	87.2	

We performed the same analyses on the "yes" and "no" trials. For the "yes" trials, entity theorists of intelligence had flatter regression slopes than did incremental theorists of intelligence, $F(1, 39) = 4.70$, $p < .05$ (M = 67.90 msec and 95.22 msec for entity and incremental theorists, respectively). However, the difference between entity and incremental theorists of morality was not significant, $F(1, 39) = 0.40$, *ns.* For the "no" trials, entity theorists had significantly flatter slopes than did incremental theorists in both the intelligence domain, $F(1, 39) = 5.52$, $p < .05$ (M = 44.70 msec and 80.10 msec for entity and incremental theorists, respectively) and the moral character domain, $F(1, 39) = 4.70$, $p < .05$ (M = 50.40 msec and 81.90 msec for entity and incremental theorists, respectively). In short, consistent with our hypothesis, entity theorists seemed to have used evaluation-based strategies to speed up the serial comparison process in memory search.

Discussion

When the stimulus persons were participants' liked or disliked acquaintances, entity theorists needed less time than did incremental theorists to complete the serial comparison process in memory search. This finding is in line with the idea that entity theorists are more likely than incremental theorists to sort impressions into positive and negative clusters. This categorization strategy allows entity theorists to selectively access only those names that match the probe's valence or to discard names that do not match the probe's valence. As a result, the time they need to complete the serial comparison process would be shortened.

In Experiment 1, we used real people in the participants' social circles as stimulus persons. Although the stimulus persons generated by entity and incremental theorists had a similar level of evaluative extremity and did not differ discernibly in the kinds of relationships they had with the participants, this procedure did leave open the question of whether the stimulus persons gen-

erated by the different lay theory groups were equivalent on all relevant dimensions. In addition, because the stimulus persons were the participants' acquaintances, the participants had other nonevaluative information about these stimulus persons. Thus, it could be argued that entity theorists did not use evaluation-based strategies. Instead, incremental theorists might try to retrieve other relevant information about the stimulus persons and used evaluation as well as other dimensions to categorize the stimulus persons. This relatively complex strategy could make incremental theorists slower in memory search. Another less interesting but nonetheless relevant alternative explanation is that incremental theorists have a generalized tendency to respond slowly in a memory search task.

To eliminate these alternative explanations, we conducted two other experiments. In Experiment 2a, participants were led to form positive or negative impressions of some fictitious stimulus persons. Next, these novel stimulus persons were used in a memory search task. Thus, the stimulus persons should be equally familiar or unfamiliar to entity and incremental theorists. Moreover, because only evaluative information about the stimulus persons was available, incremental theorists could not use other information to encode the stimulus persons. If entity theorists were still speedier than incremental theorists in serial comparison, it would suggest that entity theorists are more likely than incremental theorists to employ evaluation-based strategies in memory search. In Experiment 2b, the stimulus persons were names of fictitious people that did not carry any evaluative meaning. If incremental theorists are generally slower than entity theorists in memory search, they should have steeper regression slopes than do entity theorists even when the stimulus persons have no evaluative meaning.

EXPERIMENT 2A

Method

PARTICIPANTS

The participants were 45 (21 men, 24 women; average age = 18.7) undergraduates who did not take part in Experiment 1. They participated to receive course requirement credits.

IMPRESSION FORMATION TASK

Participants were presented with information about 32 novel stimulus persons on a computer screen. We told the participants that we had collected sample behaviors of 32 individuals. On each trial, they would see and hear the name of one of these individuals and a behavior this individual had performed. Their task was to form an impression of the individual based on the behavioral description. The behaviors used in the present experiment were found in a pretest (N = 160) to be highly socially desirable or undesirable. The 16 negative behaviors selected in the present experiment had a mean rating of 2.94 (range = 1.50 to 4.32) on a 10-point scale (1 = *very negative*, 10 = *very positive*), and the 16 positive behaviors had a mean rating of 8.27 (range = 6.57 to 9.21). Examples of the behavioral descriptions are as follows: "He invites new colleagues to his house for dinner" (desirable behavior) and " He blocks the fire exit with his old furniture" (undesirable behavior). The behavioral descriptions contained minimal information about the context of the behavior.

To facilitate memory of the impressions, we organized the stimulus persons into eight groups. Each group had four stimulus persons with the same surname. Four groups of stimulus persons had performed positive behaviors, and the remaining groups had performed negative behaviors. The participants used a 10-point scale (1 = *very negative* and 10 = *very positive*) to rate their impression of each stimulus person as well as their impression of each of the eight groups. They did the ratings after they had read the description of each stimulus person and after they had read the descriptions of the stimulus persons in each group. The mean rating of the 16 positive stimulus persons was 6.87 (SD = .81) and that of the negative ones was 3.47 (SD = .60). The mean rating of the four positive groups was 6.87 (SD = .93) and that of the four negative groups was 3.43 (SD = .73).

LAY THEORY MEASURE

As noted, lay theories are domain specific. Given the nature of the impression formation task, the relevant domain in this experiment was personality. Thus, the participants filled out the lay theory of personality measure before they performed the memory search task. The lay theory of personality measure had the same format as the other lay theory measures. The items of this measure are as follows: "The kind of person someone is is something very basic about them and it can't be changed very much," "People can do things differently but the important parts of who they are can't really be changed," and "Everyone is a certain kind of person and there is not much that can be done to really change that." Using the theoretical midpoint of 3.5 as the cutoff point, 23 participants were classified as entity theorists and 22 were classified as incremental theorists.

Recall that the participants rated their impressions of the stimulus persons during the impression formation session. The two lay theory groups did not differ in their impressions of the stimulus persons (t = –.09 for the positive stimulus persons and t = –.81 for the negative stimulus persons) or in those of the eight groups (t = –.14 for the positive groups and t = –.07 for the negative groups).

MEMORY SEARCH TASK

After the participants had completed the impression formation session, they went through the memory search task. The design and procedures of the memory search task were identical to those used in Experiment 1, with the exception that the stimulus persons in the present experiment were the fictitious persons that appeared in the impression formation session. To ensure that participants did not use the stimulus persons' surnames to categorize the names in the memory set, the memory set in each trial never contained more than one stimulus person with the same surname.

Results and Discussion

Reaction time outliners (those larger than mean plus 3 standard deviations, 1.67% of the correct responses) were excluded from further analysis. Before we eliminated the reaction time outliners, mean reaction time was 1359.65 msec, *Mdn* = 1186 msec, *SD* = 665.82 msec, and skewness = 2.63. When the outliners were eliminated, mean reaction time was 1307.11 msec, *Mdn* = 1178 msec, *SD* = 520.20 msec, and skewness was reduced to 1.27. Incorrect responses (11.02%) also were excluded.

The results replicated those found in Experiment 1. Participants generally took more time to complete the memory search when set size increased; the slope of the regression line was 104.77 msec, $F(1, 3) = 36.03$, $p < .05$. Entity and incremental theorists did not differ in the intercept of the regression function, $F(1, 43) = .11$, *ns*. As predicted, incremental theorists (M = 118.61, SD = 41.28) had a significantly steeper regression slope than did entity theorists (M = 93.49, SD = 39.01), $F(1, 43) = 4.41$, $p < .05$.

In summary, despite that the fictitious stimulus persons were equally unfamiliar to entity and incremental theorists, entity theorists still needed less time to complete the memory search than did incremental theorists. In the present study, only evaluative information was available for encoding the stimulus persons. It is unlikely that incremental theorists had used other information to encode the stimulus persons. Thus, incremental theorists were slower than entity theorists in memory search probably because they, unlike entity theorists, did not use evaluation-based strategies. However, before we conclude that this is indeed the case, we need to establish that incremental theorists do not have a generalized tendency to respond slowly in memory search.

EXPERIMENT 2B

To assess whether incremental theorists have a generalized tendency to be slower than entity theorists in memory search, we had another 50 undergraduates (8 men, 48 women, average age = 19.9) fill out the lay theory of personality measure and take part in a memory search task. In this experiment, the stimuli were 28 novel names made up by common family names and nonvalenced given names.

We adopted the same criteria used in Experiments 1 and 2a to exclude reaction time outliners (2.85%). Before the outliners were eliminated, mean reaction time = 1519.30 msec, *Mdn* = 1302 msec, *SD* = 842.69 msec, and skewness = 5.51. When outliners were excluded, mean reaction time was 1447.63 msec, *Mdn* = 1294 msec, *SD* = 585.62 msec, and skewness was reduced to 1.51. We also excluded incorrect responses (7.23%) from further analysis.

Again, participants generally took more time to complete the memory search when set size increased; the slope of the regression line (119.27 msec) was significant, $F(1, 3) = 71.61$, $p < .05$. However, the intercepts, $F(1, 48) = .02$, and the slopes, $F(1, 48) = .02$, of the entity and incremental theorists' regression lines did not differ significantly, suggesting that incremental theorists did not have a generalized tendency to respond slowly in a memory search task. When the stimulus names did not carry any evaluative meaning, entity and incremental theorists were equally slow in memory search (M slope = 96.03, SD = 72.52 for entity theorists; M slope = 71.34, SD = 40.11 for incremental theorists).

GENERAL DISCUSSION

Experiments 1 and 2a showed that entity theorists were more likely than incremental theorists to use evaluation-based strategies when they performed a memory search, both when the stimulus persons were real individuals (Experiment 1) and when they were fictitious people (Experiment 2a). Such evaluation-based strategies require grouping of the stimulus persons in the search list by their valence. Once the stimulus persons were sorted into separate clusters, entity theorists might selectively access the stimulus persons who had the same valence as the probe or exclude the stimulus persons who did not match the probe in valence. Both strategies could reduce the number of comparisons required to complete the search. Because memory search is a serial comparison process (Sternberg, 1966), fewer comparisons would result in faster responses. In both Experiments 1 and 2a, entity theorists were speedier in memory search than incremental theorists. However, it is unclear from the present research which of the two evaluation-based strategies entity theorists had used, and this is an interesting topic for future research.

None of the participants in the experiment reported in the postexperimental interview that they had used evaluation to cluster the stimulus persons. Apparently, this process took place without the participants' con-

scious awareness. As Wegner and Vallacher (1977) put it, "Since (lay theories) are used again and again in almost every interpersonal setting, our notions about others become nearly reflexive in nature, in much the same way that repeated motor skills become reflexive" (p. 16).

Previous research (Chiu, Hong, & Dweck, 1997; Hong et al., 1997) has shown that incremental theorists were less likely than entity theorists to form evaluative impressions of people based on limited behavioral information. One might argue that incremental theorists were less likely to use evaluation-based strategies because they did not attach evaluative meaning to the stimulus persons. However, in Experiment 1, the stimulus persons generated by entity and incremental theorists did not differ in evaluative extremity. In Experiment 2a, entity and incremental theorists had formed equally extreme evaluative impressions of the stimulus persons. It appears that although incremental theorists might form evaluative impressions of others as entity theorists do, they do not spontaneously use evaluation-based strategies in memory search.

However, our findings do not imply that incremental theorists do not categorize people into any mental structures. On the contrary, incremental theorists appear to have a greater tendency to categorize others on the basis of relatively dynamic behavioral mediators (e.g., goals) (Chiu, 1994). It is possible that when goals are available for organizing impressions in a memory search task, incremental theorists may be more ready than entity theorists to use goal-based strategies in memory search. This possibility merits future investigations.

Finally, it is worth noting that entity and incremental theorists do not differ in their performance on standardized tests of conceptual ability (e.g., the Academic Promise Tests) (Bennett et al., 1965) or tests of academic aptitude (SAT scores) or in their self-perceived intellectual ability (Chiu, Hong, & Dweck, 1997; Dweck et al., 1995). In other words, incremental theorists are not more cognitively competent and hence have a higher ability to deal with social information in a complex way than are entity theorists. In addition, in Experiment 2b, when the stimulus persons had no evaluative meaning to the participants, entity and incremental theorists did not differ in their performance on the memory search task. In other words, the results from Experiments 1 and 2a do not reflect generalized differences between entity and incremental theorists in their cognitive abilities.

In short, the present research showed that entity and incremental theorists may organize impressions differently. Relative to incremental theorists, entity theorists may have a greater spontaneous tendency to organize positive and negative impressions into different clusters (see also Hong et al., 1997). Such differences in categorization strategies between entity and incremental theorists are consistent with the previous findings that entity theorists are relatively sensitive to the evaluative implications of behavioral and outcome information about the self and others (Dweck, 1999). The present research also showed that entity theorists' sensitivity to evaluation could have nontrivial consequences on the organization and retrieval of person information in short-term memory.

NOTES

1. The overall pattern of the results did not change when we treated the implicit theory measures as continuous variables.

2. However, it is worth noting that regression lines with steeper (flatter) slopes have a lower (higher) projected intercept (set size = 0) even when both lines have the same reaction time at set size = 2.

REFERENCES

Bennett, F. K., Bennett, M. G., Glendenen, D. M., Deppelt, J. E., Ricks, J. H., Jr., Seashore, H. G., & Wesman, A. G. (1965). *Academic promise tests.* New York: Psychological Corporation.

Chiu, C. (1994). *Bases of categorization: The role of implicit theories in person cognition.* Unpublished doctoral dissertation, Columbia University.

Chiu, C., Dweck, C. S., Tong, J. Y., & Fu, J. H. (1997). Implicit theories and conceptions of morality. *Journal of Personality and Social Psychology, 73,* 923-940.

Chiu, C., Hong, Y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of Personality and Social Psychology, 73,* 19-30.

Coopersmith, S. (1967). *The antecedents of self-esteem.* San Francisco: Freeman.

Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development.* Philadelphia: Psychology Press.

Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and reactions: A world from two perspectives. *Psychological Inquiry, 6,* 267-285.

Dweck, C. S., Hong, Y., & Chiu, C. (1993). Implicit theories: Individual differences in the likelihood and meaning of dispositional inference [Special issue: On inferring personal dispositions from behavior]. *Personality and Social Psychology Bulletin, 19,* 644-656.

Gervey, B. M., Chiu, C., Hong, Y., & Dweck, C. S. (1999). Differential use of person information in decisions about guilt vs. innocence: The role of implicit theories. *Personality and Social Psychology Bulletin, 25,* 17-27.

Hong, Y., Chiu, C., Dweck, C. S., Lin, D.M.-S. & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology, 77,* 588-599.

Hong, Y., Chiu, C., Dweck, C. S., & Sacks, R. (1997). Implicit theories and evaluative processes in person cognition. *Journal of Experimental Social Psychology, 33,* 296-323.

Hong, Y., Chiu, C., Yeung, G. & Tong, Y. (1999). Social comparison during political transition: Interaction of entity versus incremental beliefs and social identities. *International Journal of Intercultural Relations, 23,* 257-280.

Hong, Y., Levy, S. R., & Chiu, C. (2001). The contribution of the lay theories approach to the study of groups. *Personality and Social Psychology Review, 5,* 98-106.

Jones, E. E., & Thibaut, J. W. (1958). Interaction goals as bases of inference in interpersonal perception. In R. Tagiuri & L. Petrullo (Eds.), *Person perception and interpersonal behavior* (pp. 151-178). Stanford, CA: Stanford University Press.

Kerlinger, F. N. (1984). *Liberalism and conservatism: The nature and structure of social attitudes.* Hillsdale, NJ: Lawrence Erlbaum.

Levy, S. R., Stroessner, S. J., & Dweck, C. S. (1998). Stereotype formation and endorsement: The role of implicit theories. *Journal of Personality and Social Psychology, 74,* 1421-1436.

Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology, 46*, 598-609.
Snyder, M. (1974). Self-monitoring of expressive behavior. *Journal of Personality and Social Psychology, 30*, 526-537.
Sternberg, S. (1966). High-speed scanning in human memory. *Science, 153*, 652-654.
Sternberg, S. (1969). Memory-scanning: Mental processes revealed by reaction-time experiments. *American Scientist, 57*, 421-457.
Tesser, A., & Martin, L. (1996) The psychology of evaluation. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 400-432). New York: Guilford.
Wegner, D. M., & Vallacher, R. R. (1977). *Implicit psychology: An introduction to social cognition.* New York: Oxford University Press.